గణితం/MATHEMATICS

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1. REAL NUMBERS

Euclid's Division Lemma: Given Positive integers a and b there exists whole numbers q and r satisfying $a = bq + r,\ 0 \le r < b$.

The Fundamental theorem of arithmetic: Every composite number can be expressed as a product of primes, and this factorization is unique except for the order in which the prime factors occur.

Note: (i) Every composite number can be uniquely expressed as the product of powers of primes in ascending or descending order.

(ii) Let a be a positive integer and p be a prime number such that p divides a^2, then p divides a.

(iii) There are infinitely many positive prime numbers.

(iv) Every positive integer different from 1 can be expressed as product of non negative powers of 2 and an odd number

(v) A positive integer n is prime if it is not divisible by any prime less than or equal to $\sqrt{n}$

(vi) If p is a positive prime, then $\sqrt{p}$ is an irrational number. For eg $\sqrt{2}, \sqrt{3}, \sqrt{5}, \ldots$ etc. are irrational numbers.

(vii) Let x be a rational number whose decimal expansion terminates. Then x can be expressed in the form $\frac{p}{q}$, where p and q are co prime, and the prime factorization of q is of the form $2^m \times 5^n$. When m and n are non negative integers.

$(viii)$ Let x be a rational number, such that the prime factorization of q is of the form $2^m \times 5^n$. Where m and n are non negative integers. Then x has a terminating decimal expansion which terminates after k places of decimals, where k is larger than and m and n.

(ix) Let $x = \frac{p}{q}$ be a rational number, such that the prime factorization of q is not of the form $2^m \times 5^n$ where m and n are non negative integers. Then x has non terminating repeating decimal expansion.

Logarithm: We define $\log_a x = n$ if $a^n = x$, where a and x are positive numbers and $a \ne 1$.

Laws of Logarithms:

$(i)\ \log_a m + \log_a n = \log_a mn$

$(ii)\ \log_a m - \log_a n = \log_a \frac{m}{n}$

$(iii)\ \frac{\log_a m}{\log_a n} = \log_n m$

$(iv)\ \log_a m . \log_n a = \log_n m$

$(v)\ \frac{1}{\log_a n} = \log_n a$

$(vi)\ a^{\log_a n} = n$

Solved problems:

(1) Which of the following is an irrational number

$(a)\ \sqrt{4}$ $(b)\ \sqrt{5}$ $(c)\ \frac{3}{2}$ $(d)\ \frac{4}{3}$

Solution: $\sqrt{5}$ is an irrational number

Ans: option *b*

(2) The product of prime factors of 765 is

$(a)3^2\times5^2\times17$ $(b)\ 3^2\times5^3\times13$ $(c)3^3\times5\times17$ $(d)3^2\times5\times17$

Solution: Given $765=3\times3\times5\times17=3^2\times5\times17$

Ans: option *d*

(3) $\log\cot1^0+\log\cot2^0+\log\cot3^0...+\log\cot89^0=$

$(a)0$ $(b)1$ $(c)41$ $(d)49$

Solution: $\log\cot1^0+\log\cot2^0+\log\cot3^0...+\log\cot89^0$

$=\log(\cot1^0\ .\cot2^0..\cot3^0....\cot89^0)$

$=\log(1)$

$=0$

Ans: option *a*

MULTIPLE CHOICE QUESTIONS

(1) Which of the following is an irrational number

$(a)\ \sqrt{4}$ $(b)\ \sqrt{3}$ $(c)\ \frac{5}{2}$ $(d)\ \frac{2}{3}$

(2) Which of the following a rational number

$(a)2-\sqrt{3}$ $(b)\sqrt{2}+\sqrt{3}$ $(c)\sqrt{4}-\sqrt{25}$ $(d)\ \sqrt{5}-\sqrt{9}$

(3) The rational number lie in between $\sqrt{2}$ and $\sqrt{3}$ ఆ is

$(a)\frac{3}{2}$ $(b)\ \frac{5}{2}$ $(c)\ \frac{1}{2}$ $(d)1$

(4) Which of the following rational number does not lie in between $\frac{1}{2}$ and 1

$(a)\frac{3}{5}$ $(b)\ \frac{7}{10}$ $(c)\ \frac{3}{4}$ $(d)\frac{6}{5}$

(5) Which of the following is not a factor of rational number 5005

$(a)11$ $(b)7$ $(c)5$ $(d)\ 3$

(6) The product of prime factors of 3825 is

$(a)3^2\times5^2\times17$ $(b)\ 3^2\times5^3\times13$ $(c)3^3\times5^2\times17$ $(d)3^3\times5^3\times7$

(7) If $8232=2^3\times3\times7^n$ then the value of n is

$(a)1 \quad (b)\ 2 \quad (c)3 \quad (d)4$

(8) If $156 = 2^2 \times 3 \times k$ then the value k is

$(a)5 \quad (b)\ 7 \quad (c)13 \quad (d)11$

(9) The H.C.F of $2^3 \times 3^2 \times 5$ and $2^2 \times 3^3 \times 5^2$ is

$(a)\ 2^3 \times 3^3 \times 5^2 \quad (b)\ 2^2 \times 3^2 \times 5 \quad (c)\ 2^3 \times 3^2 \times 5 \quad (d)\ 2 \times 3 \times 5$

(10) The H.C.F of $120,150$ and 210 is $k^2 - 6$, then the value of k is

$(a)\ 6 \quad (b)\ 9 \quad (c)\ 36 \quad (d)\ 30$

(11) The H.C.F of $17,23$ and 29 is

$(a)\ 1 \quad (b)\ 23 \quad (c)\ 17 \quad (d)\ 17 \times 23 \times 29$

(12) The L.C.M of $2^3 \times 3 \times 5$ and $2^2 \times 5 \times 7$ is

$(a)\ 1680 \quad (b)\ 420 \quad (c)\ 280 \quad (d)\ 840$

(13) The product of two numbers is 1600 and their H.C.F is 5 then L.C.M is

$(a)\ 8000 \quad (b)\ 1595 \quad (c)\ 320 \quad (d)\ 1605$

(14) The L.C.M of two numbers is 216 and their H.C.F is 36, one number is 72 then second number is

$(a)\ 108 \quad (b)\ 180 \quad (c)\ 156 \quad (d)\ 144$

(15) The decimal form of $\frac{21}{25}$ is

$(a)0.8 \quad (b)8.4 \quad (c)0.48 \quad (d)0.84$

(16) The decimal form of $\frac{23}{2^3 5^2}$ is

$(a)0.115 \quad (b)0.023 \quad (c)0.0115 \quad (d)0.1015$

(17) π is a/an

(a) irrational number (b) rational number (c) whole number (d) natural number

(18) $1.120120012000...$ is a

(a) irrational number (b) rational number (c) whole number (d) natural number

(19) Which of the following is an irrational number

$(a)\frac{22}{7} \quad (b)3.1416 \quad (c)3.\overline{1416} \quad (d)\ 3.141141114...$

(20) The decimal form of $\frac{13}{7}$ is

$(a)0.\overline{857142} \quad (b)1.\overline{7857142} \quad (c)1.\overline{857142} \quad (d)2.\overline{857142}$

(21) p prime number then $\sqrt{p}$

(a) irrational number (b) rational number (c) whole number (d) natural number

(22) If for all values of a,b where a,b are whole numbers $\frac{a^2+b^2}{2ab}$ is

(a) irrational number (b) rational number (c) whole number (d) prime number

(23) The decimal form of $\frac{1}{4000}$ is

$(a)\,0.0025 \quad (b)\,0.00025 \quad (c)\,0.0001 \quad (d)\,0.00004$

(24) If $\frac{52}{160} = \frac{13}{2^n \times 5^m}$ then $m+n =$

$(a)2 \quad (b)3 \quad (c)4 \quad (d)5$

(25) If 16380 can be expressed as $2^2 \times 5 \times 7 \times p^2 \times 13$ then the value of p is

$(a)1 \quad (b)3 \quad (c)11 \quad (d)17$

(26) The irrational number lie in between 4 and 5 is

$(a)\ \sqrt{4} \quad (b)\ \sqrt{20} \quad (c)\ \sqrt{25} \quad (d)\ \sqrt{\frac{5}{4}}$

(27) If x, y are prime numbers, then H.C.F of $x^3 y^2$ and $x^2 y^3$ is

$(a)\ 1 \quad (b)\ xy \quad (c)\ x^2 y^2 \quad (d)\ x^3 y^3$

(28) $\log_7 7 =$

$(a)\ 1 \quad (b)\ 0 \quad (c)\ 49 \quad (d)\ 7^7$

(29) $\log_a 1 =$

$(a)\ 1 \quad (b)\ 0 \quad (c)\ a \quad (d)\ \frac{1}{a}$

(30) $\log_a x = b$ then

$(a)\ a^x = b \quad (b)\ x^a = b \quad (c)\ x^b = a \quad (d)\ a^b = x$

(31) $\log_3 9 = x$ then x value

$(a)\ 1 \quad (b)\ 2 \quad (c)\ 3 \quad (d)\ 9$

(32) $\log_c \sqrt{c} = x$ then x value

$(a)\ 2 \quad (b)\ \frac{3}{2} \quad (c)\ \frac{1}{2} \quad (d)\ 0$

(33) $\log_a \frac{x}{y} =$

$(a)\ \frac{\log_a x}{\log_a y} \quad (b)\ \log_a x + \log_a y \quad (c)\ \log_a x - \log_a y \quad (d)\ \log_a x - y$

(34) $\log_a xy =$

$(a)\ \frac{\log_a x}{\log_a y} \quad (b)\ \log_a x + \log_a y \quad (c)\ \log_a x - \log_a y \quad (d)\ \log_a x - y$

(35) $2\log 3 + \log 5 = \log \mathrm{N}$ then N value

$(a)\ 45 \quad (b)\ 235 \quad (c)\ 75 \quad (d)\ 30$

(36) $\log_a 324 = 2$ then a value

$(a)\ 16 \quad (b)\ 18 \quad (c)\ 2 \quad (d)\ 324$

(37) $\log_c c\sqrt{c} = x$ then x value

$(a)\ -\frac{3}{2} \quad (b)\ \frac{3}{2} \quad (c)\ \frac{5}{2} \quad (d)\ -\frac{5}{2}$

(38) $\log x^2 y^m z^4 = 2\log x + 5\log y + 4\log z$ then m value

$(a)\ 2 \quad (b) 3 \quad (c)\ 4 \quad (d) 5$

(39) If $\log_{\frac{2}{3}} x = 3$ then the value of x is

$(a)\frac{8}{27} \quad (b)\ \frac{27}{8} \quad (c)\ \frac{7}{2} \quad (d)\frac{2}{3}$

(40) $\log_3 27\sqrt{3} =$

$(a)\frac{5}{2} \quad (b)\ 7 \quad (c)\ \frac{7}{2} \quad (d)\frac{3}{2}$

(41) $\log_3 3\sqrt{3} =$

$(a) 3 \quad (b)\ 3\sqrt{3} \quad (c) 3^{3\sqrt{3}} \quad (d)\frac{3}{2}$

(42) $\log_{10} 25 + \log_{10} 4 =$

$(a) 1 \quad (b) 2 \quad (c)\ 3 \quad (d) 4$

(43) $\log x + \log y = \log(x + y)$ then x value

$(a)\frac{y}{y+1} \quad (b)\ \frac{y+1}{y} \quad (c)\ \frac{y-1}{y} \quad (d)\frac{y}{y-1}$

(44) $\log_3 27 + \log_2 16 =$

$(a) 43 \quad (b) 7 \quad (c) 9 \quad (d) 5$

(45) If $\log(x+1) + \log(x-1) = \log\frac{5}{4}$ then the value of x is

$(a) 5/2 \quad (b) 1/2 \quad (c) 3/2 \quad (d) 5$

(46) If $\log_{\sqrt{6}} 216 = x$ then the value of x is

$(a) 3 \quad (b) 6 \quad (c) 216 \quad (d)\frac{1}{2}$

(47) If $\log_5(x^2 + 9) = 2$ then the value of x is

$(a) 3 \quad (b) -3 \quad (c) 4 \quad (d) 9$

(48) If $\log_{10} x = k$ then $10^{k+1} =$

$(a) x \quad (b)\frac{10}{x} \quad (c)\frac{x}{10} \quad (d) 10x$

(49) The value of $\log_{10} 0.001$ is

$(a) 3 \quad (b) -3 \quad (c) 10 \quad (d) 4$

(50) If $\log_{10} x = k$ then $10^{k-1} =$

$(a) x \quad (b)\frac{10}{x} \quad (c)\frac{x}{10} \quad (d) 10x$

(51) If $\log(x+1) + \log(x-1) = \log 24$ then the value of x is

$(a) 24 \quad (b) 2 \quad (c) 25 \quad (d) 5$

(52) If $\log_8 2 = x$ then the value of x is

$(a)3 \quad (b)2 \quad (c)\frac{1}{2} \quad (d)\frac{1}{3}$

(53) The base of a natural logarithm is

$(a)\pi \quad (b)1 \quad (c)10 \quad (d)\ e$

(54) The logarithm form of $3^2 = 9$ is

$(a)\log_9 3 = 2 \quad (b)\log_3 2 = 9 \quad (c)\log_3 9 = 2 \quad (d)\ \log_2 3 = 9$

(55) If $\log\frac{16}{81} = k(\log 2 - \log 3)$ then the value of $2k + 3$ is

$(a)4 \quad (b)14 \quad (c)11 \quad (d)\ 16$

(56) $3\log 4 =$

$(a)\log 64 \quad (b)\log 81 \quad (c)\log 12 \quad (d)\ \log 43$

(57) $\log_2 16 - \log_2 4 =$

$(a)1 \quad (b)2 \quad (c)12 \quad (d)\ 4$

(58) $\log 10 + 2\log 3 - \log 2 =$

$(a)\log 45 \quad (b)\log 90 \quad (c)\log 180 \quad (d)\ \log 120$

(59) If $2\log 3 - 3\log 2 = \mathrm{N}$ then the value of N is

$(a)\log\frac{8}{9} \quad (b)\log\frac{3}{2} \quad (c)\log\frac{2}{3} \quad (d)\ \log\frac{9}{8}$

(60) If $3\log 2 + 2\log 5 = \log \mathrm{N}$ then the value of N is

$(a)10 \quad (b)50 \quad (c)100 \quad (d)\ 200$

(61) If $\log 625 = k\log 5$ then the value of k is

$(a)2 \quad (b)3 \quad (c)4 \quad (d)\ 5$

(62) If $\log\frac{343}{125} = k(\log 7 - \log 5)$ then the value of k is

$(a)2 \quad (b)3 \quad (c)4 \quad (d)\ 5$

(63) $\log_{27} 9 =$

$(a)-3 \quad (b)3 \quad (c)\frac{2}{3} \quad (d)\ \frac{3}{2}$

(64) $\log_{\sqrt{2}} 4 =$

$(a)1 \quad (b)3 \quad (c)2 \quad (d)4$

(65) If $\log 243 + \log 1 = \log k$ then the value of k is

$(a)0 \quad (b)1 \quad (c)243 \quad (d)2431$

(66) If $3\log_5 4 = \log_5 2^k$ then the value of k is

$(a)2 \quad (b)4 \quad (c)6 \quad (d)8$

(67) $\log 100 \times \log 99 \times \log 98 \times ... \times \log 1 =$

$(a)0 \quad (b)1 \quad (c)100 \quad (d)100!$

(68) $\log\tan 41^0 + \log\tan 42^0 + \log\tan 43^0 ... + \log\tan 49^0 =$

$(a)0 \quad (b)1 \quad (c)41 \quad (d)49$

(69) $\log\tan 1^0 + \log\tan 2^0 + \log\tan 3^0 ... + \log\tan 89^0 =$

$(a)\,0 \quad (b)\,1 \quad (c)\,\infty \quad (d)\,89$

(70) $\log \cot 1^0 + \log \cot 2^0 + \log \cot 3^0 ... + \log \cot 89^0 =$

$(a)\,0 \quad (b)\,1 \quad (c)\,\infty \quad (d)\,90$

(71) $\log_{xyz} x + \log_{xyz} y + \log_{xyz} z =$

$(a)\,0 \quad (b)\,1 \quad (c)\,xyz \quad (d)\,\infty$

(72) $\log_{xyz} x^2 + \log_{xyz} y^2 + \log_{xyz} z^2 =$

$(a)\,0 \quad (b)\,1 \quad (c)\,2 \quad (d)\,6$

(73) $\log_{y^3} x^2 \times \log_{z^3} y^2 \times \log_{x^3} z^2 =$

$(a)\,0 \quad (b)\,1 \quad (c)\,\frac{8}{27} \quad (d)\,\frac{2}{3}$

ANSWERS

1. (B) 2. (C) 3. (A) 4. (D) 5. (D) 6. (A) 7. (C) 8. (C) 9. (B) 10. (A) 11. (A) 12. (D) 13. (C) 14. (A) 15. (D) 16. (A) 17. (A) 18. (D) 19. (D) 20. (C) 21. (A) 22. (B) 23. (B) 24. (C) 25. (B) 26. (B) 27. (C) 28. (A) 29. (B) 30. (D) 31. (B) 32. (C) 33. (C) 34. (B) 35. (A) 36. (B) 37. (B) 38. (D) 39. (A) 40. (C) 41. (D) 42. (B) 43. (D) 44. (B) 45. (C) 46. (B) 47. (C) 48. (D) 49. (B) 50. (C) 51. (D) 52. (D) 53. (D) 54. (C) 55. (C) 56. (A) 57. (B) 58. (A) 59. (D) 60. (D) 61. (C)62. (B) 63. (C) 64. (D) 65. (C) 66. (C) 67. (A) 68. (A) 69. (A) 70. (A) 71. (B) 72. (C) 73. (C)

2. SETS

Set: The collection of well defined objects is called a ***set***. The objects in a set are called elements.

Eg: $A=\{a,b,c,d\}, B=\{1,2,3,4,...\}$ and $C=\{$All students of a class$\}$

Roaster form: If all the elements of a set are listed and enclosed in the brackets { }, then we say the set is in the **roaster form**.

Set Builder form: In this method elements are described by their common property i.e. A set is denoted as $\{x/x$ satisfies $p(x)$ where $p(x)$ is the common property$\}$

Finite set: If the number of elements in a set are finite, then the set is called as **finite set**.

Eg: Set of days in a week, set of months in a year

Infinite set: A set which contains un counting of elements is called **infinite set**.

Eg: $N=\{1,2,3,4,...\}$

Cardinal number: The number of different elements in a set is known as its **cardinal number**. It is denoted by $n(A)$. If $A=\{a,b,c,d\}$ then $n(A)=4$.

Equal sets: Two sets A and B are said to be **equal** if they contain same elements.

Eg: $A=\{1,2,3,4\}$ and $B=\{1,2,2,3,3,3,4,4,4,4\}$

Equivalent sets: Two sets A and B are said to be **equivalent** if the number of elements in two sets are the same Eg: $A=\{a,b,c,d\}$ and $B=\{1,2,3,4\}$

Null set: A set containing no elements is called an **empty set** or **null set** or **void set**. It is denoted by ϕ

Singleton set: a set containing only one element is called **singleton set**

Eg: A set of even prime numbers $=\{2\}$

Subset: A set A is called subset of a set B if every element of A is in B. It is denoted by $A\subseteq B$. In this case B is called super set of A.

Proper subset: A set A is called proper subset of B if $A\subseteq B$ and $A\neq B$. It is denoted by $A\subset B$

Note: (i) If there are n elements in a set, then the number of subsets of that set is 2^n

(ii) If there are n elements in a set, then the number of non empty proper subsets of that set is 2^n-2

Power set: The set of all subsets of set A is called power set of A. It is denoted by $p(A)$.

Note: If A contains n different elements then $p(A)$ contains 2^n different elements.

Union of sets: The set containing the elements of A and B or both is called as union of sets. It is denoted by $A\cup B$

Intersection of sets: The set containing the elements of A and B which are common in both sets A and B is called as intersection of sets. It is denoted by $A\cap B$

Universal set: The set under consideration are all subsets of a fixed set, then the fixed set is called universal set and it is denoted by μ or $\cup$.

Note: (i) The difference of two sets A, B is denoted as $A-B$ or $B-A$.

(ii) Venn diagrams are a convenient way of showing operations between sets.

Disjoint sets: If the intersection of two sets is a null set, then they are called as **disjoint** sets.

Some Important Laws on Sets:

Idempotent Law: $A\cup A=A$ and $A\cap A=A$

Associative Law: $A \cup (B \cup C) = (A \cup B) \cup C$ and $A \cap (B \cap C) = (A \cap B) \cap C$

Commutative Law: $A \cup B = B \cup A$ and $A \cap B = B \cap A$

Distributive Law: $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ and
$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Some Important Results:

i. If $A \subseteq B$ then $A \cup B = B$ and $A \cap B = A$

ii. If $A \cup B = \phi$ then $A = \phi$ and $B = \phi$

iii. If $A \cup B = \bigcup$ then $A = \bigcup$ and $B = \bigcup$

iv. $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

v. $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(B \cap C) + n(A \cap B \cap C)$

vi. $A \Delta B = (A \cup B) - (A \cap B)$ *or* $(A - B) \cup (B - A)$

Solved problems:

(1) If $A = \{1,2,3,4,5\}$ then $n(A)$=

$(a)\,2 \quad (b)\,3 \quad (c)\,4 \quad (d)\,5$

Solution: Given $A = \{1,2,3,4,5\}$

The number of different elements in the set is 5.

$\therefore n(A) = 5.$

Ans: option *d*

(2) If $P = \{1,2,5\}, Q = \{3,4,6\}, R = \{1,3,4,6\}, S = \{3,5,6\}$ then universal set is

$(a)\,P \quad (b)\,Q \quad (c)\,R \quad (d)\,S$

Solution: Given $P = \{1,2,5\}, Q = \{3,4,6\}, R = \{1,3,4,6\}, S = \{3,5,6\}$

Universal set is the set under consideration all subsets of a fixed set, which is R

Ans: option *c*

(3) If $A = \{5,6,7,8\}, B = \{7,8,9,10\}$ then $A \cap B$=

$(a)\{7,8\} \quad (b)\{9,10\} \quad (c)\{5,6,7,8,9,10\} \quad (d)\phi$

Solution: Given $A = \{5,6,7,8\}, B = \{7,8,9,10\}$

$A \cap B = = \{5,6,7,8\} \cap \{7,8,9,10\} = \{7,8\}$

Ans: option *a*

MCQ'S

(1) The symbol of an empty set

$(a)\ \phi \quad (b)\ \mu \quad (c)\ \cup \quad (d)\ \cap$

(2) If $K = \{1,2,3,5\}$ then which is false

$(a)\ 5 \in K \quad (b)\ \{5\} \in K \quad (c)\ \{5\} \subset K \quad (d)\{1,5\} \in K$

(3) The set formed by the letters of the word SCHOOL

$(a)\{C,H,S,O,L\}$ $(b)\{S,C,H,O,L\}$ $(c)\{S,O,L,H,C\}$ (d) All the above

(4) If $A=\{2,4,6,8,10\}$ then which is not denoted by A

$(a)\{x:x=2n,n\in N\&n\le 5\}$ $(b)\{x:x=2n,n\in N\&n<5\}$

$(c)\{x:x=2n,n\in N\&1\le n\le 5\}$ $(d)\{x:x=n,n\in N\&1<n<5\}$

(5) If $A=\{1,2,3,5\}$ then $n(A)=$

$(a)2$ $(b)3$ $(c)4$ $(d)5$

(6) $n(\varphi)=$

$(a)0$ $(b)1$ $(c)2$ (d) can not decided

(7) If $A=\{6,7,8,9,10\},B=\{8,9,10\},C=\{a,b\}$ then

$(a)n(A)<n(B)$ $(b)n(A)=n(B)+n(C)$ $(c)n(A)=n(B)-n(C)$ $(d)n(B)<n(C)$

(8) If $B=\{x:x+7=7\}$ then $n(B)=$

$(a)3$ $(b)2$ $(c)1$ $(d)0$

(9) If $A\subset B$ then $A\cup B=$

$(a)\ \phi$ $(b)\ \mu$ (c) A (d) B

(10) If $A\subset B$ then $A\cap B=$

$(a)\ \phi$ $(b)\ \mu$ (c) A (d) B

(11) The symbol of an universal set is

$(a)\ \phi$ $(b)\ \mu$ $(c)\ \cup$ $(d)\ \cap$

(12) If $A=\{1,2,3,4,5\}$ then the number of subsets of A is

$(a)16$ $(b)32$ $(c)4$ $(d)64$

(13) If $P=\{1,5\},Q=\{2,4,6\},R=\{1,2,3,4,5,6\},S=\{3,5,6\}$ then universal set is

(a)P (b)Q (c)R (d)S

(14) If $A=\{5,6,7,8\},B=\{7,8,9,10\}$ then $A\cap B=$

$(a)\{7,8\}$ $(b)\{9,10\}$ $(c)\{5,6,7,8,9,10\}$ $(d)\phi$

(15) The disjoint set of $A-B$ is

$(a)\ A\cap B$ $(b)\ A\cup B$ $(c)\ B-A$ (d) All the above

(16) $A\cup\phi=$

$(a)\ \phi$ $(b)\ \mu$ (c) A $(d)\ A\cap\phi$

(17) If $A=\{1,2,3,4,5\},B=\{4,5,6,7\}$ then $A-B=$

$(a)\{2,3\}$ $(b)\{4,5\}$ $(c)\{1,2,3\}$ $(d)\{6,7\}$

(18) If $A=\{3,4,5,6,7\},B=\{1,6,7,8,9\}$ then $n(A-B)=$

$(a)5$ $(b)4$ $(c)3$ $(d)2$

(19) If $n(A)=5,n(B)=4,n(A\cap B)=3$ then $n(A\cup B)=$

$(a)9$ $(b)7$ $(c)2$ $(d)6$

(20) If A, B are disjoint sets then which of the following is true

$(a)\ n(A \cup B)=n(A)+n(B)$ $(b)A \cap B=\phi$ $(c)\ a\ \&\ b$ $(d)n(A \cup B)=n(A)-n(B)$

(21) If $A \cup B=\phi$ then which of the following is true

(a) A, B are disjoint sets $(b)A \neq \phi \& B=\phi$ $(c)\ A=\phi \& B \neq \phi$ (d) All the above

(22) If $A \cap B=\phi$ then which of the following is true

(a) A, B are disjoint sets $(b)A \neq \phi \& B=\phi$ $(c)\ A=\phi \& B \neq \phi$ (d) All the above

(23) The symbol for an element belongs to the set is

$(a)\ \in$ $(b)\ \notin$ $(c)\ \subset$ $(d)\ \not\subset$

(24) The symbol of universal set is

$(a)\ \phi$ $(b)\ \mu$ $(c)\ \cup$ $(d)\ \cap$

(25) If $a \in A \Rightarrow a \in B$ then

$(a)\ A \subset B$ $(b)B \subset A$ $(c)\ A=B$ $(d)\ A=B=\varphi$

(26) If A is an infinite set then $n(A)=$

$(a)\ 0$ $(b)\ 1$ $(c)2$ (d) can not decided

(27) If $n(A)=5, n(B)=7$ & $A \subset B$ then $n(A \cup B)=$

$(a)5$ $(b)7$ $(c)2$ $(d)12$

(28) If $n(A)=4, n(B)=9$ & $A \subset B$ then $n(A \cap B)=$

$(a)5$ $(b)4$ $(c)9$ $(d)13$

(29) If $n(A)=3, n(B)=5$ & A, B are disjoint sets then $n(A \cap B)=$

$(a)5$ $(b)3$ $(c)0$ $(d)8$

(30) If $n(A)=3, n(B)=6$ & A, B are disjoint sets then $n(A \cup B)=$

$(a)6$ $(b)3$ $(c)0$ $(d)9$

(31) If $A \subset B$ & $B \subset A$ then which of the following is true

$(a)\ A \not\subset C$ $(b)A \subset C$ $(c)C \subset B$ $(d)B \subset A$

(32) If A= {Natural numbers}, B= {Prime numbers} then $A \cap B=$

$(a)\ A$ $(b)B$ $(c)\phi$ $(d)A \cup B$

(33) If A= { Even natural numbers }, B= { Prime numbers} then $A \cap B=$

$(a)\{2\}$ $(b)B$ $(c)\{3,5,7,11,...\}$ $(d)\phi$

(34) The symbol for an element doesn't belongs to the set is

$(a)\ \in$ $(b)\ \notin$ $(c)\ \subset$ $(d)\ \not\subset$

(35) The roaster form of $\{x : x \in N$ and $0<x<5\}$ is

$(a)\{1,2,3,4,5\}$ $(b)\{1,2,3,4\}$ $(c)\{0,1,2,3,4,5\}$ $(d)\{0,1,2,3,4\}$

(36) A= $\{x : x$ is a letter of the word ASSOCIATION $\}$, B= $\{x : x$ is a letter of the word ASSOCIATE $\}$ then $A-B=$

$(a)\{A,S,O,C,I,T,N\}$ $(b)\{A,S,O,C,I,T,E\}$ $(c)\{N\}$ $(d)\{E\}$

(37) A= $\{x : x$ is a letter of the word ASSISTANCE $\}$, B= $\{x : x$ is a letter of the word ASSISTANT $\}$ then

$(a)\ A \cup B=B$ $(b)A \cap B=B$ $(c)A \cup B=\phi$ $(d)A \subset B$

(38) The roaster form of the letters of the word BETTER is

$(a)\{B,E,T,R\}$ $(b)\{B,E\}$ $(c)\{B,E,R\}$ $(d)\{B,E,T\}$

(39) If $A=\{5,10,15,20,25,30\}, B=\{15,30,45,60\}$ then $n(A\cup B)=$

$(a)6 \quad (b)4 \quad (c)8 \quad (d)2$

(40) If A, B are disjoint sets and $A\cup B=\{2,3,5,8,13,21,34\}, A=\{3,13,21,34\}$ then $B=$

$(a)\{2,3,5,8\} \quad (b)\{2,5,8\} \quad (c)\ \phi \quad (d)\ A$

(41) The union of A, B is written as

$(a)\ A\cup B \quad (b)A\cap B \quad (c)\ A-B \quad (d)\ B-A$

(42) The intersection of A, B is written as

$(a)\ A\cup B \quad (b)A\cap B \quad (c)\ A-B \quad (d)\ B-A$

(43) The difference of A, B is written as

$(a)\ A\cup B \quad (b)A\cap B \quad (c)\ A-B \quad (d)\ B\subset A$

(44) If $A\subset B$ then $A\cup B$

$(a)\ A \quad (b)B \quad (c)\ \phi \quad (d)\ \mu$

(45) If $B\subset A$ then $A\cup B$

$(a)\ A \quad (b)B \quad (c)\ \phi \quad (d)\ \mu$

(46) If $A\subset B$ then $A\cap B$

$(a)\ A \quad (b)B \quad (c)\ \phi \quad (d)\ \mu$

(47) If $B\subset A$ then $A\cap B$

$(a)\ A \quad (b)B \quad (c)\ \phi \quad (d)\ \mu$

(48) $A\cap\phi=\phi\cap A=$

$(a)\ A \quad (b)\mu \quad (c)\ \phi \quad (d)$ can not decided

(49) $A\cap\mu=\mu\cap A=$

$(a)\ A \quad (b)\mu \quad (c)\ \phi \quad (d)$ can not decided

(50) If $A\subset B$ then $A-B$

$(a)\ A \quad (b)B \quad (c)\ \phi \quad (d)\ \mu$

(51) If $A\subset B$ and $B\subset A\Rightarrow$

$(a)\ A=B \quad (b)A\neq B \quad (c)\ A\cup B=\phi \quad (d)\ A\cap B=\phi$

(52) $(A-B)\cap(B-A)=$

$(a)\ A\cup B \quad (b)\mu \quad (c)\ \phi \quad (d)\ A\cap B$

(53) $(A-B)\cup(B-A)=$

$(a)\ A\cup B \quad (b)A\cap B \quad (c)\ \phi \quad (d)\ A\Delta B$

(54) $\{x : x\in A \text{ or } x\in B\}=$

$(a)\ A\cup B \quad (b)A-B \quad (c)\ B-A \quad (d)\ A\cap B$

(55) $\{x : x\in A \text{ and } x\in B\}=$

$(a)\ A\cup B \quad (b)A-B \quad (c)\ B-A \quad (d)\ A\cap B$

(56) $\{x : x\in A \text{ and } x\notin B\}=$

$(a)\ A\cup B \quad (b)A-B \quad (c)\ B-A \quad (d)\ A\cap B$

(57) $\{x : x\notin A \text{ and } x\in B\}=$

$(a)\ A\cup B \quad (b)A-B \quad (c)\ B-A \quad (d)\ A\cap B$

(58) $\{x : x \in A \Rightarrow x \in B\}$ =

$(a)\ A \cup B$ $(b) A \subset B$ $(c)\ B \subset A$ $(d)\ A \cap B$

(59) If $n(A \cup B)=14, n(A) = 8, n(A \cap B)=4$ then $n(B)$=

$(a)18$ $(b)22$ $(c)10$ $(d)12$

(60) $A \cup A = A \cap A$ =

$(a)\ A$ $(b)\mu$ $(c)\ \phi$ (d) can not decided

ANSWERS

1. (A) 2. (B) 3. (D) 4. (D) 5. (C) 6. (A) 7. (B) 8. (C) 9. (D) 10. (C) 11. (B) 12. (B) 13. (C) 14. (A) 15. (D) 16. (C) 17. (C) 18. (C) 19. (D) 20. (C) 21. (C) 22. (D) 23. (C) 24. (A) 25. (A) 26. (D) 27. (B) 28. (B) 29. (C) 30. (D) 31. (B) 32. (B) 33. (A) 34. (B) 35. (B) 36. (C) 37. (B) 38. (A) 39. (C) 40. (B) 41. (A) 42. (B) 43. (C) 44. (B) 45. (A) 46. (A) 47. (B) 48. (C) 49. (B) 50. (C) 51. (A) 52. (C) 53. (D) 54. (A) 55. (D) 56. (B) 57. (C) 58. (B) 59. (C) 60. (A)

3. Polynomials

Polynomial: Let x be a variable, n be a positive integer and $a_0, a_1, a_2, a_3, ..., a_n$ be constants (real numbers) then $f(x) = a_0x^n + a_1x^{n-1} + a_2x^{n-2} + a_3x^{n-3} + ... + a_n$, is called a **polynomial** in variable x

Eg: $3x^2 - 4x + 1,\ x^3 - 1,\ 2x + 1,\ 5$ are polynomials.

Degree of a Polynomial: The exponent of the highest degree term in a polynomial is known as its **degree**.

Note: i. Polynomial of degree "0" is called a constant polynomial
ii. A polynomial of degree "1" is called linear polynomial
iii. A polynomial of degree "2" is called quadratic polynomial
iv. A polynomial of degree "3" is called cubic polynomial
v. A polynomial of degree "4" is called a bi-quadratic polynomial.
vi. If $f(x)$ is a polynomial and α is any real number, then the real number obtained by reducing x by α in $f(x)$ at $x = \alpha$ and is denoted by $f(\alpha)$.

Zero of a Polynomial: A real number α is called a **zero of a polynomial** $f(x)$ if $f(\alpha) = 0$.

Note: i. A polynomial of degree n can have at most n real zeros.
ii. Geometrically the zeros of a polynomial are the co ordinates of the points where the graph intersects x- axis.

iii. If α and β are the zeros of a polynomial $f(x) = ax^2 + bx + c$, then $\alpha + \beta = -\frac{b}{a}$ and $\alpha\beta = \frac{c}{a}$.

iv. If α, β and γ are the zeros of a polynomial $f(x) = ax^3 + bx^2 + cx + d$, then $\alpha + \beta + \gamma = -\frac{b}{a},\ \alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$ and $\alpha\beta\gamma = \frac{d}{a}$.

v. The quadratic polynomial whose roots are α and β is $f(x) = x^2 - (\alpha + \beta)x + \alpha\beta$

vi. The cubic polynomial whose roots are α, β and γ is $f(x) = x^3 - (\alpha + \beta + \gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma$

Division algorithm: If $f(x)$ and $g(x)$ are any two polynomials with $g(x) \neq 0$, then we can find polynomials $q(x)$ and $r(x)$ such that $f(x) = g(x)q(x) + r(x)$ where either $r(x) = 0$ or degree of $r(x) <$ degree of $g(x)$ if $r(x) \neq 0$.

Reminder's theorem: The reminder obtained by dividing $f(x)$ with $x - \alpha$ is $f(\alpha)$.

Solved problems:

Problem: (1) The degree of a polynomial $x^3 - 3x^2 + 2x - 1$

$(a)1 \quad (b)2 \quad (c)3 \quad (d)4$

Solution: The given polynomial contains 3 as exponent of the highest degree term, hence degree of the polynomial $x^3 - 3x^2 + 2x - 1$ is 3

Ans: option (c)

Problem: (2) The zeroes of the polynomial $3x^2 + 2x - 1$ are

$(a) -1, \frac{1}{3} \quad (b) -1, -\frac{1}{3} \quad (c) 3, -1 \quad (d) -3, -1$

Solution: If α and β are the zeros of a polynomial $f(x) = ax^2 + bx + c$, then $\alpha + \beta = -\frac{b}{a}$

and $\alpha\beta = \frac{c}{a}$.

By inspection it is observed that $\alpha = -1$ and $\beta = \frac{1}{3}$

Ans: option (a)

Problem: (3) The sum of zeroes of the polynomial $3x^2 + 2x - 1$ is

$(a) -\frac{2}{3}$ $(b) -\frac{4}{3}$ $(c)\,2$ $(d) -4$

Solution: If α and β are the zeros of a polynomial $f(x) = ax^2 + bx + c$, then $\alpha + \beta = -\frac{b}{a}$

and $\alpha\beta = \frac{c}{a}$.

By inspection it is observed that $\alpha = -1$ and $\beta = \frac{1}{3}$

$\therefore \alpha + \beta = -\frac{2}{3}$

Ans: option (a)

MULTIPLE CHOICE QUESTIONS

(1) Which of the following is not a polynomial

$(a)\, x^2 + \sqrt{2}x + 4$ $(b)\, x^2 + 2\sqrt{x} + 4$ $(c)\ x^2 + 2x - \sqrt{2}$ $(d)\sqrt{2}\ x^2 + 2x + 4$

(2) Which of the following is not a polynomial

$(a) 2x^3 + 4x^2 + 5$ $(b)\frac{2}{x^3} + 4x^2 + 4x + 9$ $(c)\ 2x^3 + 4x^2 + 5\sqrt{x} + 9$ $(d)\, 2x^{-3} + 4x^2 + 5$

(3) The degree of a polynomial $4x^3 - 5x^2 + x - 1$

$(a)1$ $(b)\,2$ $(c)\,3$ $(d)\,4$

(4) The degree of a quadratic polynomial is

$(a)1$ $(b)\,2$ $(c)\,3$ $(d)\,4$

(5) The degree of a cubic polynomial is

$(a)1$ $(b)\,2$ $(c)\,3$ $(d)\,4$

(6) The zero of a linear polynomial $ax + b$ is

$(a)\ \frac{a}{b}$ $(b) -\frac{a}{b}$ $(c)\ \frac{b}{a}$ $(d) -\frac{b}{a}$

(7) If $p(x) = x^2 - 5x - 10$ then the value of $p(-2)$

$(a)1$ $(b)\ 2$ $(c)\,3$ $(d)\,4$

(8) If $p(x) = x^2 - 3x + 1$ then $p(1) + p(-1) =$

$(a) -1$ $(b)\ 0$ $(c)\ 5$ $(d)\ 4$

(9) One zero of the polynomial $p(x) = x^2 + kx - 8$ is 4 then $k =$

$(a)1$ $(b)\ 2$ $(c) -1$ $(d) -2$

(10) The zeroes of a polynomial x^2-9 are

$(a)\pm 3$ $(b)\pm 9$ $(c)0,9$ $(d)\pm 81$

(11) The zeroes of a polynomial x^2-2x-3 are

$(a)3,1$ $(b)-3,-1$ $(c)3,-1$ $(d)-3,1$

(12) The zeroes of a polynomial $x^2-5\sqrt{2}x+12$ are

$(a)2\sqrt{2},3\sqrt{2}$ $(b)-2\sqrt{2},-3\sqrt{2}$ $(c)-2\sqrt{2},3\sqrt{2}$ $(d)2\sqrt{2},-3\sqrt{2}$

(13) The zero of a polynomial $p(x)=x^2-10x+25$ is

$(a)5$ $(b)\ 6$ $(c)-5$ $(d)\ 4$

(14) The zeroes of a polynomial x^3-x^2 are

$(a)0,-3$ $(b)0,-1$ $(c)0,1$ $(d)1,-1$

(15) The zeroes of a polynomial x^3-4x are

$(a)0,\pm\sqrt{2}$ $(b)0,\pm 1$ $(c)0,\pm 4$ $(d)0,\pm 2$

(16) The zeroes of a polynomial $x^2+\frac{1}{6}x-2$ are

$(a)\frac{3}{2},\frac{4}{3}$ $(b)-\frac{3}{2},\frac{4}{3}$ $(c)\frac{3}{2},-\frac{4}{3}$ $(d)-\frac{3}{2},-\frac{4}{3}$

(17) The quadratic polynomial having zeroes 2 and -3 is

$(a)\ x^2-x-6$ $(b)\ x^2+x-6$ $(c)\ x^2+x+6$ $(d)\ x^2-x+6$

(18) The quadratic polynomial having zeroes $\frac{1}{4}$ and -1 is

$(a)4x^2+3x+1$ $(b)\ 4x^2-3x+1$ $(c)\ 4x^2-3x-1$ $(d)\ 4x^2+3x-1$

(19) The quadratic polynomial having sum of zeroes -3 and product of zeroes -10

$(a)x^2+3x+10$ $(b)\ x^2-3x+10$ $(c)\ x^2-3x-10$ $(d)\ x^2+3x-10$

(20) If sum of zeroes of a quadratic polynomial ax^2+bx+c is 0 then

$(a)\ a=0$ $(b)\ b=0$ $(c)\ c=0$ $(d)\ a=c$

(21) If product of zeroes of a quadratic polynomial ax^2+bx+c is 0 then

$(a)\ a=0$ $(b)\ b=0$ $(c)\ c=0$ $(d)\ a=c$

(22) The sum of zeroes of a quadratic polynomial x^2-4x+3 is

$(a)\ 3$ $(b)\ 4$ $(c)\ -3$ $(d)\ -4$

(23) The sum of zeroes of a quadratic polynomial x^2-4 is

$(a)\ 2$ $(b)\ -2$ $(c)\ 4$ $(d)\ 0$

(24) The quadratic polynomial having zeroes 0 and $\sqrt{5}$ is

$(a)x^2+\sqrt{5}x$ $(b)x^2-\sqrt{5}x$ $(c)\ x^2-5x$ $(d)\ x^2+5x$

(25) If α,β are zeroes of a quadratic polynomial x^2-x-6 then $\alpha+\beta=$

$(a)1$ $(b)2$ $(c)\ 6$ $(d)\ -1$

(26) If α, β are zeroes of a quadratic polynomial x^2+2x-8 then $\alpha^2\beta+\alpha\beta^2=$

$(a)-8 \quad (b)-2 \quad (c)\ 16 \quad (d)\ -16$

(27) If α, β are zeroes of a quadratic polynomial x^2-3x+2 then $\alpha^3+\beta^3=$

$(a)1 \quad (b)3 \quad (c)\ 6 \quad (d)\ 9$

(28) If α, β are zeroes of a quadratic polynomial $3x^2+12x-12$ then

$(a)\ \alpha+\beta=\alpha\beta \quad (b)\alpha+\beta<\alpha\beta \quad (c)\ \alpha+\beta>\alpha\beta \quad (d)\ \alpha+\beta=-\alpha\beta$

(29) If α, β are zeroes of a quadratic polynomial $6x^2-5x+1$ then $\frac{1}{\alpha}+\frac{1}{\beta}=$

$(a)\ \frac{5}{6} \quad (b)\ \frac{1}{6} \quad (c)\ 5 \quad (d)\ -5$

(30) The sum of zeroes of a polynomial $kx^2-(k+1)x-3$ is $\frac{7}{6}$ then the value of k is

$(a)\ 7 \quad (b)\ 6 \quad (c)\ -7 \quad (d)-6$

(31) The sum of zeroes of a polynomial $x^2+(a+1)x+b$ are 3 and 4 then the values of a,b are

$(a)\ 8,12 \quad (b)\ 8,-12 \quad (c)\ -8,12 \quad (d)-8,-12$

(32) One zero of a polynomial $x^2-2kx+8$ is 2 then $k=$

$(a)3 \quad (b)\ 2 \quad (c)-4 \quad (d)4$

(33) The sum of the zeroes of a polynomial $2x^3+kx^2-14x+8$ is $\frac{5}{2}$ then $k=$

$(a)\ 7 \quad (b)-2 \quad (c)\ -7 \quad (d)-5$

(34) If α, β, γ are zeroes of a polynomial x^3+4x^2+5x-2 then $\alpha\beta+\beta\gamma+\gamma\alpha=$

$(a)5 \quad (b)-5 \quad (c)\ 4 \quad (d)\ -4$

(35) If α, β, γ are zeroes of a polynomial $2x^3+8x^2-6x-2$ then $\alpha+\beta+\gamma=$

$(a)5 \quad (b)-5 \quad (c)\ 4 \quad (d)\ -4$

(36) If α, β, γ are zeroes of a polynomial x^3+5x^2+kx+4 and $\alpha\beta+\beta\gamma+\gamma\alpha=0$ then the value of k is

$(a)2 \quad (b)-2 \quad (c)\ 0 \quad (d)\ -1$

(37) If α, β, γ are zeroes of a polynomial x^3+3x^2-x-2 then $\alpha\beta\gamma=$

$(a)2 \quad (b)-2 \quad (c)3 \quad (d)\ -1$

(38) If $p(x)=g(x)q(x)+r(x)$ and $\deg(p(x))=\deg(q(x))$ then $\deg(g(x))=$

$(a)\ 0 \quad (b)\ 1 \quad (c)\ 2 \quad (d)\ 3$

(39) If 0 is the two zeroes of a polynomial ax^3+bx^2+cx+d then third zero is

$(a)\frac{b}{a} \quad (b)-\frac{b}{a} \quad (c)\frac{c}{a} \quad (d)\ -\frac{c}{a}$

(40) $p(x)=x^2-5x+6, q(x)=x-2$ and $r(x)=0$ then $g(x)=$

$(a)\ x-3\ \ (b)\ x-4\ \ (c)\ x+2\ \ (d)\ x+3$

(41) The degree of a polynomial $p(x)=5x^3-x^2+6x-7$ is

$(a)1 \quad (b)2 \quad (c)3 \quad (d)4$

(42) The coefficient of x^5 in $p(x)=5x^7-6x^5+7x-6$ is

$(a)5 \quad (b)6 \quad (c)-6 \quad (d)7$

(43) The degree of a constant polynomial is

$(a)1 \quad (b)2 \quad (c)3 \quad (d)0$

(44) The degree of a linear polynomial is

$(a)1 \quad (b)2 \quad (c)3 \quad (d)0$

(45) The zero of a linear polynomial $p(x)=2x-5$ is

$(a)\ \frac{2}{5} \quad (b)\ -\frac{2}{5} \quad (c)\ \frac{5}{2} \quad (d)-\frac{5}{2}$

(46) The quadratic polynomial having zeroes 1 and 3 is

$(a)\ x^2+4x+3 \quad (b)\ x^2-4x+3 \quad (c)\ x^2-4x-3 \quad (d)\ x^2+4x-3$

(47) The sum of zeroes of a polynomial $x^2+7x+10$ is

$(a)\ 7 \quad (b)\ 10 \quad (c)\ -7 \quad (d)\ -10$

(48) One zero of a polynomial $x^2-2x-15$ is -3 then another zero is

$(a)3 \quad (b)\ 5 \quad (c)-3 \quad (d)-5$

(49) If $(-1,0)$ is one point that cuts the X^- axis by the curve x^2-3x-4 then another point is

$(a)\ (-4,0) \quad (b)\ (4,0) \quad (c)\ (-3,0) \quad (d)\ (3,0)$

(50) If the curve x^2+6x+p touches the X^- axis at only one point then the value of p is

$(a)\ 9 \quad (b)\ -9 \quad (c)\ 3 \quad (d)\ -3$

(51) The maximum number of terms in the polynomial $p(x)$ of degree n is

$(a)\ 2n \quad (b)\ n \quad (c)\ n+1 \quad (d)\ n-1$

(52) The quadratic polynomial having zeroes $\sqrt{3}$ and $-\sqrt{3}$ is

$(a)\ x^2+3 \quad (b)\ x^2-3 \quad (c)\ x^2+9 \quad (d)\ x^2-9$

(53) If the quadratic polynomial $4x^2-4x+k$ has only zero then the value of k is

$(a)3 \quad (b)2 \quad (c)1 \quad (d)-1$

(54) The minimum number of points that the cubic polynomial cuts the X^- axis in

$(a)3 \quad (b)2 \quad (c)1 \quad (d)0$

(55) The maximum number of points that the cubic polynomial cuts the X^- axis in

$(a)\,3 \quad (b)\,2 \quad (c)\,1 \quad (d)\,0$

(56) If the constant term is zero in a cubic polynomial then the product of zeroes is

$(a)\ 0 \quad (b)\ 1 \quad (c)\ 2 \quad (d)$ not defined

(57) If α, β, γ are zeroes of a polynomial $x^3 + 4x^2 - 5x - 2$ then $\alpha\beta + \beta\gamma + \gamma\alpha =$

$(a)\,5 \quad (b)\,-5 \quad (c)\ 2 \quad (d)\ -4$

(58) If α, β, γ are zeroes of a polynomial $x^3 + 4x^2 - 5x - 2$ then $\frac{1}{\alpha\beta} + \frac{1}{\beta\gamma} + \frac{1}{\gamma\alpha} =$

$(a)\,2 \quad (b)\,-2 \quad (c)\ 4 \quad (d)\,-\frac{1}{2}$

(59) If two zeroes of a polynomial $x^3 - 5x^2 + 6x$ are $2, 3$ then third zero is

$(a)\ 0 \quad (b)\,-2 \quad (c)\ 1 \quad (d)\ -3$

(60) If two zeroes of a polynomial $(x-1)(x^2 - x - 6)$ are $-2, 3$ then third zero is

$(a)\ 0 \quad (b)\,2 \quad (c)\ 1 \quad (d)\ -3$

(61) If the coefficient of x is zero in a quadratic polynomial then the sum of zeroes is

$(a)\ 0 \quad (b)\ 1 \quad (c)\ 2 \quad (d)$ not defined

(62) If α, β, γ are zeroes of a polynomial $ax^3 + bx^2 + cx + d$ then $\alpha\beta + \beta\gamma + \gamma\alpha =$

$(a)\,\frac{b}{a} \quad (b)\,-\frac{b}{a} \quad (c)\,\frac{c}{a} \quad (d)\ \frac{d}{a}$

(63) If α, β are zeroes of a polynomial $x^2 - 5x + 4$ then $\frac{1}{\alpha} + \frac{1}{\beta} =$

$(a)\,-\frac{5}{4} \quad (b)\,\frac{4}{5} \quad (c)\,\frac{5}{4} \quad (d)\ -\frac{4}{5}$

(64) If the coefficient of x^2 is zero in a cubic polynomial then the sum of zeroes is

$(a)\ 0 \quad (b)\ 1 \quad (c)\ 2 \quad (d)$ not defined

(65) If $p(x) = g(x)q(x) + r(x)$ and $\deg(p(x)) = 5,$ and $\deg(q(x)) = 3$ then $\deg(g(x)) =$

$(a)\ 0 \quad (b)\ 1 \quad (c)\ 2 \quad (d)\ 3$

(66) If $p(x) = g(x)q(x) + r(x)$ and $\deg(g(x)) = 1,$ and $\deg(q(x)) = 3$ then $\deg(p(x)) =$

$(a)\ 5 \quad (b)\ 4 \quad (c)\ 2 \quad (d)\ 3$

(67) If $p(x) = g(x)q(x) + r(x)$ and $g(x)$ is a factor of $p(x)$ then $r(x) =$

$(a)\ 0 \quad (b)\ 1 \quad (c)\ x \quad (d)\ g(x)$

(68) 0 is the reminder when $p(x)=x^3-10x+k$ is divided by $(x-1)$ then the value of k is

$(a)\,43 \quad (b)\,7 \quad (c)\,9 \quad (d)\,5$

(69) If $a,b,c \in R$ and ax^3+bx^2+cx+d represents a cubic polynomial then

$(a)\ a=0 \quad (b)\ b=0 \quad (c)\ a\neq 0 \quad (d)\ d\neq 0$

(70) The product of zeroes of a cubic polynomial having $3x^3-5x^2-11x-3$ is

$(a)\frac{5}{3} \quad (b)-\frac{5}{3} \quad (c)-\frac{11}{3} \quad (d)1$

(71) The polynomial having zeroes $0, 1$ and -1 is

$(a)\ x^3-x^2+1 \quad (b)\ x^3+x^2 \quad (c)\ x^3-x^2 \quad (d)\ x^3-x$

(72) The quadratic polynomial having zeroes $\sqrt{2}+1$ and $\sqrt{2}-1$ is

$(a)\ x^2+2\sqrt{2}x+1 \quad (b)\ x^2-2\sqrt{2}x-1 \quad (c)\ x^2-2\sqrt{2}x+1 \quad (d)\ x^2+2\sqrt{2}x-1$

(73) The quadratic polynomial having zeroes 2 and -5 is

$(a)\ x^2-3x-10 \quad (b)\ x^2+3x-10 \quad (c)\ x^2-2x-5 \quad (d)\ x^2+2x+5$

(74) The zeroes of a quadratic polynomial $3x^2-10x+p$ are reciprocals then $p=$

$(a)\ 10 \quad (b)3 \quad (c)\frac{1}{3} \quad (d)\ -3$

(75) If α,β,γ are zeroes of a polynomial $p(x)=(x-1)(x-2)(x-3)$ then $\alpha^3+\beta^3+\gamma^3=$

$(a)9 \quad (b)27 \quad (c)\ 35 \quad (d)36$

ANSWERS

1. (B) 2. (C) 3. (C) 4. (B) 5. (C) 6. (D) 7. (D) 8. (D) 9. (D) 10. (A) 11. (C) 12. (A) 13. (A) 14. (C) 15. (D) 16. (B) 17. (B) 18. (D) 19. (D) 20. (B) 21. (C) 22. (B) 23. (D) 24. (B) 25. (A) 26. (C) 27. (D) 28. (A) 29. (C) 30. (B) 31. (C) 32. (A) 33. (D) 34. (A) 35. (D) 36. (C) 37. (A) 38. (A) 39. (B) 40. (A) 41. (C) 42. (C) 43. (D) 44. (A) 45. (C) 46. (B) 47. (C) 48. (B) 49. (B) 50. (A) 51. (C) 52. (B) 53. (C) 54. (C) 55. (A) 56. (A) 57. (B) 58. (B) 59. (A) 60. (C) 61. (A) 62. (C) 63. (C) 64. (A) 65. (C) 66. (B) 67. (A) 68. (C) 69. (C) 70. (D) 71. (C)72. (C) 73. (B) 74. (B) 75. (D)

4. PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

KEY POINTS :

1. An equation in the form of $ax+by+c=0$ where a, b and c are real numbers and a, b are not equal to zero is called a linear equation in two variables. Whereas in pair of linear equations in two variables, we deal with two such equations.
2. A pair of linear equations in two variables x and y can be represented algebraically as $a_1x+b_1y+c_1z=0$, $a_2x+b_2y+c_2z=0$ where a_1, a_2, b_1, b_2, c_1 and c_2 are real numbers such that $a_1^2+b_1^2\neq 0$, $a_2^2+b_2^2\neq 0$.
3. The pair of linear equations can be solved and represented by two methods :
   1. Graphical Method
   2. Algebraic Method
4. To solve a pair of linear equations in two variables by graphical method, we first draw the lines represented by them.
   i. If the pair of lines intersects at a point, then we say that the pair is consistent and the coordinates of the point provide us the unique solution.
   ii. If the pair of lines are parallel, then the pair has no solution and is called inconsistent pair of equations.
   iii. If the pair of lines are coincident, then it has infinitely many solutions, each point on the line being of solution. In this case, we say that the pair of linear equations is consistent with infinitely many solutions.
5. To solve a pair of linear equations in two variables algebraically, we have following methods:
   i. Substitution method
   ii. Elimination method
   iii. Cross multiplication method
6. If $a_1x + b_1y + c_1 = 0$, $a_2x + b_2y + c_2 = 0$ is a pair of linear equations in two variables x and y such that

   i. If $\frac{a_1}{a_2}\neq\frac{b_1}{b_2}$ (or) $a_1b_2-a_2b_1\neq 0$ then the pair of linear equations is consistent and has a unique solution.

   ii. If $\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$, then the pair of linear equations is inconsistent and has no solution.

   iii. If $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$, then the pair of linear equations is dependent and consistent with infinitely many solutions.

Method of cross-multiplication:

The pair of equations has exactly one (unique) solution if $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ is given by

$x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$, $y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$.

SOLVED EXAMPLES

1. The point of intersection of the lines $x + y = 2024$, $x - y = 2022$ is…….

   1) (2022, 1) 2) (2023, 1) 3) (2024, 1) 4) (2020, 1)

   Ans: (2)

   Sol: Here, $\frac{a_1}{a_2} = \frac{1}{1} = 1$

   $\frac{b_1}{b_2} = \frac{1}{-1} = -1$

   $\therefore \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$, hence the given pair of lines has a unique solution.

   $\therefore$ Using the formula $x = \frac{b_1c_2 - b_2c_1}{a_1b_2 - a_2b_1}$, $y = \frac{c_1a_2 - c_2a_1}{a_1b_2 - a_2b_1}$, we get the solution as $x = 2023$, $y = 1$.

   $\therefore$ $(2023,1)$ is the required point of intersection.

2. The points of intersection of $y = 5x^2 - 6x + 1$ with x-axis are …….

   1) $(3,0), (2,0)$ 2) $\left(\frac{1}{2},0\right), \left(\frac{1}{4},0\right)$ 3) $(1,0), \left(\frac{1}{5},0\right)$ 4) $\left(-\frac{1}{2},0\right), \left(\frac{1}{3},0\right)$

   Ans: (3)

   Sol: For the point on x-axis, $y = 0$.

   $\therefore 5x^2 - 6x + 1 = 0$

   $\Rightarrow 5x^2 - 5x - x + 1 = 0$

   $\Rightarrow 5x(x-1) - 1(x-1) = 0$

   $\Rightarrow (x-1)(5x-1) = 0$

   $\Rightarrow x = 1, \frac{1}{5}$.

   $\therefore (1,0), \left(\frac{1}{5},0\right)$ are the required points of intersection.

3. If $3a+2b=ab$ then the line $\frac{x}{a}+\frac{y}{b}=1$ passes through …….

1) (3, 2) 2) (2, 2) 3) (3, 3) 4) (2, 3)

Ans: (4)

Sol: Given that $\frac{x}{a}+\frac{y}{b}=1 \Rightarrow bx+ay=ab \Rightarrow bx+ay=3a+2b$

Comparing terms on both sides, we get: $ay=3a,\ bx=2b \Rightarrow y=3,\ x=2.$

4. If $\frac{10}{x+y}+\frac{2}{x-y}=4$ and $\frac{15}{x+y}-\frac{5}{x-y}=-2$, then

1) $x=3,\ y=2$ 2) $x=3,\ y=-2$ 3) $x=-3,\ y=2$ 4) $x=-3,\ y=-2$

Ans: (1)

Sol: Let $\frac{1}{x+y}=a$ and $\frac{1}{x-y}=b$, then the given equations become as

$10a+2b=4$ and $15a-5b=-2$, Solving these equations, we get: $a=\frac{1}{5}$ and $b=1.$

$\Rightarrow \frac{1}{x+y}=\frac{1}{5}$ and $\frac{1}{x-y}=1$

$\Rightarrow x+y=5$ and $x-y=1$

Solving these equations, we get: $x=3,\ y=2$ Ans.

5. The pair of the lines $3x+4y-2=0$ and $6x+8y=4$ has …….

1) unique solution 2) two solutions

3) infinitely many solutions 4) no solution

Ans: (3)

Sol: Here, $\frac{a_1}{a_2}=\frac{3}{6}=\frac{1}{2},$

$\frac{b_1}{b_2}=\frac{4}{8}=\frac{1}{2},$

$\frac{c_1}{c_2}=\frac{-2}{-4}=\frac{1}{2}.$

$\therefore \frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$

Therefore, the given pair of the lines is dependent, consistent and has infinitely many solutions.

6. The pair of the lines $2x+y-5=0$ and $3x-2y-4=0$ has …….

1) unique solution 2) two solutions

3) infinitely many solutions 4) no solution

Ans: (1)

Sol: Here, $\frac{a_1}{a_2}=\frac{2}{3}$,

$\frac{b_1}{b_2}=\frac{1}{-2}=-\frac{1}{2}$,

$\frac{c_1}{c_2}=\frac{-5}{-4}=\frac{5}{4}$.

$\therefore \quad \frac{a_1}{a_2}\neq\frac{b_1}{b_2}$.

Therefore, the given pair of the lines has a unique solution.

7. The pair of the lines $4x-6=15$ and $2x-3y=15$ has …….

1) unique solution 2) two solutions

3) infinitely many solutions 4) no solution

Ans: (4)

Sol: Here, $\frac{a_1}{a_2}=\frac{4}{2}=2,,$

$\frac{b_1}{b_2}=\frac{-6}{-3}=2,$

$\frac{c_1}{c_2}=\frac{-15}{-5}=3.$

$\therefore \quad \frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$

Therefore, the given pair of the lines has no solution.

8. For what values of k the equations $9x+4y=9,\ 7x+ky=5$ have no solution?

Sol: The given equations will have no solution, if $\frac{a_1}{a_2}=\frac{b_1}{b_2}\neq\frac{c_1}{c_2}$

$\Rightarrow \quad \frac{9}{7}=\frac{4}{k}\neq\frac{9}{5} \qquad \Rightarrow \quad 9k=28 \qquad \Rightarrow \quad k=\frac{28}{9}$ Ans.

9. Find the value of k for which the system $kx+3y=5$ and $2x+y=1$ has (i) unique solution (ii) no solution.

Sol: Here, $a_1 = k,\ b_1 = 3,\ c_1 = -5$ and $a_2 = 2, b_2 = 1,\ c_2 = -1$

(i) The given pair of equations will have a unique solution,

If $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

i.e., $\frac{k}{2} \neq \frac{3}{1}$

i.e., $k \neq 6$. Ans.

(ii) The given pair of equations will have no solution,

If $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

i.e., $\frac{k}{2} = \frac{3}{1} \neq \frac{-5}{-1}$

i.e., $k = 6$. Ans.

***Note*:** In this question,

$$\frac{b_1}{b_2} \neq \frac{c_1}{c_2}.$$

Therefore, this pair of equations can never have infinitely many solutions. i.e., there exists no value of k for which this system has an infinite number of solutions.

10. 3 chairs and 2 tables cost Rs.700 and 5 chairs and 3 tables cost Rs.110. What is the cost of 2 chairs and 2 tables?

Sol: Let the cost of one chair be Rs. x and the cost of one table is Rs. y. Then according to the given conditions of the problem, we can write :

$3x + 2y = 700$ and $5x + 3y = 110$.

Solving the above equations, we get $x = 100$ and $y = 200$.

$\therefore$ Cost of one chair = Rs.100 and Cost of one table = Rs. 200.

$\therefore$ The cost of 2 chairs and 2 tables $= 2x + 2y = 2 \times 100 + 2 \times 200$ = Rs. 600 Ans.

PRACTICE BITS

1. Which of the following is not a linear equation?

   1) $3+4x=y+5$ 2) $x-2y=y-x$ 3) $9x+y=10$ 4) $2-x=y^2+5$

   Ans: (4)

2. Which of the following is an equation in single variable?

   1) $2y+1=x-3$ 2) $2x-3=5t$ 3) $3y-1=x^2$ 4) $y^2-y+2=0$

   Ans: (4)

3. The equation $x-3y=4$ has …….

   1) unique solution 2) two solutions

   3) infinitely many solutions 4) no solution

   Ans: (3)

4. The point of intersection of the lines $3x-5y=-1,\ 2x-y=-3$ is…….

   1) (1, 2) 2) (–2, –1) 3) (–1, 2) 4) (1, –2)

   Ans: (2)

5. The point of intersection of the lines $3x+2y=14,\ -x+4y=7$ is…….

   1) (3, 2) 2) $\left(3, \frac{5}{2}\right)$ 3) (–3, 2) 4) $\left(3, \frac{1}{2}\right)$

   Ans: (2)

6. The point of intersection of the lines $2x+3y=31,\ 17x-11y=8$ is…….

   1) (5, 7) 2) (–5, 7) 3) (–5, –7) 4) (5, –7)

   Ans: (1)

7. The point of intersection of the lines $\sqrt{2}x-\sqrt{3}y=0,\ \sqrt{5}x+\sqrt{2}y=0$ is…….

   1) $\left(\sqrt{3},\sqrt{5}\right)$ 2) (0, 0) 3) $\left(\sqrt{2},\sqrt{3}\right)$ 4) (2, 1)

   Ans: (2)

8. If $2x+y=35$ and $3x+4y=65$, then find the value of $\frac{x}{y}$.

   1) 3 2) 2 3) 4 4) 6

   Ans: (1)

9. If $2x+3y=11$ and $2x-y=1$, then find the value of $\frac{y}{x}$.

1) 3 2) 2 3) 4 4) 6

Ans: (1)

10. If $2x-3y=1.3$ and $y-x=-0.5$, then find the value of xy.

1) 0.2 2) -0.3 3) -0.6 4) -0.06

Ans: (4)

11. If $ax+by=a-b$ and $bx-ay=a+b$, then find the value of xy.

1) 1 2) -1 3) 2 4) -3

Ans: (2)

12. If $\frac{11}{v}-\frac{7}{u}=1$ and $\frac{9}{v}-\frac{4}{u}=6$, then find the value of uv.

1) $\frac{1}{2}$ 2) $\frac{1}{3}$ 3) $\frac{1}{5}$ 4) $\frac{1}{6}$

Ans: (4)

13. Solve the equations $3(2u+v)=7uv$ and $3(u+3v)=11uv$.

1) $\left(1,\frac{1}{2}\right),(0,0)$ 2) $\left(1,\frac{3}{2}\right),(0,0)$ 3) $(1,2),(0,0)$ 4) $(1,2)$

Ans: (2)

14. Solve the equations $\frac{3}{x}-\frac{1}{y}=-9$ and $\frac{2}{x}+\frac{3}{y}=5$.

1) $\left(\frac{1}{2},\frac{1}{3}\right)$ 2) $\left(-\frac{1}{2},\frac{1}{3}\right)$ 3) $\left(\frac{1}{2},-\frac{1}{3}\right)$ 4) $\left(-\frac{1}{2},-\frac{1}{3}\right)$

Ans: (2)

15. Solve the equations $\frac{4}{x}+5y=7$ and $\frac{3}{x}+4y=5$.

1) $\left(\frac{1}{3},-1\right)$ 2) $\left(-\frac{1}{2},\frac{1}{3}\right)$ 3) $\left(\frac{1}{3},1\right)$ 4) $\left(-\frac{1}{2},-\frac{1}{3}\right)$

Ans: (1)

16. Solve the equations $\frac{6}{x+y}=\frac{7}{x-y}+3$ and $\frac{1}{2(x+y)}=\frac{1}{3(x-y)}+3;\ x+y\neq 0,\ x-y\neq 0.$

1) $\left(\frac{4}{5},1\right)$ 2) $\left(-\frac{4}{5},1\right)$ 3) $\left(-\frac{5}{4},-\frac{1}{4}\right)$ 4) $\left(\frac{5}{4},\frac{1}{4}\right)$

Ans: (3)

17. Solve the equations $\frac{2}{x}+\frac{3}{y}=\frac{9}{xy}$ and $\frac{4}{x}+\frac{9}{y}=\frac{21}{xy}$, $x\neq 0,\ y\neq 0$.

1) $(-1, 3)$ 2) $(-1, -3)$ 3) $(1, -3)$ 4) $(1, 3)$

Ans: (4)

18. If $\frac{2}{\sqrt{x}}+\frac{3}{\sqrt{y}}=2$ and $\frac{4}{\sqrt{x}}-\frac{9}{\sqrt{y}}=-1$, then

1) $x=2,\ y=3$ 2) $x=4,\ y=9$ 3) $x=2,\ y=9$ 4) $x=4,\ y=3$

Ans: (2)

19. The pair of the lines $3x-4y=-7$ and $3x-4y=-9$ has …….

1) unique solution 2) two solutions

3) infinitely many solutions 4) no solution

Ans: (4)

20. If $\frac{a_1}{a_2}=\frac{b_1}{b_2}=\frac{c_1}{c_2}$ where $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are two linear equations,

then the equations are

(1) consistent and have a unique solution (2) consistent and have infinite solutions

(3) consistent and have finite solutions (4) Inconsistent

Ans: (2)

MORE QUESTIONS FOR PRACTICE

1. If $7x-5y=2$ and $3x+y=4$, then $x=?$

(1) 3 (2) -3

(3) 1 (4) 2

2. If $x+7y=7$ and $7x-3y=-3$, then $y=?$

(1) 1 (2) 7

(3) -3 (4) 0

3. Solution of the equations $3x-4y=7$ and $2x+3y=-1$, then is not equal to……

(1) $\frac{22}{22}, \frac{33}{33}$ (2) $\frac{33}{33}, -\frac{44}{44}$

(3) $\frac{44}{44}, -\frac{77}{77}$ (4) $\frac{77}{77}, -\frac{11}{11}$

4. $\sqrt{3}x+\sqrt{2}y=2\sqrt{2};\ \sqrt{2}x-\sqrt{3}y=3\sqrt{3}$ implies $x=$, $y=$

(1) 1, 2 (2) $\sqrt{6}, -1$ (3) 2, 1 (4) $\sqrt{2}, \sqrt{3}$

5. Solve the pair of equations $2x+3y=11$ and $2x-y=1$.

(1) $x=1,\ y=2$ (2) $x=1,\ y=3$

(3) $x=2,\ y=1$ (4) no solution

6. Solve the pair of equations $3x+2y=11$ and $2x+3y=4$.

(1) $x=-5,\ y=2$ (2) $x=5,\ y=2$

(3) $x=5,\ y=-2$ (4) no solution

7. If $\frac{1}{2x}-\frac{1}{y}=-1$ and $\frac{1}{x}+\frac{1}{2y}=8$ where $x\neq 0$ and $y\neq 0$ then the vlues of x and y are

(1) $\frac{1}{2}, \frac{1}{3}$ (2) $\frac{1}{6}, \frac{1}{4}$ (3) $\frac{1}{4}, \frac{1}{3}$ (4) None

8. If $\frac{10}{x+y}+\frac{2}{x-y}=4$ and $\frac{15}{x+y}-\frac{9}{x-y}=-2$ then $x+y=$

(1) $\frac{15}{4}$ (2) $\frac{25}{4}$ (3) $\frac{5}{4}$ (4) None

9. If $\frac{5}{x-1}+\frac{1}{y-2}=2$ and $\frac{6}{x-1}-\frac{3}{y-2}=1$ then $x=$

(1) 7 (2) 6 (3) 5 (4) 4

10. If $\frac{2}{\sqrt{x}}+\frac{3}{\sqrt{y}}=2$ and $\frac{4}{\sqrt{x}}-\frac{9}{\sqrt{y}}=-1$ then $x^2=$

(1) 4 (2) 16 (3) 9 (4) None

11. If $\frac{xy}{x+y}=\frac{6}{5}$ and $\frac{xy}{y-x}=6$ where $x\neq 0$ and $y\neq 0$ then the value of $y-x=$

(1) 1 (2) −1 (3) 0 (4) 2

12. If the system of linear equations $x - ky = 2$ and $3x + 2y = -5$ has a unique solution then k =

(1) $\frac{3}{2}$ (2) $\frac{2}{3}$ (3) −6 (4) 6

13. If the system of linear equations $3x - 4y + 7 = 0$ and $kx + 3y - 5 = 0$ has no solution then k =

(1) $\frac{9}{4}$ (2) $-\frac{9}{4}$ (3) $\frac{4}{9}$ (4) $-\frac{4}{9}$

14. If the system of linear equations $5x+2y=k$ and $10x+4y=3$ has infinitely many solutions, then k =

(1) $\frac{3}{2}$ (2) $\frac{2}{3}$ (3) $-\frac{3}{2}$ (4) $-\frac{2}{3}$

15. The value of k for which the pair of equations $3x+4y+2=0$ and $9x+12y+k=0$ represent coincident lines, is

(1) 2 (2) 3 (3) 6 (4) 12

16. The value of k for which the pair of equations $kx-y=2$ and $6x-2y=3$ has a unique solution, is

(1) $k=3$ (2) $k\neq 3$ (3) $k=0$ (4) $k\neq 0$

17. The pair of equations $y=0$ and $y=-7$ has

(1) unique solution (2) two solutions

(3) infinitely many solutions (4) no solution

18. If the system of linear equations $2x+3y=7$ and $2\alpha x+(\alpha+\beta)y=28$ hasinfinitely many solutions then α =_____ and β = _____

(1) 3, 6 (2) 2, 4 (3) 4, 8 (4) None

19. If the system of linear equations $ax+by=c$ and $lx+my=n$ have a unique solution which of the following is true

(1) $am \neq bl$ (2) $am = bl$ (3) $al \neq bm$ (4) None

20. If the system of linear equations $\alpha x + 3y = \alpha - 3$ and $12x + \alpha y = \alpha$ has no solution then the value of α = ____

(1) 4 (2) −4 (3) 5 (4) −6

21. The sum of the numerator and denominator of a fraction is 12. If the denominator is increased by 3, the fraction becomes $\frac{1}{2}$. Then the fraction is

(1) $\frac{5}{7}$ (2) $\frac{7}{5}$ (3) $-\frac{5}{7}$ (4) $-\frac{7}{5}$

22. On selling a T.V. at 5% gain and a fridge at 10% gain, a shopkeeper gains Rs.2000. But if he sells the T.V at 10% gain and a fridge at 5% loss, he gains Rs.1500 on the transaction. Then the original price of T.V. is Rs. _____

(1) 15000 (2) 25000 (3) 20000 (4) None

23. The sum of a two digit number and the number formed by interchanging the digits is 132. If 12 is added to the number, the new number becomes 5 times the sum of the digits. Then the number is

(1) 48 (2) 84 (3) 66 (4) both (1) & (2)

24. If twice the son's age in years is added to the father's age, the sum is 70. But if twice the father's age is added to the son's age, the sum is 95. Then the age ofson is

(1) 10 years (2) 15 years (3) 5 years (4) None

25. Ten years later, A will be twice as old as B and five years ago, A was three times as old as B. then the present ages of A and B in years

(1) 50, 20 (2) 40, 30 (3) 60, 10 (4) None

26. Five years ago, Ravi was thrice old as Raju. Ten years later, Ravi will twice as old as Raju. Then the age of Raju is

(1) 35 (2) 30 (3) 25 (4) 20

27. The value of "k" for which the system of equations $x+2y=5$ and $3x+ky=-15$ has no solution.

(1) 6 (2) -6 (3) $\frac{3}{2}$ (4) None

28. The area of the triangle formed by the line $\frac{x}{a}+\frac{y}{b}=1$ with coordinate axes is__sq. units.

(1) ab (2) 2ab (3) $\frac{1}{2}ab$ (4) $\frac{1}{4}ab$

29. The area of the triangle formed by the lines $y=x,\ x=6$ and $y=0$ is__sq. units.

(1) 36 (2) 18 (3) 9 (4) 72

30. The area of the triangle formed by the lines $x=3, y=4$ and $x=y$ is__sq.units.

(1) $\frac{1}{2}$ (2) 1 (3) 2 (4) None

31. The denominator of a fraction is 4 more than twice the numerator. When both the numerator and denominator are decreased by 6 , then the denominatorbecomes 12 times the numerator then the fraction is

(1) $\frac{7}{18}$ (2) $\frac{5}{18}$ (3) $\frac{7}{15}$ (4) None

32. A fraction becomes$\frac{4}{5}$, if 1 is added to both numerator and denominator. If, however, 5 is subtracted from both numerator and denominator the fraction becomes $\frac{1}{2}$, then that fraction is

(1) $\frac{5}{9}$ (2) $\frac{7}{9}$ (3) $\frac{8}{9}$ (4) $\frac{4}{9}$

33. 3 bags and 4 pens together cost Rs. 257 where as 4 bags and 3 pens together costRs. 324. Then the cost of 1 book and 2 pens is

(1) 156 (2) 157 (3) 155 (4) 154

34. 4 chairs and 3 tables cost Rs. 2100 and 5 chairs and 2 tables cost Rs. 1750. Then the cost of a chair

(1) 150 (2) 200 (3) 250 (4) 300

35. If $\frac{4}{x}+3y=14$ and $\frac{3}{x}-4y=23$ the value of y =

(1) 2 (2) -2 (3) $\frac{1}{5}$ (4) $-\frac{1}{5}$

36. The larger of two supplementary angles exceeds the smaller by 18^0. Then the larger angle is

(1) 99^0 (2) 81^0 (3) 72^0 (4) 90^0

37. The system of linear equations $5x - 4y + 8 = 0$ and $7x + 6y - 9 = 0$

37. The system of linear equations $5x - 4y + 8 = 0$ and $7x + 6y - 9 = 0$

(1) intersect at a point (2) parallel
(3) coincident (4) None

38. The system of linear equations $9x + 3y + 12 = 0$ and $18x + 6y + 24 = 0$
(1) intersect at a point (2) parallel
(3) coincident (4) none

39. If a pair of linear equations in two variables is consistent, then the lines represented by two equations are
(1) intersecting (2) parallel
(3) coincident (4) intersecting or coincident

40. If the system of equations $2x+3y=7$ and $(a+b)x+(2a-b)y=21$ has infinitely many solutions, then a =_____ and b = _____
(1) 1, 5 (2) 5, 1 (3) −1, 5 (4) 5, −1

41. 5 pencils and 7 pens together cost Rs. 50 where as 7 pencils and 5pens together cost Rs.46, then the cost of 1 pencil is__rupees.
(1) 1 (2) 2 (3) 3 (4) 4

42. The area of a rectangle gets reduced by 80 sq. units if its length is reduced by 5 units and breadth is increased by 2 units. If we increase the length by 10 units and decrease the breadth by 5 units, the area will increases by 50 sq. units, then the length of the rectangle =__units
(1) 20 (2) 21 (3) 19 (4) None

43. The cost of 2 kg apples and 1 kg of grapes on a day was found to be Rs.160. After a month, the cost of 4 Kg of apples and 2kg of grapes is the Rs.300. Which of the following equations represent this situations
(1) $x + 2y = 160, 4x + 2y = 300$ (2) $2x + y = 160, 2x + 4y = 300$
(3) $2x + y = 160, 4x + 2y = 300$ (4) None

44. The coach of a cricket team buys 3 bats and 6 balls for Rs.3900. Later he buys another bat and 3 more balls of the same kind for Rs.1300which of the following equations represent this situation.
(1) $3x + 6y = 3900, x + 3y = 1300$ (2) $6x + 3y = 3900, x + 3y = 1300$
(3) $3x + 6y = 3900, 3x + y = 1300$ (4) None

45. 10 students of class 10^{th} took part in Mathematics quiz. If the number of girls is 4 more than the number of boys. Which of the following pairs represent the situation?

(1) $x + y = 10, x - y = 4$ (2) $x + y = 4, x - y = 10$
(3) $4x + y = 4, x - y = 4$ (4) None

46. Rani went to a bank to withdraw Rs.2000. She asked the cashier to give the cash in Rs.50 and Rs.100 notes only. Rani got 25 notes in all. Then number of Rs.50 those Rani got…..

(1) 12 (2) 11 (3) 10 (4) 9

47. The ratio of incomes of two persons is 9:7 and the ratio of their expenditures is 4:3. If each of them manages to save Rs.2000 per month, their monthly incomes are

(1) 18000, 14000 (2) 36000, 28000 (3) 9000, 7000 (4) 27000, 21000

48. Two angles are complementary. The larger angle is 3^0 less than twice the measure of the smaller angle. Then the greater angle is

(1) 54^0 (2) 36^0 (3) 41^0 (4) 59^0

49. If the sum of the ages of a father and his son is 65 years and twice the difference of their ages is 50 years, then the age of the father in years is

(1) 45 (2) 40 (3) 50 (4) 55

50. 3 note books and 1 pen costs Rs.100, 5 note books and 2 pens costs Rs.170 then 2 note books and 5 pens costs how much?

(1) 140 (2) 120 (3) 130 (4) 110

Answers

1	2	3	4	5	6	7	8	9	10
3	**1**	**1**	**2**	**2**	**3**	**2**	**1**	**4**	**2**
11	12	13	14	15	16	17	18	19	20
1	**3**	**2**	**1**	**3**	**2**	**4**	**3**	**1**	**1**
21	22	23	24	25	26	27	28	29	30
1	**3**	**1**	**2**	**1**	**4**	**1**	**3**	**2**	**4**
31	32	33	34	35	36	37	38	39	40
1	**2**	**3**	**1**	**2**	**1**	**1**	**2**	**4**	**2**
41	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
3	**1**	**3**	**1**	**1**	**3**	**1**	**4**	**1**	**4**

5. QUADRATIC EQATIONS

Quadratic equation: The equation is of the form $ax^2+bx+c=0, a\neq 0$ and $a,b,c\in R$ is called a **quadratic equation**.

Eg: $3x^2-4x+1=0,\ x^2-1=0,\ x^2+2x+1=0$ are quadratic equations.

Zero or root of a Quadratic equation: A real number α is called a **zero or root** of a quadratic equation ,if $a\alpha^2+b\alpha+c=0$.

Note: i. A quadratic equation have at most 2 zeros.

ii. If α and β are the zeros of a quadratic equation $ax^2+bx+c=0$ then $\alpha+\beta=-\frac{b}{a}$ and $\alpha\beta=\frac{c}{a}$.

iii. The quadratic equation whose roots are α and β is $x^2-(\alpha+\beta)x+\alpha\beta=0$.

iv. The cubic polynomial whose roots are α,β and γ is

$f(x)=x^3-(\alpha+\beta+\gamma)x^2+(\alpha\beta+\beta\gamma+\gamma\alpha)x-\alpha\beta\gamma$

v. If $ax^2+bx+c=0, a\neq 0$, is factorisable into a product of two linear factors, then the roots of the quadratic equation $ax^2+bx+c=0$ can be found by equating each factor to zero.

vi. The roots of a quadratic equation can also be found by using the method of completing the square.

vii. The roots of a quadratic equation $ax^2+bx+c=0, a\neq 0$, can be found by using the formula $\frac{-b\pm\sqrt{b^2-4ac}}{2a}$.

viii. Nature of the roots of quadratic equation $ax^2+bx+c=0, a\neq 0$, depends upon the value of b^2-4ac, which is known as the discriminate of the quadratic equation.

ix. The quadratic equation $ax^2+bx+c=0, a\neq 0$, has

(a). Two distinct real roots, if $b^2-4ac>0$

(b). Two equal real roots, if $b^2-4ac=0$

(c). No real roots or pair of conjugate complex roots if $b^2-4ac<0$.

Solved problems:

Problem: (1) If $(m+1)x^3+6x^2+5x=16$ represents the Q.E then the value of m is

$(a)1 \quad (b)-1 \quad (c)2 \quad (d)0$

Solution: The given equation contains 3 as exponent of the highest degree term, hence degree of the equation is $(m+1)x^3+6x^2+5x=16$ is 3

Since $(m+1)x^3+6x^2+5x=16$ represents the Q.E, it must have degree 2 only when $m+1=0$

$\Rightarrow m=-1$.

Ans: option (b)

Problem: (2) The roots of the equation $3x^2+2x-1=0$ are

$(a)-1,\frac{1}{3} \quad (b)-1,-\frac{1}{3} \quad (c)3,-1 \quad (d)-3,-1$

Solution: If α and β are the roots of the equation $3x^2+2x-1=0$, then $\alpha+\beta=-\frac{b}{a}$ and $\alpha\beta=\frac{c}{a}$.

By inspection it is observed that $\alpha = -1$ and $\beta = \frac{1}{3}$

Ans: option (a)

Problem: (3) The sum of roots of the equation $3x^2 + 2x - 1 = 0$ is

$(a) -\frac{2}{3} \quad (b) -\frac{4}{3} \quad (c)\, 2 \quad (d) -4$

Solution: If α and β are the roots of the equation $3x^2 + 2x - 1 = 0$ then $\alpha + \beta = -\frac{b}{a}$ and $\alpha\beta = \frac{c}{a}$.

By inspection it is observed that $\alpha = -1$ and $\beta = \frac{1}{3}$

$\therefore \alpha + \beta = -\frac{2}{3}$

Ans: option (a)

MULTIPLE CHOICE QUESTIONS

(1) Which of the following is a Q.E

$(a) 5 + \frac{3}{x} = x^2 \quad (b) x^2 + \frac{1}{x^2} = \frac{17}{4} \quad (c)\, x(x+3) = 6x + 3 \quad (d)\ x(2x+3) = 2x^2 - 7$

(2) Which of the following is a Q.E

$(a) x^2 - 6x - 4 = 0 \quad (b)\ 2x^2 = 7x \quad (c)\ (2x+1)(3x+2) = 0 \quad (d)$ All the above

(3) Which of the following is not a Q.E

$(a)\ x(x-3) = x^2 + 7 \quad (b)\ x(x-5) = 2x^2 + 4 \quad (c)\, (2x+1)(3x+2) = 0 \quad (d)$ All the above

(4) For what value of a, $ax^2 + bx + c = 0$ is not a Q.E

$(a) 1 \quad (b) 2 \quad (c) 3 \quad (d) 0$

(5) Which of the following is a Q.E

$(a)(x+3)^3 = x + 4 \qquad (b)\, (x-2)^2 + 1 = 2x - 3$

$(c)\, x(x+1) + 8 = (x+2)(x-2) \quad (d)\, (x+2)^2 - (x-2)^2 = 0$

(6) If $(m+1)x^3 + 6x^2 + 5x = 16$ represents the Q.E then the value of m is

$(a) 1 \quad (b)\ -1 \quad (c) 2 \quad (d) 0$

(7) If $a\,x(x^2 - 4) + dx = 2x^3 + bx^2 + 10,\ b \neq 0$ represents the Q.E then the value of a is

$(a) 1 \quad (b)\ -1 \quad (c) 2 \quad (d) 0$

(8) The product of two consecutive positive numbers is 132 then the Q.E to find the numbers is

$(a)\ x^2 + x - 132 = 0 \quad (b)\ x^2 - x + 132 = 0 \quad (c)\ x^2 - x - 132 = 0 \quad (d)\ x^2 + x + 132 = 0$

(9) The product of two consecutive odd numbers is 399 then the Q.E to find the numbers is

$(a)\ x^2 + 2x - 399 = 0 \quad (b)\ x^2 + 2x + 399 = 0 \quad (c)\ x^2 + x - 399 = 0 \quad (d)\ x^2 - 2x + 399 = 0$

(10) The product of two consecutive even numbers is 120 then the Q.E to find the numbers is

$(a)\ x^2+4x-120=0$ $(b)\ x^2+2x-120=0$ $(c)\ x^2-4x+120=0$ $(d)\ x^2-2x+120=0$

(11) The sum of a number and its reciprocal is $\frac{5}{2}$ represents by the Q.E is

$(a)\ 2x^2-5x+1=0$ $(b)\ 2x^2-5x+2=0$ $(c)\ 2x^2+5x+2=0$ $(d)\ 5x^2-2x+5=0$

(12) The sum of a number and its reciprocal is 2 represents by the Q.E is

$(a)\ x^2-2x+1=0$ $(b)\ x^2+2x+1=0$ $(c)\ x^2+2x-1=0$ $(d)\ x^2+2x+2=0$

(13) The sum of squares of two consecutive odd numbers is 290 then the Q.E to find the numbers is

$(a)\ x^2+(x+2)^2=290$ $(b)\ x^2+(x+2)^2=290^2$

$(c)\ x^2-(x+2)^2=290$ $(d)\ x^2-(x+2)^2=290^2$

(14) The sum of a number and its square is 56 then the Q.E is

$(a)\ x^2+2x=56$ $(b)\ 2x^2+x=56$ $(c)\ x^2+x=56$ $(d)\ x^2-x=56$

(15) The present age of a father is twice his daughter. After four years the product of their ages is 306 then the Q.E for this data is

$(a)\ 3x^2-14x-162=0$ $(b)\ 3x^2-14x+145=0$

$(c)\ 3x^2+28x-306=0$ $(d)\ x^2+6x-145=0$

(16) The difference of two numbers is 5, the sum of their squares is 325 then the Q.E to find the big number is

$(a)\ x^2+(x+5)^2=325$ $(b)\ x^2+(x-5)^2=325$

$(c)\ x^2-(x-5)^2=325$ $(d)\ x^2-(x+5)^2=325$

(17) The roots of the Q.E $(x-4)(x+2)=0$ are

$(a)-4,2$ $(b)\ -4,-2$ $(c)\ 4,2$ $(d)\ 4,-2$

(18) The roots of the Q.E $x^2-5x+6=0$ are

$(a)-3,2$ $(b)\ -3,-2$ $(c)\ 3,2$ $(d)\ 3,-2$

(19) The roots of the Q.E $2x^2-6x=0$ are

$(a)-3,0$ $(b)\ 3,0$ $(c)\ 6,2$ $(d)\ 0,2$

(20) If α,β are the roots of the Q.E $x^2+6x+5=0$ then $\alpha+\beta=$

$(a)\ 5$ $(b)\ -6$ $(c)\ 6$ $(d)\ -1$

(21) If α,β are the roots of the Q.E $x^2-5x+6=0$ then $\alpha-\beta=$

$(a)\ 5$ $(b)\ 3$ $(c)\ 1$ $(d)\ -2$

(22) If α,β are the roots of the Q.E $x^2-3x-10=0$ then $\alpha^2+\beta^2=$

$(a)\ 25$ $(b)\ 10$ $(c)\ 21$ $(d)\ 29$

(23) If α,β are the roots of the Q.E $x^2-3x-4=0$ then $\alpha^3+\beta^3=$

$(a)\ 63$ $(b)\ 64$ $(c)\ -1$ $(d)\ 17$

(24) If α, β are the roots of the Q.E $x^2+4x+4=0$ then

$(a)\ \alpha=\beta$ $(b)\ \alpha=-2, \beta=-2$ $(c)\ \alpha+\beta=-4$ (d) All the above

(25) If α, β are the roots of the Q.E $x^2-6x+8=0$ then $\alpha\beta=$

$(a)\ 6$ $(b)\ -6$ $(c)\ -8$ $(d)\ 8$

(26) One root of the Q.E $2x^2-5x+3=0$ is

$(a)\ -1$ $(b)\ 1$ $(c)\ 0$ $(d)\ 2$

(27) If one root of the Q.E $x^2+2kx+16=0$ is 4 then the value of k is

$(a)\ 4$ $(b)\ -4$ $(c)\ 16$ $(d)\ 32$

(28) If one root of the Q.E $x^2+2\sqrt{2}\,x-k=0$ is $\sqrt{2}$ then the value of k is

$(a)\ 6$ $(b)\ -6$ $(c)\ 2\sqrt{2}$ $(d)\ -2\sqrt{2}$

(29) The Q.Es $ax^2+ax+8=0$ and $x^2+x+c=0$ have a common root 1 then the value of $a.c$ is

$(a)\ 8$ $(b)\ 4$ $(c)\ -8$ $(d)\ -4$

(30) For any value of a which of the following is one root of the Q.E

$(a+2)x^2-ax-2=0$

$(a)\ 0$ $(b)\ 2$ $(c)\ -1$ $(d)\ 1$

(31) If the roots of the Q.E $ax^2+bx+c=0$ are equal then $c=$

$(a)\ -\frac{b}{2a}$ $(b)\ \frac{b}{2a}$ $(c)\ -\frac{b^2}{4a}$ $(d)\ \frac{b^2}{4a}$

(32) The discriminate of the Q.E $ax^2+bx+c=0$ is

$(a)\ b-4ac$ $(b)\ b^2-4c$ $(c)\ b^2-4ac$ $(d)\ b^2+4ac$

(33) If the roots of the Q.E $ax^2+bx+c=0$ are equal then

$(a)\ b^2-4ac\le 0$ $(b)\ b^2-4ac<0$ $(c)\ b^2-4ac>0$ $(d)\ b^2-4ac=0$

(34) If the roots of the Q.E $ax^2+bx+c=0$ are equal then one root is

$(a)\ -\frac{b}{2a}$ $(b)\ \frac{b}{2a}$ $(c)\ -\frac{b^2}{4a}$ $(d)\ \frac{b^2}{4a}$

(35) The product of the digits in a two digit number is 6, if we add 9 to the number then the digits may interchanged then the number is

$(a)16$ $(b)23$ $(c)32$ $(d)61$

(36) In a right angled triangle one side is 3 cm more than the other side and the hypotenuse is 15 cm then which of the following Q.E is used to find the small side

$(a)\ 3x^2+6x-108=0$ $(b)\ x^2+6x-108=0$

$(c)\ x^2+3x-108=0$ $(d)\ 2x^2+3x+108=0$

(37) The Q.E used to find the two numbers if their sum is 27 and product is 182

$(a)\ x(x-27)=182$ $(b)\ x(x+27)=182$

$(c)\ x(27-x)=182$ $(d)\ x(27-x)=182(x+27)$

(38) The condition that the Q.E $3x^2+6x+k=0$ has real and distinct roots is

$(a)\ k<3$ $(b)\ k>3$ $(c)\ k=3$ $(d)\ k>4$

(39) The condition that the Q.E $x^2+kx-25=0$ has real roots is

$(a)\ k^2-100=0$ $(b)\ k^2+100<0$ $(c)\ k^2+100>0$ $(d)\ k^2+100\geq 0$

(40) The maximum value of p to find the real roots of the Q.E $2x^2-8x+p=0$ is

$(a)\ 8$ $(b)\ -8$ $(c)\ 64$ $(d)\ -64$

(41) In a triangle base is 4 cm more than the height and the area is 48 sq.cm then which of the following Q.E is used to find the height

$(a)\ x^2+4x=96$ $(b)\ x^2+4x-96=0$ $(c)\ \frac{1}{2}x(x+4)=48$ (d) All the above

(42) If the roots of the Q.E $kx^2-6x+9=0$ are not real then

$(a)\ k=0$ $(b)\ k<1$ $(c)\ k>1$ $(d)\ k^2-1=0$

(43) If the roots of the Q.E $3x^2+6x+k=0$ are complex then

$(a)\ k<0$ $(b)\ k<3$ $(c)\ k>3$ $(d)\ k=3$

(44) If the Q.E $2x^2+kx+3=0$ has two real and equal roots then the value of k is

$(a)\ 24$ $(b)\ \pm 6\sqrt{2}$ $(c)\ \pm 2\sqrt{3}$ $(d)\ \pm 2\sqrt{6}$

(45) If the Q.E $kx(x-2)+6=0$ has two real and equal roots then the value of k is

$(a)\ 2$ $(b)\ 6$ $(c)\ 4$ $(d)\ -6$

(46) If one root of the Q.E $x^2-k^2=0$ is -3 then the other root is

$(a)\ 9$ $(b)\ 3$ $(c)\ \sqrt{3}$ $(d)\ -\sqrt{3}$

(47) Which of the following Q.E has two equal roots

$(a)\ x^2+4x+4=0$ $(b)\ x^2-4x-4=0$ $(c)\ x^2+3x+9=0$ $(d)\ x^2+4x+8=0$

(48) Which of the following Q.E has two real and distinct roots

$(a)\ 2x^2-4x+6=0$ $(b)\ 2x^2+4x+6=0$ $(c)\ 2x^2-6x+3=0$ $(d)\ 2x^2+6x+8=0$

(49) The nature of the roots of the Q.E $2x^2-3x+5=0$ is

(a) real and distinct (b) real and equal (c) not real (d) complex numbers

(50) The nature of the roots of the Q.E $3x^2-4\sqrt{3}x+4=0$ is

(a) real and distinct (b) real and equal (c) not real (d) complex numbers

(51) The nature of the roots of the Q.E $2x^2+6x+3=0$ is

(a) real and distinct (b) real and equal (c) not real (d) complex numbers

(52) The roots of the Q.E $ax^2+bx+c=0$ are

$(a)\ \frac{-b\pm\sqrt{b^2-4ac}}{2}$ $(b)\ \frac{-b\pm\sqrt{b^2+4ac}}{2a}$ $(c)\ \frac{b\pm\sqrt{b^2-4ac}}{2a}$ $(d)\ \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

(53) If the roots of the Q.E $ax^2+bx+c=0$ are real and equal then

$(a)\ b^2>4ac$ $(b)\ b^2<4ac$ $(c)\ b^2=4ac$ $(d)\ a^2=b^2+c^2$

(54) If the discriminate of the Q.E $ax^2+bx+c=0$ is $b^2-4ac>0$ then the roots are

(a) real and distinct (b) real and equal (c) not real (d) complex numbers

(55) If the discriminate of the Q.E $ax^2+bx+c=0$ is $b^2-4ac<0$ then the roots are

(a) real and distinct (b) real and equal (c) not real (d) complex numbers

(56) If the discriminate of the Q.E $ax^2+bx+c=0$ is $b^2-4ac=0$ then the roots are

(a) real and distinct (b) real and equal (c) not real (d) complex numbers

(57) The discriminate of the Q.E $2x^2-4x+3=0$ is

$(a)-4$ $(b)-8$ $(c)16$ (d) 40

(58) The discriminate of the Q.E $\sqrt{3}x^2-6x+12\sqrt{3}=0$ is

$(a)\ 12\sqrt{3}$ (b) 72 $(c)36$ $(d)-108$

(59) If the discriminate of the Q.E $x^2-3x-k=0$ is 25 then $k=$

$(a)-4$ (b) 4 $(c)9$ $(d)-9$

(60) If one root of the Q.E $3x^2-6x=0$ is 2 then then the other root is

(a) 0 (b) 3 (c) 6 (d) -2

(61) If one root of the Q.E $3x^2-5x+2=0$ is 1 then then the other root is

$(a)-\frac{2}{3}$ $(b)\ \frac{3}{2}$ $(c)\ \frac{2}{3}$ (d) -1

(62) Which of the following is true for the Q.E $\sqrt{3}x^2+11x+6\sqrt{3}=0$

$(a)3\sqrt{3}$ is a root (b) real and equal (c) not a Q.E $(d)-3\sqrt{3}$ is a root

(63) Which of the following is not true for the Q.E $x^2-x-20=0$

$(a)-4$ and 5 are the roots (b) real and distinct (c) real and equal (d) (a) and (b)

(64) If the roots of the Q.E $ax^2+2x+a=0$ are equal then

$(a)\ a=\pm1$ $(b)\ a=0$ $(c)\ a=0,-1$ $(d)\ a=1,0$

(65) If the roots of the Q.E $x^2+2x+(k^2+1)=0$ are equal then the value of k is

(a) 0 (b) 1 $(c)2$ (d) 3

(66) If the roots of the Q.E $x^2+4x+k=0$ are real and distinct then

$(a)\ k>4$ $(b)k<4$ $(c)k\geq4$ $(d)\ k\leq4$

(67) If the Q.E $x^2+6x+\lambda=0$ is a perfect square then the value of λ is

(a) 3 (b) 6 $(c)9$ (d) 36

(68) If the Q.E $4x^2+4\lambda x+25=0$ is a perfect square then the value of λ is

$(a)2$ (b) 16 (c) 4 (d) ±5

(69) If the Q.E $3x^2-4\lambda x+4=0$ is a perfect square then the value of λ is

$(a)\sqrt{2}$ (b) 3 (c) 4 (d) $\sqrt{3}$

(70) The discriminate of the Q.E $(2x+3)^2=0$ is

$(a)0$ $(b)-3$ (c) 1 (d) 2

(71) The discriminate of the Q.E $3x^2+2\sqrt{5}x-5=0$ is

$(a)20$ $(b)-40$ (c) 40 (d) 80

(72) The roots of the Q.E $(3x-2)^2=-2(3x-2)^2$ are

$(a)\pm\frac{2}{3}$ $(b)\frac{2}{3},\frac{2}{3}$ $(c)\ \frac{3}{2},\frac{3}{2}$ $(d)-\frac{2}{3},-\frac{2}{3}$

(73) The roots of the Q.E $3(x-4)^2=(x-4)^2+8$ are

$(a)\pm 2$ $(b)\pm 4$ $(c)\ -2,-6$ $(d)\ 2,6$

(74) The roots of the Q.E $(x+2)^2-9=0$ are

$(a)1$ $(b)-5$ $(c)\ 5$ (d) (a) and (b)

(75) The roots of the Q.E $x^2-4x+2=0$ are

$(a)2\pm\sqrt{8}$ $(b)2\pm\sqrt{2}$ $(c)\ 4\pm\sqrt{2}$ $(d)2\pm\sqrt{3}$

(76) The roots of the Q.E $x^2+4x-4=0$ are

$(a)-2\pm 2\sqrt{2}$ $(b)2\pm 2\sqrt{2}$ $(c)\ 2,-2$ $(d)-2,-2$

(77) The roots of the Q.E $3x^2-6x+2=0$ are

$(a)3\pm\sqrt{3}$ $(b)\frac{3\pm\sqrt{3}}{2}$ $(c)\frac{3\pm\sqrt{3}}{3}$ $(d)\frac{3\pm\sqrt{3}}{6}$

(78) If one root of the Q.E $x^2-3x+1=0$ is $\frac{3+\sqrt{5}}{2}$ then the other root is

$(a)\ \frac{-3-\sqrt{5}}{2}$ $(b)3+\sqrt{5}$ $(c)\ 3-\sqrt{5}$ $(d)\ \frac{3-\sqrt{5}}{2}$

(79) The number of diagonals of a polygon having n sides is $\frac{n(n-3)}{2}$ then the number of sides of a polygon having 5 diagonals is

$(a)\ 4$ $(b)5$ $(c)\ 10$ $(d)\ 15$

(80) If the roots of the Q.E $2x^2-2\sqrt{2}x+k=0$ are equal then the roots are

$(a)\frac{1}{\sqrt{2}},\ \frac{1}{\sqrt{2}}$ $(b)\ \sqrt{2},\sqrt{2}$ $(c)\frac{1}{2},\frac{1}{2}$ $(d)1,1$

(81) $(2x+1)^3=px^3+5$ is a Q.E then the value of p is

$(a)\ 0$ $(b)\ 2$ $(c)\ 4$ $(d)\ 8$

(82) The maximum number of roots of the Q.E is

$(a)\ 0$ $(b)\ 1$ $(c)\ 2$ $(d)\ 3$

(83) The roots of the Q.E $(2x-1)(2x+1)=0$ are

$(a)\frac{1}{2},-\frac{1}{2}$ $(b)\ 2,-2$ $(c)\frac{1}{2},\frac{1}{2}$ $(d)1,1$

(84) The discriminate of the Q.E $px+qx^2+r=0$ is

$(a)\ p^2+4qr$ $(b)\ q^2-4pr$ $(c)\ p^2-4qr$ $(d)\ r^2-4pq$

(85) The discriminate of the Q.E $2x^2-4x-3=0$ is

$(a)\ -8$ $(b)\ 16$ $(c)\ -24$ $(d)\ 40$

(86) The discriminate of the Q.E $3x^2-2x+k=0$ is 0 then the value of k is

$(a)\ -3$ $(b)\ \frac{1}{3}$ $(c)\ 3$ $(d)-\frac{1}{3}$

(87) If the roots of the Q.E $4x^2+4\sqrt{3}x+k=0$ are equal then the value of k is

$(a)\ 3\ \ (b)\ \frac{1}{3}\ (c)\ \ 2\ \ (d)\frac{1}{2}$

(88) If the roots of the Q.E $4x^2+20x+k^2=0$ are equal then the root is

$(a)\ 5\ \ (b)\ -5\ (c)\ \frac{5}{2}\ \ (d)-\frac{5}{2}$

(89) If one root of the Q.E $x^2+kx+50=0$ is 5 then the value of k is

$(a)\ 5\ \ (b)\ -5\ (c)\ 15\ \ (d)-15$

(90) If α,β are the roots of the Q.E $x^2-7x+12=0$ then $\alpha\beta=$

$(a)\ 7\ \ (b)\ -7\ (c)-12\ \ (d)12$

(91) If α,β are the roots of the Q.E $x^2-7x=0$ then $\alpha+\beta=$

$(a)\ 7\ \ (b)\ -7\ (c)-1\ \ (d)1$

(92) If one root of the Q.E $kx(x-2)+6=0$ is 3 then the value of k is

$(a)\ -1\ \ (b)\ 1\ (c)\ 2\ \ (d)-2$

(93) The discriminate of the Q.E $3x^2-4\sqrt{3}\,x+4=0$ is

$(a)\ 0\ \ (b)\ 12\ (c)\ 24\ \ (d)\ 48$

(94) The Q.E used to find the two numbers if their sum is 27 and product is 182 is $x^2-k\,x+182=0$ then the value of k is

$(a)\ 27\ \ (b)\ 182\ (c)\ -27\ \ (d)\ -182$

(95) The discriminate of the Q.E $\sqrt{x^2+x+1}=2$ is

$(a)\ 13\ \ \ (b)-3\ \ \ (c)\ 11\ \ \ (d)$ none

(96) If the roots of the Q.E are $\frac{p}{q},\frac{q}{p}$ then the equation is

$(a)\,qx^2-(p^2+q^2)x+p=0\qquad (b)\,px^2-(p^2+q^2)x+q=0$

$(c)\,pqx^2-(p^2+q^2)x+pq=0\ \ (d)\ p^2q^2x^2-(p^2+q^2)x+p^2q^2=0$

(97) If one root of the Q.E $3x^2+2x+k=0$ is reciprocal to other then k is

$(a)\ 3\ \ \ (b)-3\ (c)\ 2\ \ \ (d)\ \ 6$

(98) The roots of the Q.E $x-\frac{3}{x}=2$ are

$(a)1,3\qquad (b)3,-1\qquad (c)2,2\qquad (d)\ 1,2$

(99) If one root of the Q.E $px^2+qx+r=0$ is 3 times the other then $3q^2$

$(a)\ 12\,pr\ \ \ (b)14\,pr\ (c)\ 16\,pr\ \ \ (d)\ 18\,pr$

(100) If α,β are the roots of the Q.E $x^2-3x-1=0$ then $\frac{1}{\alpha}+\frac{1}{\beta}=$

$(a)\ 3\ \ \ \ (b)-3\ \ \ (c)\frac{1}{3}\ \ \ (d)-\frac{1}{3}$

ANSWERS

1. (C) 2. (D) 3. (A) 4. (D) 5. (B) 6. (B) 7. (C) 8. (A) 9. (A) 10. (B) 11. (B) 12. (A) 13. (B) 14. (C) 15. (D) 16. (B) 17. (D) 18. (C) 19. (B) 20. (B) 21. (C) 22. (D) 23. (A) 24. (D) 25. (D) 26. (B) 27. (B) 28. (A) 29. (A) 30. (D) 31. (D) 32. (C) 33. (D) 34. (A) 35. (B) 36. (C) 37. (C) 38. (A) 39. (D) 40. (A) 41. (D) 42. (C) 43. (C) 44. (D) 45. (B) 46. (B) 47. (A) 48. (C) 49. (D) 50. (B) 51. (A) 52. (D) 53. (C) 54. (A) 55. (D) 56. (B) 57. (B) 58. (D) 59. (B) 60. (A) 61. (C) 62. (D) 63. (C) 64. (A) 65. (A) 66. (B) 67. (C) 68. (D) 69. (D) 70. (A) 71. (D) 72. (B) 73. (D) 74. (D) 75. (B) 76. (A) 77. (C) 78. (D) 79. (B) 80. (A) 81. (D) 82. (C) 83. (A) 84. (B) 85. (D) 86. (B) 87. (A) 88. (D) 89. (D) 90. (D) 91. (A) 92. (D) 93. (A) 94. (A) 95. (A) 96. (C) 97. (A) 98. (B) 99. (A) 100. (B)

6. PROGRESSIONS

Sequence: A **sequence** is an arrangement of numbers or objects in a definite order.

Arithmetic progression: An **arithmetic progression** A.P is a list of numbers in which each term is obtained by adding preceding term with a fixed number except first term. This fixed number is called common difference .

Note: (i) If a is the first term d the common difference of an A.P, then the A.P is $a, a+d, a+2d, ..., a+(n-1)d$

(ii) The n^{th} term of an A.P with first term a and common difference d is given by $a+(n-1)d$.

(iii) The sum of the first n terms of an A.P is given by $S_n = \frac{n}{2}[2a+(n-1)d]$.

(iv) If a is the first term and l is the last term of an A.P, then the sum of n terms of the A.P is given by $S_n = \frac{n}{2}[a+l]$.

Geometric progression: A **geometric progression** G.P is a list of numbers in which each term is obtained by multiplying preceding term with a fixed number except first term. This fixed number is called common ratio .

Note: (i) If a is the first term r the common ratio of a G.P, then the G.P is $a, ar, ar^2, ..., ar^{n-1}$

(ii) The n^{th} term of an G.P with first term a and common ratio r is given by $a\,r^{n-1}$.

(iii) The sum of the first n terms of a G.P is given by $S_n = \begin{cases} \frac{a(1-r^n)}{1-r} & \text{if } r<1 \\ \frac{a(r^n-1)}{r-1} & \text{if } r>1 \\ \infty & \text{if } r=1 \end{cases}$

(iv) The sum of infinite terms of a G.P is given by $S_\infty = \frac{a}{1-r}$.

Solved problems:

Problem: (1) The common difference of an A.P $3, -2, -7, -12, ...$ is

$(a)1 \quad (b)-5 \quad (c)-1 \quad (d)-2$

Solution: The given A.P is $3, -2, -7, -12, ...$

Since $d = t_2 - t_1$

$\Rightarrow d = -2-3 = -5$

Ans: option (b)

Problem: (2) The sum of first 100 positive integers is

(a) 4050 (b) 5050 (c) 5000 (d) 4950

Solution: The sum of first n positive integers is $1+2+3+...+n = \frac{n(n+1)}{100}$

The sum of first 100 positive integers is $= \frac{100(100+1)}{2} = \frac{100(101)}{2} = 5050$

Ans: option (b)

Problem: (3) $1+\cos\theta+\cos^2\theta+\cos^3\theta+...\infty =$

$(a)\frac{1}{1-\cos\theta}$ $(b)\frac{1}{1+\cos\theta}$ $(c)\frac{1}{1-\sin\theta}$ $(d)\frac{1}{1+\sin\theta}$

Solution: $S_\infty = \frac{a}{1-r} = 1+\sin\theta+\sin^2\theta+\sin^3\theta+...\infty = = \frac{1}{1-\cos\theta}.$

Ans: option (a)

MULTIPLE CHOICE QUESTIONS

(1) Which of the following is an A.P

$(a)1,3,6,10,15,...$ $(b)100,80,60,40,...$ $(c)2,4,8,16,...$ (d) $3,3,4,4,5,5,...$

(2) Which of the following is not an A.P

$(a)1,2,3,4,...$ $(b)3,3,3,3,...$ $(c)6,3,0,-3,...$ (d) $6,4,1,-3,...$

(3) Which of the following is an A.P

$(a)4,7,10,13,...$ $(b)11,6,1,-4,...$ $(c)13,19,25,...$ (d) All the above

(4) Which of the following is an A.P

$(a)1,\frac{1}{2},\frac{1}{4},\frac{1}{8},...$ $(b)1,\frac{1}{2},0,-\frac{1}{2},...$ $(c)4,8,16,32,...$ $(d)1,\frac{1}{5},\frac{1}{25},\frac{1}{125},...$

(5) The common difference of an A.P $1,-1,-3,-5,...$ is

$(a)1$ $(b)-1$ $(c)2$ $(d)-2$

(6) The k^{th} term of an A.P $5,2,-1,-4,...$ is

$(a)2-3k$ $(b)\ 8-3k$ $(c)3k-2$ $(d)2+3k$

(7) Which of the following is an infinite A.P

$(a)3,7,11,15,...$ $(b)6,9,12,15,...39$ $(c)100,95,90,...-10$ $(d)1,2,3,4,...65$

(8) The 10^{th} term of an A.P $4,10,16,22,...$ is

$(a)70$ $(b)\ 64$ $(c)58$ $(d)52$

(9) The common difference of an A.P $2x,4x,6x,8x,...$ is

$(a)x$ $(b)\ 2x$ $(c)-x$ $(d)-2x$

(10) The common difference of an A.P $\frac{1}{4},-\frac{1}{4},-\frac{3}{4},-\frac{5}{4},...$ is

$(a)\frac{1}{4}$ $(b)-\frac{1}{2}$ $(c)\frac{1}{2}$ $(d)-\frac{1}{4}$

(11) The common difference of an A.P $0.6,1.7,2.8,3.9,...$ is

$(a)0.6$ $(b)1.7$ $(c)1.1$ $(d)0.1$

(12) The common difference of an A.P $3,3+\sqrt{2},3+2\sqrt{2},3+3\sqrt{2},...$ is

$(a)3$ $(b)3+\sqrt{2}$ $(c)\ \sqrt{2}$ $(d)\ 3\sqrt{2}$

(13) The next term of an A.P $\sqrt{2},\sqrt{8},\sqrt{18},\sqrt{32},...$ is

$(a)\sqrt{64}$ $(b)\sqrt{72}$ $(c)\ \sqrt{50}$ $(d)\ \sqrt{84}$

(14) The 10^{th} term of an A.P $5,1,-3,-7,...$ is

$(a)-35$ $(b)\ -31$ $(c)-27$ $(d)41$

(15) The next term of an A.P $2,\frac{5}{2},3,\frac{7}{2},4,...$ is

$(a)\,2 \quad (b)5 \quad (c)\,\frac{9}{2} \quad (d)\,\frac{1}{2}$

(16) Which term of an A.P $21,18,15,...$ is -81

$(a)\,33 \quad (b)\,34 \quad (c)\,35 \quad (d)\,36$

(17) Which term of an A.P $21,18,15,...$ is 0

$(a)\,7 \quad (b)\,8 \quad (c)\,9 \quad (d)\,10$

(18) The sum of first n natural numbers is

$(a)\ n^2 \quad (b)\ \frac{n(n-1)}{2} \quad (c)\ \frac{n(n+1)}{3} \quad (d)\ \frac{n(n+1)}{2}$

(19) The sum of first 10 natural numbers is

$(a)\,10 \quad (b)\ 55 \quad (c)\ 45 \quad (d)\ 50$

(20) The sum of first 100 natural numbers is

$(a)\,5005 \quad (b)\ 55 \quad (c)\ 500500 \quad (d)\ 5050$

(21) The first term of an A.P is 3.5, common difference is 0 then 108^{th} term is

$(a)\,105 \quad (b)\ 3.5 \quad (c)\ 0 \quad (d)\ 111.5$

(22) The first term of an A.P is 4, common difference is -3 then 4^{th} term is

$(a)-5 \quad (b)\ -8 \quad (c)\,16 \quad (d)\ -2$

(23) In an A.P $a_1 = 2$ and $a_3 = 18$ then $a_2 =$

$(a)\,20 \quad (b)\ 10 \quad (c)\,16 \quad (d)\ 36$

(24) The number of terms of an A.P: $3,8,13,18,...,78$ is

$(a)16 \quad (b)15 \quad (c)17 \quad (d)34$

(25) The number of terms of an A.P: $7,13,19,...,205$

$(a)31 \quad (b)35 \quad (c)32 \quad (d)34$

(26) The first three terms of an A.P are $x+2,\ 2x,\ 2x+2$ then $x =$

$(a)4 \quad (b)5 \quad (c)6 \quad (d)8$

(27) The first three terms of an A.P are $x+1,\ 3x,\ 4x+2$ then $x =$

$(a)\,0 \quad (b)1 \quad (c)2 \quad (d)3$

(28) Which term of an A.P: $25,\ 20,\ 15,...$ is first negative number

$(a)5 \quad (b)6 \quad (c)7 \quad (d)8$

(29) The n^{th} term of an A.P is $a_n = 2n+3$ then the 12^{th} term is

$(a)\,23 \quad (b)165 \quad (c)\,27 \quad (d)\,38$

(30) The n^{th} term of an A.P is $a_n = 7-2n$ then common difference is

$(a)-2 \quad (b)\,2 \quad (c)-7 \quad (d)\,7$

(31) The n^{th} term of an A.P is $a_n = 3+2n$ then sum of three terms is

$(a)12 \quad (b)9 \quad (c)\,21 \quad (d)\,25$

(32) The three terms of an A.P are x, y, z then

$(a)\ y=\frac{x+z}{2}$ $(b)\ 2y=x+z$ $(c)\ y-x=z-y$ (d) All the above

(33) Which of the following is true

$(a)\ a_n=S_n+S_{n-1}$ $(b)\ a_n=a+(n-1)d$ $(c)\ S_n=n[2a+(n-1)d]$ (d) All the above

(34) The n^{th} term of an A.P is $a_n=3+2n$ then sum of 24 terms is

$(a)\ 652$ $(b)\ 762$ $(c)\ 51$ $(d)\ 672$

(35) The sum of first ten terms of an A.P $2,7,12,...$ is

$(a)\ 245$ $(b)\ 490$ $(c)\ 47$ $(d)\ 295$

(36) In an A.P: $a=-1.25$ and $d=-0.25$ then $a_4=$

$(a)-2$ $(b)\ -1.75$ $(c)\ -2.25$ $(d)\ -0.25$

(37) In an A.P: $a_1=2$ and $a_3=18$ then $a_2=$

$(a)\ 20$ $(b)\ 10$ $(c)\ 16$ $(d)\ 36$

(38) In an A.P: $a_2=6,\ a_7=-4$ and $a_n=0$ then the value of n is

$(a)\ 4$ $(b)\ 5$ $(c)\ 6$ $(d)\ 8$

(39) In an A.P, the 17^{th} term is 21 more than 10^{th} then the common difference is

$(a)\ 2$ $(b)\ 3$ $(c)\ -2$ $(d)-3$

(40) The number of multiples of 4 lie in between 1 and 250 is

$(a)\ 59$ $(b)\ 60$ $(c)\ 61$ $(d)\ 62$

(41) The 4^{th} term from last of an A.P: $-11,-8,-5,...49$ is

$(a)\ 40$ $(b)\ 43$ $(c)\ 46$ $(d)\ 58$

(42) The sum of first twelve terms of an A.P $-37,-33,-29,...$ is

$(a)\ 180$ $(b)-180$ $(c)\ 7$ $(d)-7$

(43) The sum of first eighteen terms of an A.P $3,7,11,...$ is

$(a)\ 766$ $(b)\ 666$ $(c)\ 718$ $(d)\ 659$

(44) In an A.P, $a_1=7$ and $a_{13}=35$ then $S_{13}=$

$(a)\ 546$ $(b)\ 464$ $(c)\ 273$ $(d)\ 672$

(45) In an A.P, $a_{12}=37$ and $d=3$ then $S_{12}=$

$(a)\ 41$ $(b)\ 256$ $(c)\ 276$ $(d)\ 246$

(46) In an A.P, 4^{th} term is $a_n=9-5n$ then the sum of first fifteen terms is

$(a)\ 465$ $(b)-465$ $(c)-66$ $(d)\ 66$

(47) The sum of first 40 positive integers which are divisible by 6 is

$(a)\ 4920$ $(b)\ 5920$ $(c)\ 5290$ $(d)\ 4290$

(48) The sum of n term of an A.P is $2n^2+3n$ then the common difference is

$(a)\ 3$ $(b)\ 4$ $(c)\ 5$ $(d)\ 9$

(49) The sum of n term of an A.P is $3n^2+5n$ then the second term is

$(a)\ 8$ $(b)\ 14$ $(c)\ 20$ $(d)\ 22$

(50) In an A.P $a_7=4, d=2$ and $S_8=-8$ then $S_9=$

$(a)-6 \quad (b)\ -12 \quad (c)-14 \quad (d)\ 0$

(51) The sum base numbers lie in between 100 and 200 is

$(a)\ 750 \quad (b)\ 7500 \quad (c)\ 5500 \quad (d)\ 8050$

(52) The first and last terms of an A. P are 17 and 350 respectively, common difference is 9 then $S_n =$

$(a)\ 5238 \quad (b)\ 6973 \quad (c)\ 6138 \quad (d)\ 6813$

(53) Which of the following is a G. P

$(a)\ 6,12,24,... \quad (b)\ 1,4,9,16,... \quad (c)\ 0,3,9,27,... \quad (d)$ All the above

(54) The common ratio of G. P: $\frac{1}{16},\frac{1}{64},\frac{1}{256},...$ is

$(a)\frac{1}{2} \quad (b)\frac{1}{4} \quad (c)\ 4 \quad (d)\frac{1}{16}$

(55) Which of the following is not a G. P

$(a)\frac{1}{64},\frac{1}{32},\frac{1}{8},... \quad (b)\ 30,25,20,15,... \quad (c)\ 1,4,16,64,... \quad (d)$ (a) and (b)

(56) Which of the following G. P has common ratio 3

$(a)\ 5,15,45,... \quad (b)\ 2,6,18,54,... \quad (c)\ 1,3,9,27,... \quad (d)$ All the above

(57) The common ratio of a G. P: $64,-32,16,-8,...$ is

$(a)\frac{1}{2} \quad (b)-\frac{1}{2} \quad (c)\ 2 \quad (d)-2$

(58) Which of the following G. P has first term 2 and common ratio 3

$(a)\ 3,\frac{3}{2},\frac{3}{4},\frac{3}{8},... \quad (b)\ 3,6,12,24,... \quad (c)\ 3,9,27,... \quad (d)\ 2,6,18,54,...$

(59) In a G. P, the first term is ar^2, common ratio is r then the fifth term is

$(a)\ ar^4 \quad (b)\ ar^5 \quad (c)\ ar^6 \quad (d)\ ar^7$

(60) In a G. P, $a=\sqrt{5}, r=\frac{1}{5}$ then the second term is

$(a)\frac{1}{5} \quad (b)\ \sqrt{5} \quad (c)1 \quad (d)\ \frac{1}{\sqrt{5}}$

(61) The next term of a G. P $-2,6,-18,54,...$ is

$(a)-162 \quad (b)-108 \quad (c)\ 162 \quad (d)-216$

(62) The next term of a G. P $x,1,\frac{1}{x},...$ is

$(a)1 \quad (b)\ x \quad (c)\frac{1}{x^2} \quad (d)\ \frac{1}{x^3}$

(63) The first three terms of a G. P are $x,4,4x$ then $x=$

$(a)\ 21 \quad (b)\ 1 \quad (c)\ \frac{1}{2} \quad (d)-\frac{1}{2}$

(64) The first three terms of a G. P are $x, x+2, x+6$ then the next term is

$(a)\ x+8 \quad (b)\ x+10 \quad (c)\ x+12 \quad (d)\ x+14$

(65) The common ratio of a G.P: $0.4, 0.04, 0.004, \ldots$ is

$(a) 0.1 \quad (b) 0.01 \quad (c) 0.001 \quad (d) 1$

(66) The next term of a G.P: $\frac{1}{\sqrt{2}}, -2, \frac{8}{\sqrt{2}}, \ldots$ is

$(a) -8 \quad (b) -16 \quad (c) -2\sqrt{2} \quad (d) \frac{-16}{\sqrt{2}}$

(67) The n^{th} term of a G.P: $\frac{5}{2}, \frac{5}{4}, \frac{5}{8}, \ldots$ is

$(a) 5.2^n \quad (b) \frac{5}{2^{n-1}} \quad (c) \frac{5}{2^n} \quad (d) \frac{5}{2^{n+1}}$

(68) In a G. P, $2, 8, 32, \ldots$ and $a_n = 512$ then the value of n is

$(a) 5 \quad (b) 6 \quad (c) 7 \quad (d) 9$

(69) In a G. P, the third term is 36, sixth term is 972 then the fourth term is

$(a) 27 \quad (b) 324 \quad (c) 180 \quad (d) 108$

(70) The 10^{th} term of a G. P: $5, 25, 125, \ldots$ is

$(a) 5^9 \quad (b) 5^{10} \quad (c) 5.2^9 \quad (d) 5.2^{10}$

(71) The n^{th} term of a G. P: $2, -6, 18, -54, \ldots$ is

$(a) 2(-3)^n \quad (b) -3.2^{n-1} \quad (c) 2(-3)^{n-1} \quad (d) 2(-3)^{n+1}$

(72) In a G. P $a_1 = 9$ and $r = \frac{1}{3}$ then $a_5 =$

$(a) \frac{1}{9} \quad (b) \frac{1}{27} \quad (c) \frac{1}{81} \quad (d) 1$

(73) In a G. P, the n^{th} term is $a_n = 3(2)^{n-1}$ then common ratio is

$(a) 0 \quad (b) 2 \quad (c) 4 \quad (d) 8$

(74) Which term of a G. P: $2, 2\sqrt{2}, 4, \ldots$ is 64

$(a) 10 \quad (b) 11 \quad (c) 12 \quad (d) 13$

(75) Which term of a G. P: $a, ar, \ldots, ar^n$ is

$(a) n \quad (b) n-1 \quad (c) n+1 \quad (d) n+2$

(76) The product of five terms of a G. P is 1024 then the middle term is

$(a) 4 \quad (b) 8 \quad (c) 6 \quad (d) 2$

(77) The second term of a G. P is 2 and the sum of infinite terms is 8 then the first term is

$(a) 4 \quad (b) 8 \quad (c) 6 \quad (d) 3$

(78) The first term of a G. P is 10 and the sum of infinite terms is 30 then common ratio is

$(a) \frac{3}{2} \quad (b) \frac{2}{3} \quad (c) \frac{1}{3} \quad (d) 3$

(79) $\sum n = 78$ then $n =$

$(a) 9 \quad (b) 12 \quad (c) 13 \quad (d) 39$

(80) $1+\sin\theta+\sin^2\theta+\sin^3\theta+...\infty =$

$(a)\frac{1}{1-\cos\theta}$ $(b)\frac{1}{1+\cos\theta}$ $(c)\frac{1}{1-\sin\theta}$ $(d)\frac{1}{1+\sin\theta}$

ANSWERS

1. (B) 2. (D) 3. (D) 4. (B) 5. (D) 6. (B) 7. (A) 8. (C) 9. (B) 10. (B) 11. (C) 12. (C) 13. (C) 14. (B) 15. (C) 16. (C) 17. (B) 18. (D) 19. (B) 20. (D) 21. (B) 22. (A) 23. (B) 24. (A) 25. (D) 26. (A) 27. (D) 28. (C) 29. (C) 30. (A)31. (C) 32. (D) 33. (B) 34. (D) 35. (A) 36. (A) 37. (B) 38. (B) 39. (B) 40. (D) 41. (D) 42. (B) 43. (B) 44. (C) 45. (D) 46. (B) 47. (A) 48. (D) 49. (D) 50. (D) 51. (A) 52. (B) 53. (A) 54. (B) 55. (D) 56. (B) 57. (B) 58. (D) 59. (C) 60. (D) 61. (A) 62. (C) 63. (B) 64. (D) 65. (A) 66. (B) 67. (C) 68. (A) 69. (D) 70. (B) 71. (C) 72. (A) 73. (B) 74. (B) 75. (C) 76. (A) 77. (A) 78. (B) 79. (B) 80. (C)

7. CO-ORDINATE GEOMETRY

1. The abscissa and ordinate of a given point are the distances of the point from x - axis and y - axis respectively.
2. The co-ordinates of any point on x - axis are of the form $(x,0)$.
3. The co-ordinates of any point on y -axis are of the form $(0,y)$.
4. The distance between points $P(x_1,y_1)$ and $Q(x_2,y_2)$ is given by $PQ=\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$.
5. Distance of a point $P(x,y)$ from the origin $O(0,0)$ is given by $OP=\sqrt{x^2+y^2}$.
6. The distance between two points $P(x_1,y_1)$ and $Q(x_2,y_2)$ on line parallel to x -axis is $|x_2-x_1|$.
7. The distance between two points and on line parallel to y -axis is $|y_2-y_1|$.
8. The co-ordinates of the point which divides the join of points $P(x_1,y_1)$ and $Q(x_2,y_2)$ internally in the ratio $m:n$ are $\left(\frac{mx_2+nx_1}{m+n},\frac{my_2+ny_1}{m+n}\right)$.
9. The co-ordinates of the point which divides the join of points $P(x_1,y_1)$ and $Q(x_2,y_2)$ externally in the ratio $m:n$ are $\left(\frac{mx_2-nx_1}{m-n},\frac{my_2-ny_1}{m-n}\right)$.
10. The co-ordinates of the midpoint of line segment joining the points $P(x_1,y_1)$ and $Q(x_2,y_2)$ are $\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$.
11. The point that divides each median in the ratio 2:1 is the centroid of the triangle
11. The centroid of the triangle formed by the points $A(x_1,y_1)$, $B(x_2,y_2)$ and $C(x_3,y_3)$ are $\left(\frac{x_1+x_2+x_3}{3},\frac{y_1+y_2+y_3}{3}\right)$.
12. The point which divides a line segment into three equal parts is said to be the tri sectional point i.e., either 1:2 or 2:1
13. The area of the triangle formed by the points $A(x_1,y_1)$, $B(x_2,y_2)$ and $C(x_3,y_3)$ is $\Delta=\frac{1}{2}|x_1(y_2-y_3)+x_2(y_3-y_1)+x_3(y_1-y_2)|$ square units.
14. If points $A(x_1,y_1)$, $B(x_2,y_2)$ and $C(x_3,y_3)$ are collinear then $\Delta=0$.
15. Area of the triangle formula (Heron's Formula) $\Delta=\sqrt{s(s-a)(s-b)(s-c)}$ where $s=\frac{a+b+c}{2}$.
16. Slope of the line containing the points $P(x_1,y_1)$ and $Q(x_2,y_2)$ is $m=\frac{y_2-y_1}{x_2-x_1}$.

Solved problems:

Problem: (1) If $(m+1)x^3+6x^2+5x=16$ represents the Q.E then the value of m is

$(a)1$ $(b)-1$ $(c)2$ $(d)0$

Solution: The given equation contains 3 as exponent of the highest degree term, hence degree of the equation is $(m+1)x^3+6x^2+5x=16$ is 3

Since $(m+1)x^3+6x^2+5x=16$ represents the Q.E, it must have degree 2 only when $m+1=0$ $\Rightarrow m=-1.$

Ans: option (b)

Problem: (2) The roots of the equation $3x^2+2x-1=0$ are

$(a)-1,\frac{1}{3}$ $(b)-1,-\frac{1}{3}$ $(c)3,-1$ $(d)-3,-1$

Solution: If α and β are the roots of the equation $3x^2+2x-1=0,$ then $\alpha+\beta=-\frac{b}{a}$ and $\alpha\beta=\frac{c}{a}.$

By inspection it is observed that $\alpha=-1$ and $\beta=\frac{1}{3}$

Ans: option (a)

Problem: (3) The sum of roots of the equation $3x^2+2x-1=0$ is

$(a)-\frac{2}{3}$ $(b)-\frac{4}{3}$ $(c)2$ $(d)-4$

Solution: If α and β are the roots of the equation $3x^2+2x-1=0$ then $\alpha+\beta=-\frac{b}{a}$ and $\alpha\beta=\frac{c}{a}.$

By inspection it is observed that $\alpha=-1$ and $\beta=\frac{1}{3}$

$\therefore \alpha+\beta=-\frac{2}{3}$

Ans: option (a)

MULTIPLE CHOICE QUESTIONS

(1) The point which lies on x^- axis is
(a) $(0,3)$ $(b)(-4,0)$ (c) $(3,5)(d)$ $(0,-4)$

(2) The point which lies on y^- axis is
(a) $(0,3)$ $(b)(-4,0)$ (c) $(0,0)(d)$ All the above

(3) The point $(3,-5)$ lies on the quadrant
$(a)\,Q_1$ $(b)\,Q_2$ $(c)\,Q_3$ (d) Q_4

(4) The point lies on the quadrant Q_3 is
(a) $(1,3)$ $(b)(-2,3)$ (c) $(-3,-5)(d)$ $(3,-4)$

(5) The distance between the points $(-4,0)$ and $(4,0)$ is
$(a)0$ $(b)\,8$ $(c)2$ $(d)16$

(6) The distance between the points $(0,-3)$ and $(0,-8)$ is
$(a)3$ $(b)\,5$ $(c)8$ $(d)11$

(7) If the distance between the points $(3,8)$ and $(k,8)$ is $6,$ then the value of k is
$(a)5$ $(b)6$ $(c)8$ $(d)9$

(8) The distance from $(0,0)$ to $(3,4)$ is

$(a)3 \quad (b)\ 4 \quad (c)5 \quad (d)7$

(9) The distance between the points (a,b) and $(-a,-b)$ is

$(a)\sqrt{a^2+b^2} \quad (b)\ 2\sqrt{a+b} \quad (c)4\sqrt{a^2+b^2} \quad (d)2\sqrt{a^2+b^2}$

(10) The point which lies 3 units distance from $(5,7)$ is

$(a)\ (8,4)\ (b)(0,5)\ (c)\ (3,0)(d)\ (8,7)$

(11) The point which lies on x^- axis and having 5 units distance from $(2,3)$ is

$(a)\ (6,0)\ (b)(5,0)\ (c)\ (4,0)(d)\ (-2,0)$

(12) The points $(0,0),(5,0)$ are $(0,7)$ vertices of a triangle

(a) Right angled (b) Right angled Isosceles

(c) Isosceles (d) Equilateral

(13) If $A(4,2)$ and $B(7,5)$ then the length of $\overline{AB}$ is

$(a)2\sqrt{3} \quad (b)3\sqrt{2} \quad (c)\ 5\sqrt{2} \quad (d)\ 18$

(14) If $A(x_1,y_1)$ and $B\ (x_2,y_2)$ then the length of $\overline{AB}$ is

$(a)\sqrt{(x_2+x_1)^2+(y_2+y_1)^2}\ (b)\ \sqrt{(x_2-x_1)^2+(y_2+y_1)^2}$

$(c)\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}\ (d)\sqrt{(x_2-x_1)+(y_2-y_1)^2}$

(15) If $A(x_1,y_1)$ and $B\ (x_2,y_2)$ the coordinates of the point which divides $\overline{AB}$ in the ratio $m:n$ internally are

$(a)\left(\frac{mx_2+nx_1}{m+n},\frac{my_2+ny_1}{m+n}\right)(b)\ \left(\frac{mx_2-nx_1}{m-n},\frac{my_2+ny_1}{m+n}\right)$

$(c)\left(\frac{mx_2+nx_1}{m+n},\frac{my_2-ny_1}{m-n}\right)(d)\left(\frac{mx_2-nx_1}{m-n},\frac{my_2-ny_1}{m-n}\right)$

(16) If $A(x_1,y_1)$ and $B\ (x_2,y_2)$ the coordinates of the point which divides $\overline{AB}$ in the ratio $m:n$ externally are

$(a)\left(\frac{mx_2+nx_1}{m+n},\frac{my_2+ny_1}{m+n}\right)(b)\ \left(\frac{mx_2-nx_1}{m-n},\frac{my_2+ny_1}{m+n}\right)$

$(c)\left(\frac{mx_2+nx_1}{m+n},\frac{my_2-ny_1}{m-n}\right)(d)\left(\frac{mx_2-nx_1}{m-n},\frac{my_2-ny_1}{m-n}\right)$

(17) The line joining points $A(x_1,y_1)$ and $B\ (x_2,y_2)$ divided by x^- axis in the ratio

$(a)-x_1:y_1 \quad (b)-x_1:x_2 \quad (c)-y_1:y_2 \quad (d)-x_2:y_2$

(18) The line joining points $A(x_1,y_1)$ and $B\ (x_2,y_2)$ divided by y^- axis in the ratio

$(a)-x_1:y_1 \quad (b)-x_1:x_2 \quad (c)-y_1:y_2 \quad (d)-x_2:y_2$

(19) If $A(3,5)$ and $B\ (8,10)$ then the coordinates of the point which divides $\overline{AB}$ in the ratio $2:3$ internally are

$(a)\ (7,5)\ (b)(5,8)\ (c)\ (8,6)(d)\ (5,7)$

(20) If $A(x_1, y_1)$ and $B\ (x_2, y_2)$, then the midpoint of $\overline{AB}$ is

$$(a)\left(\frac{x_2-x_1}{2}, \frac{y_2-y_1}{2}\right)(b)\left(\frac{x_1-x_2}{2}, \frac{y_1-y_2}{2}\right)\ (c)\left(\frac{x_1+x_2}{3}, \frac{y_1+y_2}{3}\right)(d)\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

(21) If $A(3,0)$ and $B\ (-5,8)$ then the midpoint of $\overline{AB}$ is

$(a)\ (-1,4)\ (b)(-2,8)\ (c)\ (4,-1)(d)\ (8,-2)$

(22) The origin divides the join of $A(6,9)$ and $B\ (-6,-9)$ in the ratio

$(a)2:3 \quad (b)3:2 \quad (c)1:1 \quad (d)1:2$

(23) The x^- axis divides the join of $(7,3)$ and $(6,-5)$ in the ratio

$(a)6:7 \quad (b)7:6 \quad (c)5:3 \quad (d)3:5$

(24) The y^- axis divides the join of $(5,-6)$ and $(-1,-4)$ in the ratio

$(a)1:5 \quad (b)5:1 \quad (c)2:3 \quad (d)3:2$

(25) The distance between the points $(a\cos\theta, 0)$ and $(0, a\sin\theta)$ is

$$(a)\,a \quad (b)\frac{a}{2} \quad (c)\,a^2 \quad (d)\sqrt{a}$$

(26) The centroid of the triangle having vertices $A(x_1, y_1), B\ (x_2, y_2)$ and $C\ (x_3, y_3)$ is

$$(a)\left(\frac{x_1+x_2+x_3}{2}, \frac{y_1+y_2+y_3}{2}\right) \qquad (b)\left(\frac{x_1-x_2}{2}, \frac{y_1-y_2}{2}\right)$$

$$(c)\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right) \qquad (d)\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$$

(27) The centroid of the triangle having vertices $(5,-2),(6,4)$ and $(7,-2)$ is

$(a)\ (6,4)\ (b)(18,0)\ (c)\ (6,-8)(d)\ (6,0)$

(28) If the centroid of the triangle having vertices $(3,-5),(-7,4)$ and $(10, y)$ is $(2,-1)$ then the value of y is

$(a)1 \quad (b)2 \quad (c)-1 \quad (d)-2$

(29) The point $(-4,6)$ divides the join of $(-6,10)$ and $(3,-8)$ in the ratio

$(a)2:1 \quad (b)2:7 \quad (c)2:8 \quad (d)7:2$

(30) If $A(-2,3), B\ (6,7)$ and $C\ (8,3)$ are three vertices of a parallelogram ABCD, then the fourth vertex D =

$(a)\ (0,1)\ (b)(0,-1)\ (c)\ (1,0)(d)\ (-1,0)$

(31) If $A(-2,3), B\ (6,7)$ and $C\ (8,3)$ are three vertices of a triangle ABC and AD is median then D =

$$(a)\left(\frac{7}{2}, \frac{9}{2}\right)(b)\left(\frac{5}{2}, \frac{1}{2}\right)(c)\ (7,5)(d)\left(5, \frac{7}{2}\right)$$

(32) The area of the triangle ABC formed by the vertices $A(0,4), B\ (0,0)$ and $C\ (6,0)$ is .... sq. units .

$(a)10$ $(b)12$ $(c)24$ $(d)2$

(33) The area of the triangle ABC formed by the vertices $A(2,0), B(1,2)$ and $C(-1,6)$ is .... sq. units .

$(a)0$ $(b)16$ $(c)4$ $(d)8$

(34) If the points $(1,2),(-1,m)$ and $(-3,-4)$ are collinear, then the value of m is

$(a)-2$ $(b)2$ $(c)1$ $(d)-1$

(35) If the points $(7,-2),(5,1)$ and $(3,k)$ are collinear, then the value of k is

$(a)3$ $(b)6$ $(c)4$ $(d)-2$

(36) If the points $(t,2t),(-2,6)$ and $(3,1)$ are collinear, then the value of t is

$(a)\frac{4}{5}$ $(b)\ \frac{3}{5}$ $(c)\ \frac{4}{3}$ $(d)\ \frac{3}{4}$

(37) If $(0,0)$ is the centroid of a triangle with vertices $(a,b),(b,c),(c,a)$ then $a^3+b^3+c^3=$

$(a)\,abc$ $(b)\ a+b+c$ $(c)\ 2abc$ $(d)\ 3abc$

(38) The perimeter of a triangle with vertices $(0,0),(2,0),(0,2)$ is...units.

$(a)4$ $(b)\ 4-2\sqrt{2}$ $(c)\ 2\sqrt{2}$ $(d)\ 4+2\sqrt{2}$

(39) $(0,3),(3,3),(3,p)$ are three vertices of an equilateral triangle, then the value of p is

$(a)\ 2$ $(b)\ 3$ $(c)\ 6$ $(d)-\sqrt{3}$

(40) The area of the rectangle formed by the vertices $(0,-1),(-2,3),(6,7),(8,3)$ is.... sq. units .

$(a)\ 20$ $(b)\ 40$ $(c)\ 80$ $(d)1600$

(41) The area of the square formed by the vertices $(3,2),(0,5),(-3,2),(0,-1)$ is.... sq. units

$(a)9$ $(b)18$ $(c)\sqrt{46}$ $(d)\sqrt{18}$

(42) The points $(4,8),(7,5),(1,-1),(-2,k)$ are vertices of a rectangle, then the value of k is

$(a)1$ $(b)2$ $(c)3$ $(d)4$

(43) If $(6,-1)$ is the centroid of a ΔABC with vertices $A(3,4), B(-2,5)$ then the $3rd$ vertex $C=$

$(a)\ (-12,17)$ $(b)(17,12)$ $(c)\ (17,-12)$ $(d)\ (-17,12)$

(44) The length of the diagonal of a rectangle having vertices $A(0,3), B(0,0), C(5,0)$ is... units .

$(a)3$ $(b)\ 5$ $(c)8$ $(d)\ \sqrt{34}$

(45) If $A(2,3), B(4,5)$ then the slope of $\overline{AB}$ is

$(a)0$ $(b)\ 1$ $(c)2$ $(d)\ 3$

(46) The slope of the line join of the points $(a,0)$ and $(0,b)$ is

$(a)\frac{a}{b}$ $(b)-\frac{a}{b}$ $(c)-\frac{b}{a}$ $(d)\frac{b}{a}$

(47) The slope of a line x^- axis is

$(a)\ 0$ $(b)\ 1$ $(c)\ -1$ (d) not defined

(48) The slope of a line parallel to x^- axis is

$(a)\ 0$ $(b)\ 1$ $(c)\ -1$ (d) not defined

(49) If $(-2,-1),(a,0),(4,b),(1,2)$ are the vertices of a parallelogram, then $(a,b) =$

$(a)\ (3,1)$ $(b)(1,3)$ $(c)\ (-1,-3)(d)\ (-3,1)$

(50) If A, B and C are collinear, then the area of ΔABC is .... sq. units .

$(a)1$ $(b)\ 2$ $(c)4$ $(d)\ 0$

ANSWERS

1. (B) 2. (A) 3. (D) 4. (C) 5. (B) 6. (B) 7. (D) 8. (C) 9. (D) 10. (D) 11. (A) 12. (A) 13. (B) 14. (C) 15. (A) 16. (D) 17. (C) 18. (B) 19. (D) 20. (D) 21. (A) 22. (C) 23. (D) 24. (B) 25. (A) 26. (C) 27. (D) 28. (D) 29. (B) 30. (B) 31. (C) 32. (B) 33. (B) 34. (D) 35. (C) 36. (C) 37. (D) 38. (D) 39. (C) 40. (B) 41. (B) 42. (B) 43. (C) 44. (D) 45. (B) 46. (C) 47. (A) 48. (A) 49. (B) 50. (D)

8. SIMILAR TRIANGLES

Geometrical figures which have the same shape and not necessarily of the same size are called "Similar figures".

Regular Polygon : A polygon in which all sides and angles are equal is called a regular polygon.

Similarity of two Triangles : Two triangles are similar if their corresponding angles are equal and corresponding sides are the same ratio.

Symbol of similarity is ~ (Tilde).

Thales Theorem : (Basic proportionality theorem). If a line is drawn parallel to one side of a triangle, to intersect other two sides at distinct points, then other two sides are devided in the same ratio.

The Converse of Thales Theorem : If a line decides two sides of a triangle in the same ratio, then the line is parallel to the third side.

Criterion for Similarity of Triangles :

AAA criterion : In two triangles if the corresponding angles are equal then the sides opposite to equal angles are in the same ratio, then the two triangles are equal.

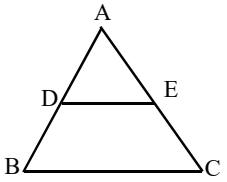
SSS criterion : If in two triangles the sides of one triangle are proportional tothe corresponding sides of the other triangles then their corresponding angles are equal and hence the triangles are equal.

SAS criterion : If one angle of a triangle is equal to one angle of the other triangle and the sides including these angles are proportional, then two triangles are similar.

Area of a Similar Triangle : The ratio of the area of two similar triangles is equal to the ratio of the squares of their corresponding sides.

Pythagoras Theorem : In a right angle triangle, the square of hypotenues is equal to the sum of the squares of the other two sides.

PROBLEMS



1) In ΔABC, DE//BC, AD = 8x + 9, DB = x + 3

AE = x + 2, CE = 2x.

Sol : ΔADE, ΔABC are similar triangles.

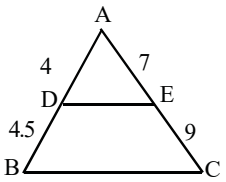
$$\text{Hence, } \frac{AD}{DB} = \frac{AE}{EC} \qquad \frac{x+9}{x+3} = \frac{x+2}{x+1}$$

$$x^2 + 10x + 9 = x^2 + 5x + 6$$

$$5x = -3$$

$$x = -\frac{3}{5}$$

2) Is it possible DE//BC, if in triangle ABC.

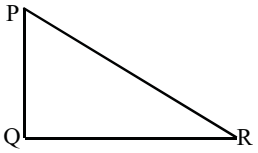


Sol : By basic proportionality theorem,

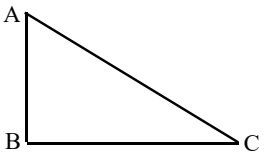
$$\frac{AD}{DB} = \frac{4}{4.5} = \frac{8}{7} \quad \frac{AE}{EC} = \frac{8}{9}$$

$\therefore$ DE//BC.

3) Sun makes 1.5 mts height person's shadow as 3.0m, then at the same time 8m length shadow of a light house's height is ?



Sol :



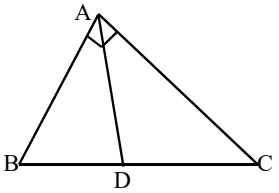
By basic proportionality theorem

ΔABC, ΔPQR are similar triangles.

$$\frac{AB}{PQ} = \frac{BC}{QR} \quad \frac{1.5}{PQ} = \frac{3}{8} \quad \Rightarrow PQ = \frac{1.5 \times 8}{3} = 4\,\text{mts}$$

4) Given $\angle BAD = \angle CAD$, AB = 3.4 cm; BD = 4cm; BC = 10cm then AC = ...?

Sol : ΔABD, ΔADC are similar triangles.

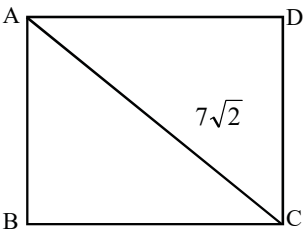


$$\frac{BD}{DC} = \frac{AB}{AC} \qquad DC = 10 - 4 = 6$$

$$\frac{4}{DC} = \frac{34}{AC}$$

$$AC = \frac{3.4 \times DC}{4} = \frac{3.4 \times 6}{4} = 5.1\text{cm}$$

5) The diagnal of a square is $7\sqrt{2}$, then its area is ?



Sol : ABCD is a square then ABC is a Rightangle triangle

By pythogarus theorem,

$AB^2 + BC^2 = AC^2 \Rightarrow a^2 + a^2 = (7\sqrt{2})^2$

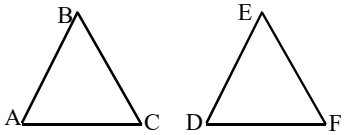
$2a^2 = 49 \times 2 = 98$

$a^2 = 49 \Rightarrow a = 7$

Area $= 7^2 = 49$ sq. cm.

6) Given $\Delta ABC \sim \Delta DEF$, and its areas are 64 sq.cm 121 sq. cm, then length of BC is

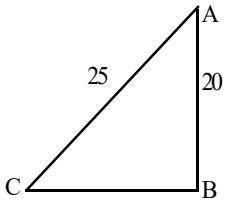
Sol : By the theorem, the ratio of areas of similar triangles is equal to Ratio of their corresponding sides



$$\frac{\Delta ABC}{\Delta DEF} = \frac{(BC)^2}{(EF)^2} \Rightarrow \frac{64}{121} = \frac{BC^2}{(15.4)^2}$$

$$BC^2 = \sqrt{\frac{64 \times 15.4}{121}} = \frac{\sqrt{64}\,\sqrt{15.4}}{\sqrt{212}} = \frac{8 \times 15.4}{11} = 8 \times 1.4 = 11.2$$

6) A ladder of length 25cm is touching a wall at a height of 20 mts from the ground. Find its distance from the ground?



Sol : By Pythogarus theorem

$AC^2 = AB^2 + BC^2$

$25^2 = 20^2 + BC^2$

$BC^2 = 25^2 - 202 = 225$

$BC = \sqrt{225} = 15$

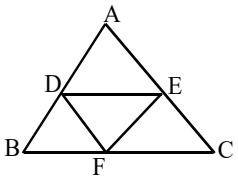
MULTIPLE CHOICE QUESTIONS

1. Similarity is represented by ( )
   A) ~ B) = C) ≅ D) //

2. Two triangles are similar it contains ( )
   A) same point B) same shape C) same size D) none

3. Basic proportionality theorem is also called as ( )
   A) Thales Theorem B) Coordinate Theorem
   C) Similar Angle Theorem D) None

4. From the given diagram DE//BC, AD : DB = 5:4, $\frac{\Delta DEF}{\Delta CFB} = ?$ ( )

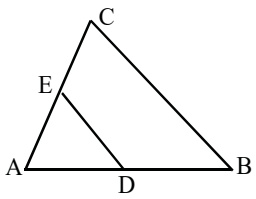


   A) $\frac{81}{25}$ B) $\frac{5}{9}$ C) $\frac{5}{4}$ D) $\frac{25}{81}$

5. The ratio of two similar triangles Perimeter is 4:9, then the ratio of their areas? ( )
   A) 16 : 9 B) 2 : 3 C) 16 : 81 D) 61 : 81

6. Which of the following are the measurements of right angled triangle? ( )
   A) 3, 4, 5 B) 12, 13, 5 C) 18, 17, 5 D) All

7. Given diagram DE//BC, AD = x_1; DB = $x - 2$; AE = $x + 2$; CE = $x - 1$, then x. ( )

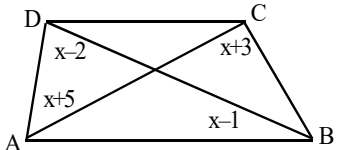


   A) 4 B) 2 C) 3 D) 1

8. ΔABC D, E, F are AB, BC, CA's mid-points then area ΔDEF : Area ΔABC ( )
   A) 1 : 3 B) 1 : 2 C) 1 : 4 D) 11 : 1

9. From the diagram AB//CD, then x_1 = ? ( )

A) 3 B) 4 C) 2 D) 7



Trepesium

10. A person travelled towards east 150 mts. from there he travelled 200m towards northly, then at what distance from the beginning place? ( )

A) 180 mts B) 160 mts C) 150 mts D) 250 mts

11. In a right angle triangle ABCD, O is a point inside, then $OB^2 + OD^2$ = ( )

A) $OA^2 + OC^2$ B) $OA^2 + OB^2$ C) $OA^2 - OC^2$ D) $OC^2 + OD^2$

12. In a right angled triangle, at vertex C there is a right angle, BC = a, CA = b, AB = c, then from c, the perpendicular AB is drawn of length p, then ( )

A) $\frac{1}{P^2} = \frac{1}{a^2} - \frac{1}{b^2}$ B) $\frac{1}{P^2} = \frac{1}{ab}$ C) $\frac{1}{P^2} = \frac{1}{a^2} + \frac{1}{b^2}$ D) None

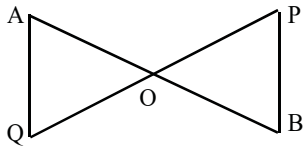
13. If in a right angle triangle ABC, at vertex A has the right angle, BL and CM are the medians then $4(BL^2 + CM^2)$ = ( )

A) $4BC^2$ B) $3BC^2$ C) $2BC^2$ D) $5BC^2$

14. From thediagram QA AB, PB $\perp$ AB A0 = 20cm, BO = 12cm, PB = 18 cm, AQ = ? ( )

A) 30 B) 20

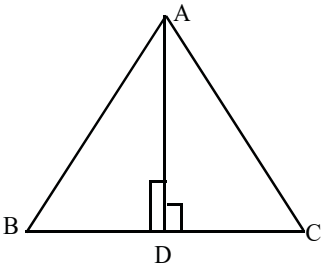
C) 10 D) 14



15. From ΔABC is a equilateral triangle AD $\perp$ BC, then AB^2 = ( )

A) BD^2 B) $\frac{3}{16}BD^2$

C) $\frac{BD^2}{2}$ D) $4BD^2$



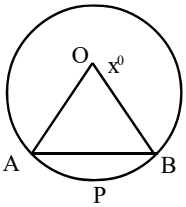
ANSWERS

1. A 2. B 3. A 4. D 5. C 6. D 7. A 8. C 9. D 10. D

11. A 12. C 13. D 14. A 15. B

9. TANGENTS AND SECANTS TO A CIRCLE

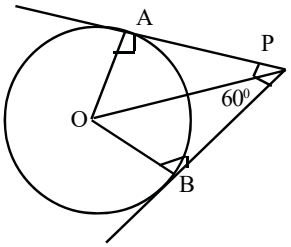
- Two lines mostly intersect at a point or don't intersect in a plane.
- **Circle :** A simple closed curve which is the collection of all those points on a plane which are at a constant distance from a fixed point.
- The word Tangent comes from the Latin word "Tangere" which means "touch."
- Tangent introduced by Thomoas Fineke in 1583.
- Tangent is a special case of Secant where the two points of intersection of a line coincide.
- The common point of the tangent and the circle is called the point of contact.
- Tangent at any point of the circle makes 90^0 with radius.
- The line containing the radius and point of contact is called normal to the circle at that point.
- The length of tangents drawn from the external point of circle are equal.
- If two concentric circles such that a chord of the bigger circle that touches the smaller circle is bisected at the point of contact with the another circle.
- If a secant line intersets the circle, then the area of circle is devided into two parts major segment and minor segment.
- Area of the sector OAPB is $= \frac{x^0}{360^0} \times \pi r^2$



- Area of segment APB = Area of sector OAPB – Area of ΔOAB.

PROBLEMS

1) In a circle, radius 5cm and the angle between the tangents is 60^0, then distance between the centre and external point.



Sol : AP line makes right angle with radius.

OAP is a right angle triangle

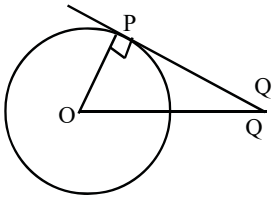
Also $\angle OPA = \angle OPB = 2\angle APB$

$\therefore \angle OPA = 30^0$.

From ΔOAP $\text{Sin}30^0 = \frac{OA}{OP} \Rightarrow \frac{1}{2} = \frac{5}{OP} \Rightarrow OP = 5 \times 2 = 10\,\text{cm}$

2) The length of tangent drawn from external point Q is 24cm. Its distane from the centre is 25cm. Then find the radius?

Sol : ΔOPQ is right angle triangle

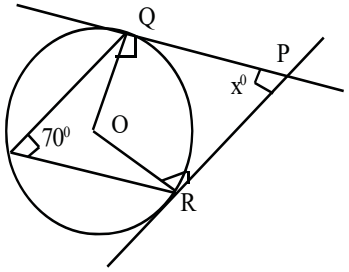


$OP^2 + OQ^2 = PQ^2$.

$r^2 + 24^2 = 25^2 \quad r^2 = 25^2 - 24^2$

$= 625 - 576 = 49 \qquad r = 7$ cm.

3) The circle with centre at a O, PQ and PR are tangents, then x = ?



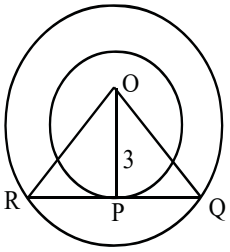
Sol : $\angle ROQ = 2 \times 70^0 = 140^0$

From quadrilateral PQOR

$\angle P + \angle Q + \angle O + \angle R = x^0 + 90^0 + 140^0 + 90^0 = 360^0$

$x = 360^0 - 320^0 = 40^0$

4) Two concentric circles of radii 5cm, 3cm. Find the length of the chord which touches the small circle?



Sol : We known the chord of the big circle which touch the small circle bisect at the contact point

$OP \perp QR, \quad RQ = x, \quad PR = \frac{x}{2}$

ΔORP is a right angled triangle

$OR^2 = RP^2 + OP^2$

$$S^2 = \left(\frac{x}{2}\right)^2 + 3^2 \Rightarrow \frac{x^2}{4} = 5^2 - 3^2 = 25 - 9 = 16$$

$x^2 = 64 \Rightarrow x = 8$

The length of big chord = 8cm.

5) The radius of the circle 7 cm and find the sector area of angle 60^0?

Sol : Sector Area $= \frac{x}{360^0} \times \pi r^2$

$$= \frac{60}{360} \times \pi \times 7^2 = \frac{1}{6} \times \frac{22}{7} \times 7 \times 7 = \frac{77}{3} \text{ sq.cm}$$

6) In a clock the minutes needle has a length 14cm. Find the area when the clock shows 10 minutes.

Sol : In ten minutes the minutes needle makes angle of $\frac{360^0}{10^0} = 60^0$

$$\therefore \text{ The sector Area } = \frac{x}{360^0} \times \pi r^2 = \frac{36}{360} \times \frac{22}{7} \times 14 \times 14$$

$$= \frac{616}{10} \text{ sq.cm}$$

MULTIPLE CHOICE QUESTIONS

1. What is the angle made by the radius with that tangent ( )
   A) 60^0 B) 0^0 C) 90^0 D) 180^0

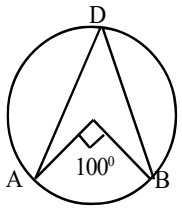
2. The number of chords can be drawn for a circle is ( )
   A) 10 B) 24 C) 90 D) Infinite

3. The locus of the point which moves equal distance from the fixed point is ( )
   A) Straight line B) Point C) Curve D) Circle

4. Angle in semi circle is ( )
   A) 90^0 B) 60^0 C) 80^0 D) 60^0

5. In cyclic quadrilateral the sum of opposite angles is ( )
   A) 90^0 B) 120^0 C) 100^0 D) 180^0

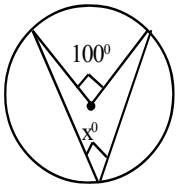
6. In a circle centre 'O' $\angle AOB = 100^0$, $\angle ADB$ ( )



   A) 110^0 B) 120^0
   C) 130^0 D) 140^0

7. The biggest chord of the circle is ( )
   A) Diameter B) Minimum segment C) Radius D) None

8. From the adjacent figure ( )



   A) 40^0 B) 45^0
   C) 100^0 D) 10^0

9. The no. of circles drawn through the three non collinear points is ( )
   A) 3 B) 2 C) 0 D) 1

10. The perimeter of semi circle is ( )
    A) $\frac{28}{7}r$ B) $\frac{32}{7}r$ C) $\frac{36}{7}r$ D) $\frac{38}{7}r$

ANSWERS

1. C 2. D 3. D 4. A 5. D 6. C 7. A 8. B 9. D 10. C

10. MENSURATION

Def : Mensuration means The study of measurement and also includes the derivation and use of Algebric formulas to calculate the areas, volumes and different parameters of Geometric figures.

Types of Figures : There are two types of figures.

1) Plane Figures : Having length and breadth and are two diemensional figures. Ex : Triangle, Square, Rectangle, Circle.

2) Solid Figures : Having length, breadth and height, they are three dimensional figures. Ex: Cube, Cone, Cylinder, Sphere.

The characteristic of plane figures is Area we can measure.

For solid figures we have volume, surfae area, total surface area, laterl surface area.

Surface Area : The area formed by all surfaces on a solid figure is called surface area.

Lateral Surface : Area formed vertical planes.

Volume : Space occupied by the geometrical figure or solid.

Surface areas of the combintionof solids is the total of surface areas of its visible parts only.

Volume of the combination of solids is the sum of volumes of its constituents.

In the conversion of solid from one shape to another shape volume is constant.

PROBLEMS

1) Find the Area of circle, with radius 5 cm?

Sol : Area of circle (A) = πr^2, r = 5cm

$= \pi \times 5^2 = 25\pi$ sq cm.

2) Find the lateral surface area of a cuboid with measurment 15cm × 12cm × 10 cm?

Sol : Lateral surface area = 2h (l + b)

l = 15cm, b = r, h = 10cm

= 2(10) (15 + 12) = 20(27) = 540 sq. cm.

3) Find the number of soaps can be placed with size 10 × 5 × 2.5 cm in a box with sizes 20 × 10 × 10cm.

Sol : Volume of the box = lbh

$= 20 \times 10 \times 10 = 2000$ cub.cm.

Volume of the soap $= 10 \times 5 \times 2.5 = 125$ cc

The no of soaps placed in a known box deviding the volume by soud.

$$= \frac{200}{125} = 16$$

4) If the ratio of area curved surfaces is 1:4. Then find the ratio's of volumes of sphere?

Sol : Area of sphere $S_1 = 4\pi r_1^2$ $S_2 = 4\pi r_1^2$

$S_1 : S_2 = 4\pi r_1^2 : 4\pi r_1^2 = r_1^2 : r_2^2$

$S_1 : S_2 = r_1^2 : r_2^2 = 1 : 4 \Rightarrow r_1 : r_2 = 1 : 4$

$V_1 : V_2 = \frac{4}{3}\pi r_1^3 : \frac{4}{3}\pi r_2^3$

$= r_1^3 : r_2^3 = \frac{r_1}{r_2} = \frac{1}{4} = r_2 = 4r,$

$= r_1^3 : (4r_1)^3 = r_1^3 : 64r_1^3 = 1 : 64.$

5) Find the volume of the pyramid; if height 12cm base area 25 sq.cm.

Sol : The volume of the pyramid = $\frac{1}{3}$ Area of base × height

$= \frac{1}{3} \times 12 \times 25 = 100$ cc. cm.

6) Find the volume of the right circular cone with radius 6 cm and height 7 cm.

Sol : Volume of the cone = $\frac{1}{3}\pi r^2 h$. r = 6cm, h = 7cm

$= \frac{1}{3} \times \pi \times 6^2 \times 7 = \frac{1}{3} \times \frac{22}{7} \times 36 \times 1 = 346 cc.$

7) A solid iron rod has a cylindrical shape. Its height is 11 cm and base diameter is 7 cm. Find the total volume of 50 rods?

Sol : Volume of cylinder = $\pi r^2 h$, $r = \frac{7}{2} cm$, $h = 11 cm$

$= \frac{22}{7} \times \frac{7}{2} \times 11 = \frac{121 \times 7}{2} = \frac{847}{2} = 423$ c.c

Total volume of 50 rods $= 50 \times \frac{847}{2} = 21175$ c.c

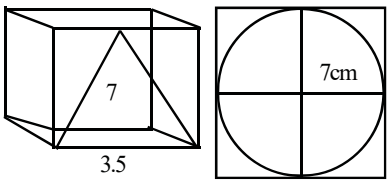
8) Find the volume of the largest circular cone that can be cut out of a cube whose edge is 7cm ?

Sol : Volume of largest circular cone is $V = \frac{1}{3}\pi r^2 h$ r = radius; h = height

r = 3.5 cm; h = 7 cm

$= \frac{1}{3} \times \frac{22}{7} \times (3.5)^2 \times 7$

$V = \frac{1}{3} \times 22 \times 3.5 \times 3.5 = 89.83$ c.c



MULTIPLE CHOICE QUESTIONS

1. The number of vertices of a cuboid ( )
   A) 4 B) 8 C) 9 D) 6

2. Formula for lateral surface area of a cylinder ( )
   A) $2\pi rh$ B) $2\pi r^2h$ C) πr^2h D) None

3. If r = 7cm, h = 10cm are the radius and height of a cone then slant height (l) = ___ cm. ( )
   A) 13.4 B) 10.3 C) 18.2 D) 12.2

4. A sphere with 6cm diameter is changed to 2cm diameter wire, then the length of the wire ( )
   A) 48 B) 12 C) 36 D) 24

5. If a cuboid has l = b = h then the diagram is ( )
   A) Cone B) Cube C) Cylinder D) None

6. A cylindrical shaped bottle volume is 88 cc, radius 2cm then its height ( )
   A) 5 B) 6 C) 7 D) 8

7. The volume of empty sphere _____ cm. ( )
   A) $\frac{4}{3}\pi(R^3-r^3)$ B) $\frac{2}{3}\pi(R^3-r^3)$ C) $\frac{1}{2}\pi(R^3-r^3)$ D) $\frac{5}{6}\pi(R^3-r^3)$

8. The ratio of volumes of cone and Cylinder of same bae radius and height is ( )
   A) 1 : 3 B) 3 : 1 C) 2 : 3 D) 3 : 2

9. A cube 4cm has as a side length and its weight is 400 kgs. What is the length of the side of 3200 Kgs? ( )
   A) 64 B) 32 C) 2 D) 16

10. The volume of the cylinder is 49.896cm^3 and its lateral surface area is 4752 cm^2. Find its radius ( )
    A) 12.3 B) 10 C) 21 D) 13.7

11. A tank has its length three times to its breadthj and depth is 256 cm, if we fill 3000*l*, then what could be tis base area? ( )
    A) 111775 m^2 B) 1171.875 m^2 C) 1.171875 m^2 D) 11.71875 m^2

12. Find the volume of the pyramid if height 12cm, base area 25 sq. cm. ( )
    A) 100 B) 150 C) 200 D) 250

13. A tent in the form of cone makes 60^0 at vertix, find the ratio of base radius and slant height. ( )
    A) 2:1 B) 2:3 C) 3:2 D) 1:2

14. A wall of sixe 30cm × 30cm × 5 cm is to be constructed and it consist of two doors 2.5mts × 1.2 mts and how many bricks are needed if the size of the brick 20 × 16 ×8 cm ( )
    A) 13500 B) 15000 C) 20050 D) 18500

ANSWERS

1. B 2. A 3. D 4. C 5. D 6. C 7. A 8. A 9. B 10. C
11. C 12. A 13. D 14. B

11. TRIGONOMETRY

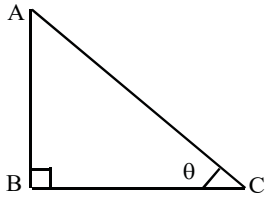
Trigonometry is the study of relationships between angles and sides of a triangle.

Six trigonometric ratios are defined in a **right angled triangle**.

The side opposite to the angle is called Opposite side.

The side adjaent to the angle is called Adjacent side.

Trigonometric Ratios :



We define six trigonometric ratios in a right angle triangle ABC

$\text{Sin}\,\theta = \frac{\text{Opposite side}}{\text{Hypotenuse}} = \frac{AB}{AC}$, $\quad \text{Cos}\,\theta = \frac{\text{Adjacent side}}{\text{Hypotenuse}} = \frac{BC}{AC}$

$\text{Tan}\,\theta = \frac{\text{Opposite side}}{\text{Adjacent side}} = \frac{AB}{BC}$, $\quad \text{Cosec}\,\theta = \frac{\text{Hypotenuse}}{\text{Opposite side}} = \frac{AC}{AB}$

$\text{Sec}\,\theta = \frac{\text{Hypotenuse}}{\text{Adjacent side}} = \frac{AC}{BC}$, $\quad \text{Cot}\,\theta = \frac{\text{Adjacent side}}{\text{Opposite side}} = \frac{BC}{AB}$

Trigonometric ratios of some allied angles :

$\text{Sin}\,(90^0 - \theta) = \text{Cos}\,\theta$, $\quad \text{Cos}\,(90^0 - \theta) = \text{Sin}\,\theta$

$\text{Cosec}\,(90^0 - \theta) = \text{Sec}\,\theta$, $\quad \text{Tan}\,(90^0 - \theta) = \text{Cot}\,\theta$

$\text{Cot}\,(90^0 - \theta) = \text{Tan}\,\theta$, $\quad \text{Sec}\,(90^0 - \theta) = \text{Cosec}\,\theta$

$\text{Sin}\,(90^0 + \theta) = \text{Cos}\,\theta$, $\quad \text{Cos}\,(90^0 + \theta) = -\text{Sin}\,\theta$

$\text{Cos}\,(180^0 - \theta) = -\text{Cos}\,\theta$ $\quad \text{Cos}\,(-\theta) = \text{Cos}\,\theta$ etc.

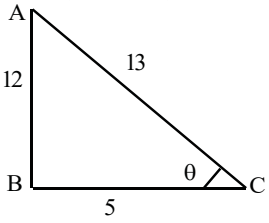
Trigonometric Identities :

	Deductions
$\text{Sin}^2\theta + \text{Cos}^2\theta = 1$	$\text{Sin}^2\theta = 1 - \text{Cos}^2\theta$, $\text{Cos}^2\theta = 1 - \text{Sin}^2\theta$
$\text{Sec}^2\theta - \text{Tan}^2\theta = 1$	$\text{Sec}^2\theta = 1 + \text{Tan}^2\theta$, $\text{Tan}^2\theta = \text{Sec}^2\theta - 1$
$\text{Cosec}^2\theta - \text{Cot}^2\theta = 1$	$\text{Cosec}^2\theta = 1 + \text{Cot}^2\theta$, $\text{Cot}^2\theta = \text{Cosec}^2\theta - 1$

PROBLEMS

1) In a right angle triangle ABC, 12, 13, 5 are the sides of AB, AC, BC then find Sinθ, Cosθ, Tanθ.

Sol : Given right angle ΔABC. $\text{Sin}\,\theta = \frac{\text{Opp. side}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{12}{13}$ $\quad AB = 12;\ BC = 5;\ AC = 13$

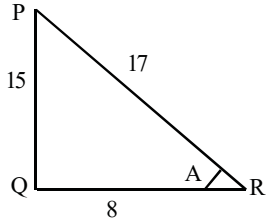


$\text{Cos}\,\theta = \frac{\text{Adj. side}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{5}{13}$

$\text{Tan}\,\theta = \frac{\text{Opp. side}}{\text{Adj. side}} = \frac{AB}{BC} = \frac{12}{5}$

2) If Cos A $= \frac{8}{17}$ Find Sin A, Tan A.

Sol : Construct a Right angle triangle. Given Cos A $= \frac{8}{17}$ QR = 8; PR = 7



$$\text{Cos A} = \frac{18}{7} = \frac{\text{Adj. side}}{\text{Hypotenuse}}$$

By Pythogorous theorem $PQ^2 + QR^2 = PR^2$

$PQ^2 + 8^2 = 17^2$

$PQ^2 + 17^2 - 8^2 = 289 - 64 = 225$

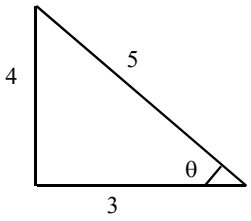
$PQ = \sqrt{225} = 15$

$$\text{Sin A} = \frac{\text{Opp. side}}{\text{Hypotenuse}} = \frac{15}{17}, \qquad \text{Tan A} = \frac{\text{Opp. side}}{\text{Adj. side}} = \frac{15}{8}$$

3) If Cotθ $= \frac{3}{4}$ Find the value of $\left(\frac{1+\text{Sin}\theta}{\text{Cos}\theta}\right)$.

Sol : Given Cotθ $= \frac{3}{4}$, by considering a right angle triangle,

$$\text{Cot}\theta = \frac{\text{Adj. side}}{\text{Opposite side}} = \frac{3}{4}$$



$$\text{Sin}\theta = \frac{4}{5}, \quad \text{Cos}\theta = \frac{3}{5}$$

$$\frac{1+\text{Sin}\theta}{\text{Cos}\theta} = \frac{1+\frac{4}{5}}{\frac{3}{5}} = \frac{\frac{5+4}{5}}{\frac{3}{5}} = \frac{9}{3} = \frac{1}{3}$$

Trigonometric Values :

θ	0^0	30^0	45^0	60^0	90^0
Sinθ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
Cosθ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
Tanθ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	α

Reciprocal Formulas :

$$\text{Cosec}\,\theta = \frac{1}{\text{Sin}\,\theta}, \quad \text{Sin}\,\theta = \frac{1}{\text{Cosec}\,\theta}$$

$$\text{Sec}\,\theta = \frac{1}{\text{Cos}\,\theta}, \quad \text{Cos}\,\theta = \frac{1}{\text{Sec}\,\theta}$$

$$\text{Cot}\,\theta = \frac{1}{\text{Tan}\,\theta}, \quad \text{Tan}\,\theta = \frac{1}{\text{Cot}\,\theta}$$

$$\text{Tan}\,\theta = \frac{\text{Sin}\,\theta}{\text{Cos}\,\theta}, \quad \text{Cot}\,\theta = \frac{\text{Cos}\,\theta}{\text{Sin}\,\theta}$$

PROBLEMS

1) Evaluate Sin 30^0 + Cos 60^0 = ?

Sol : (By the table) Sin 30^0 + Cos 60^0 = $\frac{1}{2} + \frac{1}{2} = 1$

2) Evaluate $\frac{2\text{Tan}45^0}{1+\text{Tan}^2 30^0}$ **= ?**

Sol : By the table, $\frac{2\text{Tan}45^0}{1+\text{Tan}^2 30^0} = \frac{2\times 1}{1+\left(\frac{1}{\sqrt{3}}\right)^2} = \frac{2}{1+\frac{1}{3}}$

$$= \frac{2}{\frac{3+1}{3}} = 2\times\frac{3}{4} = \frac{3}{2}$$

3) Evaluate $\frac{\textbf{Sin30}^0 \textbf{ + Tan45}^0 \textbf{ – Cosec60}^0}{\textbf{Cot45}^0 \textbf{ + Cos60}^0 \textbf{ – Sec30}^0}$ **= ?**

Sol : Given $\frac{\text{Sin}30^0 + \text{Tan}45^0 - \text{Cosec}60^0}{\text{Cot}45^0 + \text{Cos}60^0 - \text{Sec}30^0} = \frac{\frac{1}{2}+1-\frac{2}{\sqrt{3}}}{1+\frac{1}{2}-\frac{2}{\sqrt{3}}} = 1$

4) If Sin(P – Q) = $\frac{1}{2}$**, Cos (P + Q) =** $\frac{\sqrt{3}}{2}$**, Find P and Q.**

Sol : Sin (P – Q) = $\frac{1}{2}$ = Sin 30⁰; Cos (P + Q) = $\frac{\sqrt{3}}{2}$ = Cos30⁰

∴ P – Q = 30⁰ ..... (1) P + Q = 30⁰ ..... (2)

Solving (1) and (2)

$$\begin{array}{r} P - Q = 30 \\ \hline P + Q = 30 \\ \hline 2P = 60 \end{array} \qquad P = 30 \;\; Q = 0^0$$

5) If ABC are Interior Angles of a triangle ABC, show that $\text{Tan}\left(\frac{A+B}{2}\right) = \text{Cot}\frac{C}{2}$.

Sol : If ABC are interior angles of a triangle

$$A + B + C = 180^0 \quad \Rightarrow \quad \frac{A+B+C}{2} = \frac{180^0}{2}$$

$$\Rightarrow \quad \frac{A+B}{2} + \frac{C}{2} = 90^0 \quad \Rightarrow \quad \frac{A+B}{2} = 90^0 - \frac{C}{2}$$

$$\text{Tan}\left(\frac{A+B}{2}\right) = \text{Tan}\left(90 - \frac{C}{2}\right)$$

$$\text{Tan}\left(\frac{A+B}{2}\right) = \text{Cot}\frac{C}{2}$$

6) Evaluate Sin 15⁰ Sec75⁰ = ?

Sol : Sin 15⁰ Sec75⁰ = Sin 15⁰ × Sec(90⁰ – 15⁰) = Sin 15⁰ × Cosec 15⁰ = $\text{Sin}15^0 \times \frac{1}{\text{Sin}15^0} = 1$

7) Evaluate $\mathbf{Sin\ 5^0\ Cos\ 85^0 + Cos\ 5^0\ Sin\ 85^0}$ = ?

Sol : $\text{Sin } 5^0 \text{ Cos } 85^0 + \text{Cos } 5^0 \text{ Sin } 85^0 = \text{Sin } 5^0 \text{ Cos } (90^0 - 5^0) + \text{Cos } 5^0 \text{ Sin } (90^0 - 5^0)$

$= \text{Sin } 5^0 \text{ Sin}5^0 + \text{Cos } 5^0 \text{ Cos } 5^0$

$= \text{Sin}^2 5^0 + \text{Cos}^2 5^0 = 1$

8) Show that $\mathbf{(1 + Tan\ \theta + Sec\ \theta)\ (1 + Cot\ \theta - Cosec\ \theta) = 2}$.

Sol : $\text{LHS} = \left(1 + \frac{\text{Sin}\theta}{\text{Cos}\theta} + \frac{1}{\text{Cos}\theta}\right)\left(1 + \frac{\text{Cos}\theta}{\text{Sin}\theta} - \frac{1}{\text{Sin}\theta}\right) = \left(\frac{\text{Cos}\theta + \text{Sin}\theta - 1}{\text{Cos}\theta}\right)\left(\frac{\text{Sin}\theta + \text{Cos}\theta - 1}{\text{Sin}\theta}\right)$

$= \frac{(\text{Cos}\,\theta + \text{Sin}\,\theta)^2 - 1^2}{\text{Cos}\,\theta \text{Sin}\,\theta} = \frac{\text{Cos}^2\,\theta + \text{Sin}^2\,\theta + 2\text{Sin}\,\theta\text{Cos}\,\theta - 1}{\text{Cos}\,\theta \times \text{Sin}\,\theta}$

$= \frac{1 + 2\text{Sin}\theta\ \text{Cos}\,\theta - 1}{\text{Sin}\,\theta\ \text{Cos}\,\theta} = 2$

9) Show that $\mathbf{(Cosec\theta - Cot\theta)^2 = \frac{1 - Cos\theta}{1 + Cos\theta}}$.

Sol : $\text{LHS} = (\text{Cosec}\,\theta - \text{Cot}\theta)^2 = \left(\frac{1}{\text{Sin}\theta} - \frac{\text{Cos}\theta}{\text{Sin}\theta}\right)^2 = \frac{(1 - \text{Cos}\theta)^2}{\text{Sin}^2\theta} = \frac{(1 - \text{Cos}\theta)^2}{1 - \text{Cos}^2\theta}$

$= \frac{(1 - \text{Cos}\theta)^2}{(1 + \text{Cos}\theta)\ (1 - \text{Cos}\theta)} = \frac{1 - \text{Cos}\theta}{1 + \text{Cos}\,\theta}$

10) Show that $\mathbf{Tan^2\theta + Tan^4\theta = Sec^4\theta - Sec^2\theta}$.

Sol : $\text{LHS } \text{Tan}^2\theta + \text{Tan}^4\theta = \text{Tan}^2\theta\ (1 + \text{Tan}^2\theta)$

$= \text{Tan}^2\theta\ (\text{Sec}^2\theta)$

$= (\text{Sec}^2\theta - 1)\ (\text{Sec}^2\theta)$

$= \text{Sec}^4\theta - \text{Sec}^2\theta$

MULTIPLE CHOICE QUESTIONS

1. Is SinA is the product of Sin and A ? ( )

   A) Yes B) No C) Algebric Product D) Cannot be determined

2. If Cos $x = \frac{4}{3}$ does exist for what value of x ? ( )

   A) 30^0 B) 60^0 C) 90^0 D) Not possible

3. Find θ, if $\text{Tan}\,\theta = \frac{1}{\sqrt{3}}$. ( )

   A) 30^0 B) 60^0 C) 90^0 D) 75^0

4. Value of $Cos^2\theta + Sin^2\theta$ = ( )

A) 1 B) 0 C) 1/2 D) α

5. Value of Cosec $(90^0 - \theta)$ = ? ( )

A) Tanθ B) Secθ C) Sinθ D) Cosθ

6. Complimentary of 75^0 is _____ ( )

A) 35^0 B) 15^0 C) -75^0 D) 105^0

7. Is it correct to say Sin (A + B) = Sin A + Sin B ( )

A) Correct B) No, it is $\frac{\text{Sin A}}{\text{Sin B}}$ C) In correct D) Can not say

8. Sin $(90^0 - \theta)$ = ( )

A) Sin 90^0–Sinθ B) $\frac{\text{Sin}90^0}{\text{Sin}\theta}$ C) Cosθ D) 0^0

9. If Cos 7A = Sin (30–A) then A = ? ( )

A) 10^0 B) 20^0 C) 40^0 D) 75^0

10. If TanA = Cot B, Then A+B = ? ( )

A) 90^0 B) 60 C) 30^0 D) 180^0

11. If A,B,C are interior angles of a triangle ABC, then $\text{Cos}\left(\frac{A+B}{2}\right)$ = ? ( )

A) $\text{Tan}\frac{C}{2}$ B) $\text{Cot}\left(\frac{A-B}{2}\right)$ C) $\text{Sin}\frac{C}{2}$ D) $\text{Sin}\left(\frac{A+B}{2}\right)$

12. Value of Cos 12^0 – Sin 78^0 = ? ( )

A) 1 B) $\frac{1}{2}$ C) 2 D) 0

13. Express Tan 80^0 + Cos 80^0 in terms of trigonometric ratio's of angles between 0 and 20^0. ( )

A) $Sin15^0 + Cos5^0$ B) Tan20 + $Cot10^0$ C) $Sin15^0 + Cos10^0$ D) $Cot10^0 + Sin10^0$

14. If $\text{Sin A} = \frac{8}{17}$ then Cos A = ? ( )

A) $\frac{5}{17}$ B) $\frac{2}{17}$ C) $\frac{3}{17}$ D) $\frac{7}{17}$

15. If $x = 17^0$, then $Cos^2(x^2 + x) + Sin^2(x^2 + x)$ = ? ( )

A) 0 B) 1 C) 16 D) 18

16. $Cos^2\theta - Sin^2\theta = 0$ then the value of θ = ? ( )

A) $\frac{\pi}{3}$ B) $\frac{\pi}{6}$ C) $\frac{\pi}{2}$ D) $\frac{\pi}{4}$

17. Value of $\frac{1}{1+\text{Cos}\theta} + \frac{1}{1-\text{Cos}\theta} = ?$ ( )

A) $2\text{Cosec}^2\theta$ B) $2\text{Cos}^2\theta$ C) 1 D) 0

18. $\text{Tan } 48^0 \text{ Tan } 42^0 = ?$ ( )

A) 1 B) 0 C) 2^0 D) 90^0

19. The value fo $\text{Cos}1^0 \text{ Cos}2^0 \text{ Cos}3^0 .... \text{Cos}2023^0 =$ ( )

A) 0 B) 1 C) $\text{Sin}1^0 \text{ Sin}2^0 \text{ Sin}3^0 ... \text{ Sin}2023^0$ D) $\frac{1}{2}$

20. $x = \text{P Cos}\theta$, $y = \text{PSin}\theta$ then the value of $x^2 + y^2 = ?$ ( )

A) 0 B) 1 C) P^2 D) $\frac{1}{P}$

21. Value of $(1 + \text{Tan}\theta + \text{Sec}\theta)(1 - \text{Cot}\theta + \text{Cosec}\theta) = ?$ ( )

A) 1 B) 2 C) 3 D) 4

22. Evaluate $\frac{\text{Cos}^2 15^0 + \text{Sin}^2 75^0}{\text{Sin}^2 36^0 + \text{Sin}^2 54^0} = ?$ ( )

A) 0 B) $\frac{1}{2}$ C) 1 D) $\frac{1}{4}$

23. Value of $\sqrt{\frac{1+\text{SinA}}{1-\text{SinA}}} =$ ( )

A) SecA + TanA B) SecA – TanA C) SecA TanA D) $\frac{\text{SecA}}{\text{TanA}}$

24. $(\text{Sin}\theta + \text{Cos}\theta)^2 + (\text{Sin}\theta - \text{Cos}\theta)^2 = ?$ ( )

A) 1 B) 2 C) 3 D) 4

25. A chord of a circle of Radius 5cm is making an angle 60^0 at the centre. Find the length of the Chord? ( )

A) 10 B) 20 C) 205 D) 5

26. Value of $\frac{1 - \text{Tan}^2 45^0}{1 + \text{Tan}^2 45^0} = ?$ ( )

A) 0 B) 1 C) 2 D) 45

27. If $\text{Tan}\theta = \frac{a}{b}$, then $\text{Cos}\theta = ?$ ( )

A) $\frac{b}{\sqrt{a^2 - b^2}}$ B) $\frac{b}{\sqrt{a^2 + b^2}}$ C) $\frac{a}{\sqrt{a^2 - b^2}}$ D) $\frac{a}{\sqrt{a^2 + b^2}}$

28. If $\text{Sec}\theta + \text{Tan}\theta = P$, then value of $\text{Sec}\theta - \text{Tan}\theta = ?$ ( )

A) P B) P^2 C) $\frac{1}{P}$ D) P^3

29. Simplify SecA(1 – SinA) (SecA + TanA) = ? ( )

A) TanA B) SecA C) 1 D) SinA

30. Find $\frac{\text{Sin}\theta - \text{Cos}\theta + 1}{\text{Sin}\theta + \text{Cos}\theta - 1} = ?$ ( )

A) $\text{Sec}\theta + \text{Tan}\theta$ B) $\text{Sec}\theta - \text{Tan}\theta$ C) $\frac{1}{\text{Sec}\theta - \text{Tan}\theta}$ D) $\text{Sec}\theta\ \text{Tan}\theta$

ANSWERS

1. B	2. D	3. A	4. A	5. B	6. B	7. C	8. C	9. A	10. A
11. C	12. D	13. D	14. A	15. B	16. D	17. A	18. A	19. A	20. C
21. B	22. C	23. A	24. B	25. D	26. A	27. B	28. C	29. C	30. A

12. APPLICATIONS OF TRIGONOMETRY

We apply trigonometry to find various real life problems and we get easily solutions. Ex : Find height of hill, width of river, height of buildings.

Sir George Everst found the height of Mounth Everest.

Line of Sight : The imaginary line joining from eye and the viewing point.

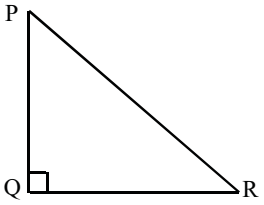
Horizontal Line : Any line parallel to Horizon or earth.

Angle of Elevation : The line of sight above the horizontal line and angle between the line of sight and horizontal line is called Angle of elevation.

Angle of Depression : The angle between the line of sight and Horizontal line is called Angle of depression.

Pythogoras Theorem : In a right angle triangle the square of the hypotenuse is equal to the sum of squares of other two sides.

$$PR^2 = PQ^2 + QR^2$$

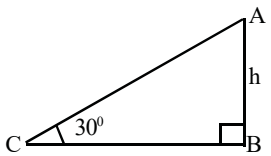


PROBLEMS

1) A boy observed the top of an tower at an angle of elevation of 30^0, at a distance 4mts away from the tower. Find the height of tower.

Sol : From the figure ABC is a right angle triangle.

AB = height; BC = Position of distance from tower



$$\text{Tan}30^0 = \frac{AB}{BC} \Rightarrow BC = AB\text{Tan}30^0$$

$$= 4\frac{1}{\sqrt{3}} = \frac{4}{\sqrt{3}} \text{mts.}$$

2) Raju observes a person standing on the ground from a hill at an angle of depression 60^0. The height of hill is 25mts, what is the distance of the person from the hill?

Sol : AB = height of hill

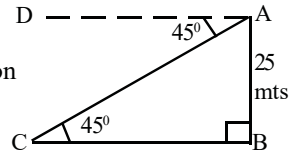
BC = Distance from hill to person

AD Imaginary horizontal making 45^0 with line of view of a person

AD || BC

$\therefore \angle DAC = \angle ACB = 45^0$, ABC is Right angle triangle,

we use Trigonometric ratios.



$$\text{Cot}45^0 = \frac{BC}{AB}$$

$$1 = \frac{BC}{AB} \Rightarrow BC = AB \Rightarrow BC = 25\text{mts}$$

3) Length of the shiadow of a 15 meter high pole is $5\sqrt{3}$ mts at 7 O clock in the morning, then what is the angle of elevation of the sun rays with the ground at the time?

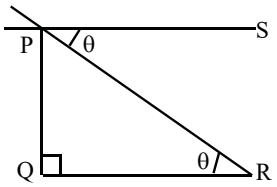
Sol : Length of shadow = 15 mts. Height of pole = $5\sqrt{3}$ mts

Angle of depression is θ. Then PS || QR

(If transversal intersect the pair of straight lines, the internal alternative angles are equal)

$\angle RPS = \angle QRP$

$\therefore$ In triangle PQR consider $\text{Tan}\theta = \frac{PQ}{QR}$



$$\text{Tan}\theta = \frac{5\sqrt{3}}{15} = \frac{1}{\sqrt{7}} \Rightarrow \theta = 30^0$$

4) A statue stands on the top of a 24m tall pedestal, from a point on the ground, the angle of elevation of the top of the statue is 60^0 and from the same point the angle of elevation of the top of the pedestal is 45^0. Find the height of the statue.

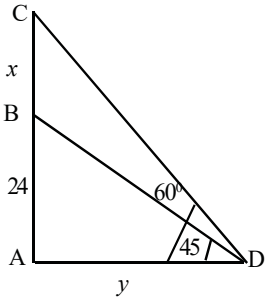
Sol : AB = 24m; BC = x (say)

From ΔABD, $\text{Tan}45^0 = \frac{24}{y} \Rightarrow 1 = \frac{24}{y} \Rightarrow y = 24$

From ΔACD, $\text{Tan}60^0 = \frac{AC}{AD}$ $AC = AD\text{Tan}60^0$

$x + 24 = y\sqrt{3}$

$x + 24 = 24\sqrt{3} \Rightarrow x = 24\sqrt{3} - 24 = 24(\sqrt{3} - 1)$ m



MULTIPLE CHOICE QUESTIONS

1. A kite is flying and is at a height of 75cm and thread is making an angle of 60^0 with horizontal. What is the length of thread used? ( )

   A) $50\sqrt{2}$ B) $\frac{50}{\sqrt{2}}$ C) $50\sqrt{3}$ D) 50

2. A lader of length 20m touches the wall at 10mts. Find the angle of lean. ( )

   A) 45^0 B) 35^0 C) 30^0 D) 90^0

3. If we want to solve problems of heights and distances. ( )

   A) All objects are linear

   B) Angle of elevation or angle of depression are with reference to horizontal

   C) Height of the observer only neglected D) All the above

4. A shooting arrow is released from the bow from the top of a building at height of 50m to the target on the ground with angle of depression of 30^0, the distance travelled by the arrow is 100mt. ( )

   A) 50m B) 100mt C) 500 mts D) None

5. From a top of light house a ship was seen with 30^0 angle of depression, find the distance from the tower to the ship. ( )

   A) $25\sqrt{3}$ m B) $75\sqrt{3}$ m C) $\frac{75}{\sqrt{2}}$ m D) $75\sqrt{2}$ mts

6. The ratio of a height of a tree and its shadow is $1:\sqrt{3}$. Then find the angle of depression of sun rays? ( )

A) 30^0 B) 60^0 C) 45^0 D) 90^0

7. If the angle of elevations of two towers of same height are 30^0, 60^0 from the point in between with a distance 80 mts apart, what are the heights of these towers? ( )

A) 24, 64 B) 34, 46 C) 34, 64 D) 34, 60

8. The angle of elevations of the top of a tower from two points at a distance of 4m and 9m, find the height of the tower from the Base of the tower and ini the same straight line with it are complimantary on same side. ( )

A) $4\sqrt{39}$ B) $3\sqrt{93}$ C) $\sqrt{39}$ D) $5\sqrt{13}$

9. The angle of elevation of a jet plane from a point A on the ground is 60^0. After a flight of 15 sec the angle elevation changes to 30^0. If the jet plane is flying at a constant height of $500\sqrt{3}$ mts. Find the speed of the jet plane. ( )

A) 200 m/s B) 400 m/s C) 600 m/s D) 500 m/s.

10. The flag of a temple seen by 2 persons with angle of elivation is 30^0 and 60^0 of height 30mts. Find the distance between them. ( )

A) $40\sqrt{3}$ B) $20\sqrt{3}$ C) $60\sqrt{3}$ D) $80\sqrt{3}$

** *** **

ANSWERS

1. C 2. C 3. D 4. B 5. B 6. A 7. D 8. C 9. A 10. A

13. PROBABILITY

We often come across certain words probably, likely, possibly are used to describe some situations like games, weather conditions etc. These situations are measured or qauntified into numerical measure is referred to as **Probability**.

Fair Coin : Symmetrical so that there is no reason for it to come down more often on one side than the other it is called as un-biased.

Random Toss : The coin to fall freely without any interference or bias.

In an experiment or simply say activity of throwing a coin there is happening of two evens falling Tail or Head. These are called events.

What is the chance of falling either head or tail. "That is probably either Head or tail."

The probability of showing up of tail or head is Probability of an event, if E is event then P(E).

Probability of an event is given by

$$P(E) = \frac{\text{No. of trails in which event is happened}}{\text{Total number of trails}}$$

Examples of Events :

1) Getting a digit 1,2,3,4,5,6 when a dice is rolled
2) Winning a game of Carrom.
3) Picking a ball from a bag.

Equally likely out comes means equal changes to happen an event in an experiment.

The definition of probability was given by Pierre Sim as laplace in 1795.

The theoritical probability of an event T written as P(T).

$$P(T) = \frac{\text{Number of outcomes favourable to T}}{\text{Number of all possible outcomes of experiment}}$$

Mutually exclusive event : In an experiment, occurence of an event prevents occurence of all other events, such an event is called mutually exclusive event.

Sure Event : The probability of an event which occurs surely is called sure event. the probability of sure event is always '1'.

Ex : In an experiment of through a adice, the probability of getting a number less than 6 is '1'.

Impossible Event : The probability of an event which is impossible to occur. Such an event is called impossible event.

Ex : Getting 7 on the dice when a dice is thrown.

Complimentary Event : In an experiment one of specific event happen and not happen. The happening of an event is P(E), then not happening event is complimentary event. It is denoted as $P(\overline{E})$.

And $P(\overline{E}) = 1 - P(E)$

In all most all cases the probability of happening of all events is equal to '1'.

$$P(E) + P(\overline{E}) = 1$$

The probability of an event occur do not have –ve value.

The range of the probabilities of all events is always (0, 1) or $0 \leq P(E) \leq 1$.

Deck of Cards : A deck of playing cards contain 52 cards. They are devidced four units of 13 cards each. Clubs, Spades, Red hearts, Red diamonds, Face Cards : Kigns, Queens, Jacks.

PROBLEMS

1) What are equally likely outcomes of troughing a coin ?

Sol : Head or tail.

2) What are equally likely outcomes of troughing a dice?

Sol : Slowing 1, 2, 3, 4, 5, 6.

3) No. of outcomes of drawing a card from a deck of playing cards.

Sol : 52.

4) What is the Probability of getting a Tail when a coin is tossed once?

Sol : In this experiment of tossiing a coin once the number of possible outcomes is Head and Tail. Let E be the event of gettinig tail. The number of favourable outomes to E is '1'. Total number of outcomes is '2'.

$$P(E) = \frac{\text{Number of favourable outcomes of falling Tail}}{\text{Total number of outcomes}} = \frac{1}{2}$$

5) One card is drawn from a well shuffled deck of 52 cards. Calculate the probability of that cards will be (i) a king, (2) not a king.

Sol : Well suffled gives a equally like out comes :

1) There are four kings.

Let E be the event of getting a king

No. of favourable outcomes = 4.

No. of Total outcomes = 52

$$P(E) = \frac{4}{52}$$

2) No. of happening of king :

Let E be the event of gettiing other than king

No. of favourable outcomes = 48.

No. of total outcomes = 52

$$P(E) = \frac{48}{52} = \frac{12}{13}$$

MULTIPLE CHOICE QUESTIONS

1. Set of all possible out comes of a in an experiment is called. ( )
   A) Set B) Space C) Sample Space D) Universal set

2. Probability of an impossible event is ( )
   A) 0 B) 1 C) α D) cannot be determined

3. In an experiment where occurance of one event prevents all other events is ( )
   A) Exclusive event B) Mutually exclusive event
   C) Elementary Unit D) None

4. For an event E, P(E) = ? ( )
   A) $P(\overline{E})$ B) $1 - P(\overline{E})$ C) $1 + P(\overline{E})$ D) $\frac{1}{P(\overline{E})}$

5. When a coin tossed the no. of out comes? ( )
   A) 2 B) 3 C) 1 D) 0

6. Probability of happening an event is P(E), $P(\overline{E})$ is not happening of P(E), then $P(E) + P(\overline{E}) =$ ( )
   A) 1 B) 0 C) $\frac{P(E)}{P(\overline{E})}$ D) $\frac{P(\overline{E})}{P(E)}$

7. When a coin is tossed, what is probability of getting Head? ( )
   A) $\frac{1}{2}$ B) 0 C) 1 D) $\frac{1}{3}$

8. When a Die is thrown, what is the probability of getting multiple of 2 is ( )
   A) $\frac{1}{3}$ B) $\frac{5}{6}$ C) $\frac{1}{2}$ D) $\frac{1}{6}$

9. The Range of probability of an event to occur ( )
   A) $0 \leq P(E) \leq 1$ B) $0 \geq P(E) \geq 1$ C) $P(E) > 1$ D) $P(E) \leq 1$

10. Which of the following can not be the probability of an event ? ( )
    A) 5.6 B) –7.8 C) 142% D) All of them

11. If one side is chosen at random from the three sides of a right angle triangle then the probability that it is hypotenuse is ( )
    A) 2 B) $\frac{7}{3}$ C) 3 D) $\frac{1}{3}$

12. The probability of getting an odd prime number when a dice is thrown. ( )
    A) $\frac{2}{6}$ B) $\frac{4}{6}$ C) $\frac{5}{6}$ D) $\frac{3}{26}$

13. A carde is drawn from a well shuffled deck of 52 cards probability of getting a Queen is ( )
    A) $\frac{3}{52}$ B) $\frac{4}{52}$ C) $\frac{1}{26}$ D) $\frac{3}{26}$

14. The probability of getting 53 Sundays in a leap year in ( )

A) $\frac{1}{7}$ B) $\frac{4}{7}$ C) $\frac{2}{7}$ D) $\frac{5}{7}$

15. From the letters of the word POLYCET, the probability of getting vowel is ( )

A) $\frac{4}{7}$ B) $\frac{2}{7}$ C) $\frac{5}{7}$ D) $\frac{6}{7}$

16. A card is drawn from 52 cards then the probability of getting a black ace is ( )

A) $\frac{1}{52}$ B) $\frac{1}{26}$ C) $\frac{3}{52}$ D) $\frac{4}{52}$

17. The probability of getting a green ball from a bag containing 5 green, 6 black, 7 red balls is ( )

A) $\frac{6}{18}$ B) $\frac{7}{18}$ C) $\frac{4}{18}$ D) $\frac{5}{18}$

18. When a ball is thrown on a squar area of 5m, the probability that hits on the perimeter point is ( )

A) $\frac{2}{5}$ B) $\frac{3}{5}$ C) $\frac{4}{5}$ D) $\frac{1}{5}$

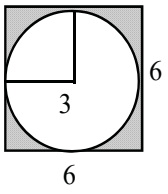
19. Two dice are thrown, the probability of getting sum on the faces is 9. ( )

A) $\frac{1}{12}$ B) $\frac{1}{9}$ C) $\frac{5}{36}$ D) $\frac{7}{36}$

20. If three coins are tossed simultaneously then find the probability of getting at most two heads ( )

A) $\frac{5}{8}$ B) $\frac{3}{8}$ C) $\frac{1}{6}$ D) $\frac{7}{8}$

21. What is the probability that a randomly thrown dart that hits the square board in the shadded region is ( )



A) $1-\frac{9\pi}{36}$ B) $1+\frac{9\pi}{36}$ C) 0 D) 1

** *** **

ANSWERS

1. B 2. A 3. B 4. B 5. A 6. A 7. A 8. D 9. A 10. D

11. D 12. A 13. B 14. C 15. B 16. B 17. D 18. C 19. B 20. B

21. A

14. STATISTICS

The word statistics is derived from Italian language "Statista." The father of statistics is "Ronal A. Fisher."

Statistics is a branch of mathematics which deals with collection, organisation, presentatin, analysing and interpretaton of observed values of data.

Data : A set of observations or values made in a survey there are two types of data. (1) Ungrouped data and (2) Grouped data.

By using statistical methods like mean, mode, median we find a value which represents for entire data, taht is called measure of central tendency. For example Mean, Median, Mode.

Mean : Let $x_1, x_2 \ldots x_n$ be the observations with respective frequencies, $f_1, f_2, f_3 \ldots f_n$, then mean of ungrouped data

$$\text{Mean } \bar{x} = \frac{f_1x_1 + f_2x_2 + \ldots\ldots f_nx_n}{f_1 + f_2 + \ldots\ldots f_n} = \frac{\sum f_ix_i}{\sum f_i}$$

Mean of grouped data : If the data is large quantity to make a meaningful study it is to be grouped. By class intervals, the data is adjusted so that the frequency of each class interval is centred around its mid point, then the mean $\bar{x} = \frac{\sum f_ix_i}{\sum f_i}$. This is known as direct method.

Another method of finding mean is assumed mean method, then mean $\bar{d} = \frac{\sum f_id_i}{\sum f_i}$ ($\bar{d}$ = mean of derivations).

$$\bar{x} = a + \frac{\sum f_id_i}{\sum f_i} \quad (a = \text{assumed Mean})$$

Step Deviation Method :

$$\text{Mean } \bar{x} = a + \left(\frac{\sum f_iu_i}{\sum f_i}\right)h \qquad \text{Where a is assumed mean, his class size } u_i = \frac{x_i - a}{h}$$

Mode : Mode is the value which occurs frequently. To calculate Mode of an ungrouped data, we have arrange them in Ascending order

$$\text{For grouped data, Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

l = lower boundary of the modal class;

h = size of the interval

f_1 = frequency of the modal class;

f_0 = frequency of the preceeding model class

f_2 = frequency of the succeeding model class.

Median of the grouped data : Median is a measure of central tendency which gives the value of middle most of the observation in the data.

For ungrouped data, arrange the values in ascendinig order. If n is odd $\left(\frac{n+1}{2}\right)^{th}$ observation is median. If n is even $\left(\frac{n}{2}\right)^{th}$ $\left(\frac{n+1}{2}\right)^{th}$ average gives the median.

For grouped data, the Median $= l + \left(\frac{\frac{n}{2} - cf}{f}\right) \times h$

Where, l = lower boundary; n = no. of observations.;

f = frequency of the median class;

cf = cumulative frequency of the preceeding interval

PROBLEMS

1) Mean of the data 7, 9, 11, 14, 16, 17, 18, 20, 27.

Sol : Mean of the ungrouped data $\frac{a}{x} = \frac{\text{Sum of the observations}}{\text{Total number of observations}}$

$$= \frac{7+9+11+14+16+17+18+20+27}{9}$$

$$= \frac{139}{9} = 1.55$$

2) Find the Mean of the data from the table.

x	3	4	6	7	8	9	10
y	2	5	7	10	4	1	1

Sol : The mean of the ungrouped data $(\bar{x}) = \frac{\sum f_i x_i}{\sum f_i}$

$$\frac{2\times3+5\times4+7\times6+10\times7+4\times8+1\times9+1\times10}{2+5+7+10+4+1+1} = \frac{189}{30} = 6.3$$

3) Find the Mode of the following data.

7, 5, 8, 6, 3, 5, 6, 7, 6, 9, 7, 2, 7

Sol : A mode is the value among the observations which occurs most frequently : 7 (repeated 4 times).

4) A survey conducted on 50 students in a locality by a group of students attendance. Find the Mode.

Class Attendance	0 - 20	20 - 40	40 - 60	60 - 80
Frequencey	15	06	18	10

Sol : Here the maximum frequency is 18, corresponding to this frequency 40-60 in the model class.

Model class 40-60 boundary limit of Model class = 40, Class size (h) = 20, frequency of the model class f_1 = 18, f_0 = the frquency of class preceeding the model class f_0 = 06, f_2 = the frequency of the class succeeding the model class f^2 = 10.

$$M = 1 + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$= 40 + \left(\frac{18 - 6}{2(18) - 6 - 10}\right) \times 20 = 40 + \frac{12}{20} \times 26 = 52$$

5) Find the medium of the data 5, 7, 9, 4, 2, 9, 8, 10, 11 ?

Sol : Arrange the numbers in the ascending order

2, 4, 5, 7, 7, 8, 9, 9, 10, 11

No. of entries = 10, even number

$\therefore$ The average of $\left(\frac{n}{2}\right)^{th}$ $\left(\frac{n+1}{2}\right)^{th}$ is the median.

$$= \frac{7 + 8}{2} = 7.5$$

6) The median of the following distribution.

Class Interval	**0 - 9**	**10 - 19**	**20 - 29**	**30 - 39**
Frequencey	**10**	**16**	**24**	**29**

Sol : No. of observations (n) = 79 (Odd)

CI	F	CF
0-9	10	10
10-19	16	26 (cf)
20-29	24	50 (cf)
30-39	29	79

$$\frac{n}{2} = \frac{79}{2} = 39.5\,; \quad l = 20$$

39.5 value lies between 20-29

c_f : Cumulative frequency of the preceeding class 16

f = Frequency of Median class

$$\text{Median} = l + \frac{\left(\frac{n}{2} - c_f\right)}{f} \times h$$

$$= 20 + \frac{39.5 - 56}{24} \times 10 \;= 20 + \frac{105}{24} = 25.125$$

MULTIPLE CHOICE QUESTIONS

1. The Arthematic Mean of 15, 20, 25, 30, 45 is ( )

   A) 23 B) 27 C) 24 D) 26

2. Median of 24, 20, 32, 18, 27, 14, 24 is ( )

   A) 24 B) 20 C) 18 D) 27

3. If 7 is added to each every item of a data the Arthemetic mean increases by ( )

   A) Equal to Arthemetic mean B) 5 times

   C) Increase to 5 to the Mean D) None

4. Modal class of the following table ( )

1-6	7-12	13-19	19-25
6	4	8	2

   A) 6 B) 4 C) 2 D) 8

5. For the data 6, 3, 7, 2, 1, 7, 9, 6, 8, 4, 6 the mode is ( )

   A) 7 B) 9 C) 8 D) 6

6. The sum of lower limit of medium class and upper limit of model class is ( )

10-20	20-30	30-40	40-50	50-60
1	3	15	9	7

   A) 60 B) 90 C) 70 D) 110

7. Find the median of $\frac{3}{4}, \frac{1}{2}, \frac{2}{3}, \frac{1}{6}, \frac{7}{12}$ ( )

   A) 0.5 B) 0.75 C) 0.66 D) $\frac{7}{12}$

8. The formula for calculating mode for grouped data distribution is ( )

   A) $1+\left(\frac{f_1-f_0}{f_1-f_0-f_2}\right)\times h$ B) $1+\left(\frac{f_1-f_0}{2f_1-f_0-f_2}\right)\times h$

   C) $1-\left(\frac{f_1-f_0}{2f_1-f_0-f_2}\right)$ D) $1+\left(\frac{f_1-f_0}{2f_1-f_0-f_2}\right)\times h$

9. The mean of a+2, a+8, a+4, a+6 is ( )

   A) a+6 B) a+5 C) a+2 D) a+4

10. Which of the following is true ( )

    A) Mean < mode < median B) Mean > Mode > Median

    C) Mode = Average + median/2 D) Mean = Median = Mode

ANSWERS

1. B 2. A 3. C 4. D 5. D 6. C 7. C 8. B 9. B 10. D

Refraction of Light at Plane Surfaces

- **Refraction of light**: The bending of light ray when it is travelling from one medium to another medium is called Refraction.
    - In refraction, speed of light changes at the interface.
    - The direction of light ray changes from one medium to another medium.

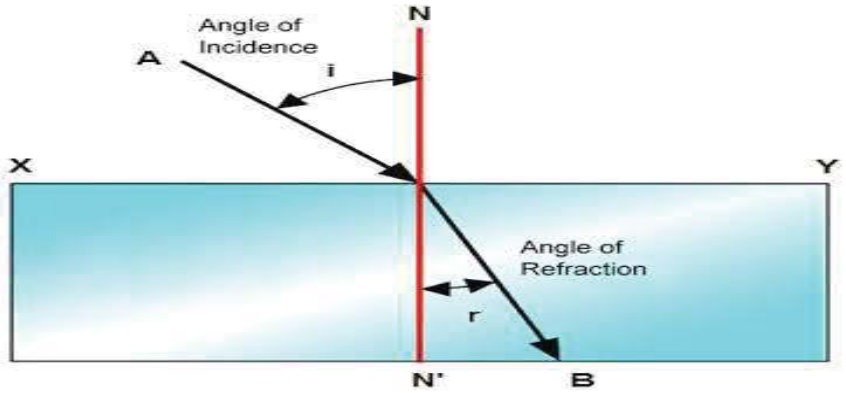


Fig: shows light travelled from lighter to denser medium.

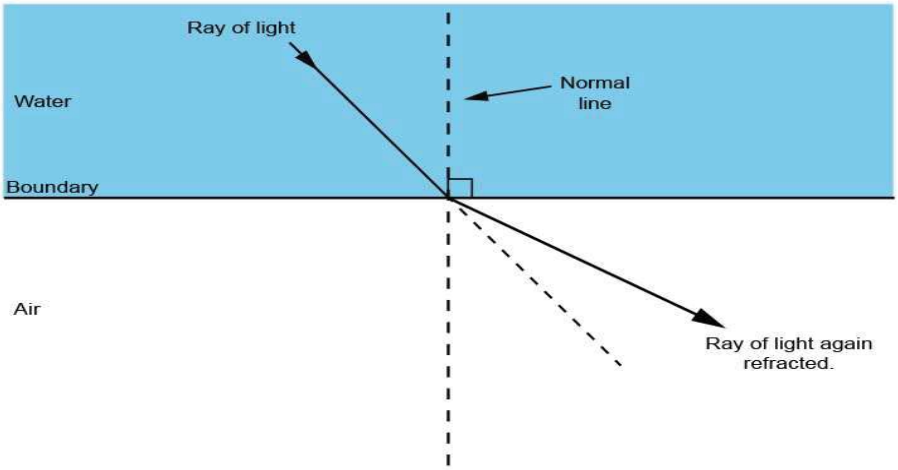


Fig: shows light travelled from denser to lighter medium.

- The refractive index of water is 1.33,where as ice is 1.31. Hence ice is less denser than water.
- The refractive index of Diamond is 2.42 is the highest.
- When light travels from rarer medium (air) to denser medium (glass), Light bends towards the normal in the denser medium, i.e wavelength decreases as speed of light decreases.
- Angle of refraction(r) is lesser than angle of incidence (i).
- When light travels from denser medium (glass) to rarer (air) then, Light bends away from the normal in rarer medium. i.e wavelength increases as speed of light increases.
- Angle of refraction(r) is greater than the angle of incidence (i)

- **Examples of refraction**:

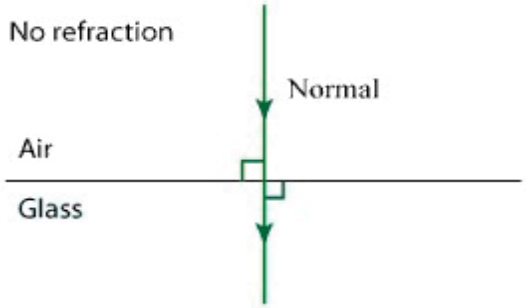
(1) The pencil appears to be bent when it is placed in a bucket filled with water.

(2) A coin kept at the bottom of a vessel filled with water appears to be raised.

(3) A lemon kept in a glass of water appears to be bigger than its original size.

(4) The printed letters below the glass slab appears to be raised.

- No bending of light when incidents normally at the interface of two mediums.



- Refractive index is a property of transparent medium, and **dimensionless** quantity, and it has no units.
- Absolute refractive index = Speed of light in vacuum(c)/Speed of light in medium(v)

$$n = c/v$$

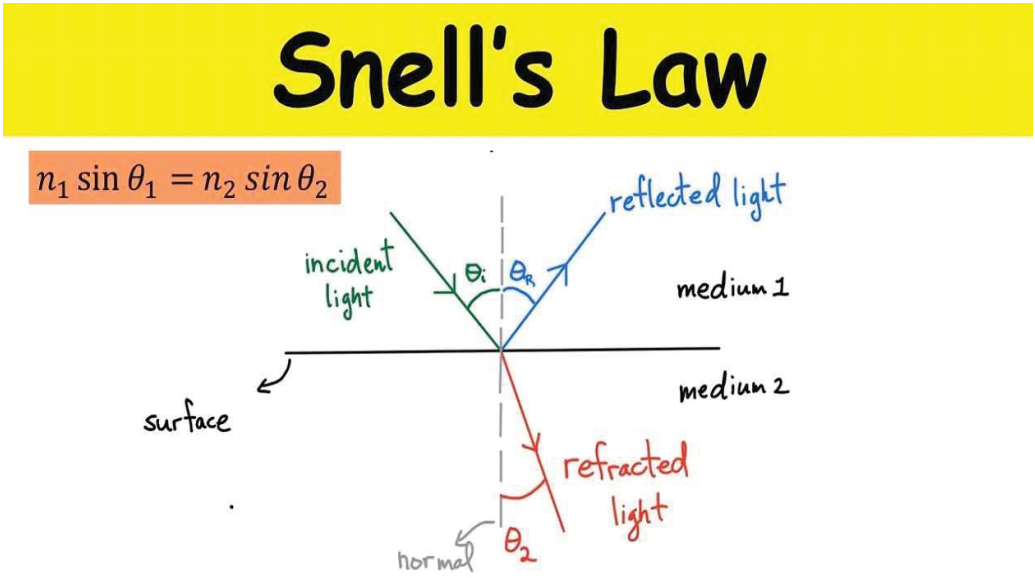
- If refractive index is **high,** speed of light in medium is **low.**
- Refractive index depends on 1) nature of material, 2) wavelength of light
  - Relative Refractive index(n_r) = $\frac{\text{Speed of light in medium 1}}{\text{speed of light in medium 2}}$
  - $n_r = n_2 / n_1 = \frac{\text{Refractive index of second medium } (n_2)}{}$

Refractive index of first medium ($n_{1)}$

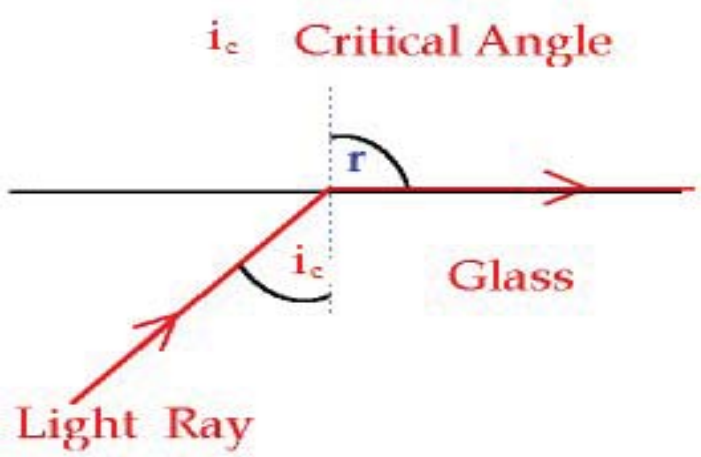
- **Laws of refraction:**
  - The incident ray, the refracted ray and the normal to the interface of two transparent media, all lie on the same plane at the point of incidence
  - Light follows Snell's law in refraction.

- **Snell's law:**

  Sin i / Sin r = n_2 / n_1 = constant



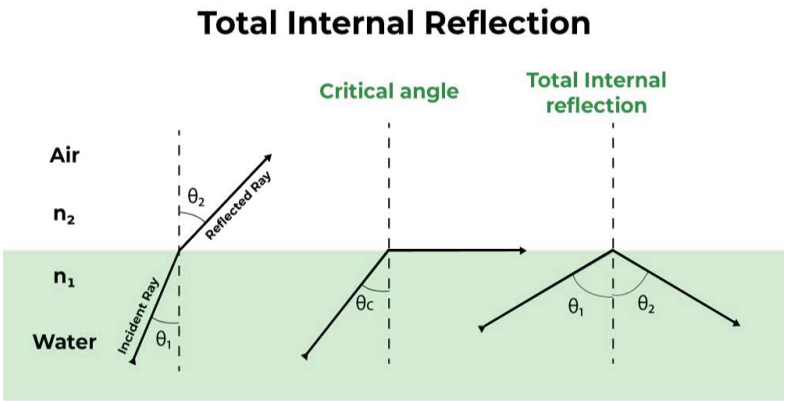
- **Critical angle:** The angle of incidence is called critical angle i.e (i=c) when the angle of refraction is 90^0.



- From snells law, Sin C/ Sin $90^0 = n_2/n_1$

NOTE: this occurs only when light ray travels at the interface of denser medium to rarer medium

- **Total internal reflection(TIR):** If the angle of incidence is greater than the critical angle (when the light ray passes from denser medium to rarer medium) then the light ray totally internally reflected back into the denser medium. This is called "total internal reflection".

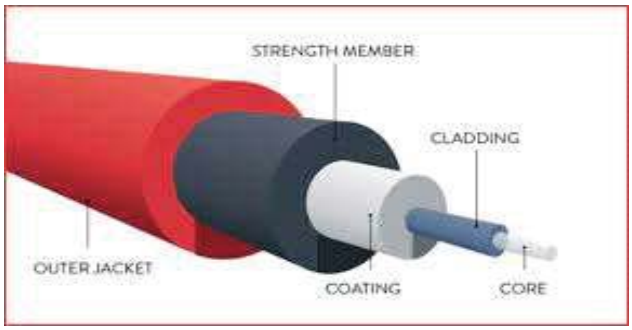


NOTE: Incident angle and reflected angle may or may not be equal.

Examples: 1) Formation of Mirages is due to Total internal reflection.

2) The brilliance of diamonds is also due to TIR as its critical angle is low (24.4^0)

- **Optical fibres:** It is a cylindrical wave guide which transports light energy. Its works on the basic principle of Total internal reflection.



- **Applications of Optical fibres:**

1) Laparoscopic surgery 2) Endoscopic surgery 3) Decorative flower vases 4) Internet cables

Multiple Choice questions:

- For critical angle, the angle of refraction is_____[ ]

a) 90^0 b) 45^0 c) 60^0 d) 180^0

2)Which of the following is Snell's law

- $n_1 \sin i = \sin r / n_2$ b) $n_1 / n_2 = \sin r / \sin i$
- $n_2 / n_1 = \sin r / \sin i$ d) $n_2 \sin i = \text{constant}$

3)The refractive index of glass with respect to air is 2. The critical angle of

glass - air interface is_____ [ ]

- 0^0 b) 45^0 c) 30^0 d)60^0

4).Total internal reflection takes place when the light ray travels from _____ [ ]

a) Denser to rarer medium b) Denser to denser medium

a) Rarer to denser medium d) rarer to rarer medium

5)The angle of deviation produced by glass slab is [ ]

a) 0^0 b) 20^0 c) 90^0 d) Depends on the light ray and normal to slab.

6) Mirage is an example of_____ [ ]

a)Total internal reflection b) Refraction c) Reflection d)None of the above.

7) Refractive index of glass relative to water is 9/8. What is the refractive index of water relative to glass? [ ]

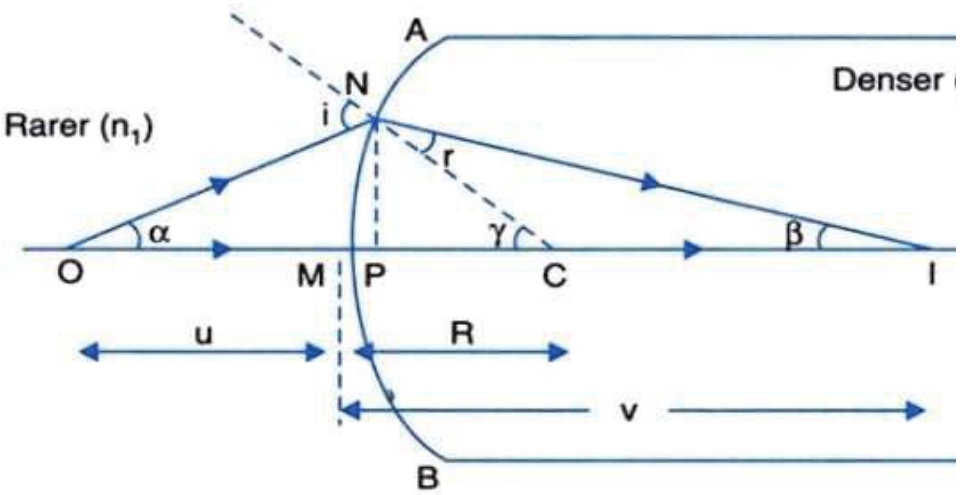
a) 9/8 b) 8/9 c)1/9 d) None

8) Optical fibre works on [ ]

- Reflection b) Refraction
- c) Total internal reflection d) All of these

Refraction of light at Curved Surfaces

- The refraction at curved surfaces is an interesting phenomina. For example, spectacle used by humans to see objects, rearview mirrors, and optical telescopes to gauge stars.
- A curved surface is a part of a sphere,The centre of the sphere is *centre of the curvature (C)of curved surface*.
- The centre of curved surface is called the *pole* (P) of curved surface.
- The line that joins the centre of curvature and the pole is called 'principal axis'.

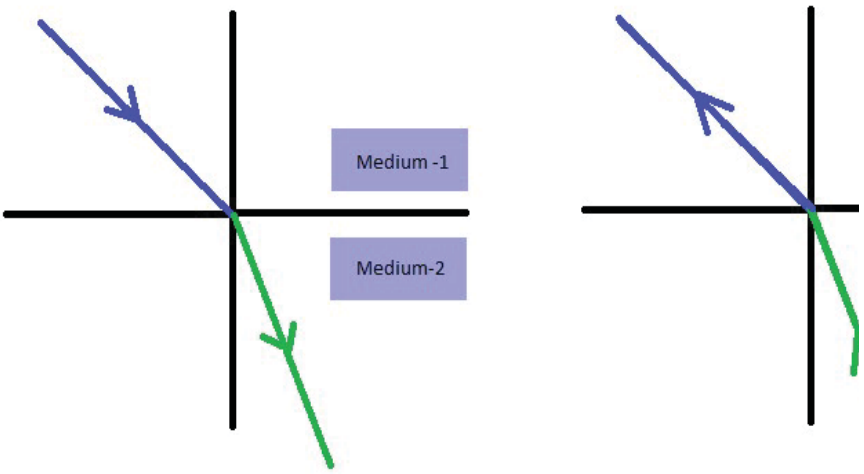


- The equation for refraction of light at curved surfaces is

$$(n_2/v) - (n_1/u) = (n_1 - n_2)/R$$

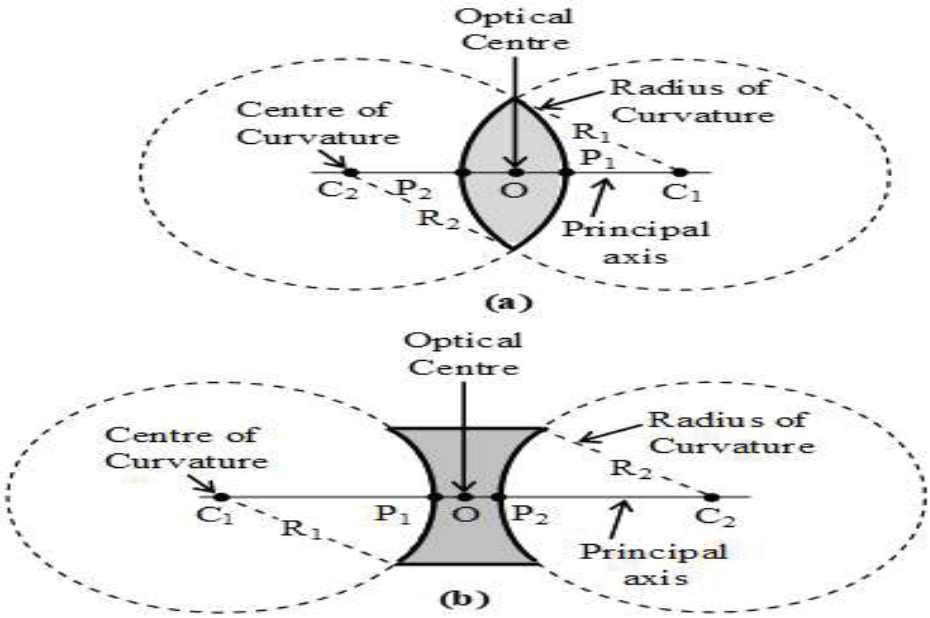
Where n_1, n_2 = the refractive indices of two material media of curved surfaces,u = object distance, v = image distance, and R = Radius of curvature

- **Focus or Focal Point:** The point of convergence of rays (or) the point where the rays appear to be emanating iscalled Focus(F) or focal point.
- Every lens has two focal points.
- The distance between optic centre and focal point is called "focal length (f)"
- The focal points are equidistant from the centre, i.e., pole of the lens.
- The distance between two focal points = $2F_1 = 2F_2$ = Twice the focal length.
- **Behaviour of certain light rays When they incident on a lens:**
    - A ray is **undeviated** when it passes through principal axis.
    - A ray is **undeviated** when it passes through the optic centre.
    - The rays travelling parallel to principal axis **converge at the focus ordiverge from the focus.**
    - The light rays obey the principle of least time,i.e they travel along shortest optical paths.
    - The ray passing **through the focus after refraction** will take a path parallel to principal axis, this is called principle of reversibility, i.e if we imagine the ray is moving in opposite to the indicated direction then it reverses its path.



- The light rays incident on a lens at an angle appear to be converge or diverge from a point lying on focal plane.

- **<u>Centre of curvature</u>:**



- It is the centre of sphere contains lens part. It is denoted by C.
- The distance between curved surface and centre of

curvatureis called “radius of curvature (R)”.

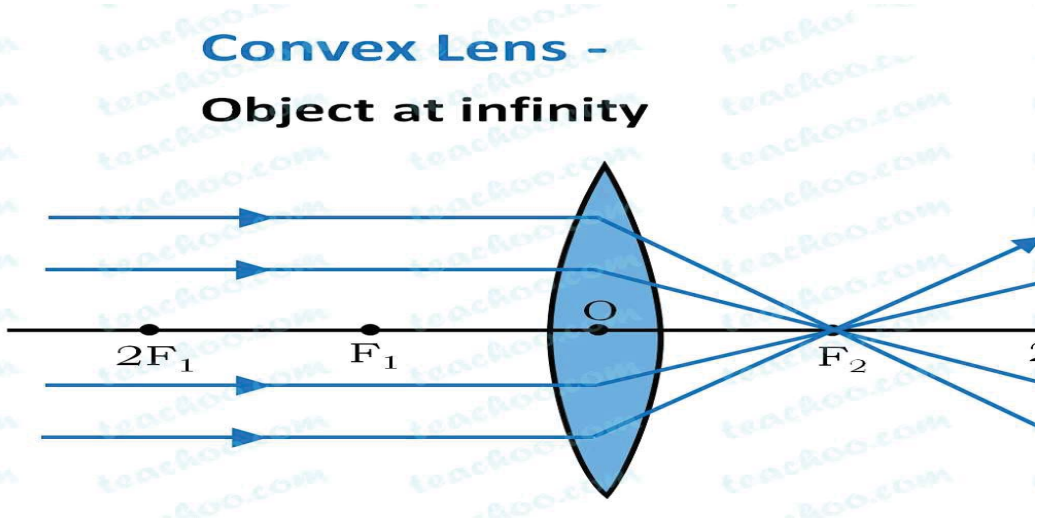
- If the lens contains two curved surfaces, it will have two centres of curvatures namely C_1 and C_2 .
- The line joining two centres is called **principal axis.**
- The mid point of the lens is called **optic centre (O)**.

- **Lenses:** A lens is made up of transparent material, Bounded by two spherical surfaces both or one is spherical surface.

Types of lenses:

Convex lens
plano convex lens
Concave lens
plano concave lens

.**Convex Lens:**



- It may have two spherical surfaces bulging outside.
- It is called double convex lens or biconvex lens.

- It is thick at the middle and thin at the edges.
- These lenses are also called as converging lenses, i.e light rays are being focussed or converges to a point.

Plano convex lens:

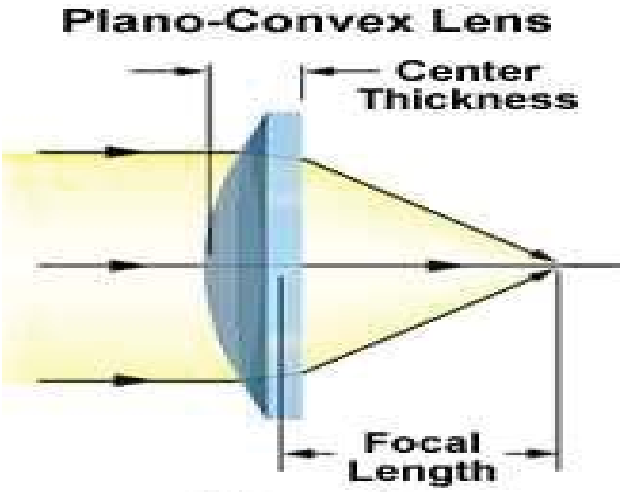
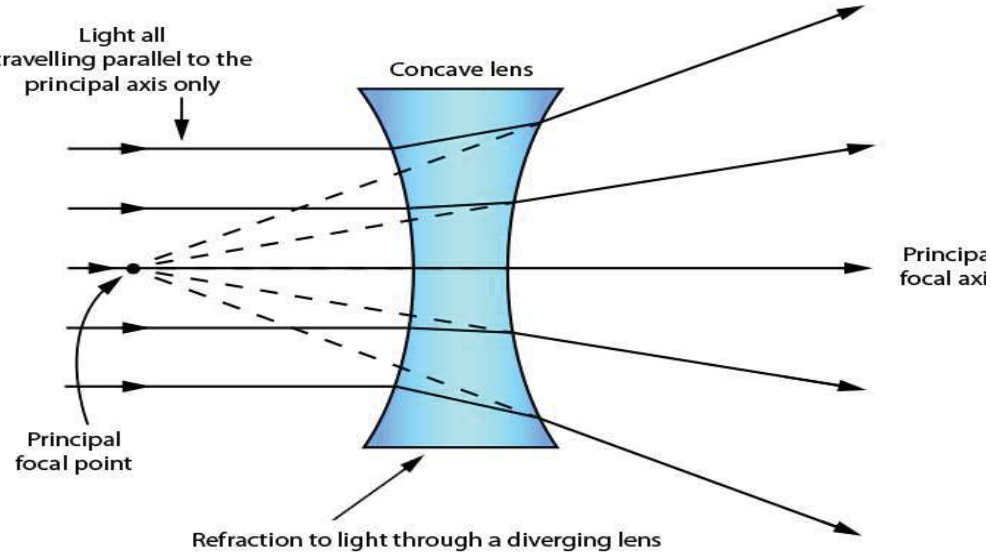


Figure 3

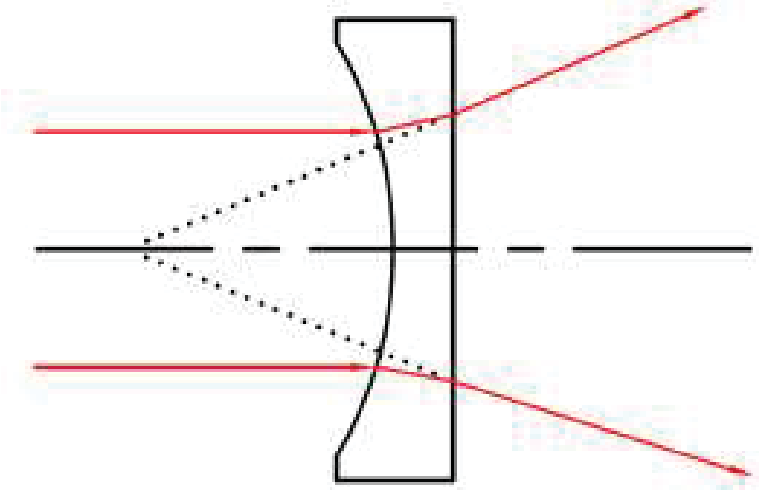
- One side of the surface of the lens is plain and the other surface is spherical in shape .
-
-

Concave lens:



- A double concave lens has two spherical surfaces.
- It is thin at middle and thick at the edges.
- Each curved surface of a lens is a part of a sphere.
- These lenses are also called as diverging lenses.

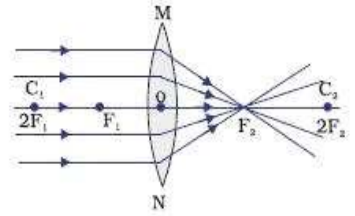
Plano concave lens:



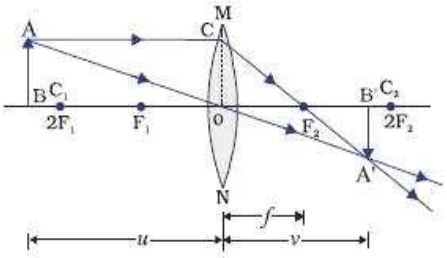
- One side of the surface of the lens is plain and the other surface

is spherical in shape and bulges inside.

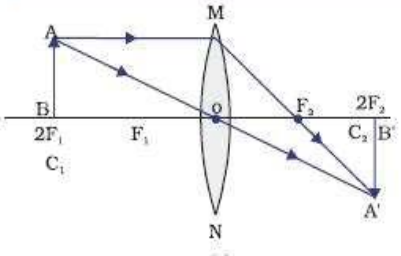
Image Formations of Convex Lens for various positions of an object:



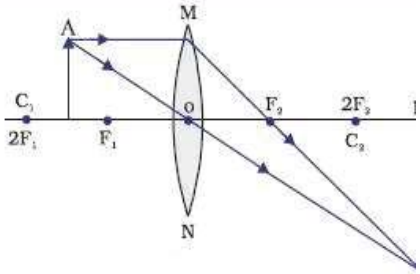
Case (i) Object at infinity



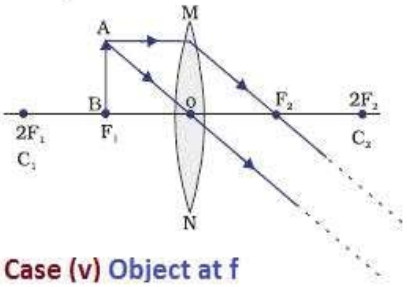
Case (ii) Object at beyond 2f



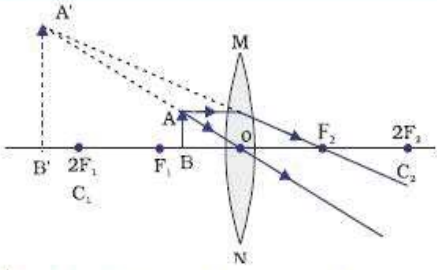
Case (iii) Object at 2f



Case (iv) Object in between f and 2f



Case (v) Object at f



Case (vi) Object distance < f

- **Object at infinity:** A point sized image **at focal point** will be formed.

- **Object beyond the centre of curvature of Principal axis:** Imagewill be *real, inverted and diminished* formed on principal axis **between the points F_1 and $2F_1$.**
- **Object at the centre of curvature (at $2F_2$)**: The **image** will be onanother side **at $2F_1$**, and a real, inverted and of same size as the object.
- **Object between Centre of curvature ($2F_2$) and Focal point(F_2):**The image will be **beyond $2F_1$** which is *real, inverted and magnified.*
- **Object at focal point (F_2)**: Image at **infinity.**
- **Object between Focus (F_1) and optic centre:**
  - Virtual, erect and magnified which can be seen witheyes**.**
  - Cannot be caught on the screen.
  - This behaviour of Convex lens is useful to construct a **microscope.**

- **Lens formula:**

$$1/v - 1/u = 1/f$$

For any lens with sign convention.

- Focal length of a lens depends upon the surrounding medium.
- Focal length of lens increases in water.

- **Lens maker's formula**: In the air medium, the relative refractive index isthe absolute refractive index(n) of the lens,

- Where R_1 and R_2 are radii of curvature.

- Here the sign conventions of radius of curvatrure depends on the direction of incident light rays impenging on the lenses.

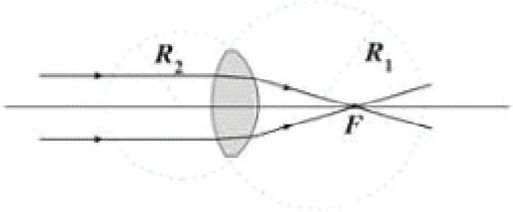
Note: Always use sign convention.

- If the refractive index of the medium is **less than** convexlens, behaves as a **convergent** lens.
- Convex lens behaves as a **divergent lens**, if the refractiveindex of the transparent medium is **greater than** lens.
- Air bubble in water behaves as a **diverging lens**.

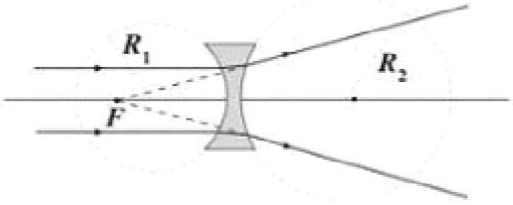
Lens-Maker's Equation

$$\frac{1}{F} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

F = focal length (1/2 C)
n = refractive index
R = radius of curvature



Positive (Converging) Lens
R_1 – positive
R_2 – negative
F – positive



Negative (Diverging) Lens
R_1 – negative
R_2 – positive
F – negative

Multiple choice questions:

- The rays from the distant object falling on the convex lens pass through [ ]

a) Focus b) centre of curvature c) Pole d) Radius of curvature

- What is the focal length of the plano convex, when R is the radius of the curvature of the surface, n is the refractive index of the lens? [ ]

a) f = R b) f = R/2 c) f = R/(n-1) d) f = (n-1)/R

- Real or virtual image is formed by which of the following lenses? [ ]

a) Bi convex lens b) Biconcave lens

c) Plano convex mirror d) all ofthese

- The value of the focal length of the lens is equal to the value of the imagedistance when the rays are [ ]

a) Passing through the optic centre b) parallel to the principal axis

c) Passing through the focus d) In all these cases

- Which of the following is the lens maker's formula [ ]

a) $1/f = (n-1)(1/R_1 + 1/R_2)$ b) $1/f = (n + 1)(1/R_1 - 1/R_2)$

c) $1/f = (n - 1)(1/R_1 - 1/R_2)$ d) $1/f = (n + 1)(1/R_1 + 1/R_2)$

Questions on Concave Mirrors:

- The image formed by concave mirror when the object is held at adistance less than the focal length, is [ ]

a) Erect b) virtual and inverted c) inverted d) None

- The property of which mirror when the object is held close

less thanthe focal length is used as a shaving mirror [ ]

a) plane mirror b) convex mirror c) concave mirror d) none

- A mirror used by dentists is [ ]

a) concave mirror b) convex mirror c) Plane mirror d) None

- Which mirror focuses the parallel sun rays at the focal point of themirror

a) convex mirror b) concave mirror c) Any mirror d) plane mirror

- Solar cooker works on the property of which mirror? [ ]

a) plane mirror b) convex mirror c) concave mirror d) none

- Archimedes burnt the ships using which property of concave mirror?

[ ]

a) Parallel rays converge at focal point of the mirror

b) Parallel rays diverge from pole

c) Deviated from centre of curvature after reflection

d) None of the above.

Q) Watchmaker uses_____to repair.

a) Convex mirror b) concave mirror c) concave lens d) convex lens

- Pick the correct answer from the following two answers: [ ]

1. Focal length of a lens depends on the surrounding medium.
2. Focal length of a lens changes with object distance.

a) both (1) and (2) are true b) both (1) and (2) are false

(c) Only (1) is true (d) Only (2) is true

- The size of the image formed by a convex lens is same as

that ofthe object, when the object is placed [ ]

a) At the centre of curvature

b) Between the centre of curvature and focus

c) Beyond the centre of curvature

d) Between focusand centre.

- The lens, which is thin, at the middle on both sides and thicker, atthe edges is [ ]

a) bi- convex b) concavo- convex

c) plano – convex d) bi -concave

- If 40 cm each is the object and image distances respectively for aconvex lens, then the focal length is

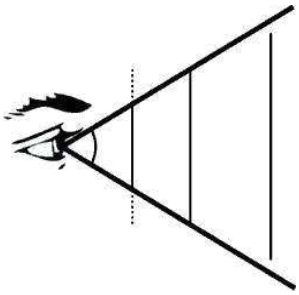
a) 80 cm b) 40 cm c) 20 cm d) 25 cm

KEY

1. a 2. c 3. a 4. c 5. c 6. a 7. c 8. a 9. b

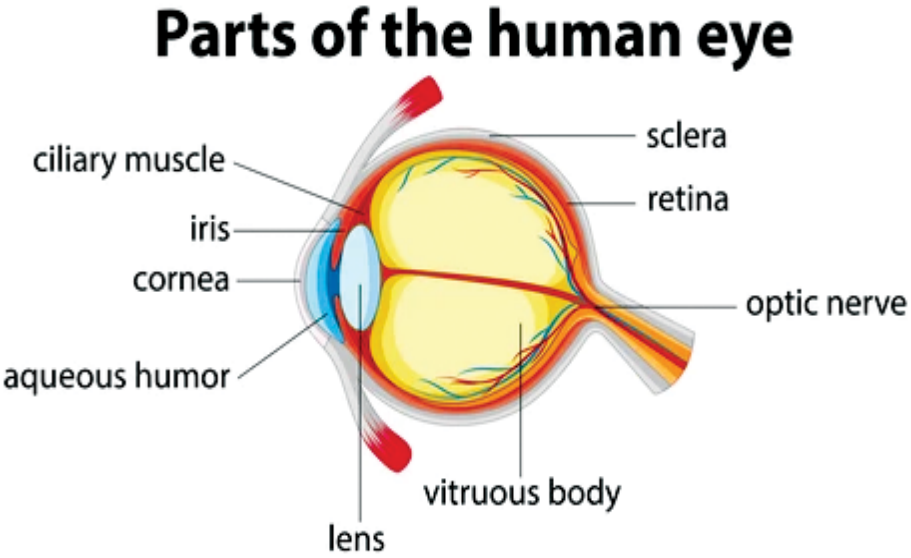
10. c 11. a 12. d 13. c 14. a 15. d 16. c

Human Eye and Colourful World



Summary:

- The maximum angle, at which humans can see the whole object is called
  angle of vision.
- The angle of vision for a healthy human being is about $\mathbf{60^0}$.
- It varies from person to person and with age.
- Humans can see an object **comfortably and distinctly** when held at adistance of 25 cm.
- This distance of 25 cm is called **least distance of distinct vision.**
- The least distance of distinct vision for children below 10 years of age is 7 to 8 cm. For old people, it will be 1 or 2 m or even more.



- The eye ball is nearly spherical in shape.
- The front portion is covered by a transparent protective membrane called the 'cornea'.
- Behind the cornea, filled with a liquid called aqueous humor and behind this a crystalline lens. It is responsible for the image formation.
- **Iris**, is the coloured part, is the muscular diaphragm, with a small hole, called pupil.
- **Iris controls** the amount of light entering the eye through 'pupil'.
- I**ris** makes pupil to act as a "variable aperture" for light to enter into the eye.
- The light that enters the eye forms an image on the retina
- The distance between **the lens and retina is about 2.5 cm**
- The image distance is fixed and is 2.5 cm for any position of object.
- the focal length of a lens depends on its material and radii of curvature of lens.
- The eye lens can change its shape with the help of ciliary muscle attached to it which change its focal length by changing the radii of curvature.
- The process of adjusting focal length of lens is called "**accommodation" of lens**.
- The eye-lens forms **a real and inverted image** of an object on the retina.
- Retina contains 125 million receptors called "rods and cones" which receive the light signals.
- Rods identify the **Intensity of light,**
- Cones identify the **colour.**
- These are transmitted to the brain through the opticnerve fibres.
- The vision becomes blurred due to **" accommodation defects" of the eye.**

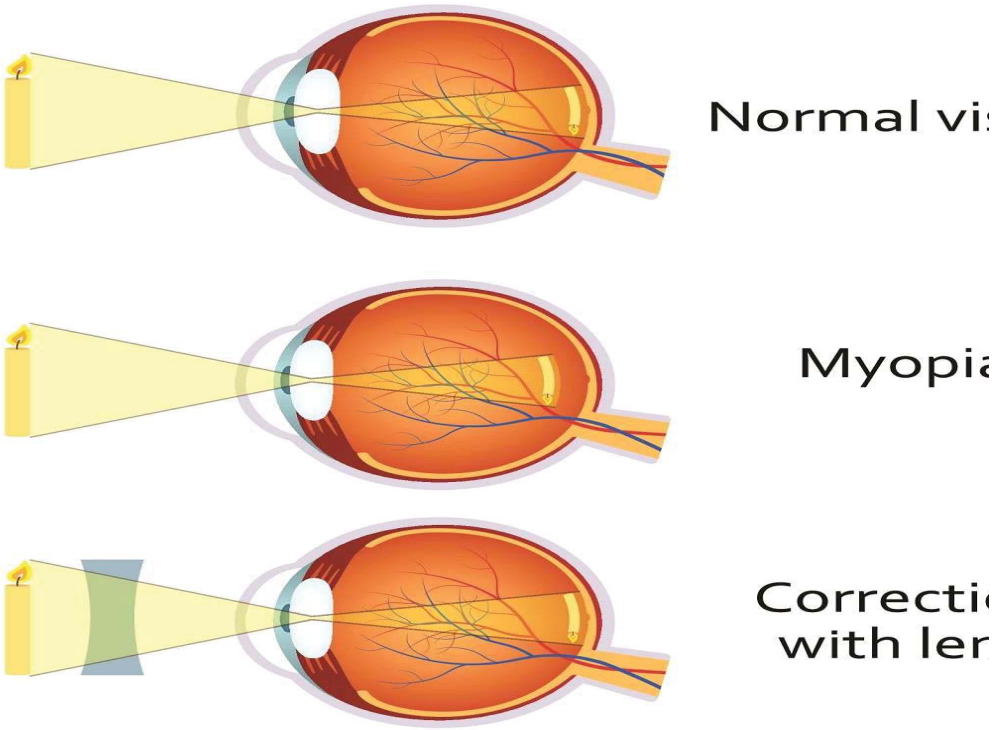
Defects of Eye:

There are mainly **three** defects of eye:

- Myopia
- Hypermetropia
- Presbyopia

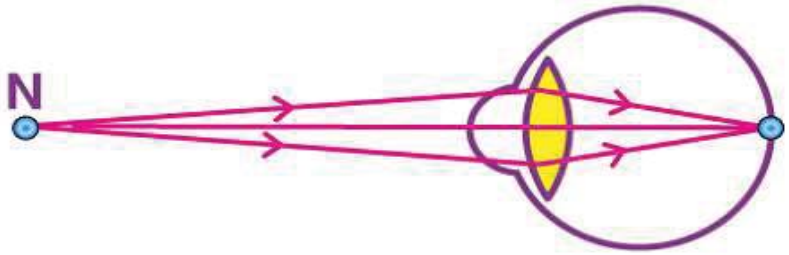
Myopia:

Cannot see objects at long distances.
Also called- near or short sightedness.
For these people, focal length is < 2.5 cm.
Image forms **before** the retina.
A **concave lens** is used to correct **myopia.**

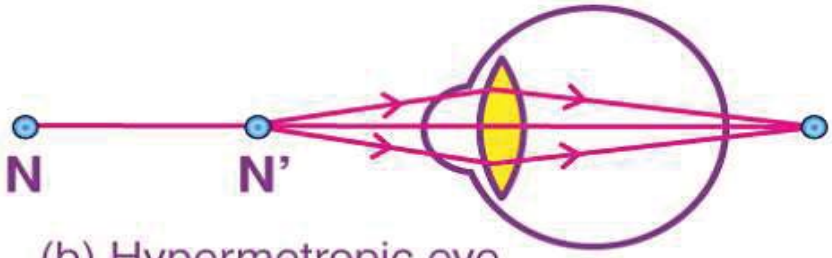


Hypermetropia:

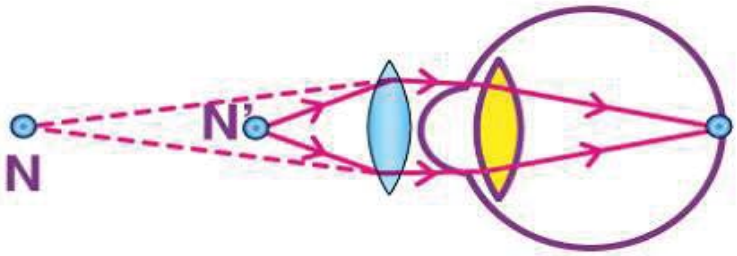
Cannot see objects at **short** distances.
Also called far or long sightedness.
For these people, focal length is > 2.27 cm.
Image forms **beyond** the retina.
A **biconvex lens** is used to correct **hypermetropia.**



(a) Near point of a Hypermetropic eye

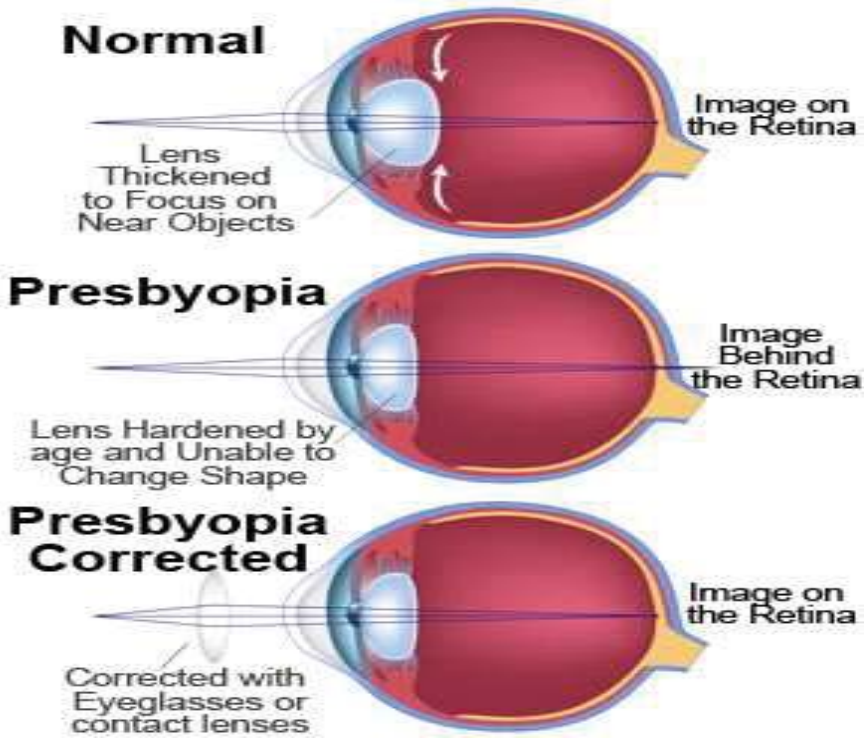


(b) Hypermetropic eye



(b) Correction for Hypermetropic eye

Presbyopia:

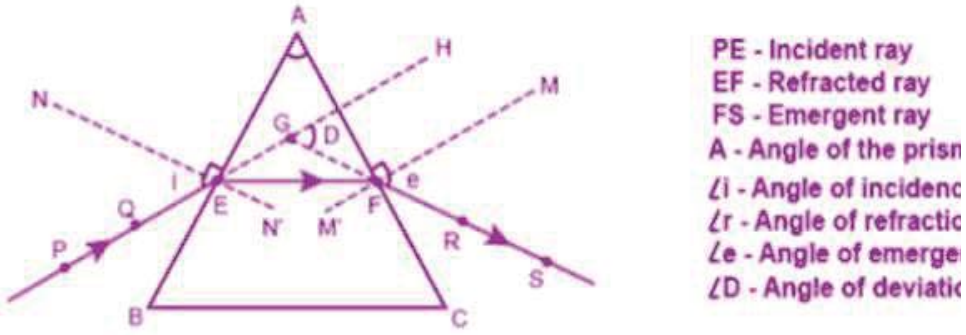


- The ability of eye decreases with age.
- Near point disappears.
- Difficult to see the nearby objects clearly and distinctly, Due to weakening of ciliary muscles and flexibility of eye lens.
- Its common in aged people.
- A person can suffer from both Myopia and hypermetropia with aging.
- To correct this defect of vision, bi - focal lenses which contain both concave and convex lenses.
- Upper portion is concave part, and lower convex part.

Power of Lens:

- It is the degree of convergence or divergence of lightrays by a lens.
- It is the reciprocal of focal length in metre, (P = 1/f).
- Unit of power of lens is dioptre. It is denoted by D.

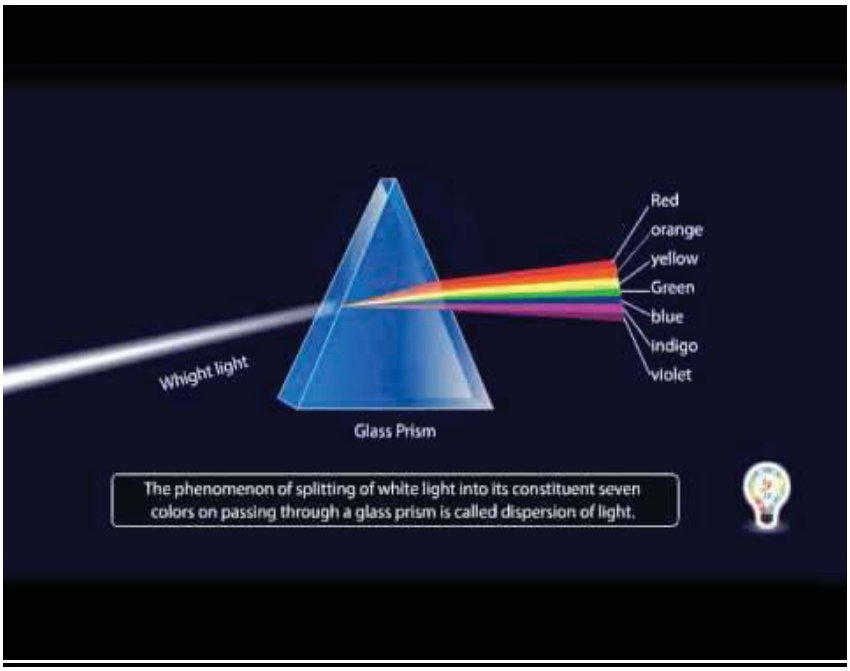
Refraction of light through a prism:



- Refractive index of prism,
- n ={ (Sin (A + D)/2)/Sin (A/2) }

Where n = refractive index of the prism, A = Angle of prism,
D = Angle of minimum deviation.

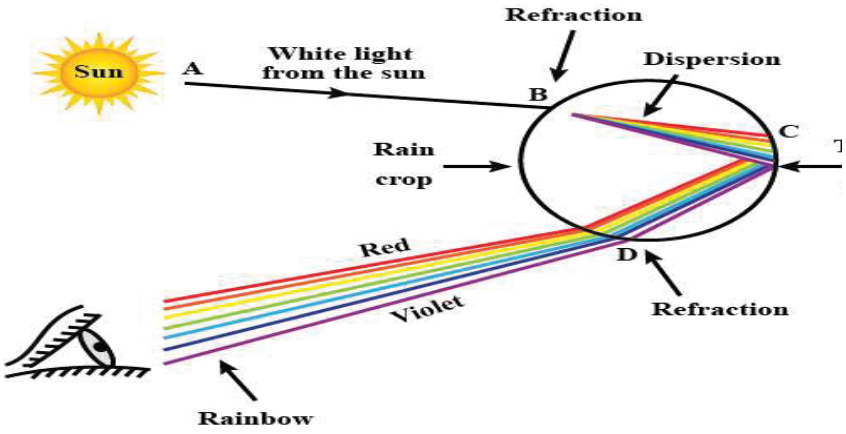
<u>Dispersion of Light through a prism</u>:



- The splitting of white light into colours (VIBGYOR) is called **Dispersion.**

- The refractive index of red colour is low and hence it suffers low deviation.

- The colours of Rainbow are **due to dispersion** of the sunlight bymillions of tiny water droplets.



- Dispersion of light into different colours i.e wavelengths is based on wave nature of light (light behaves as wave,) i.e electromagnetic wave.

- Here the refractive index of the prism is different for different colours, i.e different wavelengths, this implies that the different colours of light move with different velocities in a medium.
- In refraction, the frequency of light wave is same in both the media(rarer & denser), i.e, the frequency remains unaltered (will not change), i.e frequency is the property of the source from where light is being is generated and frequency is equal to no. of light waves leaving the source per second. This cannot be changed by any medium. but wavelength changes.
- To know the relation between speed of light wave (v), wave length (λ) and its frequency(f).

  $v = f\lambda$, where (v = speed of light in medium, f = frequency, λ = wave length).
- The refraction of light at any interfaace, $V\alpha \lambda$,i.e speed of the wave increases with increase in wavelength of light and vice versa.

Scattering of light:

- It's a complex phenomenon.
- The process of **re-emission** of absorbed light **in all directions** withdifferent intensities by atoms or molecules, is called "**scattering of light".**
- The blue colour of sea water and sky is due to scattering of light.
- The Sun appears as red in the Sun rise and Sun set due to less scattering of red light and to travel long distance to reach us.
- The Sun appears as white during noon time because water molecules rise into the atmosphere due to rise in temperature.
- Sir C.V. Raman discovered the Scattering of light.
- Raman experimentally found that **frequency of scattered light is greater than the frequency of incident light.** This is called " Raman Effect".

- **Raman effect** is used to determine the **shapes of molecules.**

Multiple choice questions:

- The least distance of distinct vision is about _____
  a)25 cm b) 50 cm c) 30 cm d) 15 cm
- The distance between eye lens and retina is about _____
  a)10 cm b) 2.5 cm c)2 cm d) 5 cm
- The maximum focal length of eye lens is about _____
  a) 2.5 cm b) 2.2 cm c)3 cm d) 1.5 cm
- The power of lens is 1D then focal length is_____
  a) 100 cm b) 50 cm c) 25 cm d)75cm
- Myopia can be corrected by which lens_____
  a) concave lens b) convex lens c) concavo-convex
  d) Plano convex
- The size of the object is perceived by an eye depends on _____
  a)size of the object b) distance of the object from the eye
  c) aperture of the pupil d) size of image on retina
- A doctor advised to use 4D lens. The focal length of the lens is
  a)25 cm b) 400 cm c) 4 cm d) 40 cm
- Which part of the human eye helps the lens to change its focal length?
  a) Retina b) Pupil c) ciliary muscle d) cornea
- For every position of an object in front of the human eye, the imagedistance is fixed at
  a) 1 cm b) 1.5 cm c) 2.5 cm d) 0.25 cm
- To correct one's hypermetropia defect, the type of lens used is _____
  a) biconvex b) biconcave c) concavo- convex
  d) Planoconcave

- With an increase in angle of incidence of light ray on a prism, theangle of deviation___
  a) remains constant b) first increases and then decreases
  c)first decreases and then increases d) first increases

and thenremains constant.

The scientific work of C.V. Raman is on

a) dispersion of light b) total internal reflection

c) defection of vision d) scattering of light

Scattering of light involves the process of

- bending of light at the interface of two media
- splitting of light into different colours
- convergence of light rays at the focus
- re -emission of absorbed light

Blue of sky is explained by

a) scattering of light b) total internal reflection

c) refraction of light d) dispersion of light

The sun appears red colour during sunset and sunrise, due to

a) scattering of red light is very small b) scattering of red light is high

c) scattering of other colours is high d) none of these

KEY

1. **a**	2. **b**	3. **a**	4. **a**	5. **a**	6. **b**
7. **a**	8. **c**	9. **c**	10. **a**		11.c
12.d	13.d	14.a	15.a		

Electric Current

Lightning is an electric discharge between two clouds or between cloud and earth. This electric discharge through air as an electric spark or lightning.

Lightning is the motion of charge in the atmosphere.

All metals are good conductors of electric current.

The nature of the substance plays an important role (connecting wires) in the transfer of energy from battery to bulb.

Drude and Lorentz proposed that positive ions in a metal (lattice points) are fixed and negative electrons are free charge carriers.

The fixed arrangement of positive ions is called **lattice.**

Electric current = electric charge/time

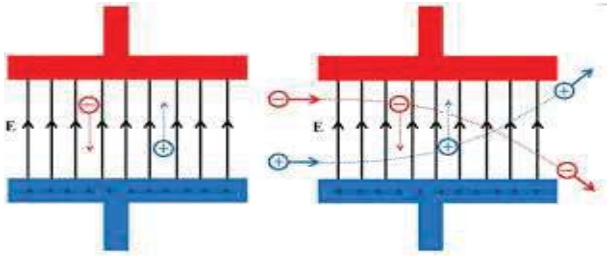
$I=Q/t$

The SI unit of electric current is ampere denoted by A.

1Ampere=1Coloumb/1Second

The free electrons in a conductor are accelerated by the electric field.

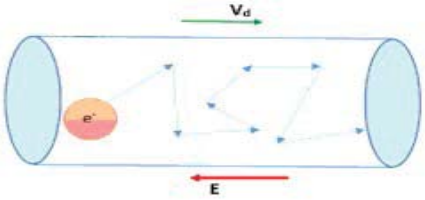
The movement of positive and negative charges in an uniform electric field is shown below,



Here top plate indicates negative charge, bottom plate indicates positive charge.

Electrons move in a direction opposite to the direction of the electric field.

The Electrons in the conductor move with a constant average speed called drift speed or drift velocity.



where E is Electric Field

I & E in the same direction , while electron flows opposite to the both I&E

Drift velocity $v_d = I/nqA$,

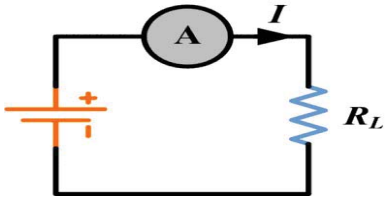
I.e (q=e), hence $v_d=I/neA$.

(where I=current, n=charge density, q=charge of electron, A=Area of cros section).

Ammeter

An **ammeter** is a device used to measure electric current.

An **ammeter** is always connected in series to the circuit.



A indicates ammeter and I indicates current including its direction.

The work done (W) in moving a charge(q) from one point to another point in an electric field is defined as potential ,

V=w/q=Fl/q,

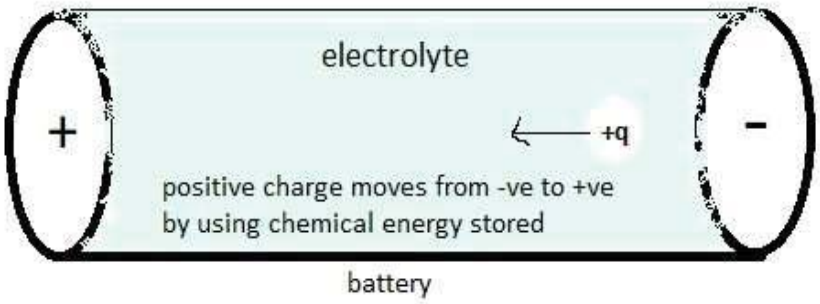
(where F is the force due to electric field and l is the distance between the two points).

This potential difference between the two points is also called as voltage.

The SI unit of potential difference is"Volt" and it is denoted by V.

1Volt=1Joule/1Coulomb (1V=1J/C)

- **Electromotive Force (emf)**: It is defined as the work done by the chemical force to move unit positive charge from negative terminal to positive terminal of the battery.



Ohm's law :

- Current passing through a conductor is directly proportional to the potential difference between the two ends of it.

  i.e., $I \alpha V$, $I = cV$ where c is constant ($c = 1/R$)

  $I = V/R$

  $V=IR$, Where R is resistance of the conductor.

  SI unit of Resistance: **Ohm**.

  The symbol of Ohm is Ω.

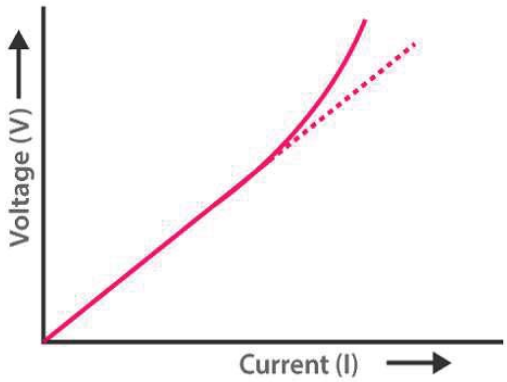
  1 Ohm = 1 Volt / 1 Ampere

  $1\Omega = 1V/A$

- Ohm's law for materials as classified into two categories.
  - Which obey Ohm's law are called ohmic materials.
    Ex: metals.
  - Which do not obey Ohm's law are called non ohmic materials.
    Example: LEDs.

  NOTE: Ohm's law is valid if the **temperature of the material (conductor) remains constant.**

  - The **resistance** of the material **changes** with temperature.
  - V-I graph is **non-linear** when **temperature changes**.



where I depends on V.

Ohm's law is **not applicable** to gaseous conductors.
Ohm's law **cannot** be applied to **semi conductors.**
Example: Germanium and silicon.

The **resistance** is the property of a conductor is defined as the obstruction to the motion of the electrons in a conductor.
The material which offers resistance to the motion of electrons is called **resistor**.

Factors affecting the resistance of a material:

Temperature, length, area of cross-section of the conductor, and nature of the conductor.
The resistance (R) of a conductor is directly proportional to its length (l)

$$R \alpha l \text{ (at constant temperature)}$$

The resistance of a conductor inversely proportional to area of its crosssection.

i.e $R\alpha 1/A$(atconstanttemperature)

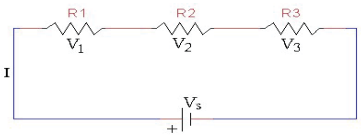
$R= \rho l/A$,(Where, ρ is a proportionality constant and is called **specific resistance or resistivity** of the conductor).
The SI unit of resistivity is **ohm-metre,** Symbolically Ω-m.

The reciprocal of resistivity is called **conductivity(σ),** unit of conuctivity is mho.
The value of resistivity of a material determine their conductivity.

Equivalent Resistance of a Series Connection:

$$V=IR_{eq}$$

$$IR_{eq}=IR_1+IR_2+IR_3$$



$$R_{eq}=R_1+R_2+R_3$$

i.e. The equivalent resistance is equal to sum of individual resistances when the resistors are **connected in series.**

- One of the resistors in series breaks down, the circuit becomes open, hence current flow does not take place.
- Hence, household electrical appliances cannot be connected in series.

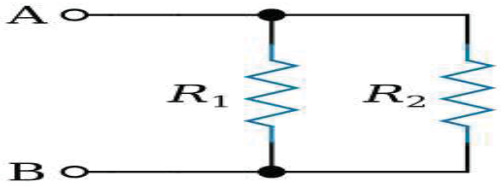
Equivalent resistance of a parallel connection

The equivalent resistance of a **parallel combination is less** than the resistance of any one of the resistors.

- Let two resistors R_1 and R_2 are connected in parallel,

$$1/R_{eq} = 1/R_1+1/R_2$$

$$R_{eq} = R_1R_2/(R_1+R_2)$$



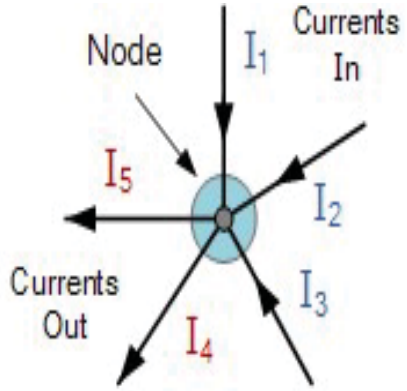
- **Kirchhoff'slaws:**

1.Current law (or) Junction law: At any junction in a circuit,the sum of the currents entering into the junction must be equal to the sum of the currents

leaving the junction.

We have $I_1+I_2+I_3=I_4+I_5$

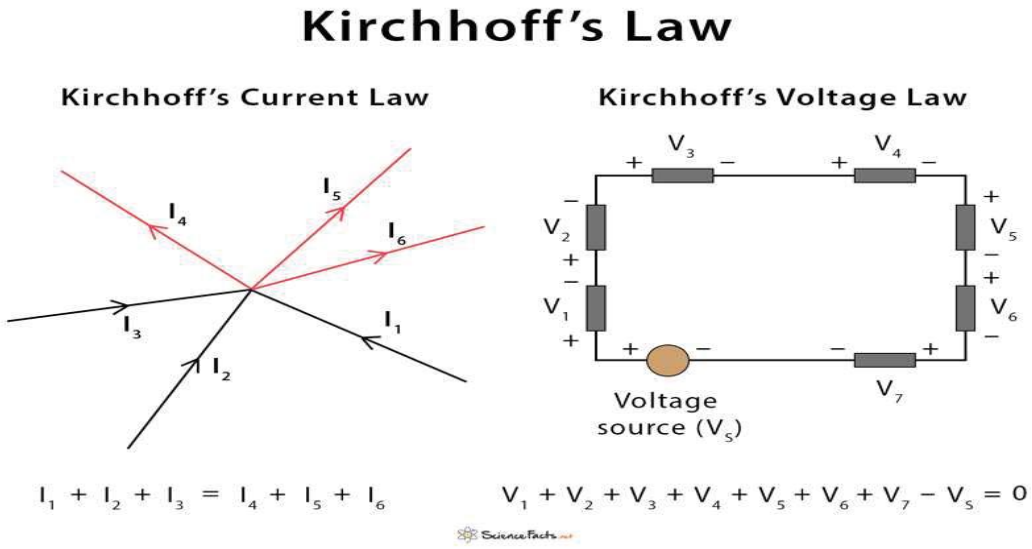
Currents Entering the Node
Equals
Currents Leaving the Node



$$I_1 + I_2 + I_3 + (-I_4 + -I_5) = 0$$

Kirchoff's voltage law (or) Loop law:

The algebraic sum of potential differences in a closed loop of a circuit is equal to zero.



ELECTRIC POWER

- **Workdone:** Let a charge q coloumb passing through a conductor from one point to another point in an electric field having a potential difference v and charge is travelling through length *l* in a time t. The work done by electric field is given by:

$$\mathbf{W=F\times d}$$ (where F=electric force,d=distance travelled)

$$W=E\times q\times d = E\times l\times q = V\times q$$, (where E is the electric field in the conductor through which charge q is travelling).

Energy lost by the charge per second =Work done per second = W/t

$$W/t = qV/t \quad \text{(we know } q/t = I\text{)}$$

$$W/t = VI$$

(I= current flowing through the conductor, W/t = work done per second).

The work is equal to the energy lost by the charge when passing through the conductor.

- **Electric power (P) :** Power is the rate of doing work. (W/t).

$$\mathbf{P=W/t=VI}$$

This equation can be used to calculate power consumption by any electric device that is connected in a circuit**.**

According to the Ohm'slaw,

$$V=IR$$

$$P=I^2R=V^2/R \quad \text{(as } P=V\times I\text{)}$$

The equation P=VI can also be used to calculate the power which be extracted from a battery or any source.
In this case modified equation P=VI

Example:

A bulb is marked 60W and 120V. This means that if this bulb is connected to 120V source, it will able to convert 60w of electrical power into heat or light in one second.

From the marking of bulb,we can measure the resistance of the bulb.
From the relation $P=V^2/R$, i.e $R=V^2/P$
Substituting the values V and P in above equation,

We get R = 120x120/60 = 240 Ω

To calculate power as we knew $P = V^2/R = 120^2/240 = 60$ watts, now according to the problem one should find the relation between watt and joule by using following steps

- Kilowatt is generally used to express power consumption.
- 1 KW= 1000 W= 1000 J/S

The unit of electric power consumption is equal to 1 KWH (one KiloWattHour).

$1KWH = (1000)\ J/S/(60x60)S = 3600x\ 1000J = 3.6x10^5\ J$

Multiple choice questions:

- The kilowatt hour is the unit of.....

  a.Power b. work c.energy d.None ofthese

- A thick wire has a-------- resistance than a thin wire.

  a.High b.low c.does not depend on thickness d.higher

- The SI unit of current is_____

  a.ampere b.volt c.ohm d.coulomb

- A unit form wire of resistance 50Ω is cut into five equal parts. These parts are now connected in parallel.Then the equivalent resistance of the combination is

  a.650Ω b.12Ω

  c.250Ω d.2Ω

- Check the following statements.

A. In series connection,the same current flows through each element.

B. In parallel connection,the same potential difference gets applied across each element.

a)both A andB are correct b)A is correct but B is wrong

c)AiswrongbutB is correct d)bothAandBarewrong

KEY

1.a 2.b 3.a 4.d 5.a

Electromagnetism

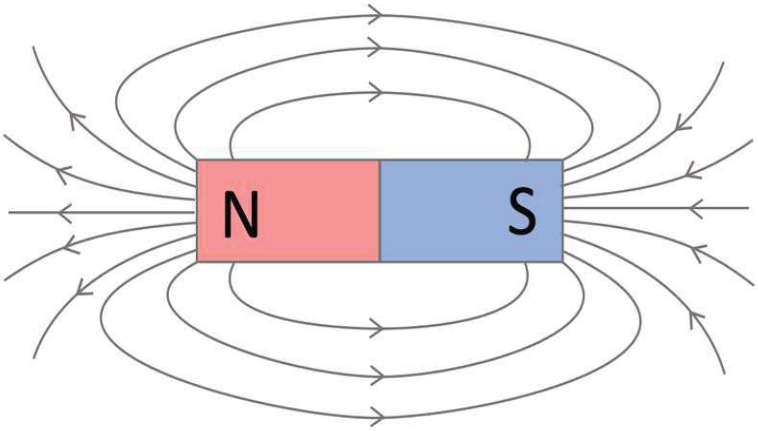
H.C. Oersted first observed that magnetic compass needle is deflected by current carrying conductor.

Oersted concluded that electricity and magnetism are related phenomena.

The unit of magnetic induction field strength is named as Oersted in his honour.

Magnetic field:

The region (or) space around a magnet where its influence is felt is called "magneticfield". The magnetic field varies with the distance from the magnet and is characterized by strength and direction. It exists in all directions i.e., it is three dimensional.



Magnetic field lines/Magnetic lines of force:

The path traced by a unit north pole in moving it near a magnet is called magnetic field lines (or) magnetic lines of force.

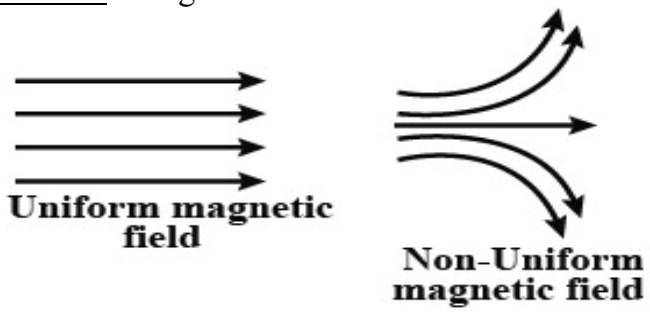
All magnetic lines of force start at north pole and ends at the south pole outside of a bar magnet, but inside the bar magnet, magnetic lines of force appear at the south pole move towards to the north pole, further these magnetic lines of force are continuous and closed loops

The tangent drawn to the field line at a point gives the direction of the magnetic field.

The field is strong when the lines are crowded (near the poles of the magnet) and if weak when the lines are apart.

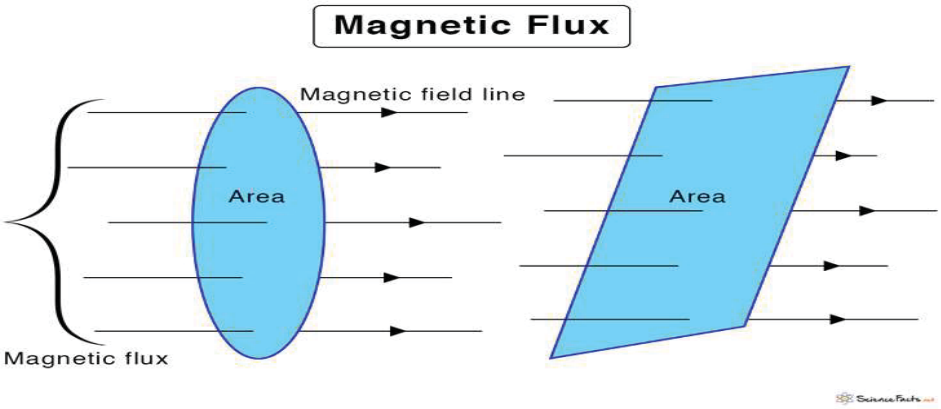
The magnetic field is said to be **non-uniform,** when strength or direction changes from point to point.

The magnetic field is said to be **uniform,** if both strength and direction are constant throughout the field.



Magnetic flux : The number of magnetic lines of force passing through the plane of area 'A' perpendicular to the field is called "magnetic flux." It is denoted by 'ϕ'.

The S.I. unit of magnetic flux is "**weber**".



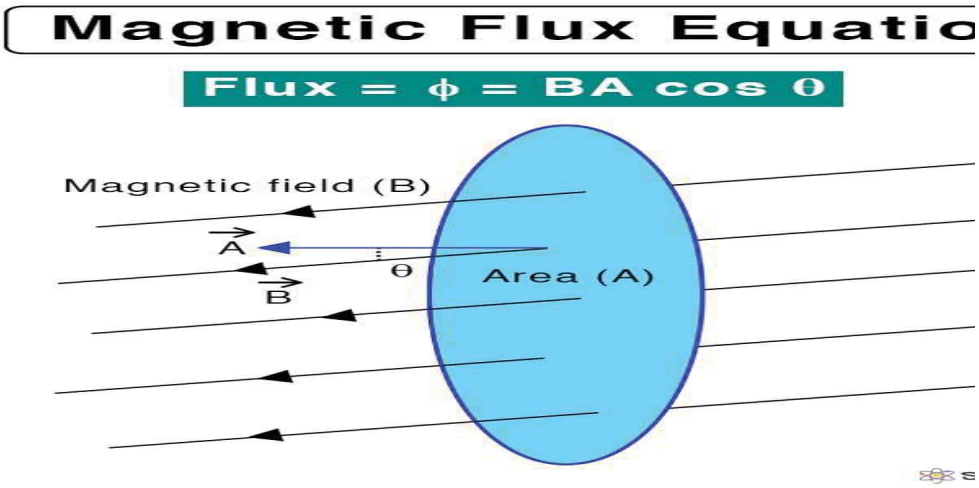
Magnetic flux density(B): It is defined as the magnetic flux passing through unit area taken perpendicular to the field. It is also known as magnetic field induction.

Magnetic flux density = Magnetic flux /Area.

$$B = \phi/A \text{ or } \phi = BA$$

If plane makes an angle Θ with field then $\phi = BA\cos\Theta = B.A$ (**here** B,A are vector quantities, i.e they have both direction and magnitude).

Unit of magnetic flux density is weber/(meter)^2 or Tesla.

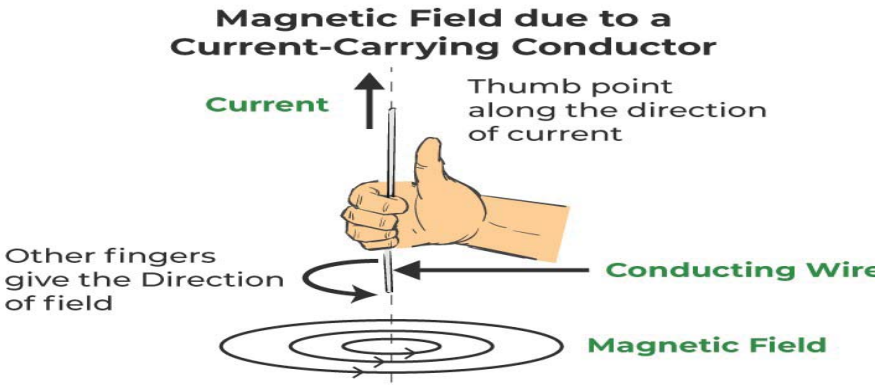


Magnetic field due to current carrying straight wire:

Current carrying in a wire produces magnetic field. The direction of the magnetic field, around a current carrying wire is determined by right hand thumb rule.

Thumb indicates the direction of current.

The curled fingers show the direction of magnetic field.

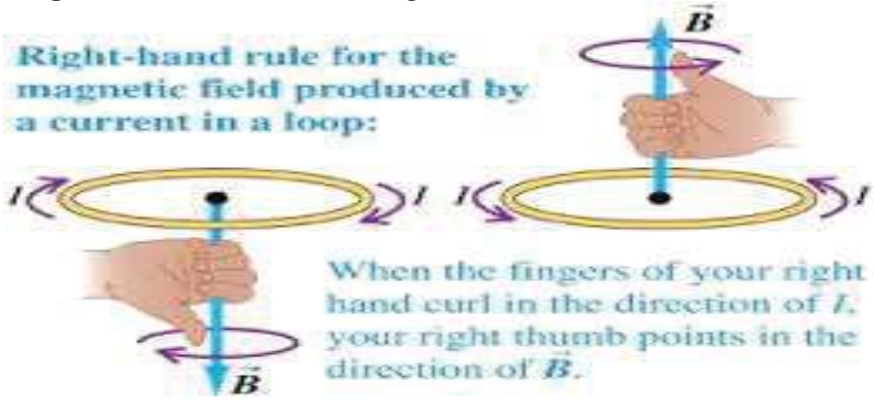


Magnetic field due to a circular coil:

The direction of the field is perpendicular to the plane of the coil.

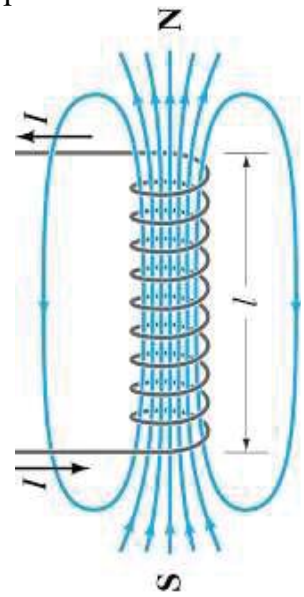
With Right Hand Thumb rule, the **thumb** points the direction of

magnetic field, the curled fingers show the direction of current.



Magnetic field due to solenoid:

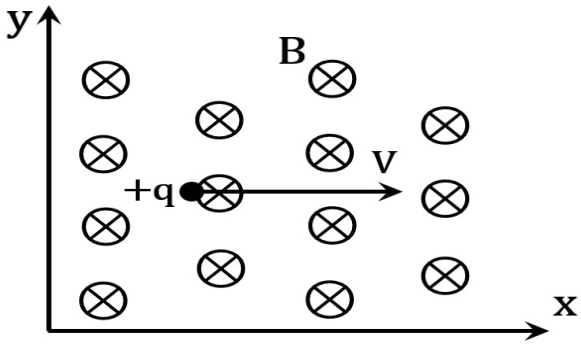
One end of the solenoid behaves as north pole and the other end behaves like a south pole.



Magnetic force on moving charge

Magnetic force on the charge = Charge x speed x magnetic flux density

$$F = qvB$$



Here direction of the velocity of charged particle is perpendicular to the direction of the magnetic field 'B',

this indicates magnetic field is perpendicular to the plane of paper and into the paper. The force experienced by the charged particle in above figure is in the direction of Y axis.

If the angle(ɵ) between the velocity direction (V) and magnetic field of direction(B), then the force experienced by the charged particle is given by

$$\vec{F} = q\vec{v} \; x \; \vec{B}$$

NOTE: since $\overline{V}$ and B are vector quantities and the symbol *x* represents as cross product and not as *x* what we read.

<u>Magnetic force acting on current carrying conductor</u> :

Magnetic force acting on current carrying conductor place in a magnetic field is given by,

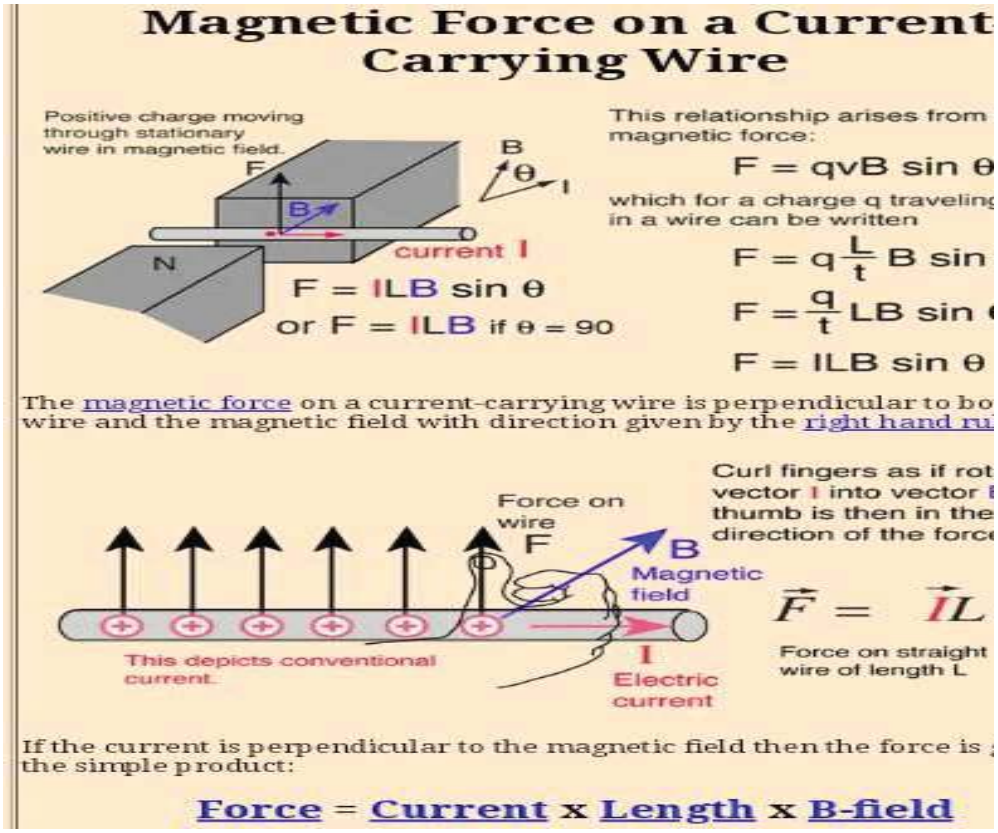
where I = Q/t where Q= total charge

I = Current in the wire, L = Length of the wire, B = Strength of uniform magnetic field.

The force on the current carrying wire when angle between current and magnetic field is **Θ ,** given by (at any angle)

F = ILBsinθ

F=ILB (where θ = 90 degrees), sinθ =1.



To find the radius of the path and time period of a charged particle:

We know that F = qvB,

r = radius of the circular path,

centripetal force = mv^2/r

$qvB = mv^2/r$

then,Time Period of the particle(T)= $2\pi r/v$

The above equation after substitution becomes, **$T = 2\pi m/Bq$**

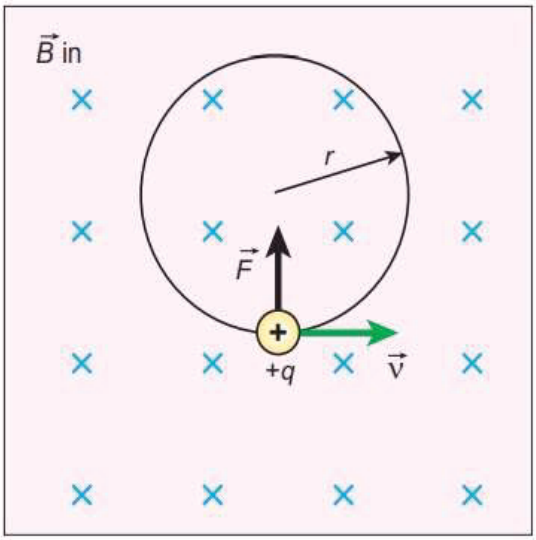
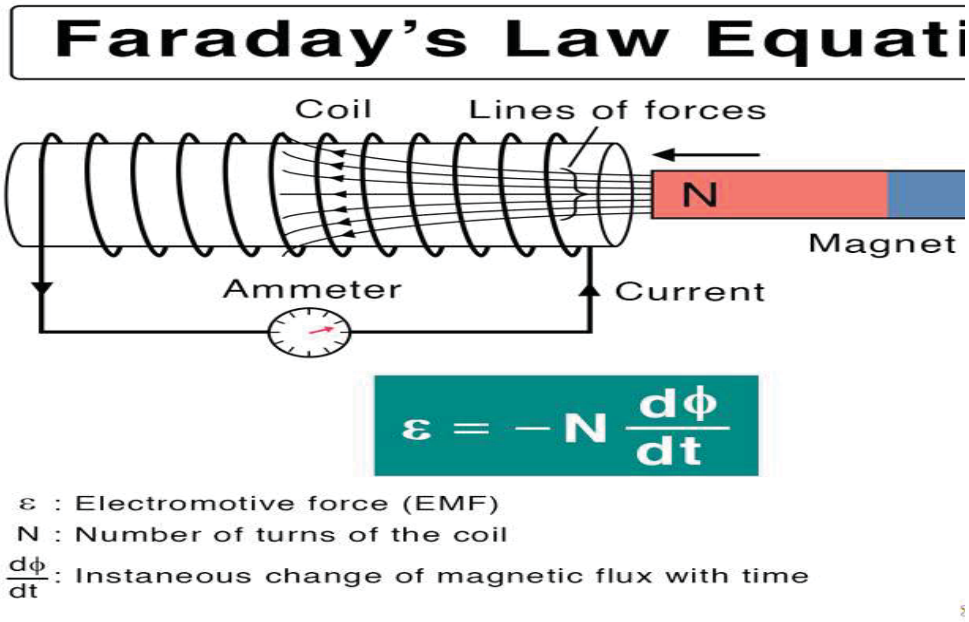


Figure 3.50 Circular motion of a charged particle in a perpendicular uniform magnetic field

Electric motor:

In an electric motor, electrical energy is converted into mechanical energy.

Faraday's law:



When there is a continuous change in magnetic flux linked with a closed coil, a current is generated or induced in the coil.

(OR)

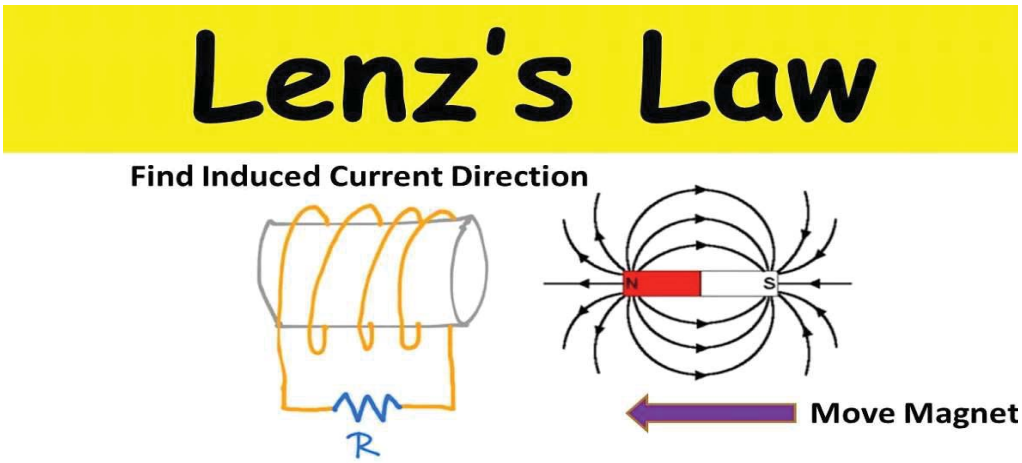
"The induced EMF generated in a closed loop is equal to the rate of change in magnetic Flux passing through it".

Induced EMF = Change in magnetic flux/time

The consequence of Faraday's law is the conservation of energy

Lenz's law:

The law states that "the induced current will appear in such a direction that it always opposes the changes in the flux of the coil."



Applications of Faraday's laws of electromagnetic induction:

For security check

Tape recorder

ATM

Induction stove

In generators, mechanical energy is converted into electrical energy.

Multiple choice questions:

Which converts electrical energy into mechanical energy

Motor b) Battery c) Generator d) Switch

Electrical energy is converted into mechanical energy by which device

Battery b) Motor c) Generator d) Switch

Mechanical energy is converted into electrical energy by which device

Generator b) Motor c) Battery d) Switch

The magnetic force on a current carrying wire placed in uniform magneticfield if the wire is oriented perpendicular to magnetic field, is

0 b) ILB c) 2ILB d) ILB/2

If a conductor is moving with a speed of 10 m/s in

the directionperpendicular to the direction of the
magnetic field of induction
0.8T, and induces an EMF of 8 V between the ends of coil, the
length ofthe coil is
a) 10 m b) 20 m c) 1m d) 100 m

KEY

1. a **2. b** **3. a** **4. b** **5. c**

I. ACIDS, BASES AND SALTS

Synopsis

1. Acids are sour to taste and turn blue litmus paper to red colour.
2. Bases are bitter to taste and soapy to touch, they turn red litmus paper to blue litmus paper.
3. Natural indicators are i) Litmus ii)Turmeric powder iii) Colored petals of flowers
4. Synthetic indicators are methyl orange and phenolphthalein. They are synthetic acid base indicators.
5. Methyl Orange indicators show yellow in bases and red color in acid Solution.
6. i) Strong acids are HCl, H_2SO_4 , and HNO_3

A) Acids

S.No	Acid Name	Formula	Nature
1	Hydrochloric acid	HCl	Strong acid
2	Sulphuric acid	H_2SO_4	Strong acid
3	Nitric acid	HNO_3	Strong acid
4	Acetic acid (vinegar)	CH_3COOH	Weak acid
5	Carbonic acid (Soda Water)	H_2CO_3	Weak acid
6	Phosphoric acid	H_3PO_4	Weak acid

B) Bases

S.No	Base Name	Formula	Nature
1	Sodium Hydroxide (Caustic Soda)	NaOH	Strong Base
2	Potassium Hydroxide	KOH	Strong Base
3	Calcium Hydroxide (Slaked lime or Milk of Lime)	$Ca(OH)_2$	Weak Base
4	Magnesium Hydroxide (Milk of magnesia)	$Mg(OH)_2$	Weak Base
5	Ammonium Hydroxide	NH_4OH	Weak Base

7. Olfactory indicators are used to test acids and bases by odour change (Smell)
   Ex. Clove oil and Vanila essence and onion .
8. Acids react with metals liberate H_2 gas.
   Acid + Metal →Salt + Hydrogen gas
   $2HCl + Zn \rightarrow ZnCl_2 + H_2\uparrow$
9. H_2 gas is identified by pop sound and by burning a match stick.
10. Granules of zinc metal are added to NaOH solution H_2 gas is liberated and form sodium zincate.
    $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2\uparrow$
11. Acids react with Carbonates and Metal Hydrogen Carbonates (Bi Carbonates) Liberate CO_2 gas.
    $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_20 + CO_2$
    ii) $NaHCO_3 + HCl \rightarrow NaCl + H_2O + CO_2$.
12. CO_2 gas is identified by puts off burning splinter and turn lime water into milky.
    $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$
13. On passing excess of CO_2 gas, in soluble Carbonate then it is converted into soluble Calcium bicarbonate.
    $CaCO_3 + H_2O + CO_2 \text{----} \rightarrow Ca(HCO_3)_2$.
14. The reaction between acid and base to give salt and water is called Neutralization
    Acid + Base →Salt + water
    $HCl + NaOH \rightarrow NaCl + H_2O$
    $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$
    Acid + Metal Oxide → Salt +Water
    $2HCl + Na_2O \rightarrow 2NaCl + H_2O$
    $2HCl + CuO \rightarrow CuCl_2 + H_2O$.
15. Reaction of base with non metal oxides is called neutralization.
    i) $2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$
    ii) $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

16. Non metallic oxides have acidic nature.
Ex. CO_2, SO_2 , SO_3 etc….,
17.Metallic oxides have basic nature.
Ex.Na_2O ,MgO , CuO, CaO etc…
18.Metal oxide show both acidic and basic nature are called amphoteric oxides.
Ex. Al_2O_3 , BeO etc..,
19. Aqueous solutions of acids , bases and salts conduct electricity are called Electrolytes. It is due to Presence of free ions.
Ex. Aqueous HCl , NaOH and NaCl Solutions .
20. Aqueous solutions of glucose urea, sugar do not conduct Electricity which are called non electrolytes, it is due to absence of ions.
21.The acidic nature of acids is due to H^+ ions and basic nature of bases is due to OH^- ions.
22. i) When the solid NaCl reacts with concentrated H_2SO_4 liberate HCl gas.
$2NaCl + H_2SO_4 \rightarrow 2HCl + Na_2SO_4$.
ii).HCl gas is tested by glass rod dipped in ammonia solution to form dense white fumes.
$HCl_{(g)} + NH_{3(g)} \rightarrow NH_4Cl_{(s)}$
iii) Dry HCl gas is not an acid but HCl aqueous solution turns blue litmus paper into red color.
23. The dissociation of HCl in water as
$HCl + H_2O \rightarrow H_3O^+ + Cl^-$
24. H^+ ion cannot exist in water but it exist as H_3O^+ (Hydronium Ion)
$H^+ + H_2O \rightarrow H_3O^+$
25.Bases in water produces OH^- ions (Hydroxide ions)
$NaOH_{(s)} \xrightarrow{water} Na^+_{(aq)} + OH^-_{(aq)}$
26.Bases which are soluble in water are called alkalis. All strong bases are alkalis.
27 $Be(OH)_2$ is a weak base but not alkali since it is slightly soluble in water.
28. a)The process of dissolving an acid or base in water is an exothermic process. (Heat liberated)
b) During the dilution of acid or base with water the concentration of H_3O^+ or OH^- ions are decreased per unit volume.
29. The acid must always be added slowly to water with constant stirring but water is not added to acid since excessive local heat is generated which causes burn and break.
30.Strong acids (HCl) and strong bases (NaOH) are strong electrolytes since bulb grows brightly.
weak acids and weak bases are weak Electrolytes since the bulb grows less intensity (dim).
31. A mixture of several indicators shows approximate P^H of solution of different colours is called universal indicator.
Strong acids show deep red color , Weak acid show light orange yellow colour .
Strong alkalis show Dark Black Color , weak alkalis show greenish blue, Neutral Solutions show Green color.
32. a) P^H scale is 0-14 and proposed by Sorenson SPL
b) The negative logarithm H+ ion molar concentration is called P^H . Mathematical form is
$P^H = - \log[H^+]$
c) P^H of neutraol solution is 7 ; for Acids P^H <7 , for bases P^H >7
d) As P^H increases H^+ ion concentration decreases, as P^H decreases H^+ ion concentration increases.
e) If H^+ ion molar concentration is 10^{-3}, then P^H is 3.
f) H^+ for acids $>10^{-7}$ M and bases $<10^{-7}$ M neutral solution, $[H^+]=[OH^-]=10^{-7}$ M.
33. P^H of acid rain is less than 5.6, it decreases P^H of soil and add lime to the soil.
34. Tooth Enamel is made up of Calcium Phosphate. $(Ca_3(PO_4)_2)$
35.Calcium phosphate is the hardest substance in the body.
36. Tooth paste is alkaline or basic , it neutralizes the excess acid and prevent the tooth decay.
37. Stomach produces HCl acid and it helps in the digestion of food.
38.Anatacids are used to neutralize the excess of acid in the stomach .
39.The Antacid, $Mg(OH)_2$ (Milk of Magnesia) is used for indigestion (Hyper Acidity) since it is a mild base (weak base).
40.Stinging hair of leaves of nettle plant contains Formic Acid (Red Ants) (Methanoic Acid- HCOOH).

41.Salts are products formed from acid & base during Neutralization.
Acid + Base → Salt + water
HCl + NaOH → Nacl + H_2O

42. NaCl is common salt called Rock Salt (Sodium Chloride).

43. Salts are 4 types based on Hydrolysis . they are
i) Salts of strong acid and strong base : These aqueous solutions are neutral P^H =7 Ex. Nacl, KCl
ii) Salts of strong acid and weak base : These aqueous solutions are acidic , P^H <7
Ex. $AlCl_3$, $FeCl_3$, $CuSO_4$, NH_4Cl
iii) Salt of weak acid and strong base : These aqueous solutions are Basic P^H>7.
Ex. CH_3COONa (Sodium acetate) , Na_2CO_3 , $NaHCO_3$
iv) Salts of weak acid and weak base : The nature of these aqueous Solutions is neutral P^H = 7
It depends on the relative strength of weak acids and bases.

44. Electrolysis of aqueous NaCl (Brine) produces NaOH (Caustic Soda) , H_2 gas is liberated at cathode and Cl_2 gas liberated at anode .
It is called chloro alkali process (or) Nelson cell method
$2NaCl + 2H_2O \rightarrow 2NaOH + H_2 \uparrow + Cl_2 \uparrow$

45. Bleaching Powder is prepared by the action of chlorine gas over dry slaked lime.
$Cl_2 + Ca(OH)_2 \rightarrow CaOCl_2 + H_2O$
Uses i) It is used as bleaching agent
ii) It is used as oxidizing agent
iii) It is used as disinfectant in purification of drinking water.
iv) It is used in preparation of chloroform ($CHCl_3$).

Name of the Chemical, Formula and uses :

S.No	Common Name	Chemical Name	Formula	Preparation	uses
1	Common Salt(Rock Salt)	Sodium Chloride	NaCl	$HCl+NaOH \rightarrow NaCl+H_2O$	It is used for making NaoH, H_2,Cl_2, Bleaching Powder , Baking Soda & Washing Soda
2	Caustic Soda	Sodium Hydroxide	NaOH	$2NaCl+2H_2O \rightarrow 2NaOH+H_2+Cl_2$	It is used in Soap Industry and lab reagent.
3	Bleaching Powder	Calcium Chlorohypo Chlorite (or) Chloride of Lime	$CaOCl_2$	$Ca(OH)_2+Cl_2 \rightarrow CaOCl_2+H_2O$	It is used as Bleaching agent Oxidising agent used to Prepare Chloroform.
4	Baking Soda (Cooking Soda)	Sodium Hydrogen Carbonate	$NaHCO_3$	$NaCl+H_2O+CO_2+NH_3 \rightarrow NaHCO_3+NH_4Cl$	In Bakery as baking powder ($NaHCO_3$+ Tartaric acid) It is used as Antacid, Antiseptic and fire extinguisher
5	Washing Soda	Sodium Carbonate	$Na_2CO_3 10H_2O$	$2NaHCO_3 \rightarrow Na_2CO_3+H_2O+CO_2$ $Na_2CO_3+10H_2O \rightarrow Na_2CO_3 10H_2O$	It is used in Glass, soap and Paper Industry, borax . It is used as cleaning agent , It is used for removing Permanent hardness of water.
6	Gypsum	Calcium Sulphate dihydrate	$CaSO_4\ 2H_2O$	$CaSO_4$ 1/2 H2O+1 1/2 $H_2O \rightarrow CaSO_4 2H_2O$	It is used in preparation of plaster of paris(POP)
7	Plaster of paris(POP)	Calcium Sulphate Hemihydrate	$CaSO_4 1/2H_2O$	$CaSO_4\ 2H_2O \rightarrow CaSO_4$ 1/2 H2O +1 1/2H_2O	Doctors use as plaster for bandages and making chalks.

Exercise -1

Objective bits(MCQ) from Acids , bases , salts

1. Which taste is a characteristic property of all acids
   (1) Sweet (2) Bitter (3) sour (4) salty
2. Acids react with some reactive metal to produce which gas
   (1) CO_2 (2) H_2 (3) Cl_2 (4) N_2
3. Aqueous solution of acids & bases conduct electricity hence they are called as
   (1) Electrolytes (2) Non- Electrolytes (3) Insulators (4) None
4. Acids react with bases to produce salt and water it is known as
   (1) Precipitation reaction (2) Redox reaction (3) Neutralisation (4)All th above
5. Acids turn Methyl Orange into which colour
   (1) Red (2) Yellow (3) Green (4) Orange
6. Bases turn Phenolphthalein into which colour
   (1) Yellow (2) Pink (3) Blue (4) Green
7. Match the following Set B with A

Set –A	Set – B
(a) Plaster of Paris	(1) $CaOCl_2$
(b) Gypsum	(2) $NaHCO_3$
(c) Baking Soda	(3) $CaSO_4.2H_2O$
(d) Bleaching powder	(4) $CaSO_4.1/2H_2O$

The correct answer is

	1	2	3	4
1)	a	b	c	d
2)	d	c	b	a
3)	a	c	b	d
4)	d	a	b	c

8. A Solution turns red litmus paper to blue, Its P^H is likely to be
   (1) 9 (2) 6 (3) 7 (4) 5
9. A Solution reacts with crurhed egg shell to give a gas that turns lime water milky, the solution is
   (1) KCl (2) NaCl (3) HCl (4) LiCl
10. Water soluble Bases are known as
    (1) Acids (2) Salts (3) Bases (4) Alkalies
11. Common Salt is Produced from the following
    (1) Sodium Thiosulphate & SO_2 gas (2) Hydrochloric Acid and Sodium Hydroxide
    (3) Chlorine gas and O_2 gas (4) Nitric Acid and Sodium Hydrogen Carbonate.
12. P^H of HCl solution is 1, it shows which colour with universal indicator
    (1) Orange (2) Purple (3) Yellow (4) Red
13. Which of the following type of Medicines are used for treating indigestion
    (1) Antibiotic (2) Analgesic (3) Antiseptic (4) Antacid
14. Which Of the following is the must accurate way of showing neutrilisation
    (1) Acid + Base $\longrightarrow$ Acid - Base solution
    (2) Acid + Base $\longrightarrow$ Salt + Water
    (3) Acid +Base $\longrightarrow$ NaCl + H_2
    (4) Acid + Base $\longrightarrow$ Neutral Solution
15. The Chemical Formula of washing soda is
    $NaHCO_3$ (2) Na_2CO_3 (3) $Na_2CO_3.7H_2O$(4) $Na_2CO_3.10H_2O$
16. Baking soda is used as
    (1) Antacid (2) Fire Extinguisher (3) Antiseptic (4) All the Above
17. The electrolysis of Aqueous NaCl the gas liberated at cathode is
    (1) Cl_2 (2) NaOH (3) H_2 (4) CO_2
18. The P^H of distilled water is
    (1) 7 (2) 9 (3) 5.6 (4) 7.4
19. The P^H of a solution is 4 the nature of solution is
    (1) Base (2) Acid (3) Neutral (4) Alkaline
20. The Nature of metal oxide in water is
    (1) Acidic (2) Basic (3) Neutral (4) None

(21) Which of the following is not acidic oxide ?
(1) SO_2 (2) CO_2 (3) CaO (4) N_2O_5
(22) Which of the following is used in bakery?
(1) Na_2CO_3 (2) $NaHCO_3$ (3) $CaOCl_2$ (4) $CaSO_4$
(23) Which of the following is not formed on heating of $NaHCO_3$?
(1) NaOH (2) Na_2CO_3 (3) CO_2 (4) All the above
(24) Which of the following is used in glass making?
(1) Na_2CO_3 (2) NaOH (3) Gypsum (4) Bleaching powder
(25) P^H of aerated water is
(1) 7 (2) 5.5 (3) 7.4 (4) 10
(26) Formula of acetic acid is
(1) HCl (2)H_2CO_3 (3) HCOOH (4) CH_3COOH
(27) Vanilla essence is an example for
(1) Olfactory indicator (2) Natural indicator (3) Synthetic indicator (4) universal indicator
(28) P^H of salt solutions of strong acid and weak base is
(1) 7 (2) 3 (3) 8 (4) 10
(29) The chemical formula of Brine Solution is
(1) NaCl (2) NaOH (3) Na_2CO_3 (4) $NaHCO_3$
(30) Gastric juice contains
(1) H_2SO_4 (2) CH_3COOH (3) HCl (4) Na_2CO_3

EXERCISE-II
ACIDS, BASES & SALTS

1. Which of the following is not used as antacid?
   1) $Al(OH)_3$ 2) $Mg(OH)_2$ 3) KOH 4) $NaHCO_3$
2. When marble chips are treated with dilute HCl, which gas is liberated
   1) H_2 2) O_2 3) Cl_2 4) CO_2
3. Which of the following compound is used to bandage for fractured bones.
   1) $CaOCl_2$ 2) $NaHCO_3$ 3) $CaSO_4.½\ H_2O$ 4) $NaHCO_3$
4. Which of the following substance play a remarkable role in the Mahatma Gandhi's "Dandi March"
   1) Common Salt 2) Bleaching Powder
   3) Baking Soda 4) Washing Soda
5. Which of the following statement is not true ?
   1) Chemical name of Baking Soda is Sodium Hydrogen carbonate
   2) Bleaching Powder is produced by the action of Cl_2 gas on dry Slaked lime.
   3) Washing Soda is used for the manufacture of Borax
   4) Aqueous NaCl solution on electrolysis produce H_2 gas at Anode.
6. A solution reacts with crushed egg shells to give a gas that turns lime water milky, the solution contains.
   1) HCl 2) NaCl 3) LiCl 4) KCl
7. The chemical formula of Baking Soda is
   1) Na_2CO_3 2) $Na_2CO_3.10H_2O$ 3) $NaHCO_3$ 4) NaOH
8. The chemical used for removing the permanent Hardness of water is
   1) Na_2CO_3 2) NaCl 3) $NaHCO_3$ 4) $CaOCl_2$
9. The P^H of salts of strong acid and strong base is
   1) 0 2) <7 3) >7 4) 7
10. IUPAC Name of Formic Acid is
    1) Ethanoic Acid 2) Methanoic Acid
    3) Propanoic Acid 4) Lactic Acid

11. Which one of the following can be used as an acid base indicator by a visually challenged student
    1) Turmeric 2) Litmus paper
    3) Methylorange 4) Vanilla essence
12. Which of the following conducts electricity?
    1) Sugar solution 2) Distilled water
    3) Dil HCl solution 4) Urea solution
13. Which of the following is not alkali?
    1) NaOH 2) KOH 3) $Mg(OH)_2$ 4) $Be(OH)_2$
14. Which of the following solution is a weak electrolyte?
    1) NaOH 2) CH_3COOH 3) HCl 4) NaCl solution
15. Na_2SO_4 is a salt of
    1) Strong acid and weak base 2) Weak acid and strong base
    3) Weak acid and weak base 4) Strong acid and strong base
16. P^H of a solution is 13 then the colour of universal indicator for this solution is
    1) Red 2) Orange 3) Black 4) Green
17. P^H of milk of magnesia is
    1) 7.4 2) 10.6 3) 6.6 4) 7
18. Four solutions A, B, C, D when tested with universal indicator showed P^H as 4, 1, 11 & 7 respectively which solution is strongly acidic
    1) D 2) C 3) B 4) A
19. Chemical formula of Blue vitriol is
    1) $CaSO_4.2H_2O$ 2) $CuSO_4.5H_2O$ 3) Na_2CO_3 $10H_2O$ 4) $CaSO_4.½\ H_2O$
20. Which gas is liberated when cone H_2SO_4 reacts with solid NaCl is
    1) Cl_2 2) H_2 3) HCl 4) NH_3

BITS FROM PREVIOUS EXAMS:

POLYCET-2022

(1) Which of the following metal librates H_2 gas on reaction with NaOH ?
1) Ca 2) Mg 3) Na 4) Zn

(2) Which of the following can't be used as X in the equation given below?
Acid+ X →Salt+CO_2+Water
(1) Metal Hydrogen Carbonates (2) Metal Carbonates (3) Both 1&2
(4) Metal Hydroxide

(3).Tooth Enamel is made up with
(1) Calcium Hydroxide (2) Calcium Phosphate
(3) Calcium Oxide (4) Calcium Carbonate

(4) what is the P^H of the salt formed from weak acid and strong base ?
(1) 3 (2) 9 (3) 7 (4) 5

(5) Which of the following is /are used to detect acidic or basic nature of solution
(1) phenolphthalein (2) MethylOrange (3) Universal indicator (4) All of these

POLYCET - 2021:

(1) Acids turns litmus paper into which colour
(1) Red to Blue (2) Red to Yellow (3) Blue to Red colour (4) Blue to Yellow

(2) Which of the following character is used in Olfactory indicator ?
(1) Colour change (2) Odour (3) Taste (4) None

(3) When Na_2CO_3 reacts with acid then which gas is liberated
(1) H_2 (2) N_2 (3) O_2 (4) CO_2

(4) Antacid is a
(1) Salt (2) Acid (3) Base (4) Acid or Base

(5) The nature of Non Metal oxide is
(1) Acidic (2) Basic (3) Neutral (4) either Acidic or basic

POLYCET 2020 :

(1) The chemical name of baking soda is
(1) Sodium carbonate (2) calcium hydrogen carbonate
(3) Calcium carbonate (4) sodium hydrogen carbonate

(2) The colour of Methyl orange in base solution is
(1) Orange (2) yellow (3) Red (4) Blue

(3) Which of the following medicine is used for indigestion.
(1) Antibiotic (2) Analgestic (3) Antacid (4) Antiseptic

(4) The number of water molecules in one formula unit of Gypsum are
(1) Two (2) Half (3) five (4) Ten

POLYCET- 2019:

(1) The colour of methyl Orange in HCl solution is
(1) Orange (2) Red (3)Yellow (4) Blue

(2). Chemical name of Plaster of Paris is
(1) Calcium Sulphate Monohydrate (2) Calcium Sulphate
(3) Calcium Sulphate dihydrate (4) Calcium Sulphate hemihydrate

(3) Electrolysis of aqueous solution of NaCl gives
(1) Cl_2 gas at Cathode (2) Cl_2 gas at anode (3) H_2 gas at Cathode (4) 2 and 3

(4) Which of the following is example for acid
(1) Dry HCl (2) Aqueous HCl solution (3) NaOH (4) NH_4OH

(5) Which of the following is a neutralization reaction
(1) Base + Salt → Acid + Water
(2) Acid +Salt → Base +water
(3) Acid +Base → Salt +Water
(4) Base +Water → Acid + Salt

POLYCET- 2018:

(1) The chemical formula of bleaching powder
(1) $Ca(OH)_2$ (2) CaO (3) $Ca(HCO_3)_2$ (4) $CaOCl_2$

(2). Which of the following solution turns Blue litmus to Red Colour
(1) HCl (2) KOH (3) NaOH (4) Na_2CO_3

(3) P^H of blood is
(1) 7-8 (2) 6-7 (3) 4-5 (4) 13-14

(4) Match the following

(a) Caustic soda	(1) $NaHCO_3$
(b) Baking soda	(2) $CaSO_4 . 2H_2O$
(c) Gypsum	(3) $CaSO_4 . ½ H_2O$
(d) Plaster of paris	(4) NaOH

The correct answer is:

	a	b	c	d
(1)	1	2	3	4
(2)	1	4	3	2
(3)	4	1	3	2
(4)	4	1	2	3

(5) $NaCl + H_2O + CO_2 + NH_3 \rightarrow X + NaHCO_3$ identify 'X' in this reaction
(1) NH_4HCO_3 (2) NH_4OH (3) NH_4Cl (4) $(NH_4)_2 CO_3$

KEY to EXERCISE- I

1) 3	2) 2	3) 1	4) 3	5) 1	6) 2	7) 2	8) 1	9) 3	10) 4
11) 2	12) 4	13) 4	14) 2	15) 4	16) 4	17) 3	18) 1	19) 2	20) 2
21) 3	22) 2	23) 1	24) 1	25) 2	26) 4	27) 1	28) 2	29) 1	30) 3

KEY to EXERCISE- II

1) 3	2) 4	3) 3	4) 1	5) 4	6) 1	7) 3	8) 1	9) 4	10) 2
11) 4	12) 3	13) 4	14) 2	15) 4	16) 3	17) 2	18) 3	19) 2	20) 3

POLYCET- 2022

1) 4	2) 4	3) 2	4) 2	5) 4

POLYCET- 2021

1) 3	2) 2	3) 4	4) 3	5) 1

POLYCET- 2020

1) 4	2) 2	3) 3	4) 1

POLYCET- 2019

1) 2	2) 4	3) 4	4) 2	5) 3

POLYCET- 2018

1) 4	2) 1	3) 1	4) 4	5) 3

II. STRUCTURE OF ATOM

Synopsis:

1. Electrons, protons, neutrons present in an atom are called sub-atomic particles (or) Fundamental particles (or) elementary particles.
2. Electrons have negative charge, protons have positive charge and neutrons have zero charge.
3. Number of protons or electrons in an atom is called Atomic number (z)
4. The concept of Atomic number was proposed by Moseley
5. The total number of protons and neutrons in an atom is called Mass number (A)
6. Number of neutrons N = (A-Z)
7. Light is an electromagnetic radiation since it creates electric and magnetic field.
8. Light travels in vacuum with velocity of $3.0X10^8$ meter/sec
9. Characteristics of electromagnetic wave
   a) Wavelength (λ)
   b) Frequency (υ)
   c) Wave number ($\bar{\nu}$)

a) Wavelength (λ): - The distance between any two successive crests or troughs in a wave is called wavelength.
It is expressed in Angstrom units, $1\ A^0 = 10^{-8}$ cm $= 10^{-10}$ meters

b) Frequency (υ): - The number of wave peaks that pass by a given point per unit time is called Frequency.

c) The reciprocal of second is called Frequency (or) Hertz: units: Sec^{-1}

d) Wavelength (λ) of light is inversely proportional to its frequency.

$$\lambda \alpha 1 / \upsilon \text{ (or) } C = \upsilon\lambda \text{ (or) } \upsilon = C / \lambda$$

e) As the frequency increases, the wavelength becomes smaller.

f) The formation of rainbow (VIBGYOR) is an example for visible spectrum.

g) Red Color has higher wavelength and lower frequency and violet color has shorter wavelength and higher frequency.

h) The range of wavelengths covering red color to violet color is called the visible spectrum.

i) The entire range of wavelengths from gamma rays to radio waves is called electromagnetic spectrum

j) Wavelengths of gamma rays have shorter wavelength (high frequency) and radio waves have longer wavelength (low frequency and lower energy) [$\lambda \alpha 1/\upsilon$ (or) $\upsilon \alpha 1/\lambda$ (or) $\upsilon = C/\lambda$ (or) $C = \upsilon\lambda$]

k) Our eyes are sensitive only to visible light.

l) All the electromagnetic waves have same velocity as that of light (C) = 3×10^8 m/s or $3x10^{10}$ cm/s

m) Descending order of energy or frequency of different electromagnetic waves or spectrum;

n) γ- rays > X-rays > UV rays > Visible (VIBGYOR) > IR > Micro waves > TV > Radio waves

o) The wavelength of visible region is about 400nm – 700 nm

p) The energy of radiation can be emitted or absorbed in quanta is represented by $E=h\upsilon$. It is called Planck's equation.

→ The value of Planck's constant is $6.626X10^{-34}$ J X Sec

→ The energy of a radiation is directly proportional to its frequency and inversely proportional to its wavelength.

$$E \alpha \upsilon \text{ (or) } E \alpha 1/\lambda$$

→ Cupric Chloride ($CuCl_2$) produces a green color flame

→ Strontium Chloride ($SnCl_2$) produces a Crimson red flame

→ Sodium Vapours produce yellow light in street lamps.

→ Bohr's model of an atom is based on Rutherford's atomic model and Planck's quantum theory

→ Concept of Stationary orbits was proposed by Neils Bohr.

→ According to Bohr, electrons in an atom revolve in a stationary orbits or energy levels

→ These are denoted by 1,2,3,4, etc., or K,L,M,N,etc.,

→ When an electron jumps from lower energy state (ground state) to higher energy state (excited state) energy is absorbed in quanta.

→ When an electron jumps from higher energy state to lower energy state, energy is emitted or released in quanta.

→ Bohr's model successfully explains line spectrum of Hydrogen atom since it contains 1 electron and He^{+1}, Li^{2+} etc.

→ Bohr's atomic model could not explain the spectrum of atoms and ions have more than 1 electron.

→ Bohr's model could not explain fine structure of H atom
He could not explain Zeeman effect & stark effect. He could not explain the formation of chemical bonds.

→ Sommerfeld proposed the concept of elliptical orbit.

→ Fine structure of H atom can be explained by Sommerfeld by adding elliptical orbit to circular orbit.

→ The number of subshells in a shell is equal to 'n'.

→ The number of elliptical orbits in an nth shell is (n-1)

If n=1, one subshell (l = 0) 1S

If n=2, two subshells (l = 0, 1) 2S, 2P

If n=3, three subshells (l = 0, 1, 2) 3S, 3P, 3d

If n=4, four subshells (l = 0, 1, 2, 3) 4S, 4P, 4d, 4f

→ Quantum Mechanical model of an atom was proposed by Erwin Schrodinger to explain the concept of Orbital (electron cloud).

→ The region of space around the nucleus where the probability of finding the electron is maximum (95%) is called Orbital.

→ Quantum numbers: Each electron in an atom is described by a set of four quantum numbers. They are n, l, ml & ms.

1) Principal Quantum number (n)

It was proposed by Neils Bohr.
It is denoted by 'n'. n has values 1,2,3,4,.. (or) K, L, M, N…etc.
As 'n' increases the size and energy of orbit also increases.
Significance

a) It denotes shells (or) orbits,
It denotes the size and energy of orbit (or) main shell.

b) The maximum number of electrons in a shell is given by $2n^2$ formula, n=1, 2, 3, 4…
Ex:- If n = 1 (K shell) 1st orbit, it has $2e^-$ ⟶ $(2X1^2)$
If n = 2 (L shell) 2nd orbit, it has $8e^-$ ⟶ $(2X2^2)$
If n = 3 (M shell) 3rd orbit, it has $18e^-$ ⟶ $(2X3^2)$
If n = 4 (N shell) 4th orbit, it has $32e^-$ ⟶ $(2X4^2)$

2) The angular – momentum quantum number(l)[1] (Orbital Quantum number (or) Azimuthal Quantum number (or) subsidiary quantum number :

It was proposed by Sommerfeld.
It depends on 'n' values.
It is denoted by l. l has values 0, 1, 2, 3… (n-1), a total of 'n' values and symbols are s,p,d,f..etc.

→ Minimum value is 0 and maximum value = (n-1)
The number of subshells in a shell = n

If n = 1, (l=0) one subshell, 1s

If n = 2, (l=0,1) two subshells, 2s, 2p

If n = 3, (l =0, 1, 2) three subshells, 3s, 3p, 3d

If n = 4, (l =0, 1, 2, 3) four subshells, 4s, 4p, 4d, 4f

If n = 5, (l =0, 1, 2, 3, 4) five subshells, 5s, 5p, 5d, 5f, 5g

Significance:

a) It denotes subshells in a shell.
b) It gives the shape of orbitals:
   s – Orbital has spherical shape
   p – Orbital has dumb bell shape
   d – Orbital has double dumb bell shape
   f – Orbital has fourfold dumb bell (complex) shape.

3) Magnetic Quantum number (m_l) :

→ It was proposed by Lande to explain Zeeman and Stark effect

→ It is denoted by m_l. m_l has values – l, O, +l

→ It depends on l values. The maximum 'm' values for a given subshell are (2l+1) m values.

If l = 0(s), m = O (One), One orbital

If l = 1(p), m = -1, 0, +1, (Three) Three orbitals (p_x, p_y, p_z)

If l = 2(d), m = -2, -1, 0, +1, +2 (five), Five orbitals

If l = 3(f), m = -3, -2, -1, 0, +1, +2, +3 (seven), Seven orbitals

Significance:

It denotes sub-subshells (Orbitals) in a shell

It gives the orientation of orbitals in space.

The maximum number of orbitals in a shell by n^2 (n = 1, 2, 3, 4)

n	l	m	Sub shell	Number of orbitals in a shell (n^2)
1	0 (s)	0	1s	1 → (1^2)
2	0 (s) 1 (p)	0 -1, 0, +1	2s 2p	1+3 = 4 → (2^2)
3	0 (s) 1 (p) 2 (d)	0 -1, 0, +1 -2, -1, 0, +1, +2	3s 3p 3d	1+3+5 = 9 → (3^2) →
4	0 (s) 1 (p) 2 (d) 3 (f)	0 -1, 0, +1 -2, -1, 0, +1, +2 -3, -2,-1,0,+1, +2, +3	4s 4p 4d 4f	1+3+5+7 = 16 (4^2)

→ The orbital is described by n, l, m_l only (Three Quantum numbers).

4) Spin Quantum number (m_s):

→ It was proposed by Uhlenbeck & Goudsmith

→ It is an independent Quantum number

→ m_s has two values. They are +1/2 & -1/2.

→ If electron rotates in clock-wise direction is denoted by +1/2,

→ If electron rotates in anti-clock-wise direction is denoted by -1/2.

Significance: It gives the spin of electrons

→ Electronic Configuration : The distribution (or) arrangement of electrons in shells, sub-shells and orbitals in an atom is called Electronic Configuration.

→ n l^x method: The method writing the electronic configuration of an element is given by nl^x method. Where n = 1, 2, 3, 4… l = Symbol of subshell (s, p, d, f)

x = number of electrons in an orbital.

Ex: $H_{(Z=1)}$ $1s^1$

$1s^1$	n	l	m	s
1e	1	0	0	+1/2

$He_{(Z=2)}$ $1s^2$

$1s^2$	n	l	m	s
1e	1	0	0	+1/2
2e-	1	0	0	-1/2

$1s^2$ $2s^1$	n	l	m	s
1^{st} e^-	1	0	0	+1/2
2^{nd} e^-	1	0	0	-1/2
3^{rd} e^-	2	0	0	+1/2

$Li_{(Z=3)}$ $1s^2$ $2s^1$

Rules for writing the electronic configuration:

1) Pauli's exclusion Principle
2) Auf bau Principle
3) Hund's rule
4) Anamalous Electronic Configuration of Cr & Cu;

1) Pauli's exclusion Principle
   1) No two electrons in an atom have same set of all 4 quantum numbers,
   2) Each orbital contain a maximum of two electrons with opposite spin (1L)

2) Auf bau Principle:

Auf bau is German word which means 'building up' (construction).

Electrons will first enter into an available orbital of least energy is called Auf bau Principle.

The energy of a subshell can be calculated by using (n + l) values.

n = Principal Quantum number (1, 2, 3, 4…)

l = 0,1,2,3 for s, p, d, f subshells

Sub-shells	(n+ l)
1s	1+0 = 1
2s	2+0 = 2
2p	2+1 = 3
3s	3+0 = 3
3p	3+1 = 4
4s	4+0 = 4
4p	4+1 = 5
4d	4+2 = 6

If the two subshells have same (n + l) value the subshell with lower 'n' value have least energy. Among 2p & 3s (n + l) value is 3, but 2p has less energy, Since n is lower(2).

Among 3p & 4s (n + l) value is 4 but 3p has less energy, Since n is lower (3).

The relative increasing order (ascending order) energies of orbitals as follows based on Moiller diagram (chart):

1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p < 5s < 4d < 5p < 6s < 4f < 5d < 6p < 7s < 5f < 6d < 7p < 8s

3) Hund's rule:

"Electron pairing in orbitals starts only when all available empty orbitals of same energy are singly occupied" is called Hund's rule.

Orbitals have same energy are called "Degenerate Orbitals".

P subshell has 3 degenerate orbitals

1	1	1

P_x P_y P_z

d subshell has 5 degenerate orbitals

1	1	1	1	1

Pairing starts in p sub shell from 4th electron

1⇓	1	1

Pairing starts d sub shell from 6th electron

1⇓	1	1	1	1

C (Z = 6) $1s^2\ 2s^2\ 2p^2$ → $(2p_x^1\ 2p_y^1\ 2p_z^0)$ → (Two unpaired electrons)
N (Z = 7) $1s^2\ 2s^2\ 2p^3$ $(2p^1\ 2p^1\ 2p^1)$ (Three unpaired electrons)
O (Z = 8) $1s^2\ 2s^2\ 2p^4$ → $(2p_x^2\ 2p_y^1\ 2p_z^1)$ → (Two unpaired electrons)

4) Anamalous Electronic Configuration of Cr & Cu:

Cr (z = 24) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$ (or) $[Ar]^z\ 4s^1\ 3d^5$ → K, L, M, N (2, 8, 13, 1)

Cu (z = 29) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$ (or) $[Ar]\ 4s^1\ 3d^{10}$ K, L, M, N (2, 8, 18, 1)

Reason: Atoms get additional stability if all the d orbital's either half filled (or) full filled.

Electronic Configuration of Elements of Atomic Numbers from 1 to 30:

Element	Atomic number(Z)	Protons	Electrons	Electronic Configuration		
				nl^x method	Inert gas method	K,L,M,N
H	1	1	1	$1s^1$		1
He	2	2	2	$1s^2$	[He]	2
Li	3	3	3	$1s^2\ 2s^1$	[He] $2s^1$	2,1
Be	4	4	4	$1s^2\ 2s^2$	[He] $2s^2$	2,2
B	5	5	5	$1s^2\ 2s^2\ 2p^1$	[He] $2s^2\ 2p^1$	2,3
C	6	6	6	$1s^2\ 2s^2\ 2p^2$	[He] $2s^2\ 2p^2$	2,4
N	7	7	7	$1s^2\ 2s^2\ 2p^3$	[He] $2s^2\ 2p^3$	2,5
O	8	8	8	$1s^2\ 2s^2\ 2p^4$	[He] $2s^2\ 2p^4$	2,6
F	9	9	9	$1s^2\ 2s^2\ 2p^5$	[He] $2s^2\ 2p^5$	2,7
Ne	10	10	10	$1s^2\ 2s^2\ 2p^6$	[Ne]	2,8
Na	11	11	11	$1s^2\ 2s^2\ 2p^6\ 3s^1$	[Ne] $3s^1$	2,8,1
Mg	12	12	12	$1s^2\ 2s^2\ 2p^6\ 3s^2$	[Ne] $3s^2$	2,8,2
Al	13	13	13	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$	[Ne] $3s^2\ 3p^1$	2,8,3
Si	14	14	14	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$	[Ne] $3s^2\ 3p^2$	2,8,4
P	15	15	15	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$	[Ne] $3s^2\ 3p^3$	2,8,5
S	16	16	16	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$	[Ne] $3s^2\ 3p^4$	2,8,6
Cl	17	17	17	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$	[Ne] $3s^2\ 3p^5$	2,8,7
Ar	18	18	18	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$	[Ar]	2,8,8
K	19	19	19	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$	[Ar] $4s^1$	2,8,8,1
Ca	20	20	20	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$	[Ar] $4s^2$	2,8,8,2
Sc	21	21	21	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^1$	[Ar] $4s^2\ 3d^1$	2,8,9,2
Ti	22	22	22	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^2$	[Ar] $4s^2\ 3d^2$	2,8,10,2
V	23	23	23	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^3$	[Ar] $4s^2\ 3d^3$	2,8,11,2
Cr	24	24	24	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ \underline{4s^1\ 3d^5}$	[Ar] $4s^1\ 3d^5$	2,8,13,1
Mn	25	25	25	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^5$	[Ar] $4s^2\ 3d^5$	2,8,13,2
Fe	26	26	26	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^6$	[Ar] $4s^2\ 3d^6$	2,8,14,2
Co	27	27	27	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^7$	[Ar] $4s^2\ 3d^7$	2,8,15,2
Ni	28	28	28	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^8$	[Ar] $4s^2\ 3d^8$	2,8,16,2
Cu	29	29	29	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ \underline{4s^1\ 3d^{10}}$	[Ar] $4s^1\ 3d^{10}$	2,8,18,1
Zn	30	30	30	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}$	[Ar] $4s^2\ 3d^{10}$	2,8,18,2

STURUCTURE OF ATOM

Exercise – I

(1) If n =1 then angular momentum quantum number
(l)(1) 0 (2) 2 (3) 1 (4) 3

(2) If a subshell is denoted as 2p then its magnetic quantum number values
are(1) -2,-1,0,+1,+2 (2) -1,0,+1 (3) Two only (4) +1/2, -/12

(3) The maximum number of electrons that an M-shell
contains(1) 8 (2) 32 (3) 2 (4)
18

(4) The minimum and maximum values for 'n'
(1) 1…n (2) 0…n (3) 1…4 (4) 0…(n-1)

(5) The minimum and maximum values for 'l'
(1) 0…n (2) 0…(n-1) (3) n…(n+1) (4) 1…n

(6) The minimum and maximum value for m_l
(1) –l,…0…+l (2) 0…(n-1) (3) 1…n (4) (2 l +1)

(7) Electron spinning in clock-wise direction is denoted by +1/2 and anti-clock-wise
directiondenoted by -1/2. It is explained by which quantum number?
(1) n (2) l (3) m_l (4) m_s

(8) An emission spectrum consists of bright spectral lines on a dark-background. Which one of
thefollowing doesnot correspond to the bright spectral lines?
(1) Frequency of emitted radiation
(2) Wavelength of emitted radiation
(3) Energy of emitted radiation
(4) Velocity of light

(9) The maximum number of electrons that can be accommodated in the 'L' shell of an
atom-(1) 2 (2) 4 (3) 8 (4) 16

(10)If l = 1 for an atom then the number of orbitals in a sub-shell
is/are(1) 1 (2) 2 (3) 0 (4) 3

(11)The quantum number which explains the size and energy of the orbit (or) shell
is(1) n (2) l (3) m_l (4) m_s

(12) Which Quantum number gives the shape of orbitals
(1) Principal Quantum number (2) Azimuthal Quantum number
(3) Spin Quantum number (4) Magnetic Quantum number

(13) Which Quantum describes orientation of orbitals?
(1) l (2) n (3) m_l (4) All the above

(14) The independent Quantum number is
(1) n (2) l (3) m_l (4) m_s

(15)After filling 4p orbital the electron enters into which
orbital?
(1) 5s (2) 3d (3) 5f (4) 4f

(16)Splitting of Spectral lines in electric field is called
(1) Stark effect (2) Photoelectric effect (3) Zeeman effect (4) None

(17)Number of orbital's present in a subshell with l=3
(1) 1 (2) 5 (3) 7 (4) 2

(18)According to which rule only two electrons are present in an orbital?
(1) Aufbau's Principle (2) Pauli's Principle
(3) Hund's Rule (4) Heisenberg's Uncertainity Principle

(19)Maximum number of electrons in any shell is given by
(1) n^2 (2) n (3) $2n^2$ (4) 2(2l+1)

(20)Which of the following has low wavelength?
(1) Violet (2) Blue (3) Yellow (4) Red

(21)Orbitals of same energy but different orientation are called
(1) Atomic orbitals (2) Degenerate orbitals
(3) Pure orbitals (4) Hybrid orbitals

(22)The fine spectrum of H atom is explained by
(1) Rutherford (2) Bohr
(3) De Broglie (4) Sommerfeld

(23)If n=3, l=2, then the orbital is represented as
(1) 3d (2) 4s (3) 3p (4) 3s

(24)Maximum number of electrons present in subshell whose l= 3 is(1) 2 (2) 10 (3) 14
(4) 6

(25)Which combination is correct
(1) n=2 l=1 2s subshell (2) n=3 l=0 3p subshell
(3) n=4 l=2 4p subshell (4) n=5 l=0 5s subshell

(26)As 'n' increases the size and energy of orbit
(1) Decreases (2) Increases (3) Decreases and increases (4) No Change

(27)Number of orbitals present in a subshell with l=2
(1) 1 (2) 5 (3) 7 (4) 3

(28)Which of the following is wrong?
(1) All electromagnetic radiations travel with same speed
(2) The wavelength range of visible region is 400nm-700nm
(3) p orbital has spherical shape
(4) Light is propagated in vaccum

(29)The number of wave peaks that spread per unit length is called
(1) wavelength (2) frequency (3) wave number (4) None

(30)Electronic configuration of Cu is
(1) [Ar] $4s^2$ $3d^4$ (2) [Ar] $4s^1$ $3d^5$ (3) [Ar] $4s^1$ $3d^{10}$ (4) [Ar] $4s^2$ $3d^9$

Exercise-2

1.The Frequency of radio wave with wave length as 3metres is1) 10^8 sec^{-1} 2) 10^{10} sec^{-1} 3)3x 10^{10} sec^{-1} 4)3x 10^8 sec^{-1}

2. The emission of light spectrum is a collection of
1) Single wave lengths 2) Group of wave lengths 3) Different velocities 4) None of these

3. Wave length as 600nm indicates
1) UV-rays 2) x-rays 3) visible rays 4) IR rays

4. Match the following

Quantum numbers	**Significance**
A) Principal quantum number(n)	1) Shape of orbital
B) Azimuthal quantum number (l)	2) Size and energy of orbits.
C) Magnetic quantum number (m_l)	3) Spin of electrons
D) Spin quantum number(m_s)	4) orientation of

orbitals in space 1) A-1, B-2 ,C-3 , D-4 2) A-4 , C-2, B-3, D-1 3) A-2 , B-1, C-3, D-4 4) A-2, B-1, C-4 ,D-3

5.The name of the orbital with

n=3 and l=0 is1) 4s 2) 3p

3) 3d 4)3s

6. The degenerate orbitals in the following are

1) 3d, 4p, 5s 2)3s, 3p, 4s 3) $2p_x$, $2p_y$, $2p_z$ 4) 4d, 5p, 6s

7. The total number of s- subshell electrons in

nitrogen atom are1) 2 2) 4 3) 7 4)3

8.The Azimuthal quantum number value for subshell contains a maximum of ten

electrons is1) 1 2) 2 3) 0 4) 3

9. The name of the main shell which contains a maximum of 32

electrons is1) N 2) K 3) L 4) M

10. The possible four quantum numbers for $2s^1$ electron in Lithium atom are

1) n=2 , l=1, m_l=0 ,m_s=1/2 2) n=2 , l=0, m_l=1 ,m_s=1/2 3) n=1 , l=0, m_l=0 ,m_s=1/2 4) n=2 , l=0, m_l=0 ,m_s=1/2

11. The number of protons and number of electrons present in

He^+ ion are1) 1, 2 2) 2,1 3)2,2 4) 2,4

12.The number of electrons to be lost by Sodium atom to get stable electron configuration of Neon atom1) 0 2) 2 3) 3 4)1

13. Which of the following statement is false

1) Every orbit can accommodate a maximum of two electrons only.
2) Electrons revolve in fixed orbits around nucleus as per Bohr's model .
3) Energy of 2p orbitals is greater than 2s orbitals,
4) The number of electrons in nitrogen atom are 7

14. Match the following

Azimuthal quantum number value	**Maximum number of electrons**
A) l=0	1) 6
B) l=1	2) 10
C) l=2	3) 2
D) l=3	4) 14

1) A-1,B-2, C-3 ,D-4 2) A-2,B-1, C-3 ,D-4 3) A-3,B-1, C-2 ,D-4 4) A-3,B-2, C-1 ,D-4

15. Which of the following statement is true

1) Absorption of light is in a continuous manner
2) Elliptical orbits proposed by Niels Bohr
3) Spectra for multi electron atoms can not be explained by Bohr
4) Minimum probability of finding the electron around the nucleus is called orbital.

16. Electrons are filled in ascending order first from lowest energy orbitals to highest energy orbitals . ThisStatement is known as

1) Hund's rule 2) pauli's principle 3) Aufbau principle 4) de Broglie principle

17. Shape of each p-orbital is

1) spherical 2) dumbbell 3) double dumbbell 4) four fold dumbbell

18.The number of unpaired electrons present in carbon atom in ground state are1) 1 2) 2 3) 4 4) 0

19. The number of M-shell electrons in chromium(Z=24) atom are1) 13 2) 12 3) 2 4)1

20. The number of possible elliptical orbits for N-shell are
1) 1 2)2 3)3 4) 4

POLYCET – 2022

(1) Who among the following did not propose Atomic model?
(1) Planck (2) Schrodinger (3) Bohr (4) Sommerfeld

(2) Which of the following electromagnetic waves has highest velocity?
(1) Violet (2) Green (3) Red (4) All the same velocity

(3) Which of the following quantum numbers gives information about orientation of orbitals?
(1) Principal quantum number (2) Angular momentum quantum number
(3) Magnetic quantum number (4) Spin quantum number

(4) The electronic configuration of element 'S' is
(1) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$ (2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$
(3) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$ (4) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$

(5) The maximum number of electrons that can be accommodated in a subshell with angular quantumnumber (l) is
(1) $2n^2$ (2) 2 (2l+1) (3) 2 (4) (2l +1)

POLYCET – 2021

(1) Principal quantum number (n) is represented with
(1) 0,1,2,3,… (2) K,L,M,… (3) X,Y,Z (4) A,B,C…

(2) Which of the following properties was explained by Bohr's atomic model?
(1) Line spectra of H atom (2) Fine spectra of H atom
(3) Both line and fine spectra of H atom (4) None of the above

(3) Maximum number of electrons held by 'p'orbital are
(1) 2 (2) 3 (3) 6 (4) 10

(4) The electronic configuration of an element is based on
(1) Auf bau Principle (2) Hund's rule
(3) Pauli's Principle (4) All the above

(5) Which of the following quantum numbers cannot have zero value?
(1) Principal quantum number (2) Azimuthal Quantum number
(3) Magnetic quantum number (4) Both (1) & (2)

POLYCET – 2020

(1) The names of the subshells present in M-shell (n = 3) are(1) 2s, 2p, 2d (2) 3s, 3p, 3d
(3) 3p, 3d, 3f (4) 4s, 4p, 4d, 4f

(2) As per Moiller Chart, the correct ascending order of their energies of the following orbitals is(1) 3s < 3p < 4s < 3d (2) 3s < 3p < 3d < 4s
(3) 3s < 4s < 3p < 3d (4) 3s < 3d < 4s < 3p

(3) The maximum number of electrons that can be accommodated in the L shell of an atom are:(1) 16 (2) 8 (3) 2 (4) 4

POLYCET – 2019

(1) The quantum mechanical model of an atom was proposed by
(1) Rutherford (2) Bohr (3) Schrodinger (4) Max.Planck

(2) The correct order of energies for the electromagnetic spectrum is
(1) UV rays > IR rays > Radio waves > X-rays (2) Radio waves > UV rays > X-rays > IR rays
(3) X-rays > UV rays > IR rays > Radio waves (4) IR rays > X-rays > Radio waves > UV rays

(3) Which of the following set of quantum numbers is not correct?(1) n = 2, l = 1, m_l = -1, m_s = +1/2
(2) n = 2, l = 0, m_l = +1, m_s = +1/2
(3) n = 2, l = 1, m_l = -1, m_s = -1/2
(4) n = 2, l = 0, m_l = 0, m_s = -1/2

(4) The possible l values for a given 'n' value are
(1) 0 to (n-1) (2) 0 to n (3) 1 to n (4) 1 to (n-1)

(5) The rule which describes the electron distribution in degenerate orbitals of an atom is
(1) Auf bau Principle (2) Pauli's Exclusion Principle
(3) Hund's rule (4) Planck's Theory

POLYCET – 2018

(1) The maximum number of orbitals accommodated in a subshell with the angular-momentumquantum number 'l' is
(1) l+1 (2) (4 l +2) (3) (2 l +1) (4) l (l +1)

(2) As per Moeiller Chart, the correct ascending order of energy in the following atomic orbitals is(1) 3p < 3d < 4s < 4p (2) 3p < 4s < 3d < 4p
(3) 3d < 3p < 4s < 4p (4) 3p < 3d < 4p < 4s

(3) The wavelength of visible light is in between
(1) 100nm – 300 nm (2) 400nm – 700 nm
(3) 700nm – 900 nm (4) 800nm – 1000 nm

Key:

Exercise I: (1) 1 (2) 2 (3) 4 (4) 1 (5) 2 (6) 1 (7) 4 (8) 4 (9) 3 (10) 4 (11) 1 (12) 2 (13) 3 (14) 4 (15) 3 (16) 3
(17) 3 (18) 2 (19) 2 (20) 4 (21) 3 (22) 2 (23) 3 (24) 3 (25) 1 (26) 2 (27) 1 (28) 4 (29) 1 (30) 2

Exercise-2 1)1 2)2 3)3 4)4 5)4 6)3 7)4 8)2 9)1 10) 4 11)2 12)4 13)1 14)3 15)3 16)3 17)2 18)2 19)1 20) 3

Polycet – 2022 : (1) 2 (2) 4 (3) 3 (4) 1 (5) 2

Polycet – 2021 : (1) 2 (2) 1 (3) 3 (4) 4 (5) 1

Polycet – 2020 : (1) 2 (2) 1 (3) 2

Polycet – 2019 : (1) 3 (2) 3 (3) 2 (4) 1 (5) 3

Polycet – 2018 : (1) 3 (2) 2 (3) 2

III. CLASSIFICATION OF ELEMENTS & PERIODIC TABLE

Synopsis

- The element was first defined by Robert Boyle
- The total number of elements known by 1940 are **108** (91 elements obtained from natural source and 17 elements are synthetic).

Dobereiner's Triad theory

- The first attempt for classification of elements was given by Doberenier.
- According to Dobereiner, a group of three elements have similar chemical properties are arranged in the ascending order of atomic weights;
- The atomic weight of the middle element is the average of atomic weights of the first and third elements is called Dobereiner law of Triads

Examples for Dobereiner Triads.

Ex = (1) Li, Na, K ; Atomic weight of Na = 7 + 39 / 2 = 23
(2) Ca,Sr, Ba
(3) Cl, Br, I
(4) S, Se,Te
(5) Mn, Cr, Fe

Newland's law of octaves;

- The elements were arranged in the ascending order of atomic weights, every 8^{th} element starting from a given element resembles in its property to that starting element like musical note. It is called Newland's law of octaves.

  Newlands periodic table was restricted to 56 elements only.

Ex = (2^{nd} period) Li Be B C N O F
(3^{rd} period) Na Mg Al Si P S Cl

- It is applicable upto calcium element only :

Mendeleev's Periodic Table: It is based on "Atomic Weight"

- The Physical & Chemical properties of elements are periodic function's of their atomic weights is called **Mendeleev's periodic law**
- Mendeleev's periodic table is also called Short form of periodic Table.
- It consists of 8 groups and 7 periods Vertical columns are called groups (8), Horizontal rows are called periods (7) There are 7 periods.
- Mendeleev's predicted the properties of some missing elements they are.

  Eka-boron - Scandium (Sc)
  Eka- aluminum - Gallium (Ga)
  Eka-silicon - Germanium (Ge)

- Mendeleev corrected the atomic weights of some elements like Be, In, Gold.

Atomic Weight = equivalent Weight x valency

According to Mendeleev's Be has atomic weight of 13.5 since equivalent of Be is 4.5 and its valency is 3 but valency is corrected as 2. So Atomic Weight of Be = 4.5 x 2 = 9. Hence the atomic Weight of Be is 9.

Limitations of Mendeleev's periodic table :

1) Anomalous pairs in Mendeleev's periodic table are :

   (1) Te, I (2) Ar, K (3) Th, Pa (4) Co, Ni

   Elements of highest atomic weight precedes with the elements of lower atomic weights. There are called Anomalous pairs.(or) Invert Pairs

2) Dissimilar elements placed together :

   IA group has Alkali metals (Li, Na, K,) and IB has coinage metals (Cu, Ag, Au)

   VIIA group has Halogens (F,Cl,Br), VIIB group contains Mn which is a metal

- **Moseley's periodic table or Modern or Long form of periodic table:**
  This type of periodic table is constructed on the basis of atomic number.
  Moseley proposed Atomic number (z) as the more fundamental atomic property than atomic weight.
  The number of positive charges (protons) in the atom of an element is called atomic number(Z).
  The properties of atoms of the elements depends on the number of electrons and their arrangement (electronic configuration).
- **Moseley's or Modern periodic law: The physical and chemical properties of elements are the periodic functions of their atomic numbers or electronic configurations.**

Modern Periodic Table (Extended form of periodic Table)

Modern periodic table consists of 7 periods and 18 groups.

Groups:

The vertical columns in the periodic table are called groups. There are 18 groups
The groups are represented by latest system (IUPAC) as 1 to 18 (or) represented by traditional notation from I to VIII with letters 'A' and 'B'.
Group of elements is also called element family or chemical family.

Group No.	Name of element family	Elements		Valency Shell configuration	Valence electrons	Valency
		From	To			
1(IA)	Alkali metal family	Li	Fr	ns^1	1	1
2(IIA)	Alkali earth metal family	Be	Ra	ns^2	2	2
13(IIIA)	Boron family	B	Tl	ns^2np^1	3	3
14(IVA)	Carbon family	C	Fl	ns^2np^2	4	4
15(V A)	Nitrogen family (Pnicogens)	N	Bi	ns^2np^3	5	3
16(VI A)	Oxygen family (Chalcogens)	O	Lv	ns^2np^4	6	2
17(VII A)	Halogen family	F	At	ns^2np^5	7	1
18(VIII A)	Noble gas family (Inert gases) or O group	He	Rn	ns^2np^6	8	0

Groups 3 to 12 (III B – VIII B, I B, II B) are paced in d- block

Periods :

The horizontal rows in the periodic table are called periods. There are 7 periods

Period	Subshells filed	Number of elements	Name of the period
1	1s	2(H-He)	Shortest period
2	2s,2p	8(Li-Ne)	Short period (Bridge elements)
3	3s,3p	8(Na-Ar)	Short period (Typical elements)
4	4s,3d,4p	18(K-Kr)	Long period
5	5s,4d,5p	18(Rb-Xe)	Long period
6	6s,4f, 5d,6p	32 (Cs-Rn)	Longest period
7	7s,5f, 6d,7p	19 (Fr - -)	Incomplete period

6) The position of the element like block, period, group etc. is identified by its electronic configuration.

Block : Subshell in which differentiating electrons enters.

Period : Number of outer shell present in the element.

Group : Number of valency electrons in the outershell (valence shell)

Ex : 1. The atomic number of an element is 7. It 's electronic configuration is $1s^2\ 2s^2\ 2p^3$. It belongs to 2^{nd} period, VA group and 'p' block in the periodic table.

2. The atomic number of an element is11. It's electronic configuration is $1s^2\ 2s^2\ 2p^6\ 3s^1$. It belongs to 3^{rd} period. IA group and 's' block in the periodic table.

- Classification of elements:

I. Based on subshell into which a differentiating electrons enters, the elements are classified into four blocks (s, p, d and f)

1) 's' block elements:

1) Differentiating electrons enters into 'ns' subshell.
2) All elements are reactive metals except hydrogen.
3) General electronic configuration is $ns^1 - ns^2$.
4) This block consists of two groups, IA and IIA (Alkali & Alkali earth metals).

2) 'p' block elements:

1) Differentiating electrons enters into 'ns, np' subshell.
2) It contains metals, metalloids and non-metals.
3) General electronic configuration is ns^2np^1 to ns^2np^6
4) This block consists of 6 groups from IIIA – VIIA and 'O' group

3) 'd' bock elements :

1) Differentiating electrons enter into (n-1)d – subshell.
2) These elements are called transition elements except IIB group elements.
3) General electronic configuration is $(n-1)d^{1-10}\ ns^{1-2}$
4) This block consists of ten groups from IB to VIII B, distributed in 4 periods.

4) 'f' block elements:

1) Differentiating electron enters into (n-2)f – subshell.
2) These are also called inner - transitional elements
3) The general electronic configuration is $(n-2)f^{1-14}(n-1)d^{0,1,2}\ ns^2$
4) These elements are placed in IIIB group and 6 and 7^{th} periods.
5) This block consists of two series of elements 4f series and 5f series.
6) '4f' series of elements from Ce_{58} to Lu_{71} (14 elements) are called lanthanides. These are also called rare earth elements.
7) '5f' series of elements from Th(90) to Lr(103) are called actinoides or actinides (14 elements)

7) Based on electronic configuration and properties, elements are classified in four types.
   1) Noble gases:
      1) 18th group (VIII A) elements are called Noble gases or Inert gases.
      2) In these elements all Subshells(s,p) are completely filled with 8 electrons (octet).
      3) These are least reactive due to octet stable electronic configuration
      4) These are available in air (Ar is the most abundant inert gas).
      5) General outer electronic configuration is ns^2np^6 (Except Helium, ns^2)
   2) Representative elements:
      1) The s and p block elements except noble gases are called representative elements.
      2) In these elements last shell is incomplete (n).
      3) The general outer electronic configuration is ns^1, $ns^2\ np^1$- $ns^2\ np^5$

   3) Transition elements:
      1) The 'd' block elements except IIB elements are called transition elements.
      2) In these elements last two shells are incomplete(n,n-1)
      3) These are placed in between s and p block elements.
      4) The general outer electronic configuration is $(n-1)d^{1-10}\ ns^{1-2}$

   4) Inner transition elements:
      1) 'f' block elements are called inner transition elements, because they are placed within the transition elements.
      2) In these elements last three shells are incomplete (n,n-1, n-2)
      3) It consists of lanthanides are actinides.
      4) These are placed at the bottom of the periodic table.

8) **Metals, non-metals and metalloids (semi metals):**

- The elements with three or less electrons in the outermost shell and form **cations** (positive charge ions) easily are called metals.
- Metals are present in s, p, d and f – blocks. Ex : Li, Na, Mg, Mn , Fe, Ce, etc.
- The elements with five or more electrons in the outermost shell and form **anions** (Negative charge Ions) easily are called non-metals
- Non-metals are present only in 'p' block. Ex: N, O, F, C*l*, Br etc.
- The elements which have properties that intermediate between metals and non-metals are called metalloids (semi metals). Ex: Al, Si, As, Ge etc.

PERIODIC PROPERTIES

- The properties of elements which repeats at regular intervals are called periodic properties (or) **periodicity.**
- The Periodicity in properties is due to same valency shell electronic configuration after regular intervals.
- Elements in a group have similar chemical properties due to similar valency shell electronic configuration.
- Elements in a period have different chemical properties due to difference in valency shell electronic configuration and there is a regular gradation in physical properties along the period.

Trends in periodic properties in groups and periods:

1) Valency:

- The combining capacity of an element with respect to hydrogen or oxygen is called valency.
- Number of electrons present in the valency shell (outermost shell) is also called valency.
- The number of hydrogen atoms or twice the number of oxygen atoms that combined with one atom of that element is called valency.
  Ex: 1) In NaH, the valency of Na is 1.
  2) In CaO, the valency of Ca is 2.
- Valency with respect to hydrogen is equal to group number (upto IV^{th} group) (or) (8 – group number), for group V or above. Ex: the Valency of chlorine is 1 (i.e.,8-7).
- Valency in a group is same for all elements, but in a period valency increases upto 4 and then decreases to 1 & 0

2) Atomic radius:

- The distance between the centre of the nucleus of atom and to its outermost shell is called atomic radius.
- Atomic radius in metals is called metallic radius.
- Metallic radius is the half of the distance between the centres of nuclei of two adjacent atoms.
- In non-metal, the atomic radius is called covalent radius.
- Atomic radius in covalent molecules is half of the distance between the centres of nuclei of two bonded atoms in a molecule.
- Distance between centres of nuclei of two bonded atoms in a covalent molecule is called bond length or bond distance.
- Atomic radius = Bond length/ 2
- Atomic radius is measure in Pm (Pico meter) units 1Pm = 10^{-12} m
- Atomic radius in a group increases from top to bottom. This is due to increase in number of shells from top to bottom in a group.
  Ex: Size of Alkali metals Group 1 : Li < Na < K < Rb< Cs
  Size of Halogens (Group 17) : F < Cl < Br < I
- Atomic radius in a period decreases from left to right due to increase in nuclear charge.
  Ex: Size of Second period elements : Li > Be > B > C > N > O > F
  Size of Third period elements : Na > Mg > Al > Si > P > S > Cl

Ionic radius:

- Ions are formed from neutral atoms by loss or gain of electrons.
- Positive ion (cation) of an element has less size and Negative ion (Anion) has bigger size than neutral atom.
  Ex: 1) Na+ ion size is smaller than 'Na" atom.
  2) Cl^- ion size is bigger than 'Cl' atom.

Iso electronic series:

- A series of ions having same number of electrons is called Iso electronic series.
  Ex: C^{4-} , N^{3-}, O^{2-}, F^{1-} , Na^{1+}, Mg^{2+}, Al^{3+}
- In Iso-electronic species, greater than atomic number, smaller the size of ion due to more nuclear charge.
  Ex: 1. Size of Cl^- is smaller than S^{2-}
  2. Size of F^- is smaller than C^{4-}

3) Ionization Energy (Ionisation Potential) :

- The energy required to remove an electron from the outermost orbit (or) shell of a neutral gaseous atom is called ionization energy (or) ionization potential.
  $M_{(g)} + IE_1 \longrightarrow M^+_{(g)} + e^-$ (IE_1 = First Ionization energy)
- The energy required to remove the electron from unipositive ion is called second ionization energy (IE_2).
  $M^+_{(g)} + IE_2 \longrightarrow M^{+2}_{(g)} + e^-$ (IE_2 = Second Ionization energy)
- Ionization energy is expressed in K.J/ mol or e. v per atom (electron volt) 1 ev = 23.06 K Cal.
- Second Ionization energy of an element is higher than its first ionization energy. This is due to more nuclear attraction on valency electrons in unipositive ion than neutral atom ($IE_1 < IE_2$)
- Ionization energy decreases from top to bottom in a group due to increasing in atomic size, decreases the nuclear attraction on valency electrons.
- Ionization energy increases in a period from left to right due to decrease of atomic size, increase in nuclear attraction on valency electrons.
- Alkali metals (IA) have lowest ionization energies whereas noble gases (VIIIA or 0 Group) have highest ionization energies.
- The element with high I.E is He and element with lowest I.E is Cs.
- First group element have highest second Ionization ($I.E_2$)., second group elements have highest 3rd I.E(IE_3) and so on.
- IP_1 of 2nd period elements : Li < Be > B < C < N > O < F < Ne

Factors affecting Ionization Energy:

- Nuclear charge
- Atomic size
- Screening effect or shielding effect.
- Penetration power of the orbitals.
- Stable electronic configuration.
- More the nuclear charge, more is the ionization energy.
  Ex: 'Cl' has more I.E than 'Na' due to high nuclear charge.
- The decrease in nuclear attraction on valence electrons by electrons in inner shells is called **Screening effect or Shielding effect.**
- More the number of electron shells between nucleus and valence shell more is the shielding effect.
- More the shielding effect, less is the ionisation energy. Ex: Cs has less I.E than Li due to more shielding effect in Cs (Cs has more number of inner shells).
- More the penetrating power of oribitals in a main shell more in the I.E.
- Order of penetration power of different orbitals in a shell. s > p > d > f
  Ex: Be has more IP than B due to high penetration power of '2s' compared to '2p' in Boron.
- Elements with stable electronic configuration has more I.E.
  Ex: 'N' has more IE than 'O' due to stable electronic configuration in N ($1s^2\ 2s^2\ 2p^3$)
- More the atomic radius, less is the IE, due to less nuclear attraction on valence electrons.
  Ex: 1) 'Cs' has lower IE, than 'Na' due to more atomic radius than Sodium
  2) 'I' has lower IE than 'F' due to more atomic radius of iodine.

4. Electron Affinity or electron gain Enthalpy:

- The energy liberated when an electron is added to neutral gaseous atom is called electron affinity.

  $X_{(g)} + e^- \longrightarrow X^-_{(g)} + EA$ (EA = Electron affinity)
- The energy liberated when an electron is added to a uninegative ion of the element is called second electron affinity.
- Second group EA is positive. That means energy is absorbed when electron is added to uni negative ion due to repulsion between added electron and electron in uninegative ion.
- Noble gases are most stable because their EA values are zero. Since they have ns^2np^6 (Octet)
- EA decreases along the group due to increase in atomic size and increases along period due to decrease in Size. Ex. EA of Halogens: Cl > F> Br > I
- Second period elements has less EA than third period elements. This is due to more repulsion between added electron and electrons present in small shell in second period elements.

  Ex: 'F' has small size than 'Cl', but the EA of 'F' is smaller than 'Cl'. This is due to more repulsion between the added electron and electrons present '2p' shell than in 'Cl' (3p shell).
- The element with highest EA is chlorine. (Cl > F > Br > I > At)
- EA is expressed in KJ. Mol^{-1} or ev/ atom
- The metal which has higher EA is gold.

5. **Electronegativity (EN):**

- The relative tendency of an atom to attract electrons towards itself when it is bonded to the atom of another element is called electronegativity.
- Electronegativity is the property of bonded atom, relative quantity and has no units.
- Mulliken scale and Pauling scales are used to measure the electronegativity values of elements.
- Pauling scale is based on bond energies and Hydrogen EN is 2.20. It is reference to measure the electrogneativity of the other elements.
- On Mulliken scale electronegativity is the average value of ionization energy and electron affinity.

  Electronegativity = $\frac{\text{Ionization energy + Electron affinity}}{2}$; **EN =** $\frac{\mathbf{IP + EA}}{\mathbf{2}}$
- Halogens have high electronegativity values F (4.0), Cl (3.0), Br (2.8), I (2.5)
- 'F' has highest Electronegativity and Cs has lowest Electronegativity.
- Electronegativity decreases from top to bottom in a group and increases from left to right in a period.

Metallic and Non-metallic properties:

- The elements with low electronegativity form cations easily are called metals.
- The ability of elements to form cations is called **electropositive character**.
- Metals are electropositive elements, due to large atomic size.
- Non-metals are electronegative and forms **anions** easily due to small atomic radii.
- Some metallic oxides are amphoteric. Ex: ZnO, Al_2O_3, SnO_2 etc.,
- The elements with properties between metals and non-metals are called metalloids (semi-metals)

- Metals are present at left and right hand side bottom and non-metals at the right hand side top of the periodic table.
- Metallic character increases while non-metallic character decreases in a group from top to bottom. Ex. IV A Group elements: C, Si, Ge,Sn, Pb. C is a non-metal, Si and Ge are metalloids, Sn and Pb are metals.
- Metallic character decreases while non-metalli character increases in a period from left to right. Ex. 3rd period elements: Na, Mg, Al, Si, P, S, Cl, Na, Mg are metals; Al, Si are metalloids, P,S and Cl are non-metals.
- In a group acidic nature of oxide decreases from top to bottom.
- In a period acidic nature of oxide increases from left to right.

Trends in periodic properties: (Periodicity)

Sl.No.	Periodic Property	Trend in	
		Groups From top to bottom	Periods From left to right
1.	Valency	Remains same	Increases and then decreases
2.	Atomic radius	Increases	Decreases
3.	Electropositivity	Increases	Decreases
4.	Metallic nature	Increases	Decreases
5.	Ionization energy	Decreases	Increases
6.	Electron affinity	Decreases	Increases
7.	Electronegativity	Decreases	Increases
8.	Non-metallic nature	Decreases	Increases

Periodic table – Novel Points:

1. Number of gaseous elements : 11 (H_2,N_2,O_2,F_2, Cl_2, He, Ne, Ar, Kr, Xe, Rn)
2. Number of liquid elements : 2 (Mercury and Bromine)
3. Liquid metals : Mercury (Hg), Gallium (Ga)
4. Liquid non-metal : Bromine (Br_2)
5. Lightest gas / element : Hydrogen (H_2)
6. Most abundant element in Universe : Hydrogen
7. The highest catenation element is : Carbon
8. Most abundant elements in Atmosphere : Nitrogen (78%), Oxygen (21%)
9. Most abundant element in Human body : Oxygen
10. Most abundant element in Earth crust : Oxygen
11. Most abundant metal in Earth crust : Aluminium
12. Most abundant metal in Human body : Calcium
13. Best conductor : Silver (Ag)
14. First metal used by man (2nd best conductor) : Copper (Cu)
15. Lightest metal : Lithium
16. Heaviest naturally occurring metal : Uranium
17. Metal with highest melting point & least conductivity : Tungsten (W)
18. Element with highest Ionization potential : He
19. Element with highest electron affinity : Chlorine (Cl)
20. Element with highest Electronegativity : Fluorine (4)
21. 2nd highest electronegativity element : Oxygen(3.5)
22. Most electro positive element : Cs (Caesium)

EXERCISE –I

1. Which of the following is not Dobereiner's triad? ( )
   1) Li, Na, K 2) S, Se, Te 3) O, S, Se 4) Mn, Cr, Fe
2. Who made the first attempt to classify the elements? ( )
   1) Newlands 2) Dobereiner 3) Moseley 4) Lother Meyer
3. In the Dobereiner's Triad, the atomic weight of middle element is equal to ( )
   1) Sum of atomic weitght of two elements
   2) Product of atomic weight of two elements
   3) Average of atomic weight of two elements
   4) Ratio of atomic weight of two elements
4. According to which law, the 8^{th} element show similar chemical property with first element ( )
   1) Triad law 2) Law of octaves 3) Mosely law 4) All of these
5. Mendeleeff's periodic table (Short form of periodic table) consists of ( )
   1) 7 periods, 7 groups 2) 7 periods, 18 groups
   3) 7 periods, 8 groups 4) 18 periods, 7 groups
6. 'Eka' - boron is ( )
   1) Scandium 2) Boron 3) Gallium 4) Bermanium
7. Which of the following relation is correct? ( )
   1) Atomic weight = Equivalent weight X Valency
   2) Atomic size = Equivalent weight X Valency
   3) Equivalent weight = Atomic weight X Valency
   4) All the above.
8. What is the valency of Eka aluminium in its oxide? ( )
   1) 1 2) 2 3) 3 4) 4
9. The formula of chloride formed by Eka silicon ( )
   1) $EsCl_2$ 2) $EsCl_4$ 3) $EsCl_3$ 4) $EsCl_6$
10. Which of the following elements atomic weight was corrected by Mendeleeff? ( )
    1) Be 2) In 3) Au 4) All the above
11. Which of the following is not anomalous pair or inversion pair in Mendeleeff's periodic table is ( )
    1) Te & 1 2) Ar & K 3) Co & Ni 4) All the above
12. The size of cation compared to neutral atom is ( )
    1) More 2) Less 3) More or less 4) Equal
13. Name of element with atomic number 101 is ( )
    1) Rutherfordium 2) Mendelevium
    3) Seaborgium 4) Bhorium
14. Who introduced the concept of atomic number? ( )
    1) Boyle 2) Mendeleef 3) Mosley 4) Bohr
15. According to Modern periodic law the physical and chemical properties of elements are the periodic functions of their ( )
    1) Atomic weight 2) Atomic number
    3) Electronic configuration 4) 2 or 3
16. Number of periods and groups in Modern periodic table ( )
    1) 7, 7 2) 7, 18 3) 18, 7 4) 10, 18

17. The longest period is containing maximum number of elements is ( )
    1) 1 2) 4 3) 6 4) 7
18. The period which contain s and p block only ( )
    1) 1 2) 2 3) 3 4) All the above
19. Most abundant metal in earth crust is in which period and group in periodic table? ( )
    1) 3, 14 2) 4,13 3) 3, 13 4) 5, 15
20. Give period number and group number for the element with atomic number 17. ( )
    1) 2, 12 2) 6, 16 3) 3, 17 4) 6, 17
21. The elements from Ce to Lu are called ( )
    1) Transition elements 2) Lanthanides
    3) Noble gases 4) Actinides
22. Actinides belongs to ( )
    1) 4f series 2) 5f series
    3) 6f series 4) 7f series
23. Which of the following is not a metalloid? ( )
    1) Si 2) As 3) Ge 4) Ca
24. The general electronic configuration of 'd'block elements is ( )
    1) $ns^1 - ns^2$ 2) $ns^2 - ns^2np^1$
    3) $(n-1)d^{1-5}\,ns^{1-2}$ 4) $(n-1)d^{1-10}\,ns^{1-2}$
25. Non – metals are present in ( )
    1) S – block 2) p – block 3) d-block 4) All the above
26. What is the valency of Na in NaH? ( )
    1) 1 2) 2 3) 3 4) 4
27. Which of the following is not a non-metal? ( )
    1) Si 2) P 3) C*l* 4) S
28. Valency of element in terms of Oxygen is ( )
    1) Equal to number of oxygen atom with which one atom of element combines
    2) Double the number of oxygen atoms with which one atom of element combines
    3) Half of the number of oxygen atom with which one atom of element combines
    4) All the above
29. The distance between centre of the nucleus and outermost electron is called ( )
    1) Ionization energy 2) Atomic radius
    3) Electron affinity 4) Atomic volume
30. Atomic radius in period from left to right ( )
    1) Decreases 2) Increases 3) Decreases and increases 4) None the above

Exercise – II

1. The pair of atomic numbers which belong to the same group
   1) 12,38 2) 16,17 3) 7,8 4) 9,15
2. Which element has highest electron affinity?
   1) F 2) Cs 3) He 4) Cl
3. Which is a metalloid
   1) P 2) K 3) Ge 4) Sc
4. Among the following the largest size is
   1) Na^{+1} 2) O^{-2} 3) Al^{3+} 4) S^{-2}

5. Which of the following element is a representative element?
   1) Ar 2) Mn 3) Ge 4) Cr
6. If the radius of an element 'X' has electronic configuration 2,8,3 ix 143pm. The radius of element y has electronic configuration 2,8,5 of Y is the radius
   1) 160pm 2) 186 pm 3) 143 pm 4) 110 pm
7. Which of the following element has most ionisation energy
   1) Li 2) Cs 3) Na 4) K
8. Eka-Aluminium predicted by Mendeleev was named after its discovery is
   1) Scandium 2) Germanium 3) Boron 4) Gallium
9. The order of electron affinity in halogens is
   1) F>Cl>Br>I 2) Br>Cl>F>I 3) Cl>F>Br>I 4) Cl>Br>F>I
10. The range of atomic numbers of lanthanide series is
    1) 90-103 2) 57-71 3) 89-103 4) 58-71
11. The elements with atomic numbers 2,10,18,36,54 and 86 are called
    1) Noble metals 2) Chalcogens 3) Halogens 4) Inert gases
12. The element with the smallest size in IVA group is
    1) Aluminium 2) Boron 3) Carbon 4) Berylium
13. The ionisation potential of Na is 5.4 ev.So the ionisation potential of potassium is
    1) 6.4 ev 2) 7.3 ev 3) 5.4 ev 4) 4.3 ev
14. Which pair of atomic numbers of the elements does not belong to the same period
    1) 12,13 2) 4,12 3) 8,7 4) 1,2
15. The first ionization energy of Mg is higher than Al because
    1) The size of Mg is smaller than Al 2) Mg has high nuclear charge than Al
    3) Mg has completely filled 3s orbital 4) None
16. Elements in which 4f orbitals are progressively filled are known as
    1) Lanthanides 2) Transition elements 3) Noble gases 4) Actinides
17. The valency of Noble gases is
    1) 5 2) 3 3) 0 4) 8
18. The correct order of first I.E of C,N,O F is
    1) O>N>F>C 2) F>N>O>C 3) F>O>N>C 4) C>N>O>F
19. Which elements have ns^2 general outer electronic configuration is
    1) Noble gases 2) Alkali earth metals 3) Halogens 4) Alkaline tales
20. Which of the following is not a Dobereiner
    1) Cl, Br, I 2) Ca, Sr, Ba 3) S,Se, Te 4) Li, Be, B

Previous Exam Bits

POLYCET – 2022:

1. Which of the following is a non-metal?
   1) Potassium 2) Chlorine 3) Silicon 4) Sodium
2. Which of the following periodic table is not based on the atomic weights of elements
   1) Dobereiner's Law of triads 2) New lands law of octave
   3) Mendeleev Periodic table 4) Modern Periodic table
3. An element with atomic number 14 has a valency of
   1) 1 2) 2 3) 4 4) 3
4. What is the family name of VII A group elements?
   1) Alkali earth metals 2) Alkali metals 3) Chalcogens 4) Halogens

POLYCET – 2021

1. In which of the following elements are arranged in ascending order of their atomic numbers.
   1) Dobereiner's Law of Triads 2) Newland's Law of Octave
   3) Modern Periodic Table 4) Mendeleev's Periodic Table
2. Which of the following quantum numbers down the group in the modern periodic table
   1) Principal Quantum number 2) Azimuthal Quantum number
   3) Magnetic Quantum number 4) Spin Quantum number
3. Which of the following are called Lanthanoids?
   1) S-block elements 2) P-block elements
   3) d-block elements 4) F-block elements
4. How many elements are present in 3^{rd} period of the modern periodic table?
   1) 32 2) 8 3) 18 4) 2
5. The valency of an element belonging to VA group of the modern periodic table is
   1) 5 2) 3 3) 7 4) 1

POLYCET – 2020

1. If the atomic weights of Lithium and Potassium respectively are 7 and 39 the atomic weight of Sodum respectively are 7 and 39 the atomic weights of sodium as per Dobereiner's law of triads is
   1) 22 2) 11 3) 46 4) 23
2. The correct order of electro negativity values of the following elements is
   1) C<N<F<O 2) C<O<N<F 3) C<N<o<F 4) N<C<o<F
3. The number of elements present in 4^{th} period of the long form of periodic table are
   1) 2 2) 8 3) 18 4) 32
4. The non-metal present in a IV A (Carbon family) group is
   1) C 2) Sn 4) Pb 4) Ge
5. The element with highest electron affinity value among the halogens is
   1) Cl 2) F 3) Br 4) I

POLYCET – 2019

1. According to the Linus pauling, the electro negativity values are based on
   1) Ionization energy 2) electron affinity
   3) Both (1) & (2) 4) Bond energies
2. The orbital with highest penetration power is
   1) S 2) P 3) d 4) f
3. Mendeleef's periodic table is based on
   1) Atomic weight 2) Atomic size 3) Atomic number 4) Atomic value
4. Total number of elements in Newland's periodic table is
   1) 64 2) 48 3) 56 4) 65

POLYCET – 2018

1. Which of the following elements constitute a Dobereiner's triad?
   1) Li, Na, K 2) Na, K, Al 3) C, O, F 4) Hc, H, C
2. Which group elements have the outer electronic configuration as ns^2np^3 ?
   1) VA 2) IV A 3) IIA 4) IIIA
3. Which of the following element has larges atomic size?
   1) Be 2) Mg 3) Ca 4) Ba
4. The correct order of Ionization energy in the following elements is
   1) F>C>O 2) F>O>C 3) O>F>C 4) C>F>O

CLASSIFICATION OF ELEMENTS & PERIODIC TABLE

Key to Exercise – I

1) 3	2) 2	3) 3	4)2	5) 3	6) 1	7)1	8) 3	9) 2	10) 4
11) 4	12) 2	13) 2	14) 3	15) 4	16) 2	17) 3	18) 4	19)3	20) 3
21) 2	22) 2	23) 4	24) 4	25) 2	26) 1	27) 1	28) 2	29) 2	30) 1

Key to Exercise – II

1) 1	2) 4	3) 3	4) 4	5) 3	6) 4	7) 1	8) 4	9) 3	10) 4
11) 4	12) 3	13) 4	14) 2	15) 3	16) 1	17) 3	18) 2	19) 2	20) 4

Polycet -2022

1) 2 2) 4 3) 3 4) 4

Polycet -2021

1) 3 2) 1 3) 4 4) 2 5) 2

Polycet -2020

1) 4 2) 2 3) 3 4) 1 5) 1

Polycet -2019

1) 4 2) 1 3) 1 4) 3

Polycet -2018

1) 1 2) 1 3) 4 4) 2

CHEMICAL BONDING

synopsis

- Noble gases belongs to 'O' group or 18th group(VIIIA) have negligible reactivity compared to other elements
- He,Ne,Ar,Kr,Xe,Rn are inert gases (Noble gases) and are available in air
- All the noble gases have eight electrons in the valency shell except Helium .This is the reason for less reactivity of noble gases
- The electrons present in the valency shell (outer most shell) are called valency electrons and these electrons are participate in chemical bonding
- The representation of a element with valency electrons as dot is called lewis dot structures.
- Lewis and Kossel proposed electronic theory of valency to explain the formation of chemical bonds between the atoms.
- Atoms of elements involved in bond get the stability by attaining eight electrons in the valency shell. This is called 'Octet rule' .
- Any atom or ion with eight electrons in the valency shell is stable (ns^2np^6)
- The force of attraction between atoms in a molecule (stable) is called chemical bond.
- Kossel proposed Ionic bond and G.N Lewis proposed covalent bond.
- Bond formed between two dissimilar atoms due to transfer of electrons is called ionic bond (Electrostatic bond or electrovalent bond)
- Ionic bond is formed between Highly reactive metals(IA) and highly reactive non-metals (VIIA). Electronegitivity difference between the atoms equal to or greater than 1.9
- NaCl , $MgCl_2$, Na_2O ,$AlCl_3$ etc are examples for ionic compounds
- Bond formed between atoms by sharing of electron pairs is called covalent bond.
- Covalent bond is formed between non- metal atoms
- Sharing of one electron pairs forms a single bond, two electron pairs form two bonds and so on.
- The number of oppositely charged ions around a particular ion the ionic crystal is called co. ordination number.
- Co. ordination number of NaCl is 6:6
- NaCl posses face centered cubic lattice
- $H_2, F_2, Cl_2, O_2, N_2, CH_4, NH_3, H_2O$ etc contain covalent bond.

- Covalent bond is formed between similar atoms is called Non-polar covalent bond.
  Ex : H_2 , O_2, N_2 etc.
- Covalent bond formed between two dissimilar atoms is called polar covalent bond .
  Ex: HCl, H_2O, NH_3
- A covalent bond formed by overlap of orbitals along the internuclear axis is called sigma(σ) bond and formed by sidewise (lateral) overlapping of orbitals is called pi (π) bond.
- π bond is weaker than σ bond.
- $1A=10^{-10}m=0.1$ nm ,$(1nm=10^{-9}m)$
- Ionic compound are crystalline solids with high melting points and are soluble in polar solvents like water
- Valence shell electron pair repulsion theory (VSEPRT) was proposed by sidgwick and Powell to explain the shape of molecules on the basis of repulsions between electron pairs in the valency shell of central atom.
- According to VSEPR theory , the order of repulsion between electron pairs is Lone pair –lone pair > lone pair: bond pair> bond pair –bond pair
- The phenomenon of intermixing of atomic orbital of equal energy to give equal number of identical orbitals is called hybridization. This concept was proposed by Linus Pauling
- Molecules undergoing sp^3 hybridization have Tetrahedral shape with bond angle $109^028'$.
  Ex: CH_4
- H_2O undergoes 'sp^3, hybridization but shape is angular and bond angle is $104^031'$ due to lone pair- lone pair repulsions
- NH_3 undergoes sp^3 hybridization , but shape is pyramidal and bond angle is $107^048'$ due to lone pair – bond pair repulsions
- Molecules undergoing sp^2 hybridisation have Trigonal planar shape with bond angle 120^0
  Ex: BF_3 (Boran tri fluoride), C_2H_4 (Ethene or ethylene) etc
- Molecules undergoing sp hybridization have linear shape with bond angle 180^0
  Ex: $BeCl_2$(Berylium chloride) , C_2H_2 (Ethyne or Acetylene) etc.

Exercise –I

1. The elements with almost negligible chemical reactivity
   1)1st group 2) 18th group
   3) 17th group 4) 2nd group

2. Which of the following element does not contain 8 electrons in the valency shell
   1)He 2) Ne
   3) Ar 4) Kr

3. Electronic theory of valency was proposed by
   1)pauling 2) London
   3) Lewis and Kossel 4) Bohr

4. The bond formed between metals and non-metals is
   1) ovelent bond
   2) Ionic bond
   3) Dative bond
   4) Metallic bond

5. Which of the following is not Ionic compound
   1) NaCl 2) $MgCl_2$

3) $AlCl_3$ 4) H_2O

6. Which of the following is not the property of Inoic compounds
1) crystalline solids
2) high melting points
3) Insoluble in water
4) soluble in water

7. In which of the following ionic bond is present
1) $MgCl_2$ 2) Na_2O
3) $AlCl_3$ 4) All the above

8. The number of ions of opposite charge that surround a given ion is called
1) Atomic number
2) Mass number
3)Co.ordination number
4) Oxidation number

9. The structure of NaCl is
1)Body centered cubic lattice
2) Face centered cubic lattice
3) primitive cubic lattice
4) Hexagonal cubic lattice

10. which of the following elements is more electronegative ?
1)sodium 2) oxygen
3) magnesium 4) calcium

11. An element $_{11}X^{23}$ forms an ionic compound with another element 'Y' Then the charge on the ion formed by X is
1) +1 2) +2
3) -1 4) -2

12. An element forms a chloride $AlCl_4$. The number electrons in the valence shell of 'A'
1)1 2) 2
3)3 4)4

13. The bond formed by the sharing of electrons is called
1)Ionic bond
2) Covalent bond
3) electrovalent bond
4) coordinate bond

14. Which of the following contains double bond
1) F_2 2) O_2
3) N_2 4) CH_4

15. Total number of covalent bonds that an atom of an element forms is called
1)Electrovalency
2) Isomers
3) Covalency
4) co.ordination number

16. 1 nanometer is equal to
1) 10^{-10}m 2) 10^{-12}m
3) 10^{-8}m 4) 10^{-9}m

17. VSEPR theory was proposed by
1) Kossel lewis
2) Sidgwick and powell
3) Hiffer and London
4) Lewis

18. Hybridisation of oxygen in water molecule is
1)sp 2) sp^2
3) sp^3 4) sp^3d

19. Bond angle in NH_3 molecule is
1) $109^0 28'$ 2) $104^0 31'$
3) $107^0 48'$ 4) 120^0

20. In which of the following lone pairs of electrons are absent
1)H_2O 2) NH_3
3)) CH_4 4) All of these

21. The shape of BF_3 molecule is
1) Pyramidal 2) Tetra hedral
3) angular 4) trigonal planar

22. Phenomenon of intermixing of atomic orbitals of almost equal energy to form equal number of identical orbitals is called
1)Isomerisation
2) Hybridisation
3) Allotropy
4) None of the above

23. The bond formed by overlapping of orbitls along the inter-nuclear axis is
1)Pi bond 2) sigma bond
3) Either sigma or pi 4) Ionic bond

24. Bond angle and shape of Beryllium chloride
1) 180^0 , planar 2) 120^0, linear
3) 180^0, linear 4) $109^0 28'$, linear

25. which of the following match is correct
Molecule Bond angle

1) CH_4 $109^028'$
2) H_2O $104^031'$
3) NH_3 $107^048'$
4) BF_3 180^0

26. HCl molecule is formed by
1) 1s orbital of 'H' & '2p' orbital of chlorine atom
2) 1s orbital of 'H' & '3p' orbital of chlorine atom
3) 2s orbital of 'H' & '2p' orbital of chlorine atom
4) 1s orbital of 'H' & '4p' orbital of chlorine atom

27. N_2 molecule consists of
1) 1σ bond & 3π bonds
2) 2σ bond & 2π bonds
3) 1σ bond & 2π bonds
4) 3σ bonds & 0π bond

28. Which of the following is highly water soluble
1) N_2 2) H_2
3) NaCl 4) O_2

29. Which of the following is Quantum mechanical model
1) Valency bond theory
2) electronic theory of valence
3) Hybridisation
4) VSEPR theory

30. In which of the following atoms, valency is equal to group number
1) N 2) F
3) O 4) Mg

Answers

1)2	6)3	11)1	16)4	21)4	26)2
2)1	7)4	12)4	17)2	22)2	27)3
3)3	8)3	13)2	18)3	23)2	28)3
4)2	9)2	14)2	19)3	24)3	29)1
5)4	10)2	15)3	20)3	25)3	30)4

EXERCISE-II

1. Which of the following does not exist
1) H_2 2) Ar_2
3) N_2 4) O_2

2. The outer most general electronic configuration of Inert gases is
1) ns^2np^1 2) ns^2np^4
3) ns^2np^5 4) ns^2np^6

3. An element 'X' with two electrons in the valency shell combines with another element with 'Y' with 7 valency electrons . The formula of Ionic compound between X and Y is
1) XY 2) X_2Y
3) XY_2 4) XY_4

4. Which of the following is true
1) Ionic bond is formed by transfer of electrons
2) Ionic bond also called electrovalent bond
3) Ionic bond is formed between two elements which differ in their electronegativity values
4) All are correct

5. The co.ordination number of Na^+ and Cl^- ions In NaCl crystal is
1) 6:6 2) 6:8
3) 8:8 4) 8:6

6. Which of the following is not favorable condition for formation of cation
1) high atomic size
2) Low ionization enthalpy
3) high ionization enthalpy
4) low electro negativity

7. For formation of ionic compound between two elements , the difference in electronegativity is
1) less than 1.9
2) greater than 1.9
3) greater or less than 1.9
4) Equal to or greater than 1.9

8. Which of the following molecule contains only single bonds
1) F_2 2) H_2O
3) NH_3 ` 4) All the above

9. Number of electrons shared between two 'N' atoms in N_2 molecule is
1) 4 2)6
3)3 4)8

10. In which of the following covalent bond is not present
1) CH_4 2) H_2O
3) NH_3 4) NaCl

11. VSEPR theory fails to explain
1) strengths of bonds
2) bond angles
3) shape of molecule
4) All the above

12. Which of the following match is wrong

Molecule	Hybridisation
1) H_2O	sp^3
2) $BeCl_2$	sp
3) BF_3	sp^3
4) NH_3	sp^3

13. Bond angle in H_2O is deviated from normal $109^0 28'$. This is because
1)bent shape
2) Lone pair-bond pair
3) Lone pair-lone pair repulsions
4) bond pair-bond pair repulsions

14. According to VSEPR theory the repulsions between different electron pairs is
1) Lp-Lp> BP-LP> BP-BP
2) BP-LP> LP-LP>BP-BP
3) BP-BP>LP-LP> BP-LP
4) All are correct

15. σ bond in NH_3 is formed by overlapping of
1) $sp^3 - sp^3$ 2) $sp^3 - s$
3) $sp^2 - s$ 4) $sp^3 - p$

16. Which of the following contain polar covalent bond
1) H_2 2) O_2
3) HCl 4) N_2

17. Which of the following is not a property of covalent compounds
1) liquid or gases at room temperature
2) low melting and boiling points
3) Reactions are very fast
4) soluble in non-polar solvents

18. Which of the following bond is also called electrostatic bond
1)Ionic bond 2) covalent bond
3) Dative bond 4) Metallic bond

19. Which of the following is not a 18^{th} group element
1)He 2) Ne
3) N_2 4) Ar

20. Which of the following forms unipositive ion easily
1) Mg 2) Na
3) O 4)Cl

21. Which of the following is not correct about ionic bond
1) It is formed by transfer of electrons
2) It is formed between highly reactive metals and highly reactive non-metals
3) It is proposed by Kossel
4) In the formation of ionic bond, electrons are transferred from non-metal to metal

22. How many electrons are transferred in the formation of $MgCl_2$ from magnesium to chlorine
1)1 2)2
3)3 4)4

23. Crystalline of nature ionic compounds like NaCl is due to
1)presence of cations and anions
2) Irregular arrangement of cations and anions
3) Orderely arrangement of cations and anions
4) Cations and anions are held together by weak attractive forces.

24. The tendency of a metals to losing electrons to attain the octet in the valency shell is called
1)Ionisation enthalphy
2) electropositivity
3) electronegitivity
4) electron affinity

25. Favourable conditions for formation of anion is
1)high electron affinity
2) high ionization potential

3) small atomic size
4) All the above

26. Which of the following match is wrong

Molecule	no.of bonds between atoms
1) Flourine	1
2) oxygen	2
3) Nitrogen	3
4) Hydrogen	2

27. Which of the following has smallest bond length
1) I_2 2) Br_2
3) Cl_2 4) F_2

28. In which of the following polar covalent bond is absent
1)HCl 2) H_2O
3) CH_4 4) NH_3

29. Which of the following, is not a postulates of valence bond theory
1) bond is formed between the atoms by overlapping of orbitals with unpaired electrons with opposite spin
2) Greater overlapping of orbitals, stronger bond is formed
3) σ bond is formed by overlapping of orbital along the inter nuclear axis
4) σ bond is weaker than π bond

30. A, B and C ate the three elements with atomic numbers 6, 11 and 17 respectively . Between which elements , Ionic bond formed predominantly
1)A and B
2) B and C
3) A and C
4) Between any two elements

Answers

1)2	6)3	11)1	16)3	21)4	26)4
2)4	7)4	12)3	17)3	22)2	27)4
3)3	8)4	13)3	18)1	23)3	28)3
4)4	9)3	14)1	19)3	24)2	29)4
5)1	10)4	15)2	20)2	25)4	30)2

Exercise – III
(Previous POLYCET Questions)

1. The number of electrons transferred during the formation of MgO is
1) 1 2)2
3)3 4)4

2. Which of the following is non- linear ?
1) CO_2 2) H_2O
3) HCN 4) BeF_2

3. End to end overlap of orbitals leads to formation of
1) sigma
2) pi
3) Ionic bond
4) coordinated covalent bond

4. Shape of NH_3(Ammonia) molecule is
1)Linear
2) 'V' shape
3) pyramidal
4) Trigonal bi pyramidal

5. Ionic compound are generally formed by combination of
1) two metals
2)Metal & non-metals
3) two non-metals
4) inert gases

6. Number of sigma bonds in ethylene
1) 4 2)5
3)2 4)1

7. Which of the following is not in pyramid shape?
1) NH_3 2)PCl_3
3) BF_3 4) PH_3

8. Shape of CO_2 molecule is
1) Linear
2) 'V' shape
3) pyramidal
4) Trigonal bi pyramidal

9. The number of σ and π bonds in N_2 are
1) 2,1 2)3,1
3)1,2 4)1,3

10. One of the following phenomenon takes place in the formation of NaCl molecule is

1) Na atom acts as oxidizing agent
2) Cl atom acts as oxidizing agent
3) Cl atom acts as reducing agent
4) They undergo neither oxidation nor reduction

11. If the positive ion configuration $1s^2 2s^2 2p^6$ and negative ion configuration is $1s^2 2s^2 2p^6$ in an ionic compound, then what is the molecular formula of the compound ?
1)KF 2) NaCl
3) NaF 4)KCl

12. If the mass number is 12 and atomic number is 6 for an element 'X', then the kind of bonds present in XH_4 are
1)Ionic bond
2) Covalent bond
3) Co-ordinate covalent bond
4) H-bonds

13. Which of the following molecules show more number of lone pairs of electrons with its central atom?
1)H_2O 2)NH_3
3) PCl_3 4) PH_3

14. Which of the following molecules contain triple bond ?
1) C_2H_2, Cl_2 2) C_2H_2, N_2
3) NH_3, C_2H_2 4) F_2, O_2

15. Mention the molecule which shows polar covalent bond
1) C_2H_4 2) $BeCl_2$
3) $CaCl_2$ 4) HCl

16. Covalent compounds are soluble in
1)polar solvents
2)Non-polar solvents
3) Concentrated acids
4) All solvents

17. Shape of methane (CH_4) molecule is
1)Linear 2)Trigonal
3) Tetrahedral 4) Hexagonal

18. π bond is
1) stronger than σ bond
2) Weaker than σ bond
3) same as strength as σ bond
4) Uncomparable with σ bond

19. The bonds present in Nitrogen molecule is
1) Three σ bonds
2) Three π bonds
3)One σ and two π bonds
4)Two σ and two π bonds

20. BF_3 molecule has
1)Triangular shape
2) Pyramidal shape
3) Square planar shape
4)Planar triangular shape

21. Complete transfer of electrons from one atom to another leads to the formation of
1)covalent bond
2)Ionic bond
3) Co-ordinated covalent bond
4) Polar covalent bond

22. The atomic number of an element which gains electrons to become a negatively charged ion is
1)12 2)13
3)17 4)29

23. Which type of bonds formed due to transfer of electrons between two dissimilar atoms?
1)electrovalent bond
2) Electrostatic bonds
3)Ionic bond
4) All of these

24. Which of the following is correct regarding the melting points of Ionic, polar covalent and non-polar covalent compounds?
1) Polar covalent > Ionic >non-polar covalent
2) Ionic > Polar covalent > non- Polar covalent
3) Ionic > non-Polar covalent > Polar covalent
4) All have same melting point

25. what is the Hybridization in H_2O molecule is
1) sp^3 2) sp
3)sp^2 4)sp^3d

26. Which among the following theories explained both shape and strength of the bond in covalent compounds?
1) Electronic theory valency
2) Valence Shell Electron Pair Repulsion theory

3) valence bond theory
4) All of the above

27. Which of the following is not an inert gas element?
1) He 2) Na
3) Ne 4) Ar

28. The number of lone pairs of electrons in CH_4 molecule is
1)0 2)1
3)2 4)4

29. The molecule that contains only sigma bonds in the following is
1) C_2H_4 2)O_2
3) N_2 4) NH_3

30. The type of hybridization in C_2H_4 molecule is
1)sp 2)sp^2
3)sp^3 4) sp^3d

Answers

1)2	6)2	11)3	16)2	21)2	26)3
2)2	7)3	12)2	17)3	22)3	27)2
3)1	8)1	13)1	18)2	23)4	28)1
4)3	9)3	14)2	19)3	24)2	29)4
5)2	10)2	15)4	20)4	25)1	30)2

V. PRINCIPLES OF METALLURGY

Synopsis:

Metallurgy: The extraction of metals in pure form from its ore is called Metallurgy.

Characteristic Properties of Metals:

1. These are hard solids except Mercury (Hg)
2. They have high melting & boiling point and density.
3. Metals have lustre, Malleable, ductile and sonority.
   - Lustre means shiny surface.
   - Malleability means ability to form thin sheets
   - Most malleable metal is Gold.
   - Ductility means ability to drawn into thin wires.
   - Sonority means ability to produce sound.
4. Metals are good conductors of heat and electricity due to free mobile electrons. The best conductor is Ag. 2^{nd} best conductor is Cu. It is widely used because it is cheaper.
5. The non-metal that conducts electricity is Graphite (Carbon)
6. Metals have ability to form Alloys.
7. Alloy: A homogenous mixture of two (or) more metals having metallic property is called Alloy. Examples for Alloys: Bronz(Cu+Sn), Brass (Cu+Zn) steel (Fe+C), Stainless steel (Fe+Ni+Cr), Nichrome (Ni+Fe+Cr).
8. Elements which are available in native state (or) free state
   Ex.Cu, Ag & Pt due to less reactivity. Hence these are called Noble metals (or)passive metals.
9. Based on reactivity metals are divided into three groups. They are
   (i) High reactive metals: K, Na, Ca, Mg, AP. They never found in Free State.
   (ii) Moderate Reactive metals: Zn, Fe, Pb, Cu; they found as oxides, sulphides, carbonates.
   (iii) Less reactive metals: Au & Ag: They found in free state
10. 16^{th} group (VI A) elements are called oxygen–Sulphur family (or) chalcogens (ore forming elements)
11. Important Technical terms in Metallurgy:
    1) Mineral: The natural occurring of compounds of metals in earth crust are called Minerals.
       Ex. Haematite (Fe_2O_3), Magnetite(Fe_3O_4) & Copper Iron Pyrites (Cu Fe S_2)
    2) Ore: A Mineral from which a metal can be extracted easily and economically is called ore.
       Ex: Haematite is the ore of Iron
       Bauxite is the ore of Al (Al_2O_3 $2H_20$)
       All ores are minerals but all minerals are not ores.

	Name of the Ore	Metal	Formula
1) Oxide ores	Haematite Magnetite Bauxite Pyrolusite Zincite	Iron(Ferrum) Iron Aluminium Manganese Zinc	Fe_2O_3 Fe_3O_4 Al_2O_3 $2H_2O$ MnO_2 ZnO
2) Sulphide ores	Iron pyrites Copper glance Galena Zinc blend Cinnabar Silver glance	Iron Copper Lead Zinc Mercury Silver	FeS_2 Cu_2S PbS ZnS HgS Ag_2S

3) Carbonate ores	Magnesite Dolomite Lime stone (Marble)	Magnesium Calcium and Magnesium Calcium	$MgCO_3$ $CaCO_3$ $MgCO_3$ $CaCO_3$
4) Halide ores	Horn Silver Rock salt Carnallite	Silver Sodium Potassium & Magnesium	AgCl NaCl KCl Mg Cl_2 $6H_2O$
5) Sulphate ores	Epsom salt Gypsum	Magnesium Calcium	$MgSO_4$ $7H_2O$ $CaSO_4$ $2H_2O$

3) Gangue (Matrix): The earthy impurities associated with mineral (or) ore is called Gangue.
Ex: Clay & sand (SiO_2)

4) Flux: A Chemical substance used to remove Gangue from the ore is called Flux.
These are two types (1) Acidic flux 2) Basic flux
Acidic flux: SiO_2, P_2O_5 ;
Basic flux: CaO, MgO

5) Slag: The fusible product formed from gangue and flux is called slag.

Gangue + Flux $\longrightarrow$ Slag

Ex: $SiO_2 + CaO \longrightarrow CaSiO_3$, Calcium silicate

$FeO + SiO_2 \longrightarrow FeSiO_3$, iron silicate

- The most abundant metal in earth crust is **Al**.
- The most abundant element (non metal) in earth crust is **oxygen**.
- **Extraction of metals from ore (metallurgy) involves mainly 3 steps**

Step1: concentration of ore or dressing
Step2: Extraction of crude metal
Step3: Purification of metal

I. Concentration of ore (or) ore dressing: It involves mainly 4 methods.

1. Hand picking 2) Levigation (washing)
3) Froth flotation process 4) Electromagnetic separation

- Sulphide ores are generally concentrated by froth flotation process.
  Ex: PbS (Galena), HgS (Cinnabar), ZnS (Zinc Blend) Ag_2S (Silver glance)

Froth Flotation process is based on difference in wetting properties of ore with oil and gangue particulars by water.

Haematite (Fe_2O_3) and Magnetite (Fe_3O_4) are separated from non-magnetic purities by electromagnetic separation method.

In the purification of Bauxite, NaOH is used as leaching agent.

II. Extraction of crude metal: It depends on the reactivity of metals.

Electro chemical Series: A series of metals which are arranged in the decreasing order of reactivity is called electrochemical series (or) Activity series.

Activity Series:

K, Na, Ca, Mg, Al	Zn, Fe, Pb, Cu	Ag, Au
High Reactivity	Moderate reactivity	Low reactivity

a) Extraction of metals at the top of the activity series:

- More active metals like K, Na, Ca, Mg, Al etc are not prepared from ore by chemical reduction with coke & CO.

- These are obtained by electrolytic reduction of their molten (or) fused compound, but not with their aqueous solution compounds (Aqueous NaCl - Brine)
- Na metal is extracted by the electrolysis of fused NaCl is used as electrolyte steel cathode and Graphite is used as anode.
- In this process Cl_2 gas is liberated at anode and Na metal is deposited at cathode.
- During electrolysis oxidation takes place at anode and reduction takes place at cathode.
- Suitable compounds are added to ore before electrolysis to decrease the melting point of ore.

b) Extraction of metals in the middle of the activity series:

It involves two stages.

1. Conversion of ores into oxides
2. Reduction of oxides into metals.

1. **Conversion of ores into oxides**:

It can be done by three methods.

(i) Roasting (ii) Calcination (iii) smelting

(i) Roasting: It is a Pyrochemcial process in which the ore is heated in presence of oxygen (or) air below its melting (or) fusion

During roasting Sulphide ores are converted into oxides

Ex: $2\,ZnS_{(s)} + 3O_{2\,(g)} \longrightarrow 2\,ZnO_{(s)} + 2SO_{2\,(g)}$

$2\,PbS_{(s)} + 3O_{2\,(g)} \longrightarrow 2\,PbO_{(s)} + 2\,SO_{2\,(g)}$

It is carried out in Reverberatory furnace.

(ii) **Calcination**: It is a Pyrochemical process in which the ore is heated in the absence of air without fusion. During calcination carbonate ores are converted into oxides.

$ZnCO_3 \longrightarrow ZnO + CO_2\uparrow$

$CaCO_3 \longrightarrow CaO + CO_2\uparrow$

It is also carried out in Reverberatory furnace.

(iii) Smelting: It is a pyrochemical process in which the ore is heated by adding reducing agent and flux.

During smelting molten metal is obtained and gangue is removed as slag by flux.

Ex: Extraction of Iron from Haematite ore.

$Fe_2O_3 + 3C \xrightarrow{\text{Reduction}} 2\,Fe_{(Molten)} + 3CO\uparrow$

$SiO_2 + CaO \longrightarrow CaSiO_3$

(Gangue) (Flux) (Slag)

Smelting is carried out in Blast Furnace.

2. Reduction of oxides into the metals:

It can be done by various methods.

(i) Reduction of metal oxide by carbon into metal

$PbO + C \longrightarrow Pb + CO$

(ii) Reduction of metal oxide into molten metal by using CO

$Fe_2O_3 + 3\,CO \longrightarrow 2\,Fe + 3\,CO_2$

(iii) Auto reduction of Cu_2O into Cu metal by using Cu_2S by partial roasting.

i) $2\,Cu_2S + O_2 \xrightarrow[\text{Roasting}]{\text{Partial}} 2\,Cu_2O + 2SO_2$

ii) $2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$

(iv) Reduction by more active metals.

The displacement of less active metal like Iron from its ore by a more active metal like Al is called Gold Schmidt Alumino thermi process (or) Thermite process.

It is an exothermic process.

Ex- $Fe_2O_3 + 2\,Al \longrightarrow Al_2O_3 + 2\,Fe + Heat$

$Cr_2O_3 + 2\,Al \longrightarrow Al_2O_3 + 2\,Cr + Heat$

In thermite process Al is used as reducing agent and molten metal is obtained.

This process is used in welding of railway tracks.

(C) **Extraction of the metals at the bottom of the activity series:**

(i) Less active metals like Hg, Ag & Au are obtained by heating (or) by chemical displacement from aqueous solutions. It is called Hydrometallurgy

(ii) HgS (Cinnabar) is heated in air HgO is formed and it is on further heating mercury(Hg) is obtained.

i. $2\,HgS + 3O_2 \xrightarrow{Air} 2\,HgO + 2O_2$

ii. $2\,HgO \xrightarrow[\text{heating}]{\text{further}} 2\,Hg + O_2$

Silver and Gold are extracted by treating the aqueous solutions of compounds in KCN (or) NaCN with a more active metal like Zn. It is called Hydrometallurgy

Ex $Ag_2S + 4CN^- \xrightarrow{KCN} 2[Ag(CN)_2]^- + S^{-2}$

$[Ag(CN)2]^- + Zn_{(s)} \longrightarrow [Zn(CN)_4]^{-2} + 2Ag_{(s)}$
(aq) (aq)

$[Ag(CN)2]^-$ complex ion is called dicyano Argentate(I)Ion.

In the above reaction 'Zn' acts as reducing agent.

III) **Purification of the crude metal (Impure metal):** It can be done by the following methods.

i) Distillation ii) Poling iii) Liquation iv) Electrolytic refining.

(i) Distillation : It is used for low boiling metals containing high boiling impurities.
Ex: - Zn, Hg (mercury)

(ii) Liquation : - It is used for low melting metals containing high melting impurities.
Ex :- Tin (Sn) Lead (Pb)

(iii) Poling : It is used for metals containing metal oxide as impurities and stirred with green wood logs (or) poles
Ex:- Blister copper

(iv) Electrolytic refining: In this process impure metal is used as anode, pure metal is used cathode and acidified salt solution is used as electrolyte. During electrolysis pure metal is deposited at cathode and impurities are settle down as anode mud.

Electrolysis reactions.

(i) Ionisation : $Cu\,SO_4 \longrightarrow Cu^{2+} + SO_4^{2-}$

(ii) At Anode (oxidation) $Cu \longrightarrow Cu^{2+} + 2e^-$

(iii) At Cathode (Reduction) $Cu^{2+} + 2e^- \longrightarrow Cu$

Corrosion: The process of damage of metals by the action of environment is called Corrosion.

Ex: i) Rusting of Iron (Ironoxide, Fe_2O_3)

ii) Tarnishing of silver (Silver Sulphide, Ag_2S)

iii) Development of green coating on copper & Bronze (Copper carbonate, $CuCO_3$)

Corrosion is an electro chemical process:

At Anode : $2Fe \longrightarrow 2Fe^{2+} + 4e^-$ (Oxidation)

At Cathode : $O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O$ (Reduction)

Net reaction : $2Fe + O_2 + 4H^+ \longrightarrow 2Fe^{2+} + 2H_2O$

Chemical formula of Rust is $Fe_2O_3\,xH_2O$ (It is called Hydrated Ferric oxide).

Rust can be prevented by

(i) The metals can be isolated from air & moisture.

(ii) By using paintings and covered by active metals like Zn (or) Mg

Galvanisation of Iron. The coating of zinc on Iron metal surface is called Galvanisation.

The chemical used to prevent Iron metal from corrosion is **Bis-phenol.**

The devise which is used to carry out Pyrochemical process in metallurgy is called **furnace**

- The place inside the furnace where the ore is kept for the heating purpose is called **Hearth**.
- The outlet through which flue (waste) gases go out of the furnace is called **Chimney**.
- The part of the furnace where the fuel is kept for burning is called **fire box**.
- In **blast furnace** both fire box and hearth are combined in big chamber, which accommodates both ore and fuel.
- In reverboratory furnace both fire box and hearth are separated, but the vapours (flame) obtained due to the burning of the fuel touch the ore in the hearth and heat it.
- In retort furnace there is no direct contact between the hearth and fire box, and even the flames do not touch the ore.

EXERCISE – 1 BITS IN METALLURGY

1. The method used for the concentration of Sulphide ores.
   1) Hand packing 2) Washing
   3) froth flotation method 4) Electromagnetic separation
2. Which of the following is a Carbonate ore
   1) Bauxite 2) Magnesite 3) Galena 4) Gypsum
3. The method used for the purification of low boiling metals containing high boiling impurities
   1) Poling 2) Fusion 3) Distillation 4) Electrolytic refining
4. Corrosion occurs in
   1) Air 2) Water 3) Only water 4) 2 & 3
5. The heating of the ore strongly absence of air without fusion is known as
   1) Roasting 2) Calcination 3) Smelting 4) None
6. The heating of the ore strongly in presence of air without fusion is called
   1) Smelting 2) Roasting 3) Calcination 4) Thermite process
7. The Pyro chemical process in which the ore is strongly heated by adding a flux and reducing agent is known as
   1) Roasting 2) Calcination 3) Smelting 4) Froth-flotation method

8. The impurities associated with the mineral is called
   1) Flux 2) Gangue 3) Slag 4) Mineral
9. The formula of Gypsum is
   1) $CuSO_4$. $5H_2O$ 2) $CaSO_4$ ½ H_2O 3) Na_2CO_3 $10H_2O$ 4) $CaSO_4.2H_2O$
10. Galena is an ore of
    1) Zn 2) Pb 3) Hg 4) Al
11. The metal that occurs in the native form is
    1) Pb 2) Au 3) Fe 4) Hg
12. The most abundant metal in the earth's crust is
    1) Oxygen 2) Aluminium 3) Zinc 4) Iron
13. The reducing agent used in Thermite process is
    1) Al 2) Mg 3) Fe 4) Si
14. During smelting ore undergoes
    1) Oxidation 2) Reduction 3) Neutralisation 4) None
15. Arrange the following metals in the decreasing order of reactivity
    1) K > Zn > Hg 2) Zn < K < Hg 3) K > Zn < Hg 4) K < Zn > Hg
16. Poling is used in the purification of
    1) Zn 2) Ag 3) Pb 4) Cu
17. During corrosion which reaction takes place at Anode
    1) Reduction 2) Oxidation 3) Redox reaction 4) None
18. Reaction occur in Blast Furnace is
    1) Calcination 2) Roasting 3) Smelting 4) None
19. The place inside the furnace where the ore is kept for heating purpose is called
    1) Hearth 2) Chimney 3) Fire box 4) None
20. Which of the following is a Manganese ore
    1) Epsom salt 2) Pyrolusite 3) Carnalite 4) Cinnabar
21. Stainless steel contains
    1) Iron 2) Ni 3) Chromium 4) All the above
22. Liquid metal at room temperature is
    1) Mercury 2) Bromine 3) Galium 4) Carbon
23. The metal which is not available in free state in nature
    1) Gold 2) Platinum 3) Silver 4) Copper
24. The formula of rust is
    1) Fe_2O_3 2) Fe_3O_4 3) Fe_2O_3 xH_2O 4) $FeCO_3$
25. The non-metal that conducts electricity is
    1) Copper 2) Silver 3) Bromine 4) Graphite
26. Which of the following is a calcination reaction?
    1) $2ZnS + O_2 \longrightarrow 2ZnO + 2SO_2$ 2) $ZnCO_3 \longrightarrow ZnO+CO_2$
    3) $Fe_2O_3+3CO \longrightarrow 2Fe+3CO_2$ 4) All the above
27. During extraction of iron from Haematite ore in Blast furnace, the flux used is
    1) SiO_2 2) CaO 3) P_2O_5 4) Coal
28. The element present in the hardest substance
    1) Copper 2) Carbon 3) Iron 4) Potassium
29. Common salt is an example for which minerals
    1) Oxides 2) Carbonates 3) Sulphates 4) Chlorides

30. The property of ability of an atom can be beaten into thin sheets is called
    1) Lustre 3) Malleability 3) Ductility 4) Sonority

EXERCISE-II

1. Formula of Magnetite is
   1) Fe_2O_3 2) $FeCO_3$ 3) FeS_2 4) Fe_3O_4
2. The most malleable metal is
   1) Silver 2) Lead 3) Gold 4) Aluminium
3. The metallic compound from which a metal can be extracted easily and economically is called
   1) Mineral 2) Ore 3) Gangue 4) Flux.
4. Galvanised Iron is protected from rust, because it has coating of
   1) Sn 2) Cr 3) Zn 4) Hg
5. The ability of metals can be drawn into thin wires is called
   1) Conductivity 2) Ductility 3) Malleability 4) Sonority
6. Smelting is carried out in Blast Furnace. It convert's
   1) Sulphide ore into oxides 2) Carbonate Ore into oxides
   3) Oxide Ore into molten metal 4) All the above
7. Mercury metal can be purified from its impurities by the process is called
   1) Liquation 2) Distillation 3) Poling 4) Cupellation
8. Which oil is used in the concentration of Sulphide Ores by froth flotation
   1) Pine oil 2) Coconut Oil 3) Kerosene 4) Sun flower Oil
9. Auto reduction is used in the extraction of which metal Sulphide Ore
   1) Zn 2) Fe 3) Al 4) Cu
10. The electrolysis of fused NaCl the product formed at cathode is
    1) Cl_2 2) Na Metal 3) H_2gas 4) NaOH
11. During electrolytic refining of metal the impure metal is used as
    1) Anode 2) Cathode 3) Electrolyte 4) All the above
12. Which metal is used as sacrificial anode in the protection of Iron from corrosion
    1) Pb 2) Mg 3) Ag 4) Cu
13. Which slag is formed in the extraction of Iron from Haematite Ore
    1) $CaCO_3$ 2) SiO_2 3) $FeSiO_3$ 4) $CaSiO_3$
14. The substance added to the Ore to remove gangue from the Ore is called
    1) Flux 2) Slag 3) Alloy 4) None of the above
15. During corrosion the reaction that occurs at anodic part is
    1) Reduction 2) Oxidation
    3) Redox reaction 4) Thermite reaction

16. Which pairs of metals are moderate reactive?
    1) K & Zn 2) Zn & Fe 3) Hg & Au 4) K & Pb
17. In which furnace the fire box and hearth are combine in a big chamber
    1) Reverberatory furnace 2) Retort furnace
    3) Blast furnace 4) None
18. Match the following:

Formula	Name
a) PbS	i) Pyrolusite
b) $CaSO_4$ $2H_2O$	ii) Carnalite
c) KCl $MgCl_2.6H_2O$	iii) Galena
d) MnO_2	iv) Gypsum

1) a – iii b – ii c – I d – iv
2) a – i b – ii c – iii d – iv
3) a – iv b – iii c – ii d – i
4) a – iii b – iv c – ii d – i

19. Example for corrosion is/ are
    1) Rusting of Iron 2) Tarnishing of Silver
    3) Development of green coating on Copper 4) All the above
20. The Chief Ore of Aluminium is
    1) Haematite 2) Bauxite 3) Cinnabar 4) Carnalite

METALLURGY

POLYCET – 2022

1. Highest abundant metal in earth's crust is
   1) Al 2) Au 3) N_2 4) Fe
2. Which of the following is not sulphide ore?
   1) Pyrolusite 2) Galena 3) Cinnabar 4) Copper iron pyrites
3. Which of the following ores undergo roasting?
   1) Carbonate Ore 2) Oxide ores 3) Sulphide ores 4) All of these
4. Which of the following metals liberate H_2 on reaction with steam but not with cold water?
   1) Pb 2) Na 3) Fe 4) K

POLYCET – 2021

1. The impurities such as soil and sand associated with ore are called
   1) Slag 2) Flux 3) Mineral 4) Gangue
2. The spot at which corrosion occurs on the surfaced of an iron material, behave as
   1) Cathode 2) Anode
   3) Either cathode (or) Anode 4) It has no relation with electrode
3. which of the following minerals contains Manganese?
   1) Galena 2) Cinnabar 3) Pyrolusite 4) Horn silver
4. which of the following methods are used to prevent corrosion?
   1) Painting 2) Electroplating
   3) Sacrificial electrode of another metal 4) All of these.

POLYCET – 2020

1. Which one of the following layers of a metallic compound can be formed on electric wire as insulator during rainy season and causes the power supply to our home from the electric to be interrupted.
   1. Metal sulphide 2) Metal oxide
   3) Metal carbonate 4) Metal peroxide
2. A thin layer of 'X' metal is used as galvanizing on iron surface to protect from rusting of Iron. The name of X-metal is
   1. Tin 2) Lead 3) Zinc 4) Aluminum
3. Match the following

Ore	Formula
(a) Fe_3O_4	i) Magnetite
(b) $MgCO_3$	ii) Magnetite
(c) ZnS	iii) Cinnabar
(d) Hg_2S	iv) Zinc Blender

1) a-I, b-ii, c-iii, d-iv
2) a-ii b-I c-iii d-iv
3) a-ii, b-I c-iv d-iii
4) a-1, b-ii c-iv d-iii

4. The most suitable method for concentration of sulphide ore is
   1. Washing 2) Hand picking
   3) Froth flotation 4) Magnetic separation.
5. The name of complex ion formed when Ag_2s is dissolved in KCN solution is
   1. Monocyano argentite(I) ion 2) Dicyano argentate(I)ion
   3) Tricyano argentate(I) ion 4) Tetracyano Argentate(I) ion

POLYCET – 2019

1. The tarnishing of Silver spoon in presence of moisture is due to the formation of
   1. AgO_2 2) Ag_2S 3) $AgNO_3$ 4) AgCl
2. Match the following

(a) Haematite	i) HgS
(b) Cinnabar	ii) $Fe_3 O_4$
(c) Horn Silver	iii) $Fe_2 O_3$
(d) Magnetite	iv) AgCl

   1) a-iii, b-iv, c-I, d-ii 2) a-iii b-i c-iv d-ii
   3) a-ii, b-iv, c-I, d-iii 4) a-ii, b-il c-iv, d-iiii
3. Which of the following metals is reactive ?
   1) Mg 2) Au 3) K 4) Fe
4. Heating of carbonate ore in the absence of air is called
   1) Calcination 2) Roasting
   3) Smelting 4) Refining
5. For extraction of highly reactive metal compounds from their ores, some impurities are added during the electrolysis process. The role of impurity is
   1) To give colour to the ore 2) To increase the melting point of ore
   3) To incease weight of ore 4) To increase the melting point of ore

POLYCET – 2018

1. The low reactivity metal in the following
   1) Au 2) Mg 3) Zn 4) Cu
2. $CaCO_3 \rightarrow CaO + Co_2$ this reaction is example for
   1) Smelting 2) Calcination 3) Reduction 4) Roasting
3. Ag2S is dissolved in KCN solution to get
   1) AgCN 2)$[Ag(CN)_2]^-$ 3) Ag_3SCN 4) KNC

Key to Exercise – I

1) 3	2) 2	3) 3	4) 4	5) 2	6) 2	7) 3	8) 2	9) 4	10) 2
11) 2	12) 2	13) 1	14) 2	15) 1	16) 4	17) 2	18) 3	19) 1	20) 2
21) 4	22) 1	23) 4	24) 3	25) 4	26) 2	27) 2	28) 2	29) 4	30) 2

Key to Exercise – II

1) 4	2) 3	3) 2	4) 3	5) 2	6) 3	7) 2	8) 1	9) 4	10) 2
11) 1	12) 2	13) 4	14) 1	15) 2	16) 2	17) 3	18) 4	19)	20) 2

Polycet -2022

1) 2 2) 1 3) 3 4) 3

Polycet -2021

1) 4 2) 2 3) 3 4) 4

Polycet -2020

1) 2 2) 3 3) 3 4) 3 5) 2

Polycet -2019

1) 2 2) 2 3) 3 4) 1 5) 4

Polycet -2018

1) 1 2) 2 3) 2

6.CARBON AND ITS COMPOUNDS

synopsis

- Carbon is a non metal, belongs to IV A group and contain four valency electrons in the valency shell (**Tetra valency)**
- Electronegativity of carbon is 2.5 and carbon forms **four covalent bonds** with own atoms or atoms of other elements
- Carbon form single or double or Triple bonds with same or other atoms
- Carbon in excited state ($1s^2 2s^2 2p_x^1 2p_y^1 2p_z^1$) involved in bond formation. The energy required to excite the electron is obtained from the energy released in the formation of bonds
- The distribution of orbitals of almost equal energy of an atom to give equal number of new identical orbitals is called hybridization. The concept of hybridization was introduced by **Linus Pauling**
- Carbon in carbon compounds undergoes three types of hybridization in excited state
- Types of hybridization

Types of Hybrisation	Bond angle	Shape of molecule	example	No.of bonds
1. sp^3	$109^0 28'$	Tetrahedral	CH_4(Methane) C_2H_6 (Ethane)	4σ (sp^3- sp^3) 7σ (1 sp^3- sp^3) (6 sp^3-s)
2. sp^2	120^0	Trigonal planar	Ethene/ Ethylene (C_2H_4)	4σ (1 sp^2- sp^2) (4 sp^2-s) 1 π (p-p)
3. sp	180^0	Linear	Ethyne / acetylene	3σ (1 sp- sp) (2 sp-s) 2 π (p-p)

- The property of element to exist in different physical forms is called **allotropy**
- Dimond, Graphite, Buck minster fullerene (C_{60}) Etc are crystalline allotores of carbon
- Coal, coke, wood charcoal , Animal charcoal, lanp black , Gas carbon , petroleum coke, sugar charcoal etc are amorphous allotropes of carbon
- **Diamond is hardest** substance and its hardness is due to strong C-C bonds.
- Graphite has layered structure and layers are separated by a distance of **3.35** $\overset{0}{A}$
- Graphite is a **good conductor** due to delocalized π electrons
- The layers in graphite are attracted by **London dispersion forces**
- Carbon in diamond, Graphite and C_{60} undergoes sp^3 , sp^2 and sp^2 hybridisation respectively.
- Spherical Fullerenes are called bukkyballs
- C_{60} molecule contains **12 pentagonal** and **20 hexagonal rings**
- Nano tubes consists of hexagonal arrays of covalently bonded carbon atoms, these are electrical conductors and used as molecular wires
- **Urea (NH_2CONH_2)** is the first organic compound prepared in laboratory from heating of **ammonium cyanate (NH_4CNO)**
- The ability of carbon to form long chains and rings is called **Catenation**. Carbon is the element with highest catenation ability.
- Carbon is a versatile element and versatile nature is due to
  1) Catenation ability
  2) forms longest number of compounds
  3) forms various types of bonds

- Compounds containing carbon and Hydrogen are called **hydrocarbons**
- Hydrocarbons containing **single bonds** between carbons are called **Alkanes**
- Hydrocarbons containing **double bonds** between carbons are called **Alkenes**
- Hydrocarbons containing **triple bonds** between carbons are called **Alkynes**
- The series of carbon compounds in which two successive compounds differ by **$-CH_2$** unit is called **Homologous series**
- Compounds having same molecular formula but different properties due to different structures are called isomers and the phenomenon is called isomerism
- The atom or group of atoms responsible for properties of organic compounds is called functional group
- Group obtained by removal of one hydrogen from alkanes is called alkyl group.
- General formula of Alkanes C_nH_{2n+2} and Alkyl group is C_nH_{2n+1}
- Most of the organic compounds burns with sooty flame
- Combustion of organic compounds is exothermic and produces water , CO_2 and energy.
- Oxidizing agents (oxidants) are substances that oxidize other substances and themselves undergoes reduction
- Oxidation of alcohol with oxidizing agents like alkaline $KMnO_4$ or acidified potassium dichromate gives carboxylic acids
- Saturated hydrocarbons (alkanes) are less reactive and mainly undergoes substitution reactions
- Unsaturated hydrocarbons (alkenes and alkynes) mainly undergoes addition reaction
- A substance which regulates (increase / decrease) the rate of chemical reaction without undergoing any chemical change is called catalyst.
- Ni (nickel) is used as a catalyst in hydrogenation of oils
- Ethyl alcohol (Ethanol) is prepared on large scale by hydration of ethylene (Ethene) in presence of catalyst like P_2O_5.
- The process of conversion of starches and sugars to C_2H_5OH is called **fermentation process**.
- 100% alcohol is called absolute alcohol.
- Methyl alcohol mixed with ethyl alcohol is called **denaturated spirit**
- 10% ethanol in gasoline (gasonol) is a good motor fuel.
- Ethanol is an active ingredient in all alcoholic drinks.
- Potassium dichromate ($K_2Cr_2O_7$) is used in the instrument used by police to detect alcohol consumed drivers
- Dehydration of ethyl alcohol with conc. H_2SO_4 at 170^0C gives ethene.
- Ethyl alcohol and ethanoic acid (Acetic acid) liberates H_2 gas by reaction with 'Na' metal
- 5-8% solution of acetic acid in water is called **vinegar** and used as a **preservative** in pickles.
- The strength acid is expressed interms of p^{ka} values.
- The reaction between carboxylic acid and alcohol in presence of conc. H_2SO_4 to ester is called **esterification**
- Esters are sweet smelling organic compounds.
- Sodium or Potassium salt of higher fatty acids like palmitic, oleic, stearic acids etc is called soap.
- Fats are tri esters of higher fatty acid and Glycerol (trihydroxy alcohol)
- Alkaline hydrolysis of fats (tri esters of higher fatty acids) producing soaps is called **saponification.**
- Size of solute particle in true solution is less than 1nm and in colloidal solution is greater than 1 nm and less than 1000 nm ($1nm=10^{-9}m$)
- Soap is an electrolyte and forms micelle above a particular concentration called **critical micelle concentration (CMC)**
- A spherical aggregate of soap molecules of colloidal size in water is called **'micelle'**
- Soap anion contain hydrophilic end (polar end) hydrophobic end (non-polar end)
  In the cleaning action of soap, a micelle is formed as polar heads/hydrophilic ends($-COO^-$ group of soap) attached water and non –polar tails/hydrophobic ends(alkyl group of soap) attached to greasy matterin the dirty cloth.

Nomenclature of organic compounds

1. **Root word:**To indicate number of carbon atoms present in continuous longest possible carbon chain as
   Main chain in the compound. C_1-Meth; C_2-Eth; C_3-Prop; C_4-But;C_5-Pent; C_6-Hex; C_7-Hept; C_8-Oct; C_9-Non; C_{10}-Dec;
2. **Prefix:** To indicate substituents/side chains. It has different parts as
   (1) Number prefix(1,2, 3---substituent attached to which carbon number in the chain)
   (2)Numerical prefix (di, tri, --for same sbstituent repeated twice or thrice -)
   (3) primary prefix used for cyclic compounds only (cyclo)
   (4) Secondary prefix tells about substituents/secondary grade functional group (Cl- choloro,-CH_3-methyl, -C_2H_5-ethyl, NO_2- nitro, -OH-hydroxy, -CHO- formyl, -OR-alkoxyetc).
3. **Suffix**: (1) Primary suffix indicates saturation/ unsaturation in the compound
   (a) For saturated (C-C),primary suffix is an (b) For unsaturated (C=C) primary suffix is en
   (c)) For unsaturated (C≡C) primary suffix is yn
   (2) secondary suffix indicates functional group like(a) for alcohol(-OH) as ol ,
   (b) For aldehyde (-CHO) as al
   (3) number suffix(1,2,3—functional group to which carbon number) and numerical suffix (di, tri-for same functional group repeated twice or thrice)

class	Functional group formula	As prefix	As suffix
1.Acid halides	-COX	----	oyl halide
2.Alcohols	-OH	hydroxy	ol
3.Aldehydes	-CHO	formyl	al
4.Ketones	-C=O	oxo	one
5.carboxylic acids	-COOH	carboxy	oic acid
6. Ethers	R-O-R	Alkoxy	-------
7.Esters	-COOR	oxycarbonyl	oate
8. Amides	-$CONH_2$	carbamoyl	carboxamide
9.Amines	-NH_2	amino	amine
10.Nitiles	-CN	cyano	Nitrile/carbonytrile

The descending order of priority to choose main functional group as secondary suffix for naming the organic
Compound is
-COOH> $(CH_3CO)_2O$->-COOR > -COX >-$CONH_2$>-CN >-CHO >-CO > -OH >-NH_2
Acid anhydride ester acid halide amide nitrile aldehyde ketone alcohol amines

Inter national**U**nion of **P**ure and **A**pplied **C**hemistry (**IUPAC** Rules for Naming the organic compouds)

1.Rule(1): The possible longest continuous carbon chain selected as main chain and remaining consider as side chains or substituents.

2.Rule(2): we can numbering the carbon atoms in main chain from left to right or from right to left so that sum of the numbers indicating the positions of substituents and functional groups should be minimum possible.

3.Rule(3):The lowest possible number should be given for functional group carbon even if it does not obey Rule(2).

4.Rule(4): The carbon atoms of the chain terminating functional group say –CHO or –COOH groups should be Given always number '1' even if it does not obey Rules(2) &(3).

Note: n-butane and isobutene(2-methyl propane) are structural Isomers.

Exercise-I

1. Which of the following is true
1) Carbon is a nonmetal
2) Electronegitivity of carbon is 2.5
3) Carbon forms four bonds with other atoms
4) All are correct

2. The phenomenon of redistribution of orbital of almost equal energy of atoms to give equal number of new orbital with identical properties is called-
1)Isomerisation
2) Hybridisation
3) Allotropy
4) oxidation

3. Hybridisation of carbon in ethane molecule is
1) sp^3 2)sp
3)sp^2 4)sp^3d

4. Number of $\sigma and \pi$ bonds in C_2H_2 is
1)4,0 2)2,3
3)3,2 4)5,1

5. Which of the following is not amorphous allotrope of carbon
1)coal 2)coke
3) animal chrcoal 4) Diamond

6. Hybridisation of carbon in C_{60} is
1)sp 2) sp^2
3)sp^3 4)none

7. First organic compound prepared in the laboratory is
1)NH_4CNO 2) NH_2CONH_2
3) CH_4 4)CH_3COOH

8. The element with highest catenation ability is
1) carbon 2) Nitrogen
3) Oxygen 4) Sulphur

9. Which of the following is not hydrocarbon
1) C_2H_6 2) C_6H_6
3) C_2H_5OH 4) C_2H_2

10. Different members in homologue series is differ by
1)CH_3 2) C_2H_5
3) CH_4 4) CH_2

11. Functional group present in Aldehydes
1) –OH 2) –CHO
3) –COOH 4) –COOR

12. Organic compounds containing –COOH functional group are called
1)alcohols 2)ethers
3)carboxylic acids 4)esters

13. Suffix used to indicate the functional group in esters is
1)al 2)one
3) oate 4) alkoxy

14. In the IUPAC nomenclature , the root word for the compound containing four carbons is
1) Meth 2) Eth
3) But 4)Tetra

15. The formula of ethyl group is
1) CH_3 2) C_2H_5
3) C_3H_7 4) C_5H_{11}

16. The IUPAC name of $CH_3 - \underset{\underset{CH_3}{|}}{C}H - CH_2 - CH_3$
1) 3-methyl pentane
2) 3-methyl butane
3) 2-methyl butane
4) pentane

17. $2\ C_2H_6 + 7\ O_2 \rightarrow 4\ CO_2 + 6H_2O$++ energy. This is an example of
1)combustion reaction
2) Addition reaction
3) Hydration
4) substitution reaction

18. Combustion reaction is
1) Endothermic
2) Exothermic
3) Endothermic or Exothermic
4) none of the above

19. Which of the following is a saturated hydrocarbon
1) C_2H_6 2) CH_4
3) C_3H_8 4) All the above

20. Oxidation of ethyl alcohol with acidified $K_2Cr_2O_7$ on heating gives
1) CH_3CHO 2) CH_3COOH

3) $CH_3\ CH_3$ 4) $CH_3\ CH_2COOH$

21. Unsaturated hydrocarbons mainly undergoes
1) oxidation reactions
2) Substitution reactions
3) Reduction reactions
4) Addition reactions

22. Catalyst used in hydrogenation of oils is
1) H_2 2) Ni
3) Fe 4) Cu

23. $CH_4 + Cl_2 \xrightarrow{sunlight} CH_3Cl + HCl$ .This is an example of
1) Addition reaction
2) Substitution reaction
3) Elimination reaction
4) oxidation reaction

24. Which of the following match is incorrect

Compound	IUPAC name
1) C_2H_5OH	ethanol
2) CH_3COOH	Ethanoic acid
3) CH_3CHO	Ethanal
4) $CH_3COO\ C_2H_5$	Ethyl acetate

25. Alkanes mainly undergoes
1) Addition reaction
2) Substitution reaction
3) Elimination reaction
4) oxidation reaction

26. $CH_2 = CH_2 + H_2O \xrightarrow[\Delta]{catalytic} compound\ X.X$ is
1) Ethyl alcohol 2) Ethanal
3) Acetic acid 4) Ether

27. When ethyl alcohol is treacted with 'Na' metal the gas liberated is
1) O_2 2) CH_4
3) H_2 4) N_2

28. The percentage of acetic acid in vinegar is
1) 5-10% 2) 5-8%
3) 10-12% 4) 20-25%

29. Which of the following compound has sweet odour
1) Aldehydes 2) Esters
3) Ether 4) Acids

30. A spherical aggregate of soap molecules in water is called
1) Coagulant 2) Solution
3) Micelle 4) phase

Answers

1)4	6)2	11)2	16)3	21)4	26)1
2)2	7)2	12)3	17)1	22)2	27)3
3)1	8)1	13)3	18)2	23)2	28)2
4)3	9)3	14)3	19)4	24)4	29)2
5)4	10)4	15)2	20)2	25)2	30)3

Exercise-II

1. Which of the following is not correct about Graphite
1) It has layered structure
2) 'C' undergoes sp^3 hybridisation
3) London dispersion forces are present between the layers
4) Distance between two layers is 3.35 A

2. Which of the following is amorphous Allotrope form of carbon
1) Dimond 2) Graphite
3) C_{60} 4) Gas carbon

3. C_{60} contains
1) 12 pentagonal rings & 12 hexagonal rings
2) 12 pentagonal rings & 20 hexagonal rings
3) 20 pentagonal rings & 12 hexagonal rings
4) 20 pentagonal rings & 20 hexagonal rings

4. Which of the following is a Non conductor
1) Graphite 2) Diamond
3) Nanotubes 4) All the above

5. The ability of carbon to form longest chains with its own atoms is called
1) Isomerism 2) Tetravalnecy

3) Catenation 4) allotropy

6. Which of the following is a ring compound
1) n-penatne 2) Isopentane
3) cyclopentane 4) Isobutane

7. Which of the following does not belongs to the same homologue series
1) CH_4 2) C_2H_4
3) C_2H_6 4) C_3H_8

8. For Isomers, which is not different
1) Molecular formula
2) Structures
3) Properties
4) All the above

9. Which of the following combination is wrong

Compound	Functional group
1)Aldehydes	R-CHO
2) Ketones	R-O-R
3) Carboxylic acids	R-COOH
4) Esters	R-COOR

10. The prefix used for aldehyde group in nomenclature is
1)Hydroxy 2) Formyl
3)oxo 4) amino

11. Which of the following match is incorrect

Formula	Nature of compound
1) C_3H_8	Alkane
2) C_3H_6	Alkene
3) C_6H_6	Alkyne
4) C_3H_4	Alkyne

12. Carbon is a versatile element in nature . This is due to
1) form longest number of compounds
2) to show catenation
3) to form various types of bonds
4) All the above

13. Which of the following is not a characteristic feature of the compound is homologous series
1) They have one general formula
2) Successive compounds in the series differ by CH_2 unit
3) They possess different chemical properties
4) They show regular gradation in physical properties

14. The Molecular formula of a first member in homologous series is C_2H_4 . The molecular formula of 4th member in the series is
1) C_2H_6 2) C_5H_{10}
3) C_5H_{12} 4) C_4H_8

15. n-penatne and isopentane are
1) same compounds
2) Homologous
3) structural isomers
4) Allotropes

16. Which of the following is correct
1)saturated aliphatic hydrocarbons are called alkanes
2) Compounds with same molecular formula with different properties are called isomers
3)the property of the element to exist in two or more physical forms is called allotropy
4)All the statements are correct

17. Urea (NH_2CONH_2) is the first organic compound synthesized in the laboratoty. This compound is formed by heating
1) CH_3COONH_4 2)NH_4NO_3
3)NH_4CNO 4) NH_4NCO

18. The IUPAC name of
$CH_3–CH=CH–CH_2–C\equiv CH$ is
1)Hex-2-en-5-yne
2) Hex-3-en-5-yne
3) Hex-4-en-1-yne
4) Hex-2-en-2-yne

19. The formula of 1,3 butadiene is
1) $CH_3-CH_2-CH=CH_2$
2) $CH_2=CH-CH=CH_2$
3) $CH_3-CH=\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}-CH_3$
4) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-CH_3$

20. $CH_3-C\equiv C-CH_3 \xrightarrow[Ni\ \text{catalyst}]{H_2}$
$CH_3CH_2CH_2CH_3$. This is an example of
1) Addition reaction
2) Substitution reaction
3) Oxidation reaction
4) Combustion reaction

21. The process of conversion of starches and sugars to C_2H_5OH (ethyl alcohol) is called
1)oxidation
2) hydration
3) fermentation
4) Hydrolysis

22. Which of the following match is wrong.

Substance (reagent)	function
1) Catalyst	Regulates the rate of reaction
2) Yeast enzyme	Fermentation
3) Conc.H_2SO_4 at 170^0C	Dehydration reaction
4) Alkaline $KMnO_4$ + Heat	Reduction reaction

23. Which of the following gas liberated when ethanoic acid reacts with sodium carbonate is
1)H_2 2) O_2
3) CO_2 4)N_2

24. Which of the following is ester
1)Ethyl alcohol
2) Ethyl acetate
3) Ethanoic acid
4) Sodium ethoxide

25. The strength of acid may be expressed in terms of
1)p^{kw} 2) K_w
3)p^{ka} 4) all the above

26. The diameter of the particles in colloids is
1) 1nm-100nm 2) 1nm- 1000 nm
3) 10 nm- 1000nm 4) 100-1000nm

27. Sodium or potassium salts of higher fatty acids is called
1)saponification
2) detergent
3) soap
4) micelle

28. Which of the following is not correct about 'micelle'
1) It is formed by soaps
2) It is formed in low concentrated solutions
3) Micelle is formed above critical micelle concentration.
4) polar end in soap hydrophobic and non-polar end in hydrophobic

29. $CH_3COOH+CH_3CH_2OH \xrightarrow{con.\ H_2SO_4} CH_3COOC_2H_5 + H_2O$. This reaction is called
1) Substitution reaction
2) addition reaction
3) Hydrolysis reaction
4) Esterification reaction

30. Which of the following is formed in the cleaning action of soap.
1) Micelle
2) True solution
3) Emulsion
4) None of the above

Answers

1)2	6)3	11)3	16)4	21)3	26)2
2)4	7)2	12)4	17)3	22)4	27)3
3)2	8)1	13)3	18)3	23)3	28)4
4)2	9)2	14)2	19)2	24)2	29)4
5)3	10)2	15)3	20)1	25)3	30)1

Exercise – III

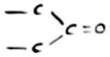
Previous POLYCET questions

1. The shape in which carbon atoms are arranged in diamond is
   1)Square planar
   2) Tetrahedral
   3) Trigonal planar
   4) Linear
2. Carbon can form large number of compounds because of
   1)Catenation
   2) Isomerism
   3) formation of multiple bonds
   4) All the above
3. Alkenes and Alkynes are
   1)Isobars
   2) Unsaturated hydrocarbons
   3) Saturated hydrocarbons
   4) None
4. The formula of Glycerol is
   1)CH_3COOH
   2) COOH-COOH
   3) CH_2OH-CHOH-CH_2OH
   4) CH_2OH-CH_2OH
5. The name of $-NH_2$ group is
   1) Acid group 2) Amine group
   3) Ester group 4) Ketone group
6. The difference between successive layers is graphite is
   1)3.35A 2) 1.35A
   3) 1.42A 4) 1.54A
7. The hydrocarbon used for artificial refining of fruits is
   1)Ethene 2) Acetylene
   3)Ethane 4) Benzene
8. The name of C_6H_{10} is
   1) Hexane 2) Hexyne
   3) Octane 4) Hexene
9. -COOR group is called
   1) Ether group 2) Acid group
   3) Amine group 4) Hexene
10. The process of obtaining of soap from oils or fats by hydrolysis in presence of base is called
    1) Defecation 2) Saponification
    3) Carbonation 4) Sulphitation
11. Alkenes undergoes
    1) Addition reactions
    2) Substitution reactions
    3) Combustion reactions
    4) Polymerization reactions
12. Functional group in aldehyde is
    1) –C-O-C- 2)-CHO
    3) $-CO-NH_2$ 4) –CO-C-
13. Unsaturated hydrocarbons among the following
    1) propane 2) butane
    3) ethene 4) ethane
14. Functional group in alcohols
    1) –CHO 2) –COOH
    3)-COOR 4)-OH
15. The number of carbon atoms in Buckminsterfullerene
    1) 20 2)30
    3) 60 4)50
16. The compound with a molecular formula $CH_3COOC_2H_5$ contains the followimg functional group.
    1)Acid 2) Alcohol
    3) Ketone 4) Ester
17. Compounds having the same molecular formula but different structural formulae are called
    1)Allotropes 2) Isomers
    3)Isotopes 4) Isobars
18. Allotrope of carbon among the following
    1)propane 2) Ethene
    3) Coke 4) Ethane
19. The crystalline allotrope of carbon among the following is
    1)Coke 2) Lampblack

3) Carbon black 4) Diamond

20. Alkene undergoes the following reaction.
1)Substitution reactions
2) Addition reactions
3) Condansation reactions
4) Elimination reactions

21. The formula of Alkene
1) C_nH_{2n} 2)C_nH_{2n-2}
3) C_nH_{2n+2} 4) C_nH_{2n-6}

22. Name the functional group  is
1) Alcohol 2) Aldehyde
3)Amine 4) Ketone

23. The reaction $C_3H_6+H_2 \rightarrow C_3H_8$ is an example for
1) Substitution 2) Addition
3)Polymerisation 4) Esterification

24. The gas evolved in fermentation is
1)SO_2 2) CO_2
3) N_2 4)O_2

25. Soaps are
1) Salts of fatty acids
2) Triesters of glycerol and fatty acids
3)Fatty alcohols sulphates
4) Fatty alcohols

26. The formula of steric acid is
1) $C_{17}H_{33}COOH$ 2) $C_{17}H_{35}COOH$
3) $C_{12}H_{22}O_{11}$ 4) C_2H_5OH

27. The number of sigma and pi bonds in C_2H_2 molecule is
1) 3 sigma and zero pi
2) 3 sigma and two pi
3) 2 sigma and 3 pi
4) 3 sigma and 1 pi

28. Which of the following is not a conductor ?
1) Graphite 2) Carbon nano tubes
3) diamond 4) All of these

29. Which of the following is an unsaturated hydrocarbon ?
1) Butane 2) Butyne
3) Isobutane 4) Cyclobutane

30. What does an oxidizing agent do?

1) It reduces other substance and itself undergoes oxidation
2) It reduces other substance and itself undergoes reduction
3) It oxidizes other substance and itself undergoes oxidation
4) It oxidizes other substance and itself undergoes reduction

Answers

1)2	6)1	11)1	16)4	21)3	26)2
2)4	7)1	12)2	17)2	22)4	27)4
3)2	8)2	13)3	18)3	23)2	28)3
4)3	9)4	14)4	19)4	24)2	29)4
5)2	10)2	15)3	20)2	25)2	30)4

POLYCET–2023

Q. B. No. **A**

Hall Ticket No. | | | | | | | |

Signature of The Candidate

Time : 2 Hrs. **Full Marks : 120**

Note : Before answering the questions, read carefully the instructions given on the OMR sheet.

ప్రశ్నలకు జవాబులు వ్రాయుటకు ముందు OMR జవాబు పత్రములో ఇవ్వబడిన సూచనలను జాగ్రత్తగా చదవండి.

SECTION—I : MATHEMATICS

1. After how many decimal places, the decimal expansion of the rational number $\frac{23}{2^2 \times 5}$ will terminate?

$\frac{23}{2^2 \times 5}$ అను అకరణీయ సంఖ్య యొక్క దశాంశ విస్తరణ ఎన్ని దశాంశ స్థానాల తరువాత అంతమగును?

(1) 1 (2) 2

(3) 3 (4) 4

2. The sum of the exponents of the prime factors in the prime factorization of 156 is

156 యొక్క ప్రధాన కారణాంక విభజనలోని ఘాతాంకాల మొత్తం

(1) 2 (2) 3

(3) 4 (4) 6

3. For any natural number n, 9^n ***cannot*** end with which one of the following digits?

ఏదైనా సహజ సంఖ్య n కు, 9^n విలువ ఈ క్రింది ఏ అంకెతో అంతం కాదు?

(1) 1 (2) 2

(3) 9 (4) None of these
ఇవేవీ కావు

4. If the LCM of 12 and 42 is $10m + 4$, then the value of m is

12 మరియు 42 సంఖ్యల క.సా.గు. $10m + 4$ అయితే, m విలువ

(1) $\frac{1}{5}$ (2) $\frac{4}{5}$

(3) 5 (4) 8

SPACE FOR ROUGH WORK / చిత్తుపనికి స్థానము

5. The value of $\frac{1}{\log_3 60}+\frac{1}{\log_4 60}+\frac{1}{\log_5 60}$ is

$\frac{1}{\log_3 60}+\frac{1}{\log_4 60}+\frac{1}{\log_5 60}$ యొక్క విలువ

(1) 0 (2) 1

(3) 5 (4) 60

6. Which of the following collections is ***not*** a set?

ఈ క్రింది వానిలో ఏ సమదాయం ఒక సమితి కాదు?

(1) The collection of natural numbers between 2 and 20

2 మరియు 20 మధ్య గల సహజ సంఖ్యల సముదాయం

(2) The collection of numbers which satisfy the equation $x^2-5x+6=0$

$x^2-5x+6=0$ అనే సమీకరణాన్ని తృప్తిపరిచే సంఖ్యల సముదాయం

(3) The collection of prime numbers between 1 and 100

1 మరియు 100 మధ్య గల ప్రధాన సంఖ్యల సముదాయం

(4) The collection of all brilliant students in a class

ఒక తరగతిలోని అందరు తెలివైన విద్యార్థుల సమూహం

7. If $P=\{3m : m\in\mathbb{N}\}$ and $Q=\{3^m : m\in\mathbb{N}\}$ are two sets, then

$P=\{3m : m\in\mathbb{N}\}$ మరియు $Q=\{3^m : m\in\mathbb{N}\}$ లు రెండు సమితులైన

(1) $P\subset Q$ (2) $Q\subset P$

(3) $P=Q$ (4) $P\cup Q=\mathbb{N}$

8. If A and B are disjoint sets and $n(A)=4, n(A\cup B)=7$, then the value of $n(B)$ is

A మరియు B లు వియుక్త సమితులు మరియు $n(A)=4, n(A\cup B)=7$ అయితే, $n(B)$ విలువ

(1) 7 (2) 4

(3) 3 (4) 11

9. If the sum and product of the zeroes of a quadratic polynomial are 3 and –10 respectively, then the polynomial is

ఒక వర్గ బహుపది యొక్క శూన్యాల మొత్తము మరియు లబ్ధములు వరుసగా 3 మరియు –10 అయితే, ఆ బహుపది

(1) $x^2-3x-10$ (2) $x^2+3x-10$

(3) $x^2+3x+10$ (4) $x^2-3x+10$

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10. If $x - 2$ is a factor of the polynomial $x^3 - 6x^2 + ax - 8$, then the value of a is

$x^3 - 6x^2 + ax - 8$ అనే బహుపదికి $x - 2$ ఒక కారణాంకమైతే, a యొక్క విలువ

(1) 10 (2) 12

(3) 14 (4) 18

11. If α, β and γ are the zeroes of the cubic polynomial $2x^3 + x^2 - 13x + 6$, then the value of $\alpha\beta\gamma$ is

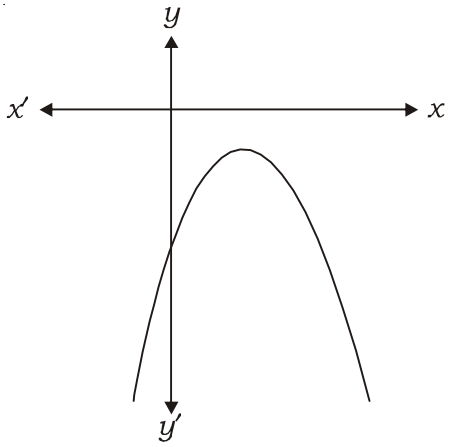
$2x^3 + x^2 - 13x + 6$ అనే ఘన బహుపది యొక్క శూన్యాలు α, β, γ లు అయితే, $\alpha\beta\gamma$ యొక్క విలువ

(1) 3 (2) –3

(3) $-\frac{1}{2}$ (4) $-\frac{13}{2}$

12. The number of zeroes of the polynomial shown in the graph is

గ్రాఫ్‌లో చూపబడిన బహుపది యొక్క శూన్యాల సంఖ్య



(1) 0 (2) 1

(3) 2 (4) None of these

ఇవేవీ కావు

13. The pair of linear equations $x + 2y - 5 = 0$ and $3x + 12y - 10 = 0$ has

$x + 2y - 5 = 0$ మరియు $3x + 12y - 10 = 0$ అనే రేఖీయ సమీకరణాల జతకు

(1) no solution
సాధన లేదు

(2) two solutions
రెండు సాధనలు ఉంటాయి

(3) unique solution
ఏకైక సాధన ఉంటుంది

(4) infinitely many solutions
అనంత సాధనలు ఉంటాయి

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14. In a competitive examination, 1 mark is awarded for each correct answer while $\frac{1}{2}$ mark is deducted for each wrong answer. If a student answered 120 questions and got 90 marks, then the number of questions that the student answered correctly is

ఒక పోటీ పరీక్షలో, ప్రతి సరియైన సమాధానానికి 1 మార్కు ఇస్తారు, అలాగే ప్రతి తప్పు సమాధానానికి $\frac{1}{2}$ మార్కు తీసివేస్తారు. ఒక విద్యార్థి 120 ప్రశ్నలకు సమాధానాలు వ్రాయగా 90 మార్కులు వచ్చినట్లయితే ఆ విద్యార్థి సరియైన సమాధానాలు వ్రాసిన ప్రశ్నల సంఖ్య

(1) 90 (2) 100

(3) 110 (4) None of these
ఇవేవీ కావు

15. Which of the following is ***not*** a quadratic equation?

ఈ క్రింది వానిలో ఏది వర్గ సమీకరణము కాదు?

(1) $(x+1)^3 = x^3 - 2$ (2) $(x+1)^2 = 3(x-2)$

(3) $(x+2)^2 + 3 = x - 1$ (4) $(x+2)(x-1) = (x+1)(x-3)$

16. If one root of the quadratic equation $a(b-c)x^2 + b(c-a)x + c(a-b) = 0$ is 1, then the other root is

$a(b-c)x^2 + b(c-a)x + c(a-b) = 0$ అనే వర్గ సమీకరణానికి 1 ఒక మూలమైతే, మరొక మూలము

(1) $\frac{b(c-a)}{a(b-c)}$ (2) $\frac{a(b-c)}{c(a-b)}$

(3) $\frac{a(b-c)}{b(c-a)}$ (4) $\frac{c(a-b)}{a(b-c)}$

17. If the sum and product of the roots of the quadratic equation $kx^2 + 6x + 4k = 0$ are equal, then the value of k is

$kx^2 + 6x + 4k = 0$ అనే వర్గ సమీకరణం యొక్క మూలాల మొత్తం, మూలాల లబ్ధానికి సమానమైతే, k విలువ

(1) $-\frac{3}{2}$ (2) $\frac{3}{2}$

(3) $\frac{2}{3}$ (4) $-\frac{2}{3}$

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18. If the numbers $n - 3$, $4n - 2$ and $5n + 1$ are in arithmetic progression, then the value of n is

$n - 3$, $4n - 2$ మరియు $5n + 1$ సంఖ్యలు అంకశ్రేఢిలో ఉంటే, n విలువ

(1) 1 (2) 2

(3) 3 (4) 4

19. In an arithmetic progression, 25th term is 70 more than the 15th term, then the common difference is

ఒక అంకశ్రేఢిలో 25 వ పదము, 15 వ పదము కంటే 70 ఎక్కువ అయిన, సామాన్య భేదము

(1) 5 (2) 6

(3) 7 (4) 8

20. Which term of the geometric progression $2, 2\sqrt{2}, 4, \ldots\ldots$ is 128?

$2, 2\sqrt{2}, 4, \ldots\ldots$ అనే గుణశ్రేఢిలో 128 ఎన్నవ పదము?

(1) 11th (2) 12th

(3) 13th (4) 14th

21. If the geometric progressions 162, 54, 18, ... and $\frac{2}{81}, \frac{2}{27}, \frac{2}{9}, \ldots\ldots$ have their nth term equal, then the value of n is

162, 54, 18, ...మరియు $\frac{2}{81}, \frac{2}{27}, \frac{2}{9}, \ldots\ldots$ అనే గుణశ్రేఢుల n వ పదాలు సమానమైన, n విలువ

(1) 3 (2) 4

(3) 5 (4) 6

22. The points $A(-5, 0)$, $B(5, 0)$ and $C(0, 4)$ are the vertices of which triangle?

$A(-5, 0)$, $B(5, 0)$ మరియు $C(0, 4)$ బిందువులు శీర్షాలుగా గల త్రిభుజము ఏది?

(1) A right-angled triangle
ఒక లంబకోణ త్రిభుజము

(2) An equilateral triangle
ఒక సమబాహు త్రిభుజము

(3) An isosceles triangle
ఒక సమద్విబాహు త్రిభుజము

(4) A scalene triangle
ఒక విషమబాహు త్రిభుజము

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23. The X-axis divides the line joining the points $A(2,-3)$ and $B(5,6)$ in the ratio of

$A(2,-3)$ మరియు $B(5,6)$ బిందువులను కలిపే రేఖాఖండాన్ని X-అక్షం విభజించే నిష్పత్తి

(1) 1 : 2 (2) 2 : 1

(3) 3 : 5 (4) 2 : 3

24. If four vertices of a parallelogram are $(-3,-1),(a,b),(3,3)$ and $(4,3)$ taken in order, then the ratio of a and b is

$(-3,-1),(a,b),(3,3)$ మరియు $(4,3)$ లు అదే క్రమంలో తీసుకున్న ఒక సమాంతర చతుర్భుజం యొక్క నాలుగు శీర్షాలైతే, a మరియు b ల నిష్పత్తి

(1) 4 : 1 (2) 1 : 2

(3) 1 : 3 (4) 3 : 1

25. If the points $(a,0),(0,b)$ and $(1,1)$ are collinear, then $\frac{1}{a}+\frac{1}{b}=$

$(a,0),(0,b)$ మరియు $(1,1)$ అనే బిందువులు సరేఖీయాలైన, $\frac{1}{a}+\frac{1}{b}=$

(1) -1 (2) 0

(3) 1 (4) 2

26. If the centroid of the triangle formed by the points $(3,-5),(-7,4)$ and $(10,-k)$ is at the point $(k, -1)$, then the value of k is

$(3,-5),(-7,4)$ మరియు $(10,-k)$ అనే బిందువులతో ఏర్పడే త్రిభుజం యొక్క గురుత్వ కేంద్రం, $(k, -1)$ బిందువు వద్ద ఉన్నట్లయితే k విలువ

(1) 1 (2) 2

(3) 3 (4) 4

27. If AM and PN are the altitudes of two similar triangles ΔABC and ΔPQR respectively and $(AB)^2 : (PQ)^2 = 4 : 9$, then $AM : PN =$

AM మరియు PN లు రెండు సరూప త్రిభుజాలైన ΔABC మరియు ΔPQR ల ఉన్నతులు వరుసగా మరియు $(AB)^2 : (PQ)^2 = 4 : 9$ అయితే, $AM : PN =$

(1) 3 : 2 (2) 16 : 81

(3) 4 : 9 (4) 2 : 3

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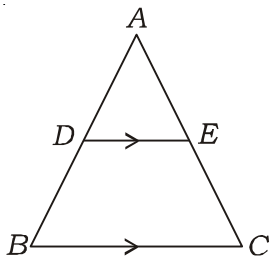
28. In the given ΔABC, if $DE \parallel BC$, $AE = a$ units, $EC = b$ units, $DE = x$ units and $BC = y$ units, then which of the following is true?

ఇచ్చిన పటంలోని ΔABC లో, $DE \parallel BC$, $AE = a$ యూనిట్లు, $EC = b$ యూనిట్లు, $DE = x$ యూనిట్లు మరియు $BC = y$ యూనిట్లు అయితే, ఈ క్రింది వానిలో ఏది సత్యము?



(1) $x = \frac{ay}{a+b}$ (2) $y = \frac{ax}{a+b}$

(3) $x = \frac{a+b}{ay}$ (4) $\frac{x}{y} = \frac{a}{b}$

29. If the lengths of the diagonals of a rhombus are 24 cm and 10 cm, then each side of the rhombus is

ఒక రాంబస్ (సమ చతుర్భుజం) యొక్క కర్ణాల పొడవులు 24 సెం. మీ. మరియు 10 సెం. మీ. లు అయితే, దాని ప్రతి భుజము పొడవు

(1) 12 cm
12 సెం. మీ.

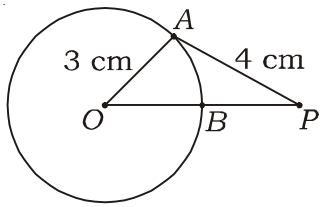
(2) 14 cm
14 సెం. మీ.

(3) 15 cm
15 సెం. మీ.

(4) 13 cm
13 సెం. మీ.

30. In the given figure, PA is the tangent drawn from an external point P to the circle with center O. If the radius of the circle is 3 cm and PA = 4 cm, then the length of PB is

ఇచ్చిన పటంలో, PA అనేది బాహ్య బిందువు P నుండి O కేంద్రం గల వృత్తానికి గీయబడిన స్పర్శరేఖ. వృత్త వ్యాసార్ధము 3 సెం. మీ. మరియు PA = 4 సెం. మీ. అయితే PB యొక్క పొడవు



(1) 3 cm
3 సెం. మీ.

(2) 4 cm
4 సెం. మీ.

(3) 5 cm
5 సెం. మీ.

(4) 2 cm
2 సెం. మీ.

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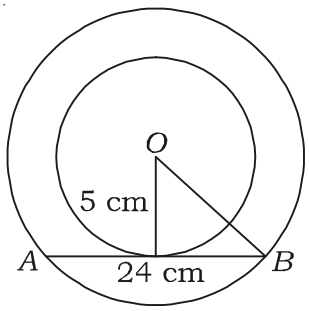
31. In two concentric circles, a chord of length 24 cm of larger circle becomes a tangent to the smaller circle whose radius is 5 cm. Then the radius of the larger circle is

రెండు ఏక కేంద్ర వృత్తాలలో, 24 సెం. మీ. పొడవు గల పెద్ద వృత్తము యొక్క జ్యా, 5 సెం. మీ. వ్యాసార్ధము గల చిన్న వృత్తానికి స్పర్శరేఖ అయితే, పెద్ద వృత్తము యొక్క వ్యాసార్ధము



(1) 8 cm
8 సెం. మీ.

(2) 10 cm
10 సెం. మీ.

(3) 12 cm
12 సెం. మీ.

(4) 13 cm
13 సెం. మీ.

32. The area of the circle that can be inscribed in a square of side 10 cm is

10 సెం. మీ. భుజంగా గల చతురస్రములో అంతర్లిఖించబడిన వృత్తం యొక్క వైశాల్యము

(1) 40π cm^2
40π చ.సెం.మీ.

(2) 30π cm^2
30π చ.సెం.మీ.

(3) 100π cm^2
100π చ.సెం.మీ.

(4) 25π cm^2
25π చ.సెం.మీ.

33. If the height of a conical tent is 3 m and the radius of its base is 4 m, then the slant height of the tent is

ఒక శంఖువు ఆకార గుడారం యొక్క ఎత్తు 3 మీ. మరియు దాని భూ వ్యాసార్ధము 4 మీ. అయితే, ఆ గుడారం యొక్క ఏటవాలు ఎత్తు

(1) 3 m
3 మీ.

(2) 4 m
4 మీ.

(3) 5 m
5 మీ.

(4) 7 m
7 మీ.

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34. If the radius of the base of a right-circular cylinder is halved, keeping the height same, then the ratio of the volume of the cylinder thus obtained to the volume of original cylinder is

ఒక క్రమ వృత్తాకార స్థూపము యొక్క ఎత్తును అలాగే వుంచి, దాని భూ వ్యాసార్ధమును సగానికి తగ్గించి నట్లయితే, ఆ విధంగా ఏర్పడిన స్థూపము మరియు అసలు స్థూపముల ఘనపరిమాణాల నిష్పత్తి

(1) 1 : 4 (2) 2 : 1

(3) 1 : 2 (4) 4 : 1

35. If $\tan\theta = \sqrt{3}$, then the value of $\sec\theta$ is

$\tan\theta = \sqrt{3}$ అయితే, $\sec\theta$ యొక్క విలువ

(1) 2 (2) $\frac{1}{2}$

(3) $\frac{\sqrt{3}}{2}$ (4) $\frac{2}{\sqrt{3}}$

36. A chord of a circle of radius 6 cm is making an angle 60° at the centre. Then the length of the chord is

6 సెం. మీ. వ్యాసార్ధం కలిగిన వృత్తంలో ఒక జ్యా కేంద్రం వద్ద 60° ల కోణం చేస్తుంది. అయితే ఆ జ్యా పొడవు

(1) 3 cm
3 సెం. మీ. (2) 6 cm
6 సెం. మీ.

(3) 12 cm
12 సెం. మీ. (4) $3\sqrt{3}$ cm
$3\sqrt{3}$ సెం. మీ.

37. The value of $\tan10^\circ \tan15^\circ \tan75^\circ \tan80^\circ$ is

$\tan10^\circ \tan15^\circ \tan75^\circ \tan80^\circ$ యొక్క విలువ

(1) –1 (2) 0

(3) 1 (4) None of these
ఇవేవీ కావు

38. If $\tan\theta + \cot\theta = 5$, then the value of $\tan^2\theta + \cot^2\theta$ is

$\tan\theta + \cot\theta = 5$ అయితే, $\tan^2\theta + \cot^2\theta$ యొక్క విలువ

(1) 1 (2) 7

(3) 23 (4) 25

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39. $\cos 36^\circ \cos 54^\circ - \sin 36^\circ \sin 54^\circ =$

$\cos 36^\circ \cos 54^\circ - \sin 36^\circ \sin 54^\circ =$

(1) 1 (2) 0

(3) -1 (4) $\frac{1}{2}$

40. If two towers of heights h_1 and h_2 subtend angles of 60° and 30° respectively at the mid-point of line segment joining their feet, then the ratio of their heights $h_1 : h_2$ is

h_1 మరియు h_2 ఎత్తులు కలిగిన రెండు గోపురాలు వాటి పాదాలను కలిపిన రేఖా ఖండం యొక్క మధ్య బిందువు నుండి చేయు ఊర్ధ్వకోణాలు వరుసగా 60° మరియు 30° అయితే వాటి ఎత్తుల నిష్పత్తి $h_1 : h_2$ =

(1) 1 : 2 (2) 2 : 1

(3) 1 : 3 (4) 3 : 1

41. The angles of elevation and depression of the top and bottom of a lighthouse from the top of a 60 m high building are 30° and 60° respectively. Then the difference between the heights of the lighthouse and building is

60 మీ. ఎత్తు గల ఒక భవనం పై నుండి ఒక దీప స్థంభం యొక్క పై భాగము మరియు అడుగు భాగాలు వరుసగా 30° మరియు 60° ఊర్ధ్వ మరియు నిమ్న కోణాలు చేస్తున్నట్లయితే, దీప స్థంభం మరియు భవనం యొక్క ఎత్తుల భేదము

(1) 20 m
20 మీ.

(2) 80 m
80 మీ.

(3) 60 m
60 మీ.

(4) 40 m
40 మీ.

42. Which of the following ***cannot*** be the probability of an event?

ఈ క్రింది వానిలో ఒక ఘటన యొక్క సంభావ్యత కానిది ఏది?

(1) 0 (2) $\frac{4}{5}$

(3) $\frac{5}{4}$ (4) 1

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43. If one card is drawn at random from a well-shuffled deck of 52 playing cards, then the probability of getting a non-face card is

బాగా కలుపబడిన 52 పేక ముక్కలు గల ఒక కట్ట నుండి యాదృచ్ఛికంగా ఒక కార్డును తీసినట్లయితే, ఆ కార్డు ముఖ కార్డు కాకపోవడానికి గల సంభావ్యత

(1) $\frac{3}{13}$ (2) $\frac{10}{13}$

(3) $\frac{7}{13}$ (4) $\frac{4}{13}$

44. A lot consists of 144 ball pens of which 20 are defective and the others are good. Rafia will buy a pen if it is good but will not buy if it is defective. The shopkeeper draws one pen at random and gives it to her. The probability that she will buy that pen is

ఒక లాట్‌లో 144 బాల్ పెన్నులు కలవు. వాటిలో 20 లోపభూయిష్టమైనవి, మిగిలినవి మంచివి. రఫియా మంచి పెన్నును మాత్రమే కొంటుంది, లోపభూయిష్టమైన పెన్నును కొనదు. దుకాణదారుడు యాదృచ్ఛికంగా ఒక పెన్నును తీసి ఆమెకు ఇస్తే దానిని ఆమె కొనుగోలు చేయడానికి గల సంభావ్యత

(1) $\frac{5}{36}$ (2) $\frac{20}{36}$

(3) $\frac{31}{36}$ (4) $\frac{31}{144}$

45. A bag contains 3 red balls and 5 black balls. If a ball is drawn at random from the bag, then the probability of getting a red ball is

ఒక సంచిలో 3 ఎరుపు బంతులు మరియు 5 నలుపు బంతులు కలవు. ఆ సంచి నుండి యాదృచ్ఛికంగా ఒక బంతిని తీసినపుడు అది ఎరుపు బంతి అగుటకు గల సంభావ్యత

(1) $\frac{1}{2}$ (2) $\frac{3}{4}$

(3) $\frac{5}{8}$ (4) $\frac{3}{8}$

46. If the mean of the following frequency distribution is 15, then the value of y is

ఈ క్రింది పౌనఃపున్య విభాజనము యొక్క సగటు 15 అయితే, y విలువ

x	5	10	15	20	25
f	6	8	6	y	5

(1) 8 (2) 7

(3) 10 (4) 9

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47. If the difference between mode and mean of a data is k times the difference between median and mean, then the value of k is

ఒక దత్తాంశము యొక్క బాహుళకము మరియు అంక మధ్యమముల మధ్య భేదం, దాని మధ్యగతము మరియు అంక మధ్యమముల భేదానికి k రెట్లు అయితే, k విలువ

(1) 2 (2) 3

(3) 1 (4) Cannot be determined

కనుక్కోలేము

48. The median of the first 10 prime numbers is

మొదటి 10 ప్రధాన సంఖ్యల మధ్యగత విలువ

(1) 11 (2) 12

(3) 13 (4) 14

49. For the given data with 50 observations 'the less than ogive' and 'the more than ogive' intersect at the point (15·5, 20). The median of the data is

ఒక దత్తాంశానికి ఆరోహణ మరియు అవరోహణ ఓజివ్‌లు 50 అంశాలపై ఉన్నాయి. అవి (15·5, 20) అనే బిందువు వద్ద ఖండించుకుంటున్నాయి. అయితే దత్తాంశం యొక్క మధ్యగతము

(1) 15·5 (2) 20

(3) 14·5 (4) 15

50. The modal class for the following frequency distribution is

ఈ క్రింది పౌనఃపున్య విభాజనం యొక్క బాహుళక తరగతి

x	Less than 10 10 కన్నా తక్కువ	Less than 20 20 కన్నా తక్కువ	Less than 30 30 కన్నా తక్కువ	Less than 40 40 కన్నా తక్కువ	Less than 50 50 కన్నా తక్కువ	Less than 60 60 కన్నా తక్కువ
f	3	12	27	57	75	80

(1) 30 - 40 (2) 20 - 30

(3) 10 - 20 (4) 50 - 60

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SECTION—II : PHYSICS

51. The value of –10 °C temperature in Kelvin scale is

కెల్విన్ మానంలో –10 °C ఉష్ణోగ్రత విలువ

(1) 283 K (2) 263 K

(3) 273 K (4) 0 K

52. According to the principle of method of mixtures, if A and B are the net heat lost and net heat gain respectively, then

మిశ్రమాల పద్ధతి సూత్రం ప్రకారం, A మరియు B లు వరుసగా వేడివస్తువులు కోల్పోయిన ఉష్ణం మరియు చల్లని వస్తువులు గ్రహించిన ఉష్ణం అయితే

(1) $A > B$ (2) $A < B$

(3) $A = B$ (4) None of these

ఇవేవీ కావు

53. When wet cloths dry, water in it disappears. This is due to

తడి బట్టలు పొడిగా అయినపుడు, అందులోని నీరు మాయమవుతుంది. కారణం

(1) freezing

ఘనీభవనం

(2) condensation

సాంద్రీకరణం

(3) melting

ద్రవీభవనం

(4) evaporation

భాష్పీభవనం

54. The relationship between average kinetic energy (E) of water molecules and its absolute temperature (T) is given by

నీటి పరమాణువుల సరాసరి గతిజశక్తి (E) మరియు దాని పరమ ఉష్ణోగ్రత (T) ల మధ్య సంబంధం

(1) $E \propto \frac{1}{T}$ (2) $E \propto \frac{1}{\sqrt{T}}$

(3) $E \propto T$ (4) E is independent of T

T పై E ఆధారపడదు

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55. Pick the ***false*** statement on specific heat.

క్రింది వాటిలో విశిష్టోష్ణముపై తప్పు వాక్యము ఏది?

(1) Its value is same for all the substances

దీని విలువ అన్ని పదార్థాలకు సమానం

(2) Its S.I. unit is J/kg-K

దీని S.I. ప్రమాణం J/kg-K

(3) Its value is high when the rate of rise (or fall) of temperature is low

దీని విలువ ఎక్కువైతే ఉష్ణోగ్రత పెరుగుదల (తేదా తగ్గుదల) రేటు స్వల్పం

(4) Its value for water is 1 cal/g-°C

నీటికి దాని విలువ 1 cal/g-°C

56. Freezing of water takes place at a temperature and atmospheric pressure of

నీరు ఘనీభవనం చెందు ఉష్ణోగ్రత మరియు వాతావరణ పీడనాలు వరుసగా

(1) 100 °C, 1 atm (2) 1 °C, 100 atm

(3) 0 °C, 100 atm (4) 0 °C, 1 atm

57. Refraction ***does not*** take place when the angle between the incident light ray and normal to the interface is

పతన కాంతి కిరణానికి మరియు లంబానికి మధ్య ఏ కోణం వద్ద వక్రీభవనం జరగదు

(1) 0° (2) 22·5°

(3) 45° (4) 60°

58. The refractive index of a medium is 2. The speed of light in that medium is

ఒక యానకం యొక్క వక్రీభవన గుణకం 2. ఆ యానకంలో కాంతివేగము

(1) 6×10^8 m/s (2) 10^8 m/s

(3) 5×10^8 m/s (4) $1{\cdot}5 \times 10^8$ m/s

59. Which among the following are used in transport communication signals through light pipes?

సమాచార సంకేతాలను ప్రసారం చేయడానికి వాడు కాంతిగొట్టాలు

(1) Plane mirrors
సమతల దర్పణాలు

(2) Concave lenses
పుటాకార కటకాలు

(3) Prisms
పట్టకాలు

(4) Optical fibers
ఆప్టికల్ ఫైబర్‌లు

SPACE FOR ROUGH WORK / చిత్తుపనికి స్థానము

60. Which among the following statements on mirage is ***false***?

ఎండమావులకు సంబంధించి క్రింది వాటిలో తప్పు వాక్యము

(1) It is an optical illusion

అది దృక్ భ్రమ

(2) It is the real image of the sky

ఇది ఆకాశం యొక్క నిజ ప్రతిబింబము

(3) It appears on the distant road

ఇది దూరపు రోడ్లపై కనిపిస్తుంది

(4) It appears during hot summer day

వేసవి ఎండలందు కనిపిస్తాయి

61. If v_1 and v_2 are the speeds of light in the two media of refractive indices n_1 and n_2 respectively, then

n_1 మరియు n_2 వక్రీభవన గుణకం విలువలు కలిగిన రెండు యూనకాలలో కాంతివేగాలు వరుసగా v_1 మరియు v_2 అయితే

(1) $\frac{v_1}{v_2} = \frac{n_1}{n_2}$

(2) $\frac{v_1}{v_2} = \frac{n_2}{n_1}$

(3) $\frac{v_1}{v_2} = \sqrt{\frac{n_1}{n_2}}$

(4) $\frac{v_1}{v_2} = \sqrt{\frac{n_2}{n_1}}$

62. Which of the following rays undergoes deviation by a lens?

క్రింది వాటిలో కటకం వలన విచలనం పొందు కాంతి కిరణాలు

(1) Ray passing along the principal axis

ప్రధానాక్షం గుండా పోవు కిరణాలు

(2) Ray passing through the optic centre

దృక్ కేంద్రం గుండా పోవు కిరణాలు

(3) Ray passing parallel to the principal axis

ప్రధానాక్షానికి సమాంతరంగా పోవు కిరణాలు

(4) None of the above

ఇవేవీ కావు

SPACE FOR ROUGH WORK / చిత్తుపనికి స్థానము

63. Pick the ***correct*** answer from the following two statements :

క్రింది రెండు వాక్యముల నుండి సరియైన సమాధానం ఎంపిక చేసుకోండి :

(a) Virtual image can be seen with the eyes.

మిథ్యా ప్రతిబింబం కంటికి కనిపిస్తుంది.

(b) Virtual image can be captured on the screen.

మిథ్యా ప్రతిబింబాన్ని తెరపై పొందవచ్చు.

(1) Only *(a)* is true
(a) మాత్రమే నిజం

(2) Only *(b)* is true
(b) మాత్రమే నిజము

(3) Both *(a)* and *(b)* are true
(a) మరియు *(b)* రెండూ నిజాలే

(4) Both *(a)* and *(b)* are false
(a) మరియు *(b)* రెండూ తప్పులే

64. The lens bounded by two spherical surfaces curved inwards is

రెండు వైపులా గోళాకార ఉపరితలాలను లోపలివైపుకు వంగి ఉన్న కటకం

(1) biconvex
ద్వికుంభాకార

(2) biconcave
ద్విపుటాకార

(3) plano-convex
సమతల కుంభాకార

(4) plano-concave
సమతల పుటాకార

65. If the object and image distances due to a convex lens are x each, then its focal length is

ఒక కుంభాకార కటకం యొక్క వస్తు మరియు ప్రతిబింబ దూరాలు ఒక్కొక్కటి x అయితే నాభ్యాంతరం

(1) $2x$

(2) $x/2$

(3) $2x/3$

(4) $4x$

66. Irrespective of the position of the object on the principal axis, a concave lens always forms an image of nature

ప్రధానాక్షంపై వస్తువు స్థానంతో సంబంధం లేకుండా, ఒక పుటాకార కటకం ఎల్లప్పుడూ ఏర్పరచు ప్రతిబింబ స్వభావము

(1) real, invert
నిజ, తలక్రిందులుగా

(2) real, erect
నిజ, నిట్టనిలువుగా

(3) virtual, erect
మిథ్యా, నిట్టనిలువుగా

(4) Does not form any image
ప్రతిబింబం ఏర్వరచదు

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67. Usually Doctors, after testing for defects of vision, prescribe the corrective lens indicating their

సాధారణంగా డాక్టర్లు, దృష్టిదోషాలను పరీక్షించిన తరువాత, సూచించు సర్దుబాటు కటకాన్ని క్రింది వాటి రూపంలో వ్రాసి ఇస్తారు

(1) radius of curvature
వక్రతా వ్యాసార్ధము

(2) refractive index
వక్రీభవన గుణకం

(3) mass
ద్రవ్యరాశి

(4) power
సామర్థ్యం

68. Farsightedness is called

దూరపు వస్తువులను స్పష్టంగా చూడగలిగి, దగ్గరి వస్తువులను సరిగా చూడలేకపోవు దృష్టిదోషము

(1) hypermetropia
దీర్ఘ దృష్టి

(2) myopia
హ్రస్వదృష్టి

(3) presbyopia
చత్వారం

(4) cataract
కెటరాక్ట్

69. Relationship among the speed of light wave (v), wavelength (λ) and frequency (f) is given by

కాంతి తరంగ వేగం (v) తరంగ దైర్ఘ్యం (λ) మరియు పౌనఃపున్యం (f) ల మధ్య సంబంధం

(1) $f = v\lambda$

(2) $v = f\lambda$

(3) $\lambda = fv$

(4) $\lambda = \sqrt{fv}$

70. Which of the following statements on red colour light is ***true***?

క్రింది వాటిలో ఎరుపురంగు కాంతికి సంబంధించి నిజమైన వాక్యము

(1) It has low refractive index and suffers high deviation
అది అల్ప వక్రీభవన గుణకం కలిగి, అధిక విచలనం చెందుతుంది

(2) It has low refractive index and suffers low deviation
అది అల్ప వక్రీభవన గుణకం కలిగి, అల్ప విచలనం చెందుతుంది

(3) It has high refractive index and suffers high deviation
అది అధిక వక్రీభవన గుణకం కలిగి, అధిక విచలనం చెందుతుంది

(4) It has high refractive index and suffers low deviation
అది అధిక వక్రీభవన గుణకం కలిగి, అల్ప విచలనం చెందుతుంది

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71. Blue colour of the sky is due to the scattering of light by the molecules of

కాంతి క్రింది పరమాణువులతో పరిక్షేపణం చెందడం వలన ఆకాశం నీలంగా కనబడుతుంది

(1) H_2 (2) H_2O

(3) CO_2 (4) N_2 and O_2

N_2 మరియు O_2

72. If i_1 and i_2 are the angle of incidence and angle of emergence due to a prism respectively, then at the angle of minimum deviation

ఒక పట్టకం యొక్క పతన కోణం మరియు బహిర్గామి కోణాలు వరుసగా i_1 మరియు i_2 లు అయితే కనిష్ట విచలన కోణం వద్ద జరుగునది

(1) $i_1 = i_2$ (2) $i_1 > i_2$

(3) $i_1 < i_2$ (4) None of these

ఇవేవీ కావు

73. The minimum focal length of the eye-lens of a healthy human being is

ఆరోగ్య వంతుడైన మానవుని యొక్క కంటి–కటక కనిష్ట నాభ్యాంతరము

(1) 25 cm (2) 2·5 cm

25 సెం. మీ. 2·5 సెం. మీ.

(3) 2·27 cm (4) 1 cm

2·27 సెం. మీ. 1 సెం. మీ.

74. Volt per ampere is called

వోల్ట్ / ఆంపియర్ దేనికి సమానం

(1) watt (2) ohm

వాట్టు ఓమ్

(3) coulomb (4) joule

కూలూంబ్ జౌల్

75. The device which maintains a constant potential difference between its ends is called

తన రెండు చివరలా స్థిర పొటెన్షియల్ తేడాను కలుగచేయు సాధనం

(1) battery (2) multimeter

బ్యాటరీ మల్టీమీటర్

(3) ammeter (4) electric bulb

అమ్మీటర్ విద్యుత్ బల్బు

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76. Two resistors of 0·4 Ω and 0·6 Ω are connected in parallel combination. Their equivalent resistance is

0·4 Ω మరియు 0·6 Ω విలువలు గల రెండు నిరోధాలను సమాంతరం సంధానం చేసినారు. ఫలిత నిరోధం విలువ

(1) 1 Ω
(2) 0·5 Ω
(3) 0·24 Ω
(4) 0·1 Ω

77. The junction law proposed by Kirchhoff is based on

కిర్ఖ్‌హాఫ్ ప్రతిపాదించిన సంధి నియమం దీనిపై ఆధారపడుతుంది

(1) conservation of mass
ద్రవ్యరాశి నిత్యత్వ సూత్రం
(2) conservation of momentum
ద్రవ్యవేగ నిత్యత్వ సూత్రము
(3) conservation of energy
శక్తి నిత్యత్వ సూత్రం
(4) conservation of charge
ఆవేశాల నిత్యత్వ సూత్రం

78. The materials which have large number of free electrons and offer low resistance are called

అధిక సంఖ్యలో స్వేచ్ఛా ఎలక్ట్రానులను కలిగి ఉండి అల్పనిరోధం కలిగి ఉండు పదార్థాలు

(1) semiconductors
అర్ధవాహకాలు
(2) conductors
వాహకాలు
(3) insulators
బంధకాలు
(4) None of these
ఇవేవీ కావు

79. A fuse is made up of

ఫ్యూజ్ తయారీకి వాడు తీగ

(1) thin wire of high melting point
సన్నగా ఉండి, అధిక ద్రవీభవన స్థానం కలిగి ఉండడం
(2) thin wire of low melting point
సన్నగా ఉండి, అల్ప ద్రవీభవన స్థానం కలిగి ఉండడం
(3) thick wire of high melting point
మందంగా ఉండి, అధిక ద్రవీభవన స్థానం కలిగి ఉండటం
(4) thick wire of low melting point
మందంగా ఉండి, అల్ప ద్రవీభవన స్థానం కలిగి ఉండడం

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80. If the specific resistance of a wire of length 2 m and area of cross-section 1 mm^2 is 10^{-8} Ω-m, then calculate the resistance.

2 m పొడవు మరియు 1 mm^2 మధ్యచ్ఛేద వైశాల్యం కలిగిన ఒక తీగ విశిష్ట నిరోధం 10^{-8} Ω-m అయితే ఆ తీగ నిరోధం ఎంత

(1) 10^{-2} Ω (2) 2 Ω

(3) 2×10^{-5} Ω (4) 2×10^{-2} Ω

81. An evidence for the motion of charge in the atmosphere is provided by

వాతావరణంలో ఆవేశాల చలనాన్ని తెలియజేయు ఉదాహరణ

(1) rainbow
ఇంద్రధనస్సు

(2) mirage
ఎండమావులు

(3) thunder
ఉరుము

(4) lightening
మెరుపు

82. The electric energy (in kWh) consumed in operating a bulb of 60 W for 10 hours a day is

60 W సామర్థ్యం గల బల్బు ఒక రోజులో 10 గంటలు వాడితే వినియోగం విద్యుత్‌శక్తి (kWh లలో)

(1) 0·6 (2) 6

(3) 36 (4) 12

83. The scientific demonstration of H.C. Oersted is related to the study of

H.C. ఆయిర్ స్టెడ్ శాస్త్రీయంగా రుజువుచేసిన ప్రయోగం

(1) electric discharge through air
గాలిలో విద్యుత్ ఉత్సర్గం

(2) relationship between voltage and current
వోల్టేజికి, విద్యుత్ ప్రవాహానికి మధ్య సంబంధం

(3) magnetic effect of current
విద్యుత్ ప్రవాహం వల్ల అయస్కాంత ప్రభావం

(4) refraction of light
కాంతి వక్రీభవనం

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84. Pick the ***correct*** answer from the following two statements :

క్రింది రెండు వాక్యములనుండి సరియైన సమాధానం ఎంపిక చేయండి :

(a) Within a bar magnet, magnetic field lines travel from south pole to north pole.

దండాయస్కాంతం లోపల, అయస్కాంత బలరేఖలు దక్షిణ ధృవం నుండి ఉత్తరధృవం వైపుకు ప్రయాణిస్తాయి.

(b) Outside bar magnet, magnetic field lines travel from north pole to south pole.

దండాయస్కాంతం వెలుపల, అయస్కాంత బలరేఖలు ఉత్తర ధృవం నుండి దక్షిణధృవం వైపుకు ప్రయాణిస్తాయి.

(1) Both *(a)* and *(b)* are true

(a) మరియు *(b)* రెండూ నిజాలే

(2) Both *(a)* and *(b)* are false

(a) మరియు *(b)* రెండూ తప్పులే

(3) Only *(a)* is true

(a) మాత్రము నిజము

(4) Only *(b)* is true

(b) మాత్రమే నిజము

85. Weber is the S.I. unit of

వెబర్ అనునది దేనికి S.I. ప్రమాణం

(1) magnetic pole strength
అయస్కాంత ధృవసత్వము

(2) magnetic moment
అయస్కాంత భ్రామకం

(3) magnetic flux
అయస్కాంత అభివాహం

(4) magnetic flux density
అయస్కాంత అభివాహ సాంద్రత

86. The magnetic force acting on a straight wire of length l carrying a current I which is placed perpendicular to the uniform magnetic field B is

l పొడవు మరియు I విద్యుత్ ప్రవాహం కలిగి ఉన్న ఒక తీగను ఏకరీతి అయస్కాంత క్షేత్రం B కు లంబంగా ఉంచినపుడు, ఆ తీగపై పని చేయు అయస్కాంత బలం

(1) IlB

(2) I/Bl

(3) B/Il

(4) I^2Bl

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87. Mechanical energy is converted into electrical energy in

యాంత్రిక శక్తిని విద్యుత్ శక్తిగా మార్చు సాధనము

(1) motors
మోటార్

(2) electric geysers
విద్యుత్ గీసర్

(3) generators
జనరేటర్

(4) televisions
టెలివిజన్

88. The device which contains slip rings to reverse the direction of current through coil is called

తీగచుట్టలో విద్యుత్ ప్రవాహ దిశను వ్యతిరేక దిశకు మార్చడంలో ఉపయోగపడు స్లిప్ రింగులను కలిగి ఉండు సాధనము

(1) resistor
నిరోధము

(2) battery
బ్యాటరీ

(3) electric motor
విద్యుత్ మోటారు

(4) solenoid
సోలినాయిడ్

89. An increase in magnetic flux through a coil of 500 turns in 0·1 s is 0·001 Wb. The maximum induced EMF generated in the coil is

500 చుట్లు కలిగిన ఒక తీగచుట్టలో 0·1 s లో జరిగిన అయస్కాంత అభివాహం పెరుగుదల 0·001 Wb. అందులో ఏర్పడిన గరిష్ట ప్రేరిత విద్యుత్‌చ్ఛాలక బలము

(1) 50 V
(2) 10 V
(3) 0·5 V
(4) 5 V

90. If ε and Δt are the induced EMF and time respectively, then the change in magnetic flux is given by

ε మరియు Δt లు వరుసగా ప్రేరిత విద్యుత్‌చ్ఛాలక బలం మరియు కాలం అయితే అయస్కాంత అభివాహం మార్పు

(1) $\frac{\varepsilon}{\Delta t}$
(2) $\varepsilon \Delta t$
(3) $\sqrt{\frac{\varepsilon}{\Delta t}}$
(4) $\sqrt{\varepsilon \Delta t}$

SPACE FOR ROUGH WORK / చిత్తుపనికి స్థానము

SECTION—III : CHEMISTRY

91. CH_3COOH solution turns red litmus into

CH_3COOH ద్రావణముకు రెడ్ లిట్మస్ కలిపినపుడు

(1) blue
నీలిరంగుకు మారును

(2) Remains red
ఎరుపురంగుగానే ఉండును

(3) colourless
వర్ణరహితమగును

(4) None of these
ఇవేవీ కావు

92. Identify the hardest substance in the body.

శరీరంలో అత్యంత కఠినమైన పదార్థం ఏది

(1) Calcium sulphate
కాల్షియం సల్ఫేట్

(2) Calcium chloride
కాల్షియం క్లోరైడ్

(3) Calcium phosphate
కాల్షియం ఫాస్ఫేట్

(4) Magnesium sulphate
మెగ్నీషియం సల్ఫేట్

93. $2HCl + Zn \longrightarrow$

(1) $ZnCl_2$

(2) $ZnCl_2 + Cl_2$

(3) H_2

(4) $ZnCl_2 + H_2$

94. Methyl orange shows _____ colour in acidic solution.

ఆమ్ల ద్రావణములకు మిథైల్ ఆరంజ్ కలిపినపుడు ఏ రంగును చూపించును

(1) yellow
పసుపు

(2) red
ఎరుపు

(3) green
ఆకుపచ్చ

(4) blue
నీలం

95. Which of the following is ***not correct***?

క్రింది వానిలో నిజం కానిది

(1) $2p^6$

(2) $3s^1$

(3) $4f^{12}$

(4) $2d^3$

SPACE FOR ROUGH WORK / చిత్తుపనికి స్థానము

96. Quantum numbers of a subshell are $n = 2$ and $l = 1$. Identify the subshell.

$n = 2$ మరియు $l = 1$ క్వాంటం సంఖ్యలు గల ఉపకర్పరం ఏది

(1) $2s$ (2) $1s$

(3) $2p$ (4) $2d$

97. l values of subshells d, s, f, p are respectively

d, s, f, p ఉపకర్పరాల l విలువలు వరుసగా

(1) 1, 2, 0, 3 (2) 3, 2, 1, 0

(3) 0, 1, 2, 3 (4) 2, 0, 3, 1

98. In visible light, red colour possesses

దృశ్యకాంతిలోని ఎరుపురంగు

(1) high wavelength and high frequency

అధిక తరంగ ధైర్ఘ్యము మరియు అధిక పౌనఃపున్యం కలిగి ఉండును

(2) high wavelength and low frequency

అధిక తరంగ ధైర్ఘ్యము మరియు తక్కువ పౌనఃపున్యం కలిగి ఉండును

(3) low wavelength

తక్కువ తరంగ ధైర్ఘ్యము కలిగి ఉండును

(4) All of the above

పైన ఉన్నవన్నీ

99. Identify the degenerated orbitals.

క్రింది వానిలో సమశక్తి గల అర్బిటాళ్ళను గుర్తించండి

(1) $2p_x$ $2p_y$ $2p_z$ (2) $2s$, $3s$, $4s$

(3) $3p_x$ $3p_y$ $3p_z$ (4) Both (1) and (3)

(1) మరియు (3) రెండూ

100. Elements having 5, 6, 7 valency electrons are

5, 6, 7 సంఖ్యలో వేలన్సీ ఎలక్ట్రానుల గల మూలకాలు

(1) P, S, Cl (2) P, Cl, Na

(3) P, Cl, S (4) P, S, Na

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101. Electronic configurations of Mg^{+2} ion and Cl^- ion are
Mg^{+2} అయాను మరియు Cl^- అయానుల ఎలక్ట్రాన్ విన్యాసములు
(1) 2, 8 and 2, 8, 8
2, 8 మరియు 2, 8, 8
(2) 2, 8, 2 and 2, 8, 8
2, 8, 2 మరియు 2, 8, 8
(3) 2, 8, 8 and 2, 8
2, 8, 8 మరియు 2, 8
(4) 2, 8, 2 and 2, 8, 7
2, 8, 2 మరియు 2, 8, 7

102. Coordination number of Na^+ in NaCl crystal is
NaCl స్ఫటికంలో Na^+ యొక్క సమన్వయ సంఖ్య
(1) 1
(2) 6
(3) 2
(4) 8

103. Bonds present in Nitrogen molecule are
నైట్రోజన్ అణువులోని బంధమలో _____ ఉన్నవి.
(1) 3σ
(2) 1σ and 2π
1σ మరియు 2π
(3) 3π
(4) 2π and 2σ
2π మరియు 2σ

104. $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$ configuration is related to
$1s^2, 2s^2, 2p^6, 3s^2, 3p^6$ ఎలక్ట్రాన్ విన్యాసము _____ కు చెందినది.
(1) P^{-3}
(2) Cl^-
(3) S^{-2}
(4) All of these
అన్నియు

105. The number of electrons gained by non-metal element is equal to its
ఒక అలోహ మూలకము పొందిన ఎలక్ట్రానుల సంఖ్య దాని _____ కి సమానము.
(1) valency
వేలన్సీ
(2) group number
గ్రూపు సంఖ్య
(3) bond length
బంధ ధైర్ఘ్యము
(4) All of these
అన్నియు

106. Corrosion of copper produces
రాగి క్షయము నొందినపుడు _____ ఏర్పడును.
(1) copper oxide
కాపర్ ఆక్సైడ్
(2) copper carbonate
కాపర్ కార్బోనేట్
(3) copper sulphate
కాపర్ సల్ఫేట్
(4) pure copper
స్వచ్ఛమైన రాగి

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107. 22-carat Gold contains

22 కేరట్స్ బంగారము _____ మరియు _____ ను కలిగి ఉండును.

(1) 22 parts of Gold + 2 parts of Nickel

22 భాగాల బంగారము + 2 భాగాలు నికెల్

(2) 22 parts of Gold + 2 parts of Copper

22 భాగాల బంగారము + 2 భాగాలు రాగి

(3) 22 parts of Gold + 22 parts of Silver

22 భాగాల బంగారము + 22 భాగాలు వెండి

(4) 22 parts of Gold + 2 parts of Chromium

22 భాగాల బంగారము + 2 భాగాలు క్రోమియం

108. Formula of Rust is

తుప్పు యొక్క ఫార్ములా

(1) $Fe_2O_3 \times H_2O$ (2) $Fe_2O_4 \times H_2O$

(3) $Fe(OH)_2$ (4) $Fe(OH)_3$

109. Chemical used to remove impurities from ore is called

ధాతువులోని మలినాలను తొలగించుకు వాడే పదార్థాన్ని _____ అంటారు.

(1) gangue
గాంగ్

(2) mineral
ఖనిజము

(3) flux
ద్రవకారి

(4) slag
లోహమలం

110. By moving top to bottom in group, valency will

గ్రూపులో పై నుండి క్రిందకు వచ్చే కొలది, వాలన్సి

(1) increase
పెరుగుతుంది

(2) decrease
తగ్గుతుంది

(3) No change
మారదు

(4) increase and decrease
పెరుగును మరియు తగ్గును

111. Atomic number of the element of VA group, coming after nitrogen is

VA కు చెందిన నైట్రోజన్ తర్వాత, ఆ గ్రూపులో వచ్చే మూలక పరమాణు సంఖ్య

(1) 7 (2) 15

(3) 14 (4) 17

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112. Identify the element that belongs to 2nd group and 3rd period.

రెండవ గ్రూపు మరియు 3 వ పిరియడ్ కు చెందిన మూలకం ఏది

(1) Na (2) Al

(3) Mg (4) Cl

113. Identify the ***correct*** statement.

సరి అయిన స్టేట్‌మెంట్ (ప్రతిపాదన) ను గుర్తించండి

(1) All *s* block elements are metals

s బ్లాకు మూలకాలన్నీ లోహాలు

(2) All *p* block elements are metals

p బ్లాకు మూలకాలన్నీ లోహాలు

(3) All *s* block elements are non-metals

s బ్లాకు మూలకాలన్నీ అలోహాలు

(4) All *p* block elements are non-metals

p బ్లాకు మూలకాలన్నీ అలోహాలు

114. VIA group elements are called

VIA గ్రూపు మూలకాలను _____ అంటారు.

(1) chalcogens
చాల్కోజన్స్

(2) oxygen family
ఆక్సిజన్ కుటుంబం

(3) halogens
హాలోజన్స్

(4) Both (1) and (2)
(1) మరియు (2) రెండూ

115. Identify the structure of propyne.

క్రింది వానిలో ప్రొపైన్ అణువు నిర్మాణం ఏది

(1) $HC \equiv CH$ (2) $H_3C - C \equiv CH$

(3) $H_2C = CH - CH_3$ (4) $H_2C = CH_2$

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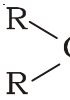
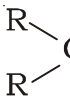
116.  functional group indicates

 ప్రమేయ సమూహం పేరు ఏమి

(1) aldehyde
ఆల్డిహైడ్

(2) ester
ఎస్టర్

(3) alcohol
ఆల్కహాల్

(4) ketone
కీటోన్

117. Ethyl alcohol upon oxidation produces
ఇథైల్ ఆల్కహాల్ ఆక్సీకరణం చెంది _____ను ఇచ్చును.

(1) ester
ఎస్టర్

(2) aldehyde
ఆల్డిహైడ్

(3) ether
ఈథర్

(4) alkane
ఆల్కేన్

118. Ethene and ethyne differ in
ఈథీన్ మరియు ఇథైన్ విబేధించే అంశాలు

(1) number of carbons
కార్బన్‌ల సంఖ్య

(2) number of bonds
బంధముల సంఖ్య

(3) number of hydrogens
హైడ్రోజన్‌ల సంఖ్య

(4) Both (2) and (3)
(2) మరియు (3) రెండూ

119. Which of the following are called paraffins?
క్రింది వానిలో వేటిని పారాఫిన్స్ అంటారు?

(1) Alkanes
ఆల్కేనులు

(2) Alkenes
ఆల్కినులు

(3) Alkynes
ఆల్కైనులు

(4) Alkyls
ఆల్కైలులు

120. Cough Syrup contains
దగ్గు టానిక్‌లలోని ముఖ్య అనుఘటకము

(1) ethanol
ఇథనోల్

(2) ethanoic acid
ఇథనోయిక్ ఆమ్లం

(3) ethanal
ఇథనాల్

(4) ethyl acetate
ఇథైల్ ఎసిటేట్

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