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DPM CLASSES

6th to 10th (Math's & Science), 11th & 12th (Physics, Chemistry, Math's)

BASIC NOTES (CBSE/NCERT)

EXPONENTS & POWERS

PART -1 OUT OF 1

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∴ Exponents and powers :-

Q. powers with Negative exponents :-

$$10^2 = 10 \times 10, 10^1 = 10, 10^0 = 1$$

$$10^{-1} = \frac{1}{10}, 10^{-2} = \frac{1}{10^2}, 10^{-3} = \frac{1}{10^3}$$

Similar manners -

$$3^{-1} = 1 \div 3 = \frac{1}{3}$$

$$3^{-2} = 1 \div 3^2 = \frac{1}{3^2} = \frac{1}{3 \times 3} = \frac{1}{9}$$



general formula -

$$a^{-m} = \frac{1}{a^m} \text{ where } m \text{ is a positive integer.}$$

a^{-m} is the multiplicative inverse of a^m

Q. Expanded form using exponents :- $[a^0 = 1]$

$$1425 = 1 \times 1000 + 4 \times 100 + 2 \times 10 + 5 \times 1$$

$$= 1 \times 10^3 + 4 \times 10^2 + 2 \times 10^1 + 5 \times 10^0$$

Similarly -

$$1425.36 = 1 \times 1000 + 4 \times 100 + 2 \times 10 + 5 \times 1 + 3 \times \frac{1}{10} + 6 \times \frac{1}{100}$$

$$= 1 \times 10^3 + 4 \times 10^2 + 2 \times 10^1 + 5 \times 10^0 + 3 \times 10^{-1} + 6 \times 10^{-2}$$



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∴ Exponents and powers :-

②. Laws of Exponents :-

$$1. a^m \times a^n = a^{m+n}$$

$$2. a^{-m} = \frac{1}{a^m}$$

$$3. a^m \div a^n = a^{m-n}$$

$$4. (a^m)^n = a^{m \times n}$$

$$5. a^m \times b^m = (a \times b)^m$$

$$6. \frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$$

$$7. a^0 = 1.$$

Exponents and powers are using with fraction, Addition, Subtraction, multiplication and division simplification. Also used in Polynomial, Algebra etc.

③. Standard form :-

$$1. 0.000035 = 3.5 \times 10^{-5}$$

(point going to right then negative power)

$$2. 4050000 = 4.05 \times 10^6$$

(point going to left then positive power)

④. Usual form :-

$$1. 3.52 \times 10^5 = 3.52 \times 100000 = 352000$$

(positive power move point toward right)

$$2. 7.54 \times 10^{-4} = \frac{7.54}{10000} = 0.000754$$

(Negative power move point toward left)

2.

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∴ Exponents and powers:-

Q. Express 256 as a power 2.

Sol.

$$256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

$$256 = 2^8$$

2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

Q. Which one is greater 2^3 or 3^2

$$2^3 = 2 \times 2 \times 2 = 8$$

$$3^2 = 3 \times 3 = 9$$

 $9 > 8$, so, 3^2 is greater than 2^3 Q. Which one is greater 8^2 or 2^8

Sol. do itself.

Q. Expand a^3b^2 , a^2b^3 , b^2a^3 , b^3a^2 , Are they all same?

$$\text{Sol. } a^3b^2 = a \times a \times a \times b \times b$$

$$a^2b^3 = a \times a \times b \times b \times b$$

$$b^2a^3 = b \times b \times a \times a \times a = a \times a \times a \times b \times b$$

$$b^3a^2 = b \times b \times b \times a \times a = a \times a \times b \times b \times b$$

~~all are~~ $a^3b^2 = b^2a^3$ are same.

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∴ Exponents and powers :-

Q. Express the following numbers as a product of powers of prime numbers or factors :

(i) 72 (ii) 432 (iii) 1000 (iv) 16000

Sol. 72

$$= 2 \times 36$$

$$= 2 \times 2 \times 18$$

$$= 2 \times 2 \times 2 \times 9$$

$$= 2 \times 2 \times 2 \times 3 \times 3$$

$$= 2^3 \times 3^2$$



2	72
2	36
2	18
3	9
3	3
	1

Thus $72 = 2^3 \times 3^2$ (required prime factor product form)
Other do it self.

Q. Work out $(1)^5$, $(-1)^3$, $(-1)^4$, $(-10)^3$, $(-5)^4$

Sol. $(1)^5 = 1 \times 1 \times 1 \times 1 \times 1 = 1$

$$(-1)^3 = -1 \times -1 \times -1 = -1$$

$$(-1)^4 = -1 \times -1 \times -1 \times -1 = 1$$

$$(-10)^3 = -10 \times -10 \times -10 = -1000$$

$$(-5)^4 = -5 \times -5 \times -5 \times -5 = 625$$

$$(-1)^{\text{odd power}} = -1$$

$$(-1)^{\text{even power}} = +1$$



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∴ Exponents and powers :-

Q. Find the value of :

(i) 2^6 (ii) 9^3 (iii) 11^2 (iv) 5^4

Sol. $11^2 = 11 \times 11 = 121$ [Other do itself.]

Q. Express the following in exponential form:

(i) $6 \times 6 \times 6 \times 6$ (iv) $5 \times 5 \times 7 \times 7 \times 7$

(ii) $t \times t$ (v) $2 \times 2 \times a \times a$

(iii) $b \times b \times b \times b$ (vi) $a \times a \times a \times c \times c \times c \times c \times d$

Sol. (iv) $5 \times 5 \times 7 \times 7 \times 7 = 5^2 \times 7^3$ [Other do itself.]

Q. Express each of the following numbers using exponential notation :-

(i) 512 (ii) 343 (iii) 729 (iv) 3125

Sol. (ii) 343

$343 = 7 \times 7 \times 7$

$343 = 7^3$ [Other do itself]

$$\begin{array}{r|l}
 7 & 343 \\
 \hline
 7 & 49 \\
 \hline
 7 & 7 \\
 \hline
 & 1
 \end{array}$$

Q. Identify the greater number, wherever possible, in each of the following ?

(i) 4^3 or 3^4 (ii) 5^3 or 3^5 (iii) 2^8 or 8^2

(iv) 100^2 or 2^{100} (v) 2^{10} or 10^2

Sol. do itself

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∴ Exponents and powers :-

Q. Express each of the following as product of powers of their prime factors:

(i) 648 (ii) 405 (iii) 540 (iv) 3600

Sol.

(i) 648

$$= 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3$$

$$= 2^3 \times 3^4$$

[do other itself]



2	648
2	324
2	162
3	81
3	27
3	9
3	3
	1

Q. Simplify :-

(i) 2×10^3 (ii) $7^2 \times 2^2$ (iii) $2^3 \times 5$ (iv) 3×4^4 (v) 0×10^2 (vi) $5^2 \times 3^3$ (vii) $2^4 \times 3^2$ (viii) $3^2 \times 10^4$

Sol.

$$(i) 2 \times 10^3 = 2 \times 10 \times 10 \times 10 = 2000$$

$$(v) 0 \times 10^2 = 0 \times 10 \times 10 = 0$$

$$(vi) 5^2 \times 3^3 = 5 \times 5 \times 3 \times 3 \times 3 = 25 \times 27 = 675$$

[other do itself]



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∴ Exponents and powers :-

Q. Simplify :-

(i) $(-4)^3$ (ii) $(-3) \times (-2)^3$ (iii) $(-3)^2 \times (-5)^2$

(iv) $(-2)^3 \times (-10)^3$

Sol. (iv) $(-2)^3 \times (-10)^3$

$$= -2 \times -2 \times -2 \times -10 \times -10 \times -10$$

$$= -8 \times -1000$$

$$= 8000 \quad [\text{do other itself}]$$



Q. Compare the following numbers :-

(i) 2.7×10^{12} ; 1.5×10^8 (ii) 4×10^{14} ; 3×10^{17}

Sol. 2.7×10^{12} ; 1.5×10^8

$$2.7 \times 10^{12} > 1.5 \times 10^8 \quad \text{Compare power of 10}$$

Q. Can you tell which one is greater $(5^2) \times 3$ or $(5^2)^3$

Sol. $5^2 \times 3 = 5 \times 5 \times 3 = 75$

$$(5^2)^3 = (5)^{2 \times 3} = (5)^6 = 5 \times 5 \times 5 \times 5 \times 5 \times 5 = 15,625$$

Therefore, $(5^2)^3 > (5^2) \times 3$



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∴ Exponents and powers :-

Q. multiplying powers with the same Exponents:

$$(i) 2^3 \times 3^3 \quad (ii) 4^4 \times 3^4 \quad (iii) 3^2 \times 9^2 \quad (iv) a^4 \times b^4$$

Sol. (ii) $4^4 \times 3^4 = (4 \times 3)^4 = (12)^4$ $[a^m \times b^m = (a \times b)^m]$

(iv) $a^4 \times b^4 = (a \times b)^4 = (ab)^4$ [do other itself]

Q. Express the following terms in the exponential form:

$$(i) (2 \times 3)^5 \quad (ii) (2a)^4 \quad (iii) (-4m)^3$$

Sol.

$$(ii) (2a)^4$$

$$= 2a \times 2a \times 2a \times 2a$$

$$= 2 \times 2 \times 2 \times 2 \times a \times a \times a \times a$$

$$= 16a^4$$

$$(iv) (-4m)^3$$

$$= -4m \times -4m \times -4m$$

$$= -4 \times -4 \times -4 \times m \times m \times m$$

$$= -64m^3$$

do other itself.

$$\left[\begin{array}{l} (-1)^{\text{even number}} = +1 \\ (-1)^{\text{odd number}} = -1 \end{array} \right]$$



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∴ Exponents and powers :-

Q. Dividing powers with the same exponents :-

(i) $2^4 \div 3^4$ (ii) $a^3 \div b^3$

Sol. (i) $2^4 \div 3^4$

$$= (2 \div 3)^4$$

$$= \left(\frac{2}{3}\right)^4$$

$$a^m \div b^m = \frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$$

Q. Expand : (i) $\left(\frac{3}{5}\right)^4$ (ii) $\left(-\frac{4}{7}\right)^5$

Sol. $\left(\frac{3}{5}\right)^4$

$$= \frac{3}{5} \times \frac{3}{5} \times \frac{3}{5} \times \frac{3}{5}$$

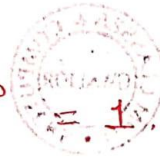
$$[a^0 = 1]$$

Q. Numbers with exponents zero

$$\frac{3^5}{3^5} = \frac{3 \times 3 \times 3 \times 3 \times 3}{3 \times 3 \times 3 \times 3 \times 3} = 1$$

~~Q.~~ (Alternate)

$$3^5 \div 3^5 = 3^{5-5} = 3^0 = 1$$



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∴ Exponents and powers :-

Q. Write exponential form for $8 \times 8 \times 8 \times 8$ taking base as 2.

Sol. $= 8 \times 8 \times 8 \times 8$

$= 8^4$

$[8 = 2 \times 2 \times 2 = 2^3]$

$= [2^3]^4$

$= (2)^{12}$

$[(a^m)^n = a^{mn}]$



Q. Simplify and write the answer in the exponential form.

(i) $\left(\frac{3^7}{3^2}\right) \times 3^5$ (ii) $2^3 \times 2^2 \times 5^5$ (iii) $(6^2 \times 6^4) \div 6^3$

(iv) $[(2^2)^3 \times 3^6] \times 5^6$ (v) $8^2 \div 2^3$

Sol. (i) $\left(\frac{3^7}{3^2}\right) \times 3^5$

$= [3^7 \div 3^2] \times 3^5$

$= [3^{7-2}] \times 3^5$

$= 3^5 \times 3^5$

$= 3^{5+5}$

$= 3^{10}$



(iv) $[(2^2)^3 \times 3^6] \times 5^6$

$= [2^6 \times 3^6] \times 5^6$

$= (2 \times 3)^6 \times 5^6$

$= 6^6 \times 5^6$

$= (6 \times 5)^6$

$= (30)^6$

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∴ Exponents and powers :-

Q. Simplify :-

(i)
$$\frac{12^4 \times 9^3 \times 4}{6^3 \times 8^2 \times 27}$$

(ii) $2^3 \times 2^3 \times 5a^4$

(iii) $\frac{2 \times 3^4 \times 2^5}{9 \times 4^2}$

Sol. (i)
$$\frac{12^4 \times 9^3 \times 4}{6^3 \times 8^2 \times 27}$$



$$= \frac{(2 \times 2 \times 3)^4 \times (3 \times 3)^3 \times 2 \times 2}{(2 \times 3)^3 \times (2 \times 2 \times 2)^2 \times 3 \times 3 \times 3}$$

$$= \frac{(2^2 \times 3)^4 \times (3^2)^3 \times 2^2}{(2 \times 3)^3 \times (2^3)^2 \times 3^3}$$

$$= \frac{(2^2)^4 \times 3^4 \times (3^2)^3 \times 2^2}{2^3 \times 3^3 \times (2^3)^2 \times 3^3}$$



$$= \frac{2^8 \times 3^4 \times 3^6 \times 2^2}{2^3 \times 3^3 \times 2^6 \times 3^3}$$

$$= \frac{2^8 \times 2^2 \times 3^4 \times 3^6}{2^3 \times 2^6 \times 3^3 \times 3^3}$$

$$= \frac{2^{10} \times 3^{10}}{2^9 \times 3^9} = 2^{10-9} \times 3^{10-9} = 2 \times 3 = 2 \times 81 = 162$$

[do other itself]

ii.

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-! Exponents and powers :-

Q. Using laws of exponents, simplify and write the answer in exponential form :-

(i) $3^2 \times 3^4 \times 3^8$ (ii) $6^{15} \div 6^{10}$ (iii) $a^3 \times a^2$
 (iv) $7^x \times 7^2$ (v) $(5^2)^3 \div 5^3$ (vi) $2^5 \times 2^5$
 (vii) $a^4 \times b^4$ (viii) $(3^4)^3$ (ix) $(2^{20} \div 2^{15}) \times 2^3$

Sol. (iv) $7^x \times 7^2$

$$[a^m \times a^n = a^{m+n}]$$

$$= 7^{x+2}$$

(viii) $(3^4)^3$

$$= 3^{4 \times 3}$$

$$= 3^{12}$$

$$[(a^m)^n = a^{mn}]$$

(ix) $(2^{20} \div 2^{15}) \times 2^3$

$$2^{20-15} \times 2^3$$

$$[a^m \div a^n = a^{m-n}]$$

$$2^5 \times 2^3$$

$$[a^m \times a^n = a^{m+n}]$$

$$2^{5+3}$$

$$2^8$$

[do other itself]

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- Exponents and powers :-

Q. Simplify and express each of the following in exponential form :-

(i) $\frac{2^3 \times 3^4 \times 4}{3 \times 32}$

(ii) $((5^2)^3 \times s^4) \div s^7$ (iii) $25^4 \div 5^3$

(iv) $\frac{3 \times 7^2 \times 11^8}{21 \times 11^3}$

(v) $\frac{3^7}{8^4 \times 3^3}$

(vi) $2^0 + 3^0 + 4^0$

(vii) $2^0 \times 3^0 \times 4^0$

(viii) $(3^0 + 2^0) \times 5^0$

(ix) $\frac{2^8 \times a^5}{4^3 \times a^3}$

(x) $\left(\frac{a^5}{a^3}\right) \times a^8$

(xi) $\frac{4^5 \times 9^6 \times b^3}{4^5 \times a^5 \times b^2}$

(xii) $(2^3 \times 2)^2$

Sol. (i) $\frac{2^3 \times 3^4 \times 4}{3 \times 32}$

$$= \frac{2^3 \times 3^4 \times 2^2}{3 \times 2^5}$$

$$= \frac{2^{3+2} \times 3^4}{2^5 \times 3}$$

$$= 2^5 \times 3^4 \times 2^{-5} \times 3^{-1}$$

$$= 2^{5+(-5)} \times 3^{4+(-1)}$$

$$= 2^0 \times 3^3$$

$$= 1 \times 3^3$$

$$= 3^3$$

(ii) $[(5^2)^3 \times s^4] \div s^7$

$$= [5^6 \times s^4] \div s^7$$

$$= 5^{6+4} \div s^7$$

$$= 5^{10} \div s^7$$

$$= 5^{10-7}$$

$$= 5^3$$

(vii) $2^0 \times 3^0 \times 4^0$

$$= 1 \times 1 \times 1$$

$$= 1$$

[do other itself]

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-! Exponents and powers :-

Q. Say true or false and justify your answers:-

(i) $10 \times 10^{11} = 100^{11}$ (ii) $2^3 > 5^2$ (iii) $2^3 \times 3^2 = 6^5$

(iv) $3^0 = (1000)^0$

Sol.

$$(i) \quad 10 \times 10^{11} \\ 10^{1+11} \\ 10^{12} \neq 100^{11} \quad \text{False}$$



$$(ii) \quad 2^3 > 5^2 \\ 2 \times 2 \times 2 > 5 \times 5 \\ 8 > 25 \quad \text{False}$$



$$(iii) \quad 2^3 \times 3^2 = 6^5 \\ 2 \times 2 \times 2 \times 3 \times 3 = 6 \times 6 \times 6 \times 6 \times 6 \\ 72 \neq 36 \times 36 \times 6 \quad \text{False}$$

$$(iv) \quad 3^0 = (1000)^0 \\ 1 = 1 \quad \text{True}$$

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∴ Exponents and powers :-

Q. Express each of the following as a product of prime factors only in Exponential form:

(i) 108×192 (ii) 270 (iii) 729×64 (iv) 768Sol. (i) 108×192

$$= (2 \times 2 \times 3 \times 3 \times 3) \times (2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3)$$

$$= (2^2 \times 3^3) \times (2^6 \times 3^1)$$

$$= 2^{2+6} \times 3^{3+1}$$

$$= 2^8 \times 3^4$$

$$(a^m \times a^n = a^{m+n})$$

2	108
2	54
3	27
3	9
3	3
	1

2	192
2	96
2	48
2	24
2	12
2	6
3	3
	1

do other itself.



Q. Simplify :-

$$(i) \frac{(2^5)^2 \times 7^3}{8^3 \times 7}$$

$$(ii) \frac{25 \times 5^2 \times 4^8}{10^3 \times 4^4}$$

$$(iii) \frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5}$$

$$(i) = \frac{(2^{5 \times 2}) \times 7^3}{(2^3)^3 \times 7}$$

$$= \frac{2^{10} \times 7^3}{2^9 \times 7}$$

$$= 2^{10-9} \times 7^{3-1} [a^m \div a^n = a^{m-n}]$$

$$= 2 \times 7^2 = 2 \times 7 \times 7 = 98$$

[do other itself]



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∴ Exponents and powers :-

Q. Expressing large numbers in the standard form :-

$$\begin{aligned} \text{Mass of the earth} &= 5,976,000,000,000,000,000,000,000 \\ &= 5.976 \times 10^{24} \text{ kg} \end{aligned}$$

$$\begin{aligned} \text{Mass of Uranus} &= 86,800,000,000,000,000,000,000,000 \\ &= 8.68 \times 10^{25} \text{ kg} \end{aligned}$$

Q. Express the following numbers in the standard form:

(i) 5985.3 (ii) 65,950

(iii) 3,430,000 (iv) 70,040,000,000



$$\text{Sol. (i) } 5985.3 = 59853 \times 1000 = 5.9853 \times 10^3$$

$$(ii) 3,430,000 = 3.43 \times 1000000 = 3.43 \times 10^6$$

[other do itself]

Q. Write the following numbers in the expanded form:

279404, 3006194, 2806196, 120719, 20068

$$\text{Sol. (i) } 279404 = 2 \times 10^5 + 7 \times 10^4 + 9 \times 10^3 + 4 \times 10^2 + 4 \times 10^1$$

$$(ii) 20068 = 2 \times 10^4 + 0 \times 10^3 + 0 \times 10^2 + 6 \times 10^1 + 8 \times 10^0$$

[do other itself]



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-! Exponents and powers! -

Q. Find the number from each of the following expanded form:

(i) $8 \times 10^4 + 6 \times 10^3 + 0 \times 10^2 + 4 \times 10^1 + 5 \times 10^0$

Sol. 86045

(ii) $4 \times 10^5 + 5 \times 10^3 + 3 \times 10^2 + 2 \times 10^0$

Sol. $4 \times 10^5 + 0 \times 10^4 + 5 \times 10^3 + 3 \times 10^2 + 0 \times 10^1 + 2 \times 10^0$

405302

Q. Express the following numbers in standard form:

(i) 5,00,00,000 (ii) 70,00,000 (iii) 3,18,65,00,000

(iv) 3,90,878 (v) 39087.8 (vi) 3908.78

Sol. (i) 5,00,00,000

$= 5.0 \times 10^7$

(v) 39087.8

$= 3.90878 \times 10^4$ [do other itself]

Q. Express the number appearing in the following statement in standard form:

(i) The distance b/w Earth and moon is 384,000,000 m

Sol. 3.84×10^8 m

(ii) Diameter of earth is 1,27,56,000 m

Sol. 1.2756×10^7 m [do other from books itself]

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∴ Exponents and powers :-

Q. Find the value of :-

(i) 2^{-3}

(ii) $\frac{1}{3^{-2}}$

Ans. (i) $2^{-3} = \frac{1}{2^3} \quad [a^{-m} = \frac{1}{a^m}]$

$$= \frac{1}{2 \times 2 \times 2}$$

$$= \frac{1}{8}$$

(ii) $\frac{1}{3^{-2}} = 1 \times 3^2 \quad [\frac{1}{a^{-m}} = a^m]$
 $= 3 \times 3$
 $= 9$



Q. Simplify :-

(i) $(-4)^5 \times (-4)^{-10}$

(ii) $2^5 \div 2^{-6}$

Ans. (i) $(-4)^5 \times (-4)^{-10}$

$$= (-4)^{5+(-10)} \quad [a^m \times a^n = a^{m+n}]$$

$$= (-4)^{5-10}$$

$$= (-4)^{-5} \quad [a^{-m} = \frac{1}{a^m}]$$

$$= \frac{1}{(-4)^5}$$



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∴ Exponents and powers :-

Q. Express 4^{-3} as a power with the base 2.

Sol. 4^{-3}

$$= (2^2)^{-3}$$

$$= (2)^{2 \times -3} \quad [(a^m)^n = a^{mn}]$$

$$= (2)^{-6}$$

$$\begin{array}{r} 2 \overline{) 4} \\ 2 \\ \hline 1 \end{array}$$



Q. Simplify and write the answer in the form exponential form :-

(i) $(2^5 \div 2^8)^5 \times 2^{-5}$ (ii) $(-4)^{-3} \times (5)^{-3} \times (-5)^{-3}$

(iii) $\frac{1}{8} \times (3)^{-3}$ (iv) $(-3)^4 \times (\frac{5}{3})^4$

Sol. (i) $(2^5 \div 2^8)^5 \times 2^{-5}$

$$= (2^{5-8})^5 \times 2^{-5} \quad [a^m \div a^n = a^{m-n}]$$

$$= (2^{-3})^5 \times 2^{-5}$$

$$= (2)^{-3 \times 5} \times 2^{-5} \quad [(a^m)^n = a^{mn}]$$

$$= 2^{-15} \times 2^{-5}$$

$$= 2^{-15+(-5)} \quad [a^m \times a^n = a^{m+n}]$$

$$= 2^{-15-5}$$

$$= 2^{-20} = \frac{1}{2^{20}} \quad [a^{-m} = \frac{1}{a^m}] \quad \text{[do the itself]}$$



DPM CLASSES

6th to 10th (Math's & Science), 11th & 12th (Physics, Chemistry, Math's)

∴ Exponents and powers :-

Q. Find m so that $(-3)^{m+1} \times (-3)^5 = (-3)^7$

Sol. $(-3)^{m+1} \times (-3)^5 = (-3)^7$

$$(-3)^{m+1+5} = (-3)^7$$

$$(-3)^{m+6} = -3^7$$

Comparing powers

$$m+6 = 7$$

$$m = 7 - 6$$

$$m = 1$$



Q. Find the value of $\left(\frac{2}{3}\right)^{-2}$

Sol. $\left(\frac{2}{3}\right)^{-2} = \left(\frac{3}{2}\right)^2$ $\left[\left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m\right]$

$$= \frac{3 \times 3}{2 \times 2}$$

$$= \frac{9}{4}$$



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∴ Exponents and powers :-

Q. Simplify :-

(i) $\left\{ \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{2}\right)^{-3} \right\} \div \left(\frac{1}{4}\right)^{-2}$

(ii) $\left(\frac{5}{8}\right)^{-7} \times \left(\frac{8}{5}\right)^{-5}$



Sol. (i) $\left\{ \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{2}\right)^{-3} \right\} \div \left(\frac{1}{4}\right)^{-2}$

$$= \left\{ (3)^2 + (2)^3 \right\} \div (4)^2 \quad \left[a^{-m} = \frac{1}{a^m} \right]$$

$$= [9 + 8] \div 16$$

$$= 15 \div 16$$

$$= \frac{15}{16}$$



(ii) $\left(\frac{5}{8}\right)^{-7} \times \left(\frac{8}{5}\right)^{-5}$

$$\left(\frac{5}{8}\right)^{-7} \times \left(\frac{5}{8}\right)^5 \quad \left[\left(\frac{a}{b}\right)^m = \left(\frac{b}{a}\right)^m \right]$$

$$\left(\frac{5}{8}\right)^{-7+5}$$

$$\left(\frac{5}{8}\right)^{-2} = \left(\frac{8}{5}\right)^2 = \frac{8 \times 8}{5 \times 5} = \frac{64}{25}$$

DPM CLASSES

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∴ Exponents and powers :-

Q. Evaluate:

$$(i) 3^{-2} \quad (ii) (-4)^{-2} \quad (iii) \left(\frac{1}{2}\right)^{-5}$$

$$\text{Sol. } (iii) \left(\frac{1}{2}\right)^{-5} = \left(\frac{2}{1}\right)^5 \left[\left(\frac{a}{b}\right)^{-m} = \left(\frac{b}{a}\right)^m \right]$$

$$= 2^5$$

$$= 2 \times 2 \times 2 \times 2 \times 2$$

$$= 32 \quad [\text{do other itself}]$$



Q. Simplify and express the result in power notation with positive exponent.

$$(i) (-4)^5 \div (-4)^8 \quad (ii) \left(\frac{1}{2^3}\right)^2 \quad (iii) (-3)^4 \times \left(\frac{5}{3}\right)^4$$

$$(iv) (3^{-7} \div 3^{-10}) \times 3^{-5} \quad (v) 2^{-3} \times (-7)^{-3}$$

$$\text{Sol. } (ii) \left(\frac{1}{2^3}\right)^2 = \left(\frac{1}{8}\right)^2$$



$$(v) 2^{-3} \times (-7)^{-3}$$

$$(2 \times -7)^{-3}$$

$$[a^m \times b^m = (a \times b)^m]$$

$$(-4)^{-3}$$

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

$$[a^{-m} = \frac{1}{a^m}]$$

[do other itself]

DPM CLASSES

6th to 10th (Math's & Science), 11th & 12th (Physics, Chemistry, Math's)

∴ Exponents and powers :-

Q. Find the value of

(i) $(3^0 + 4^{-1}) \times 2^2$ (ii) $(2^{-1} \times 4^{-1}) \div 2^{-2}$

(iii) $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2}$ (iv) $(3^{-1} + 4^{-1} + 5^{-1})^0$

(v) $\left\{\left(-\frac{2}{3}\right)^{-2}\right\}^2$

Sol. (i) $(3^0 + 4^{-1}) \times 2^2$

$$= \left(\frac{1}{1} + \frac{1}{4}\right) \times 2^2$$

$$= \left(\frac{4+1}{4}\right) \times 2^2$$

$$= \frac{5}{4} \times 4$$

$$= 5$$

$$\left[\begin{array}{l} a^0 = 1 \\ a^{-m} = \frac{1}{a^m} \end{array} \right]$$

[other do it self]

(iv) $(3^{-1} + 4^{-1} + 5^{-1})^0$

$$= 1$$

$$[a^0 = 1]$$

(v) $\left[\left(-\frac{2}{3}\right)^{-2}\right]^2$

$$\left(-\frac{2}{3}\right)^{-2 \times 2}$$

$$[(a^m)^n = a^{mn}]$$

$$\left(-\frac{2}{3}\right)^{-4} = \left(\frac{3}{-2}\right)^4 = \frac{3 \times 3 \times 3 \times 3}{-2 \times -2 \times -2 \times -2} = \frac{81}{16}$$

Q3.

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~! Exponents and powers! ~

Q. Evaluate:

(i) $\frac{8^{-1} \times 5^3}{2^{-4}}$

(ii) $(5^{-1} \times 2^{-1}) \times 6^{-1}$

$$\begin{aligned}
 \text{Sol. (i)} \quad & \frac{8^{-1} \times 5^3}{2^{-4}} \\
 &= \frac{(2^3)^{-1} \times 5^3}{2^{-4}} \\
 &= 2^{-3} \times 5^3 \times 2^4 \\
 &= 2^{-3+4} \times 5^3 \\
 &= 2^1 \times 5^3 \\
 &= 2 \times 5 \times 5 \times 5 \\
 &= 250
 \end{aligned}$$

$$\begin{array}{r}
 2 \overline{) 8} \\
 \underline{2} \\
 4 \\
 \underline{1} \\
 2 \\
 \underline{1} \\
 1
 \end{array}$$



$$[(a^m)^n = a^{mn}]$$

$$[a^{-m} = \frac{1}{a^m}]$$

$$[a^m \times a^n = a^{m+n}]$$

(ii) $(5^{-1} \times 2^{-1}) \times 6^{-1}$

$$= \left(\frac{1}{5} \times \frac{1}{2}\right) \times \frac{1}{6}$$

$$= \frac{1}{10} \times \frac{1}{6}$$

$$= \frac{1}{60}$$



$$[a^{-m} = \frac{1}{a^m}]$$

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-! Exponents and powers :-

Q. Find the value of m for which $5^m \div 5^{-3} = 5^5$

Sol. $5^m \div 5^{-3} = 5^5$ $[a^m \div a^n = a^{m-n}]$

$$5^{m-(-3)} = 5^5$$

$$5^{m+3} = 5^5 \quad [\text{power comparing}]$$

$$m+3 = 5$$

$$m = 5-3$$

$$m = 2$$

Q. Evaluate: (i) $\left\{\left(\frac{1}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right\}^{-1}$ (ii) $\left(\frac{5}{8}\right)^{-7} \times \left(\frac{8}{5}\right)^{-4}$

Sol. (i) $\left\{\left(\frac{1}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right\}^{-1}$ $\left[\frac{1}{a^m} = a^{-m}\right]$

$$= \{3^1 - 4^1\}^{-1}$$

$$= (3-4)^{-1}$$

$$= (-1)^{-1}$$

$$= -1$$

[other do itself]

$$[(-1)^{-1} = -1]$$



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∴ Exponents and powers :-

Q. Simplify :-

(i)
$$\frac{25 \times t^{-4}}{5^{-3} \times 10 \times t^{-8}}$$

(ii)
$$\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}}$$

Sol. (ii)
$$\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}}$$

$$= \frac{3^{-5} \times (2 \times 5)^{-5} \times 5^3}{5^{-7} \times (2 \times 3)^{-5}}$$

$$= \frac{3^{-5} \times 2^{-5} \times 5^{-5} \times 5^3}{5^{-7} \times 2^{-5} \times 3^{-5}}$$

$$= 3^{-5} \times 2^{-5} \times 5^{-5} \times 5^3 \times 5^{+7} \times 2^5 \times 3^5 \left[\frac{1}{a^m} = a^{-m} \right]$$

$$= 3^{-5+5} \times 2^{-5+5} \times 5^{-5+3+7} [a^m \times b^n = a^{m+n}]$$

$$= 3^0 \times 2^0 \times 5^{+10+3} [a^0 = 1]$$

$$= 1 \times 1 \times 5^{13}$$

$$= 5^{13}$$

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6th to 10th (Math's & Science), 11th & 12th (Physics, Chemistry, Math's)

∴ Exponents and power :-

Q. Express the following numbers in Standard form :-

(i) 0.00000000000085 (ii) 0.000000000000942

(iii) 6020000000000000 (iv) 0.000000000837

(v) 31860000000

Sol. (i) 0.00000000000085

$$= 8.5 \times 10^{-12}$$



(ii) 31860000000

$$= 3.186 \times 10^{10} \text{ [do other itself]}$$

Q. Express the following numbers in usual form :

(i) 3.02×10^{-6} (ii) 4.5×10^4

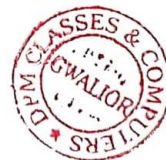
(iii) 3×10^{-8} (iv) 1.0001×10^9

(v) 5.8×10^{12} (vi) 3.61492×10^6

Sol. (i) $3.02 \times 10^{-6} = \frac{3.02}{10^6}$

$$= \frac{3.02}{1000000}$$

$$= 0.00000302$$



do other itself

27.

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-! Exponents and powers :-

Q. Express the number appearing in the following statements in standard form:-

(i) 1 micron is equal to $\frac{1}{1000000}$ m

(ii) charge of an electron is 0.000,000,000,000,000,000,16 C

(iii) Size of a bacteria is 0.0000005 m

(iv) Size of a plant cell is 0.00001275 m

(v) Thickness of a thick paper is 0.07 mm

Sol. (iii) Size of a bacteria is 0.0000005 m

Sol. 5.0×10^{-7} m

(v) Thickness of a thick paper is 0.07 mm

Sol. 7.0×10^{-2} mm

[do other itself]

Q. In a stack there are 5 books each of thickness 20 mm and 5 paper sheet each of thickness 0.016 mm. What is the total thickness of the stack.

Sol. Thickness of 5 books = $5 \times 20 = 100$ mm

thickness of 5 paper sheet = $5 \times 0.016 = 0.080$ mm

Total thickness of the stack = $(100 + 0.080)$ mm

$= 100.080$ mm

$= 1.0008 \times 10^2$ mm