**ROOTS ACADEMY**
Dedicated to Excellence

**JEE|NEET|NTSE|OLYMPIAD|BOARD EXAM**

## Class: XII

## SESSION : 2023-2024

## SUBJECT: PHYSICS

**Maximum Marks: 50 Marks.**                    **Time Allowed: 1 hours 45 min.**

**General Instructions:**

(1) There are 26 questions in all. All questions are compulsory

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.

(3) Section A contains fifteen MCQ of 1 mark each, Section B contains five questions of two marks each, Section C contains two questions of three marks each, section D contains three long questions of five marks each and Section E contains one case study based questions of 4 marks each.

(5) Use of any electronic gadgets are strictly prohibited

### Section-A

Q1) The electric potential on the axis of an electric dipole at a distance

'r from it's centre is V. Then the potential at a point at the same

distance on its equatorial line will be

(i) 2V

(ii) -V

(iii) V/2

(iv) Zero

Q2) The temperature (T) dependence of resistivity of materials A and material B is represented by fig (i)

and fig (ii) respectively.

Identify material A and material B.

fig. (i)    fig. (ii)
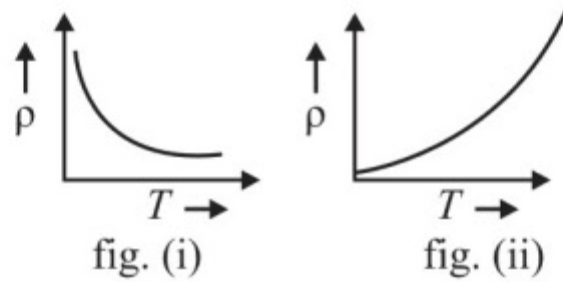
(i) material A is copper and material B is germanium

(ii) material A is germanium and material B is copper

(iii) material A is nichrome and material B is germanium

(iv) material A is copper and material B is nichrome

Q3) If an electric dipole is kept in a uniform electric field then resultant electric force on it is :
(a) always zero
(b) never zero
(c) depend upon capacity of dipole
(d) None

Q4) The number of electrons contained in one coulomb of charge is:
(a) $6.25 \times 10^{18}$
(b) $6.25 \times 10^{17}$
(c) $6.25 \times 10^{19}$
(d) $1.6 \times 10^{19}$

Q5)In a region of constant potential
(a) the electric field is uniform.
(b) the electric field is zero.
(c) there can be no charge inside the region.
(d) both (b) and (c) are correct.

Q6) An electric dipole of moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$ . Then
(i) the torque on the dipole is $\vec{p} \times \vec{E}$
(ii) the potential energy of the system is $\vec{p} . \vec{E}$
(iii) the resultant force on the dipole is zero. Choose the correct option.
(a) (i), (ii) and (iii) are correct
(b) (i) and (iii) are correct and (ii) is wrong
(c) only (i) is correct
(d) (i) and (ii) are correct and (iii) is wrong

Q7)Dielectric constant for a metal is

(a) zero

(b) infinite

(c) 1

(d) 10

Q8) In a parallel plate capacitor, the capacity increases if
(a) area of the plate is decreased.
(b) distance between the plates increases.
(c) area of the plate is increased.
(d) dielectric constantly decreases.

Q9) In a Wheatstone bridge if the battery and galvanometer are interchanged then the deflection in galvanometer will
(a) change in previous direction
(b) not change
(c) change in opposite direction
(d) none of these.

Q10) If n cells each of emf e and internal resistance r are connected in parallel, then the total emf and internal resistance will be

(a) $\varepsilon, \dfrac{r}{n}$

(b) $\varepsilon, nr$

(d) $n\varepsilon, \dfrac{r}{n}$

(d) $n\varepsilon, nr$

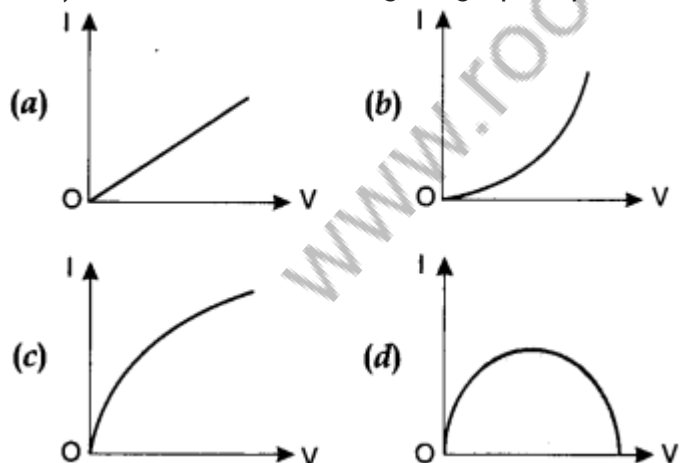Q11) The resistivity of alloy manganin is
(a) Nearly independent of temperature
(b) Increases rapidly with increase in temperature
(c) Decreases with increase in temperature
(d) Increases rapidly with decrease in temperature

Q12) Which of the following I-V graph represents ohmic conductors?



Q13) Which of the following statements is not true about Gauss's law?
(a) Gauss's law is true for any closed surface.
(b) The term q on the right side side of Gauss's law includes the sum of all charges enclosed by the surface.
(c) Gauss's law is not much useful in calculating electrostatic field when the system has some symmetry.

(d) Gauss's law is based on the inverse square dependence on distance contained in the coulomb's law

**Assertion Reason type**

Two statements are given-one labelled Assertion (A) and the other

labelled Reason (R). Select the correct answer to these questions

from the codes (a), (b), (c) and (d) as given below.

a) Both A and R are true and R is the correct explanation of A

b) Both A and R are true and R is NOT the correct explanation of A

c) A is true but R is false

d) A is false and R is also false

Q14) Assertion : Voltmeter is connected in parallel with the circuit.

Reason : Resistance of a voltmeter is very large.

Q15) Assertion : The total charge stored in a capacitor is zero.

Reason : The field just outside the capacitor is $\sigma/\varepsilon_0$ . ($\sigma$ is the charge density).

**Section-B**

Q16) Two large, thin metal plates are parallel and close to each other. On

their inner faces, the plates have surface charge densities of opposite

signs and of magnitude $17.7 \times 10^{-22}$ C/m2

 What is electric field intensity E.

(a) in the outer region of the first plate, and

(b) between the plates?

Q17) When a glass rod is rubbed with a silk cloth, charges appear on both. A similar phenomenon is observed with many other pairs of bodies. Explain how this observation is consistent with the law of conservation of charge.

Q18) (a) An electrostatic field line is a continuous curve. That is, a field line cannot have sudden breaks. Why not?

(b) Explain why two field lines never cross each other at any point?

Q19) .A set of n-identical resistors, each of resistance R ohm when connected in series have an effective resistance of X ohm and when the resistors are connected in parallel the effective resistance is Y ohm. Find the relation between R, X and Y ?

Q20) Two electric bulbs A and B are marked 220V, 40 w and 220V, 60 W respectively. Which one has a higher resistance?

**Section-C**

Q21) A 10 v battery of negligible internal resistance is connected across a 200 V battery and a resistance of 38Ω as shown in the figure. Find the value of the current in circuit.



10 V

38 Ω        200 V
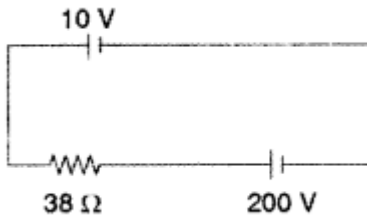
Q22)Derive an expression for electric field at axial position of dipole

**Section-D**

Q23) (a)Draw equipotential surfaces for (i)an electric dipole and (ii) two

identical positive charges placed near each other.

(b) In a parallel plate capacitor with air between the plates, each

plate has an area of 6 x 10-3m2

 and the separation between the

plates is 3 mm.

(i) Calculate the capacitance of the capacitor.

(ii) If the capacitor is connected to 100V supply, what would be the

the charge on each plate?

(iii) How would charge on the plate be affected if a 3 mm thick mica

sheet of k=6 is inserted between the plates while the voltage supply

remains connected ?.

Q24) (a) State the two Kirchhoff's rules used in the analysis of

electric circuits and explain them.

(b) Derive the equation of the balanced state in a Wheatstone

bridge using Kirchhoff's laws.

Q25) (a) Explain Gauss law.

(b)(i) Obtain the expression for the electric field intensity due to a

uniformly charged infinite rod at a distance r from

(ii) Draw a graph showing the variation of electric field intensity E

with r.

**Section-E**

Q26) **Case study-**

Resistance is a measure of the opposition to current flow in an electrical circuit. Resistance is measured in ohms. Also Resistivity, the electrical resistance of a conductor of unit cross-sectional

area, and unit length. ... A characteristic property of each material, resistivity is useful in comparing various materials on the basis of their ability to conduct electric currents.


comparing resistance in electrical models
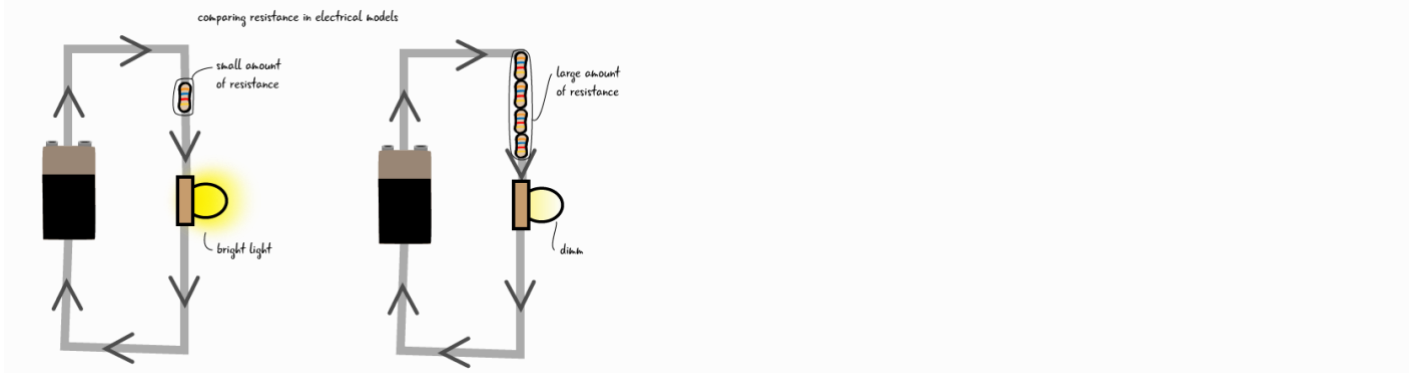
1. Resistivity is independent of:
    1. nature of material
    2. temperature
    3. dimensions of material
    4. none of the above
2. As compare to short wires, long wires have _____ resistance.
    1. more
    2. less
    3. same
    4. zero
3. As compare to thin wires, thick wires have _____ resistance.
    1. more
    2. less
    3. same
    4. zero
4. The resistance of a wire depends upon:
    1. cross-sectional area
    2. length of wire
    3. wire's nature
    4. all of the above