



Devesh Jindal's

The Weavers Institute

TARGET: Class 12th CBSE Boards 2024-25

Physics (Electrostatics)

BATCH: 12th

DURATION: 1 HR 30 min

MAX. MARKS: 35

Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose

INSTRUCTIONS

Section A – From question 1 to 6 are MCQs and 7-8 are assertion and reason based of 1 mark each.

Section B – Question no. 9-10 are Very Short Answer Type Questions, carrying 2 marks each.

Answer to each question should not exceed 40 words.

Section C contains Q.11 to Q.13 are Short Answer Type Questions, carrying 3 marks each.

Answer to each question should not exceed 60 words

Section D – Questions no 14 are case based questions with three sub questions and are of 4 marks each.

Section-E - Question no. 15-16 are long answer type questions, carrying 5 marks each.

Answer to each question should not exceed 120 words

There is no overall choice in the question paper. However, an internal choice has been provided in few questions. Only one of the choices in such questions have to be attempted.

You may use the following values of physical constants where ever necessary

- i. $c = 3 \times 10^8 \text{ m/s}$
- ii. $m_e = 9.1 \times 10^{-31} \text{ kg}$
- iii. $e = 1.6 \times 10^{-19} \text{ C}$
- iv. $\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$
- v. $h = 6.63 \times 10^{-34} \text{ Js}$
- vi. $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2\text{N}^{-1}\text{m}^{-2}$
- vii. Avogadro's number = 6.023×10^{23} per gram mole

Section A

1. The electric power consumed by a 220 V -100 W bulb when operated at 110 V is
(A) 25 W (B) 30 W (C) 35 W (D) 45 W
2. A car battery is charged by a 12 V supply, and energy stored in it is $7.20 \times 10^5 \text{ J}$. The charge passed through the battery is
(A) $6.0 \times 10^4 \text{ C}$ (B) $5.8 \times 10^3 \text{ J}$ (C) $8.64 \times 10^6 \text{ J}$ (D) $1.6 \times 10^5 \text{ C}$
3. A potential difference of 200 V is maintained across a conductor of resistance 100Ω . The number of electrons passing through it in 1s is
(A) 1.25×10^{19} (B) 2.5×10^{18} (C) 1.25×10^{18} (D) 2.5×10^{16}

4. Two sources of equal emf are connected in series. This combination is connected to an external resistance R . The internal resistance of two source are r_1 and r_2 ($r_2 > r_1$). If the potential difference across the source of the internal resistance r_2 is zero, then R equals to
- (A) $\frac{r_1+r_2}{r_2-r_1}$ (B) $r_2 - r_1$ (C) $\frac{r_1 r_2}{r_2-r_1}$ (D) $\frac{r_1+r_2}{r_1 r_2}$
5. Which of the following characteristics of electrons determines the current in a conductor?
- (A) Drift velocity alone (B) Thermal velocity alone
(B) Both drift velocity and thermal velocity (D) Neither drift nor thermal velocity
6. Kirchhoff's current rule is based on the law of conservation of
- (A) charge (B) energy (C) mass (D) (B) and (C)

Assertion Reason

- Both A and R are true and R is the correct explanation of A.
- Both A and R are true but R is not the correct explanation of A.
- A is true but R is false.
- A is false but R is true.
- Both A and R are false

7. Assertion (A): in balanced condition, if the galvanometer and the voltage source is interchanged, the balanced condition remains same in a Wheatstone bridge.

Reason (R) : The balanced condition of Wheatstone bridge does not depend on the value of the resistance.

8. Assertion (A) : The resistance of superconductor is zero.

Reason (R): Super conductors are used for electrical power transmission.

Section B

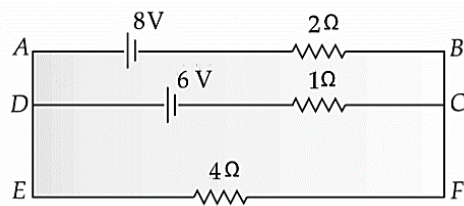
9. A wire of length L_0 has a resistance R_0 . it is gradually stretched till its length becomes $2 L_0$.
- Plot a graph showing variation of its resistance R with its length L during stretching.
 - What will be its resistance when its length becomes $2 L_0$.

10. Use Kirchhoff's rules to obtain conditions for the balance condition in a Wheatstone bridge.

Section C

11. (a) Difference between electrical resistance and resistivity of a conductor.
(b) Two metallic rods, each of length L , area of cross-section A_1 and A_2 , having resistivity ρ_1 and ρ_2 are connected in parallel across a dc battery. Obtain the expression for the effective resistivity of this combination.
12. (a) Define internal resistance of a cell.
(b) A cell of emf E and internal resistance r is connected across a variable resistor R . Plot the shape of graphs showing variation of terminal voltage V with (i) R and (ii) circuit current I .

13. Calculate the potential difference across the 4Ω resistor in the given electrical circuit, using Kirchhoff's rules.



OR

- (a) Define the term 'conductivity' of a metallic wire. Write its SI unit
 (b) Using the concept of free electrons in a conductor, derive expression for the conductivity of a wire in terms of current density and relaxation time. Hence obtain the relation between current density and the applied electric field E .

Section D

14. Read the following text and answer any four of the following questions on the basis of the same:
 Electric Toaster: Small industries Services institute Takyelpat Industrial Estate Imphal has designed an Electric toaster which is operated at 220 volts A.C. single phase and available in four different rated capacity such as 600 W, 750 W, 1000 W and 1250 W. The heating element is made of nichrome 80/20 (80% nickel, 20% chromium), since Nichrome does not get oxidised readily at high temperature and have higher resistivity, so it produces more heat. The element is wound separately on Mica sheets and fitted with body of toaster with the help of ceramic terminals.

Q1. Heating element of the toaster is made of

- (B) Copper (B) Nichrome (C) Chromium (D) nickel

Q2. What is meant by 80/20 Nichrome?

- (A) 80% Chromium and 20% Nickel (B) 80% Nickel and 20% Chromium
 (C) Purity 80%, Impurity 20% (D) it is a mixture of Chromium and Nickel

Q3. Which one will consume more electricity?

- (A) 600 W (B) 750 W (C) 1000 W (D) 1200 W

Q4. Operating voltage of the device is

- (A) 220 V AC, single phase (B) 220 V, AC three phase
 (C) 220 V DC (D) 220 V AC/DC

Q5: Insulating material used in the device are

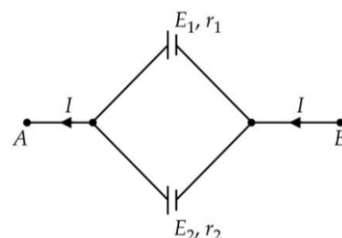
- (A) Mica (B) Ceramic (C) Mica, ceramic, Nichrome (D) Mica, ceramic

Section E

15. (i) Derive an expression for drift velocity of electrons in a conductor. Hence deduce Ohm's law.
(ii) A wire whose cross-sectional area is increasing linearly from its one end to the other, is connected across a battery of V volts. Which of the following quantities remain constant in the wire?
(a) drift speed (b) current density (c) electric current (d) electric field

Justify your answer.

16. (a) Two cells of emfs E_1 and E_2 and internal resistance r_1 and r_2 respectively are connected in parallel as shown in the figure. Deduce the expression for the
(i) equivalent emf of the combination
(ii) equivalent internal resistance of the combination
(iii) potential difference between the points A and B



- (b) if two batteries of 10 V each with internal resistance 1Ω are connected in parallel. Calculate equivalent E.M.F.

