

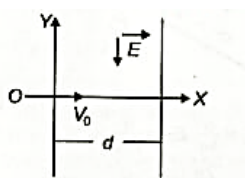
# JEE MOCK TEST

CH 1, 2, 3

FM – 100

TIME – 1 HR

1. A charged particle (mass  $m$  and charge  $q$ ) moves along X-axis with velocity  $v_0$ . When it passes through the origin, it enters a region having uniform electric field  $\vec{E} = E\hat{j}$ , which extends up to  $x = d$ . Equation of path of electron in the region  $x > d$  is:



Options:  $y = \frac{qEd}{mv_0^2}(x - d)$     $y = \frac{qEd}{mv_0^2}x$     $y = \frac{qEd}{mv_0^2}\left(\frac{d}{2} - x\right)$     $y = \frac{qEd}{mv_0^2}x$

2. A particle of charge  $q$  and mass  $m$  is subjected to an electric field

$$E = E_0(1 - ax^2)$$

in the X-direction, where  $a$  and  $E_0$  are constants. Initially, the particle was at rest at  $x = 0$ .

The kinetic energy of the particle becomes zero when the distance of the particle from the origin is:

Options:  $\sqrt{\frac{3}{a}}$     $\sqrt{\frac{2}{a}}$     $\sqrt{\frac{1}{a}}$     $a$

3. Two identical charged particles each having a mass  $10 \text{ g}$  and charge  $2.0 \times 10^{-7} \text{ C}$  are placed on a horizontal table with a separation  $L$  between them such that they stay in limited equilibrium.

If the coefficient of friction between each particle and the table is  $0.25$ , find the value of  $L$ .

Use  $g = 10 \text{ m s}^{-2}$ .

Options:  $12 \text{ cm}$     $10 \text{ cm}$     $8 \text{ cm}$     $5 \text{ cm}$

4. For a uniformly charged ring of radius  $R$ , the electric field on its axis has the largest magnitude at a distance  $h$  from its centre.

The value of  $h$  is:

Options:  $\frac{R}{\sqrt{2}}$     $\frac{R}{\sqrt{5}}$     $R$     $R\sqrt{2}$

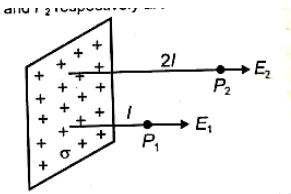
5. A vertical soil electric field of magnitude  $E = 100 \text{ N/C}$  exists. A particle of mass  $0.1 \text{ g}$  is falling freely.

The value of charge on the particle is:

(Given  $g = 9.8 \text{ m/s}^2$ )

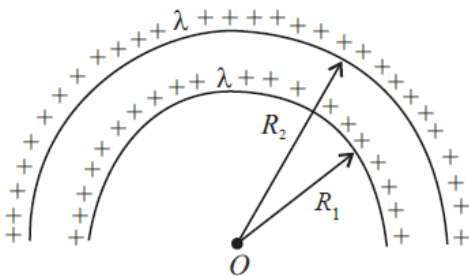
Options:  $1.6 \times 10^{-9} \text{ C}$        $1.8 \times 10^{-9} \text{ C}$        $3.2 \times 10^{-9} \text{ C}$        $0.5 \times 10^{-9} \text{ C}$

6. An infinite large plane sheet of positive charge is shown.  $P_1$  and  $P_2$  are two points near it. If  $\sigma$  is the surface charge density, then the electric fields  $E_1$  and  $E_2$  at  $P_1$  and  $P_2$ , respectively are:



Options:  $E_1 = \frac{\sigma}{2\epsilon_0}, E_2 = \frac{\sigma}{2\epsilon_0}$        $E_1 = \frac{\sigma}{\epsilon_0}, E_2 = \frac{\sigma}{\epsilon_0}$        $E_1 = \frac{\sigma}{2\epsilon_0}, E_2 = \frac{\sigma}{\epsilon_0}$   
 $E_1 = \frac{\sigma}{\epsilon_0}, E_2 = \frac{\sigma}{2\epsilon_0}$

7. The electric potential at the centre of two concentric half rings of radii  $R_1$  and  $R_2$ , having same linear charge density  $\lambda$ , is:



- (a)  $\frac{2\lambda}{\epsilon_0}$   
 (b)  $\frac{\lambda}{\epsilon}$   
 (c)  $\frac{\lambda}{4\epsilon_0}$   
 (d)  $\frac{\lambda}{\epsilon_0}$

8. Electric potential at a point 'P' due to a point charge of  $5 \times 10^{-9} \text{ C}$  is 50 V. The distance of 'P' from the point charge is: (Assume,  $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$ )

- (a) 3 cm  
 (b) 9 cm

(c) 90 cm

(d) 0.9 cm

9. If the potential energy between two molecules is given by

$$U = -\frac{A}{r^6} + \frac{B}{r^{12}},$$

then at equilibrium, separation between molecules, and the potential energy

(a)  $\left(\frac{2B}{A}\right)^{\frac{1}{6}}, -\frac{A^2}{2B}$

(b)  $\left(\frac{B}{2A}\right)^{\frac{1}{6}}, \frac{A^2}{2B}$

(c)  $\left(\frac{2B}{A}\right)^{\frac{1}{6}}, -\frac{A^2}{4B}$

(d)  $\left(\frac{B}{A}\right)^{\frac{1}{6}}, 0$

10. A current of 3 A flows through a copper wire of cross-sectional area  $3 \times 10^{-6} \text{ m}^2$ . If the number density of free electrons is  $8 \times 10^{28} \text{ m}^{-3}$ , then the drift velocity of electrons is nearly:

(a)  $0.26 \times 10^{-4} \text{ m/s}$

(b)  $0.78 \times 10^{-4} \text{ m/s}$

(c)  $7.8 \times 10^{-4} \text{ m/s}$

(d)  $2.6 \times 10^{-4} \text{ m/s}$

11. Two resistors of  $100 \Omega$  each are connected in series with a 9 V battery. A voltmeter of resistance  $400 \Omega$  is connected across one resistor. The voltmeter reading is:

(a) 3.0 V

(b) 3.6 V

(c)  $4.0\text{ V}$

(d)  $4.5\text{ V}$

12. The maximum rated power of an LED is  $2\text{ mW}$ . It is used with an input voltage of  $5\text{ V}$ . The current through a resistance  $R$  is  $0.5\text{ mA}$ . The minimum series resistance required so that the LED is not damaged is:

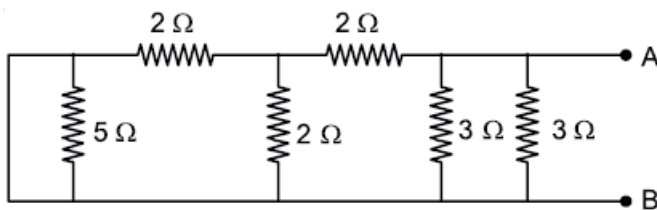
(a)  $1\text{ k}\Omega$

(b)  $2\text{ k}\Omega$

(c)  $5\text{ k}\Omega$

(d)  $10\text{ k}\Omega$

13. The equivalent resistance of the given circuit between the terminals A and B is:



Options:

(1)  $3\ \Omega$

(2)  $1\ \Omega$

(3)  $\frac{9}{2}\ \Omega$

(4)  $0\ \Omega$

14. Resistance of the wire is measured as  $2\ \Omega$  and  $3\ \Omega$  at  $10^\circ\text{C}$  and  $30^\circ\text{C}$  respectively. Temperature co-efficient of resistance of the material of the wire is:

Options:

(1)  $0.033^\circ\text{C}^{-1}$

(2)  $-0.033^\circ\text{C}^{-1}$

(3)  $0.011^\circ\text{C}^{-1}$

(4)  $0.055^{\circ}\text{C}^{-1}$

15. The resistance of a conductor at  $15^{\circ}\text{C}$  is  $16\ \Omega$  and at  $100^{\circ}\text{C}$  is  $20\ \Omega$ . What will be the temperature coefficient of resistance of the conductor?

Options:

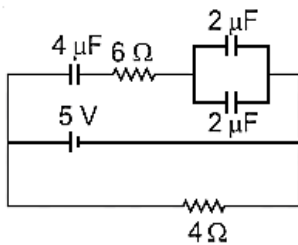
(1)  $0.010^{\circ}\text{C}^{-1}$

(2)  $0.003^{\circ}\text{C}^{-1}$

(3)  $0.033^{\circ}\text{C}^{-1}$

(4)  $0.042^{\circ}\text{C}^{-1}$

16. Calculate the amount of charge on capacitor of  $4\ \mu\text{F}$ . The internal resistance of battery is  $1\ \Omega$ :



Options:

(1) Zero

(2)  $8\ \mu\text{C}$

(3)  $4\ \mu\text{C}$

(4)  $16\ \mu\text{C}$

17. Five identical cells each of internal resistance  $1\ \Omega$  and emf  $5\ \text{V}$  are connected in series and in parallel with an external resistance 'R'. For what value of 'R', current in series and parallel combination will remain the same?

Options:

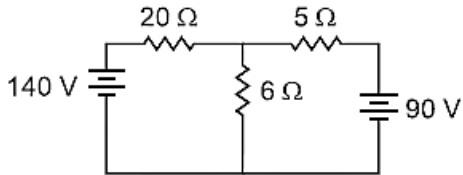
(1)  $10\ \Omega$

(2)  $5\ \Omega$

(3)  $1\ \Omega$

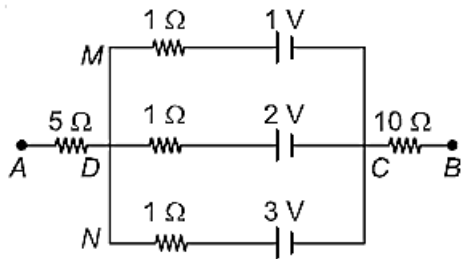
(4)  $25\ \Omega$

18. The value of current in the 6 ohm resistance is



- (1) 8
- (2) 10
- (3) 6
- (4) 4

19. In the circuit shown, the potential difference between A and B is



- (1) 6 V
- (2) 3 V
- (3) 2 V
- (4) 1V

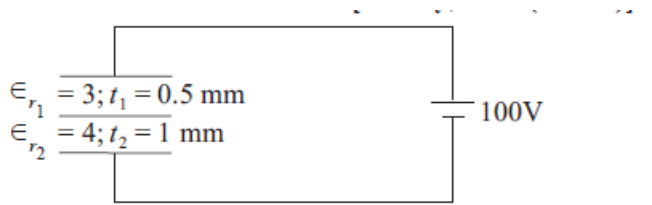
20. A composite parallel plate capacitor is made up of two different dielectric materials with different thickness ( $t_1$  and  $t_2$ ) as shown in figure. The two different dielectric materials are separated by a conducting foil  $F$ . The voltage of the conducting foil is \_\_\_\_\_ V.

Given:

$$\epsilon_{r1} = 3, t_1 = 0.5 \text{ mm}$$

$$\epsilon_{r2} = 4, t_2 = 1 \text{ mm}$$

Applied voltage = 100 V



21. The electric field in a region is given by

$$\vec{E} = \frac{2}{5}E_0\hat{i} + \frac{3}{5}E_0\hat{j}, \text{ with } E_0 = 4.0 \times 10^3 \text{ N C}^{-1}$$

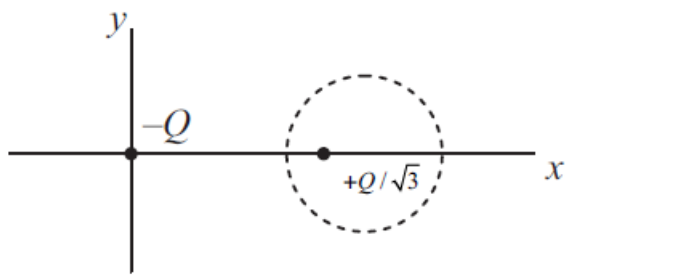
The flux of this field through a rectangular surface of area  $0.4 \text{ m}^2$  parallel to the  $yz$ -plane is \_\_\_\_\_  $\text{N m}^2\text{C}^{-1}$ .

22. A point charge  $q_1 = 4q_0$  is placed at the origin. Another point charge  $q_2 = -9q_0$  is placed on the  $x$ -axis at  $x = 12 \text{ cm}$ .

23. A proton (charge  $q_0$ ) is placed on the  $x$ -axis such that the electrostatic force on it is zero.

The position of the proton from the origin is \_\_\_\_\_  $\text{cm}$ .

24. Two point charges  $-Q$  and  $+\frac{Q}{\sqrt{3}}$  are placed in the  $xy$ -plane at the origin  $(0,0)$  and a point  $(2,0)$  respectively, as shown in the figure. This results in an equipotential circle of radius  $R$  and potential  $V = 0$  in the  $xy$ -plane with its center at  $(b,0)$ . All lengths are measured in meters.



(a) The value of  $R$  is \_\_\_\_\_ meter.

25. A parallel plate capacitor with plate area  $A$  and plate separation  $d$  is filled with a dielectric material of dielectric constant  $K = 4$ . The thickness of the dielectric material is  $x$ , where  $x < d$ .

Let  $C_1$  and  $C_2$  be the capacitance of the system for  $x = \frac{1}{3}d$  and  $x = \frac{2d}{3}$ , respectively. If  $C_1 = 2 \mu\text{F}$ , the value of  $C_2$  is \_\_\_\_\_  $\mu\text{F}$ .

