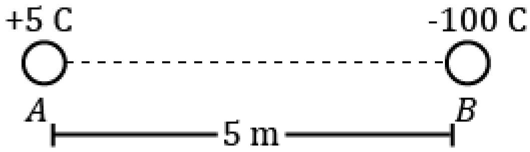
JEE Main Part Test 3

Subject: Physics Class: Standard XII

1. Find the distance of the point from A where the net electric field will be zero for the given configuration.



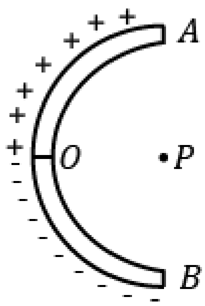
A. $0.4\ \mathrm{m}$ towards left

B. $1.4\ \mathrm{m}$ towards left

C. $2.4\ \mathrm{m}$ towards left

D. $3.4\ \mathrm{m}$ towards left

2. A thin Non-conducting rod is bent into a semicircle of radius r. A charge $+Q$ is uniformly distributed along the upper half and a charge $-Q$ is uniformly distributed along the lower half, as shown in figure. Find the electric field E at P.



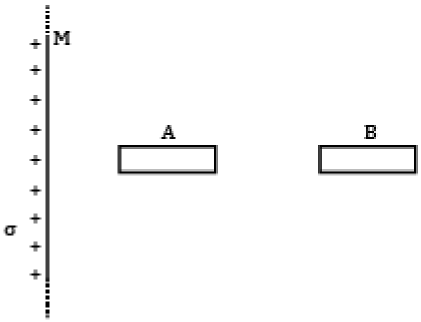
A. $\dfrac{Q}{\pi^2\epsilon_0 r^2}$

B. $\dfrac{2Q}{\pi^2\epsilon_0 r^2}$

C. $\dfrac{4Q}{\pi^2\epsilon_0 r^2}$

D. $\dfrac{Q}{4\pi^2\epsilon_0 r^2}$

3. A large non-conducting sheet M is given a uniform charge density. Two uncharged small metal rods A and B are placed near the sheet as shown in figure. Which of the following options is incorrect?



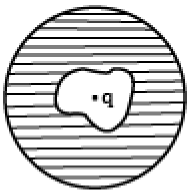
A. M attracts A

B. M attracts B

C. A attracts B

D. B repels A

4. A charge $+q$ is kept inside the cavity present in a solid conducting sphere, as shown in figure.



If the sphere is given a charge Q, then total charge appearing on outer surface of sphere will be:

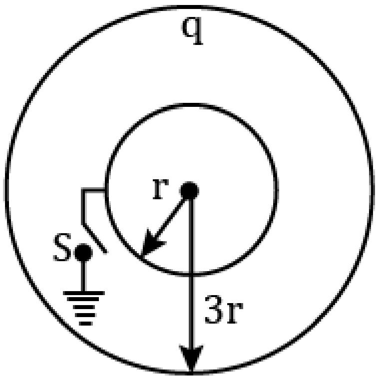
A. $Q-q$

B. Q

C. $-(q+Q)$

D. $Q+q$

5. Figure shows two conducting thin concentric shells of radii r and $3r$. The outer shell carries q while inner shell is neutral and is connected to earth by a switch S. Find the charge that will flow from earth to inner shell after the switch S is closed.



A. $-\frac{q}{3}$

B. $-\frac{q}{2}$

C. $\frac{q}{3}$

D. $\frac{2q}{3}$

6. What is the capacitance of a parallel plate capacitor having $40\ \mathrm{cm} \times 40\ \mathrm{cm}$ square plates separated by the distance $10\ \mathrm{cm}$?
(Take $\epsilon_o = 8.85 \times 10^{-12}\ \mathrm{F/m}$)

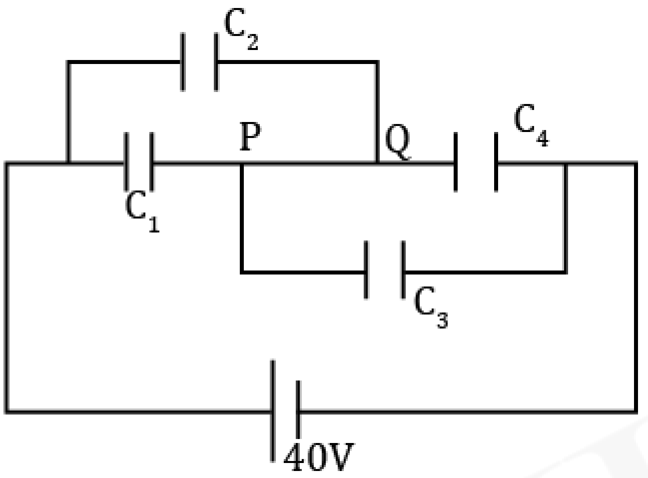
A. $2.8 \times 10^{-12}\ \mathrm{F}$

B. $1.4 \times 10^{-11}\ \mathrm{F}$

C. $2.8 \times 10^{-11}\ \mathrm{F}$

D. $1.4 \times 10^{-12}\ \mathrm{F}$

7. The figure shows a circuit where $C_1 = C_2 = C_3 = C_4 = 4\ \mu\mathrm{F}$. What is the extra charge flown through the battery when a $12\ \mu\mathrm{F}$ capacitor is introduced between P and Q?



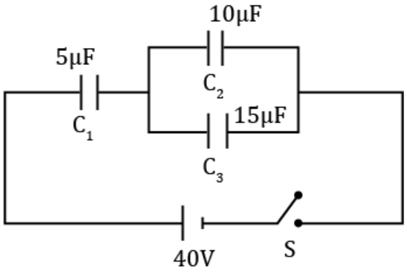
A. 0

B. $100\ \mu\mathrm{C}$

C. $200\ \mu\mathrm{C}$

D. $80\ \mu\mathrm{C}$

8. If at $t=0$ switch S is closed, then at steady state find charge (in$\mu\mathrm{C}$) across each capacitor as shown in figure.



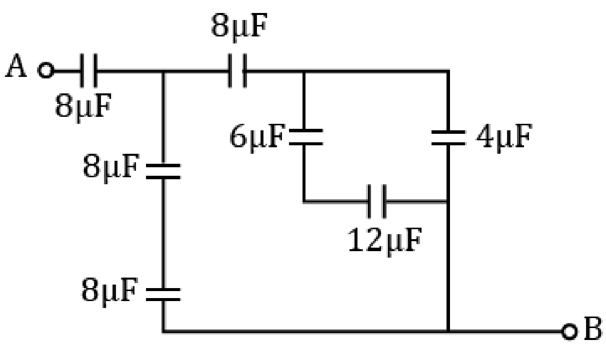
A. $\frac{400}{3}, \frac{200}{3}, 150$

B. $\frac{100}{3}, \frac{200}{3}, 50$

C. $\frac{500}{3}, \frac{400}{3}, 200$

D. $\frac{500}{3}, \frac{200}{3}, 100$

9. The equivalent capacitance across AB is



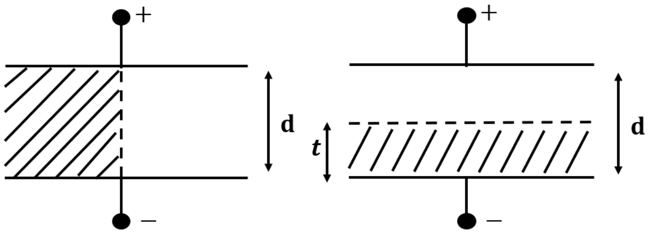
A. $8\ \mu\mathrm{F}$

B. $12\ \mu\mathrm{F}$

C. $4\ \mu\mathrm{F}$

D. $24\ \mu\mathrm{F}$

10. A capacitor is half filled with a dielectric of dielectric constant $K = 2$ as shown in figure -A. If the same capacitor has to be filled with same dielectric as shown in figure B, What would be the thickness of dielectric such that capacitor still has the same value of capacitance.



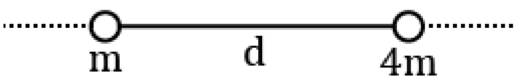
A. $\frac{2d}{3}$

B. $\frac{3d}{2}$

C. $\frac{3d}{4}$

D. $\frac{4d}{3}$

11. Two point masses m and $4m$ are separated by a distance d on a straight line as shown in figure. A third point mass m_o is to be placed at a point on the line such that the net gravitational force on it is zero.



The distance of the m_0 from the m is

A. $\frac{d}{2}$

B. $\frac{d}{4}$

C. $\frac{d}{3}$

D. $\frac{d}{5}$

12. If V is the gravitational potential on the surface of the earth, then what will be its value at the centre of the earth?

A. $2V$

B. $3V$

C. $\frac{3V}{2}$

D. $\frac{2V}{3}$

13. If a tunnel is cut at any orientation through earth, then find the time taken by a ball released from one end to reach the other end. (neglect earth rotation and take radius of earth as $R = 64 \times 10^5 \text{ m}$ and $g = 10 \text{ m/sec}^2$)

A. 84.6 minutes

B. 41.9 minutes

C. 8 minutes

D. depend on orientation

14. A space station is set up in space at a distance equal to earth's radius from the surface of earth. Suppose a satellite can be launched from the space station also. Let v_1 and v_2 be the escape velocities of the satellite on the earth's surface and space station respectively, then

A. $v_2 = v_1$

B. $v_2 < v_1$

C. $v_2 > v_1$

D. $1,\ 2$ and 3 are valid depending on the mass of satellite.

15. In a wire of cross-section radius r, free electrons travel with drift velocity v when a current I flows through the wire. What is the current in another wire of half the radius and of the same material when the drift velocity is $2v$?

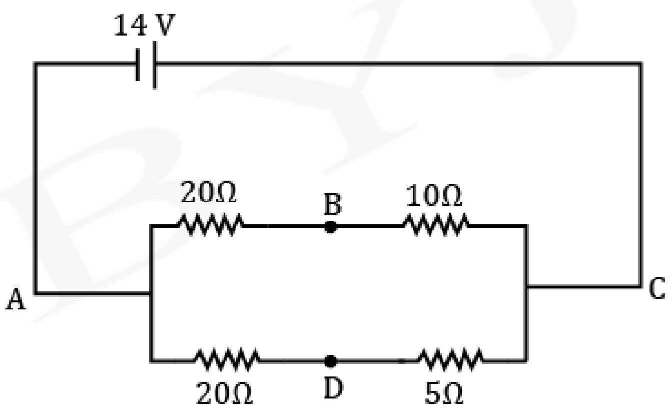
A. $2I$

B. I

C. $I/2$

D. $I/4$

16. What resistor should be connected in parallel with the $20\ \Omega$ resistor in branch ADC in the circuit shown in figure, so that potential difference between B and D may be zero ?



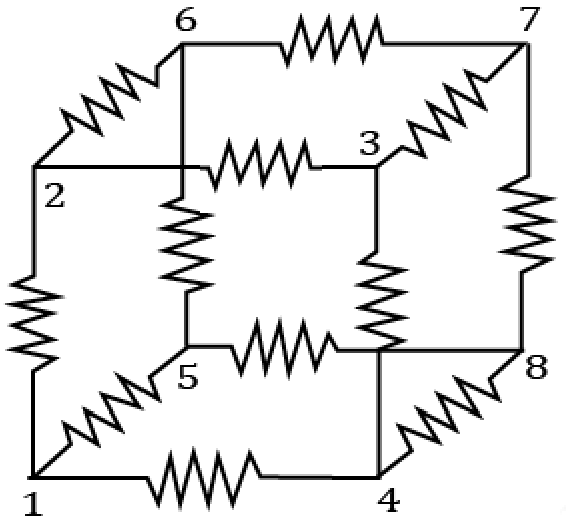
A. $20\ \Omega$

B. $10\ \Omega$

C. $5\ \Omega$

D. $15\ \Omega$

17. Twelve resistors each of resistance r are connected together so that each lies along the edge of the cube as shown in the figure. The equivalent resistance between points 1 and 4 is



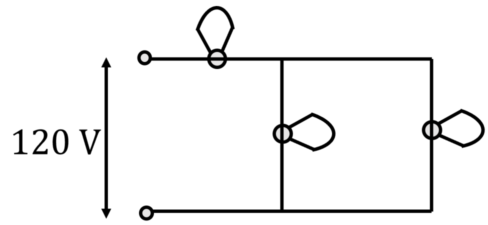
A. $\frac{5r}{12}$

B. $\frac{7r}{12}$

C. $\frac{11r}{12}$

D. $\frac{13r}{12}$

18. Three light bulbs $(60\ \mathrm{W}, 120\ \mathrm{V})$ are connected across a $120\ \mathrm{V}$ power source. If the resistance of each bulb does not change with current, then find out total power delivered to the three bulbs.



A. $80\ \mathrm{W}$

B. $60\ \mathrm{W}$

C. $40\ \mathrm{W}$

D. $20\ \mathrm{W}$

19. If an ammeter is to be converted into a voltmeter, then we must connect with the ammeter a

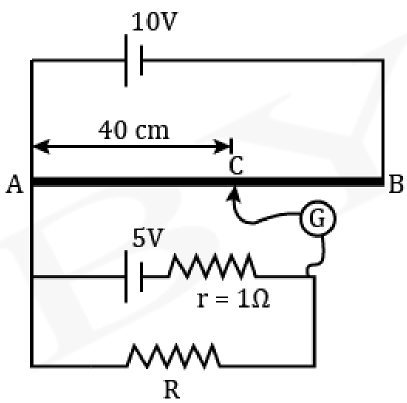
A. Low resistance in parallel

B. High resistance in parallel

C. High resistance in series

D. Low resistance in series

20. A potentiometer wire AB is $100\ \text{cm}$ long and has a total resistance of $10\ \Omega$. if the galvanometer shows zero deflection at the position C, then find the value of unknown resistance R.



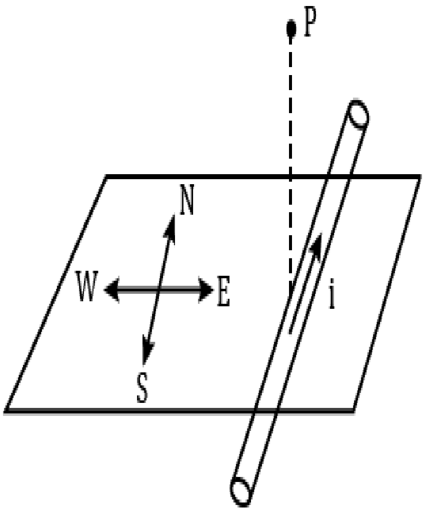
A. $4\ \Omega$

B. $6\ \Omega$

C. $5\ \Omega$

D. $2.5\ \Omega$

21. Current flows due north in a horizontal transmission line as shown in the figure. Magnetic field at a point P vertically above it is directed



A. northwards

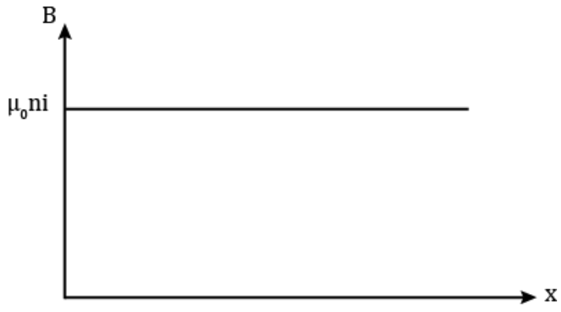
B. southwards

C. towards east

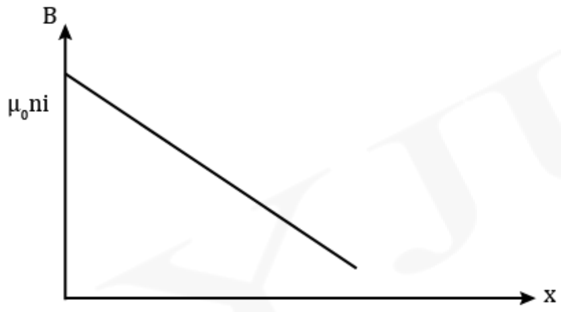
D. towards west

22. Which of the following graphs correctly represent the variation of magnetic field (B) inside a finite length solenoid with respect to distance x from its center. The current in solenoid having n turns per unit length is i.

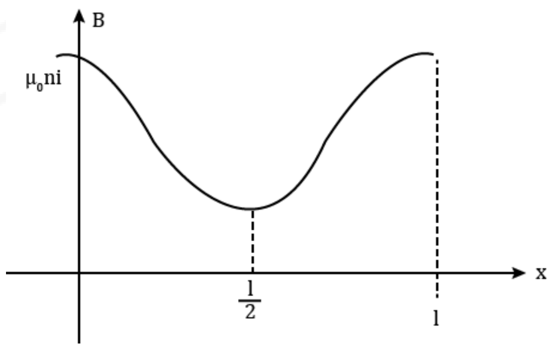
A.



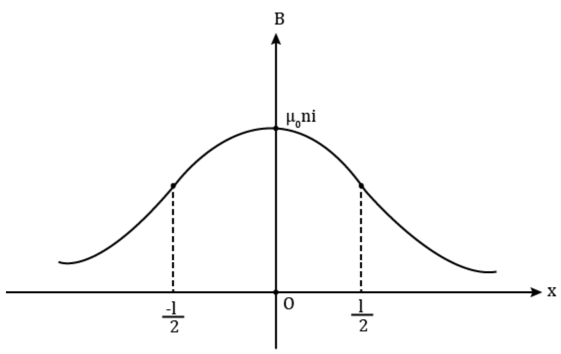
B.



C.



D.



23. A toroid has a core of inner radius $20\ \mathrm{cm}$ and outer radius $22\ \mathrm{cm}$ around which 4200 turns of a wire are wound. If the current in the wire is $10\ \mathrm{A}$, what is the magnetic field inside the core ?

A. $3 \times 10^{-2}\ \mathrm{T}$

B. $1 \times 10^{-2}\ \mathrm{T}$

C. $4 \times 10^{-2}\ \mathrm{T}$

D. $2 \times 10^{-2}\ \mathrm{T}$

24. An electron is travelling along the x-direction. It encounters a magnetic field in the y-direction. Its subsequant motion will be

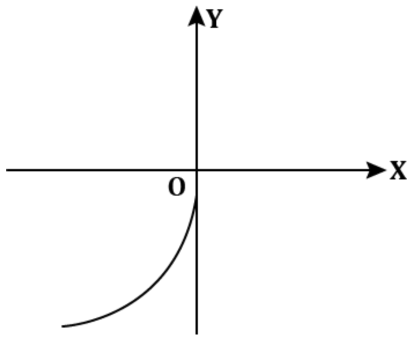
A. Straight line along the x-direction

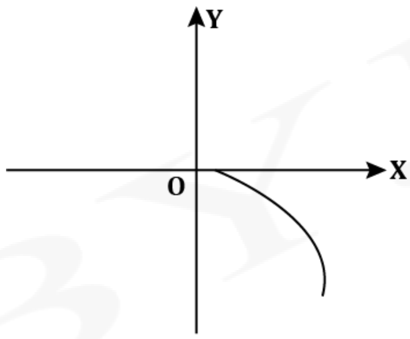
B. A circle in the x-z plane

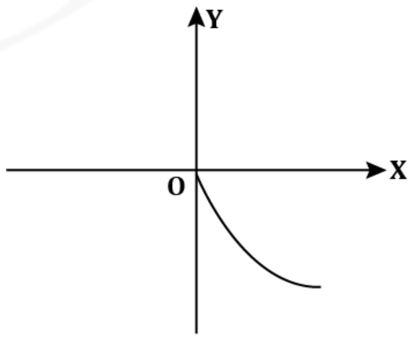
C. A circle in the y-z plane

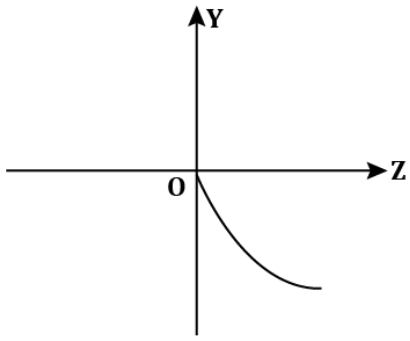
D. A circle in the x-y plane

25. In a region , uniform electric field is present as $\overrightarrow{E} = E_0\hat{j}$ and a uniform magnetic field is present as $\overrightarrow{B} = -B_0\hat{k}$. An electron is released from rest at origin. Which of the following best represents the path followed by electron after release.

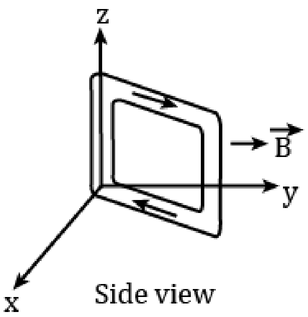
A.


B.


C.


D.


26. The square loop in the figure has sides of length $20\ \mathrm{cm}$. It has 5 turns and carries a current of $2\ \mathrm{A}$. The normal to the loop is at 37° to a uniform field, $B=0.5\hat{j}\ \mathrm{T}$. Find the work needed to rotate the loop from its position of minimum energy to the given orientation.



A. $-0.04\ \mathrm{J}$

B. $+0.04\ \mathrm{J}$

C. $-0.02\ \mathrm{J}$

D. $+0.02\ \mathrm{J}$

27. Two long current carrying wires. separated by a distance d carry currents I_1 and I_2 in the same direction They exert a force F on each other. Now the current in one of them is increased to two times and its direction is reversed. The distance is also Increased to $3d$ The new value of the force between them is

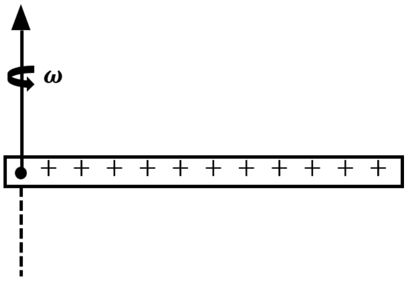
A. $\frac{-F}{3}$

B. $\frac{F}{3}$

C. $\frac{2F}{3}$

D. $\frac{-2F}{3}$

28. A non conducting rod of length $l = 20 \text{ cm}$ carries a charge $q = 3 \text{ C}$ uniformly distributed on it. The rod is pivoted at one of its ends as shown in the figure and is rotated at an angular frequency $\omega = 10 \text{ rad/s}$ about a fixed axis perpendicular to rod and passing through pivot. The magnetic moment of the rod system is:



A. 500 A cm^2

B. 1000 A cm^2

C. 2000 A cm^2

D. Zero

29. A moving coil galvanometer has following characteristics,
Number of turns = 80, Area of coil =50 mm^2, Resistance of coil = $20 \ \Omega$, magnetic field = 0.2 T, torsional constant of the suspension wire = $5 \times 10^{-9} \text{ N-m/rad}$.
Which of the following statements are correct.

A. The angular deflection produced due to a potential difference of 0.01 mV is 0.08 div

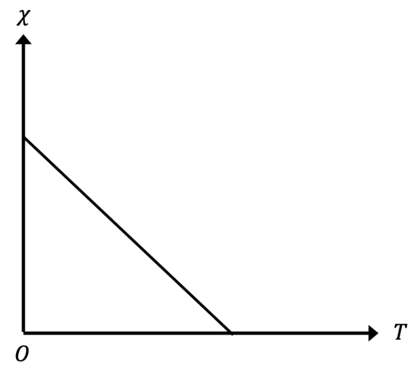
B. Current sensitivity of the device is 160 div/mA

C. Voltage sensitivity of the device is 8 div/mV

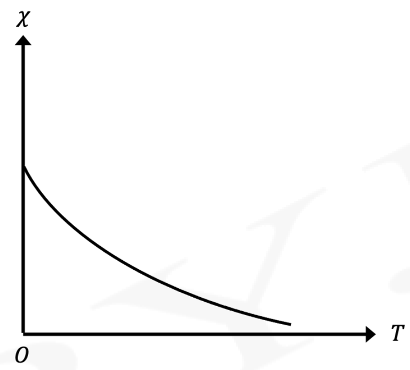
D. All of the above.

30. The variation of magnetic susceptibility χ with absolute temperature T, for a ferromagnetic material, is best shown by which of the following graphs?

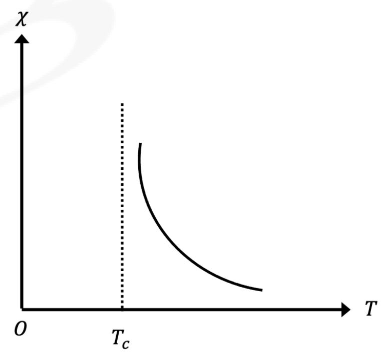
A.



B.



C.



D.