doubtnut
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PHYSICS

BOOKS - AAKASH SERIES

APPENDICES (REVISION EXERCISE)

REVISION EXERCISE (ELECRIC CHARGES AND FIFLDS)

1. $-10\mu C, 40\mu C$ and q are the charges on three identical conductors P,Q and R respectively, Now P and Q attract each other with a force F when they are separated by a distance d. Now P and Q are made in contact with each other and then separated . Again Q and R are touched and they are separated by a distance 'd' . The repulsive force between Q and R is 4F . Then the charge q is:

A. $10\mu C$

B. $30\mu C$

C. $40\mu C$

D. $65\mu C$

Answer: D

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2. Three identical charges of magnitude $2\mu C$are placed at the corners of right angled triangle ABC whose base BC and height BA respectively 4 cm and 3 cm. Forces on charge at right angled corner B due to charges at 'A' and 'C' are respectively F1 and F2. The angle between their resultant force and F2 is

A. $\sin^{-1}\left(\frac{3}{4}\right)$

B. $\tan^{-1}\left(\frac{16}{9}\right)$

C. $\cos^{-1}\left(\frac{1}{3}\right)$

D. 45°

Answer: B

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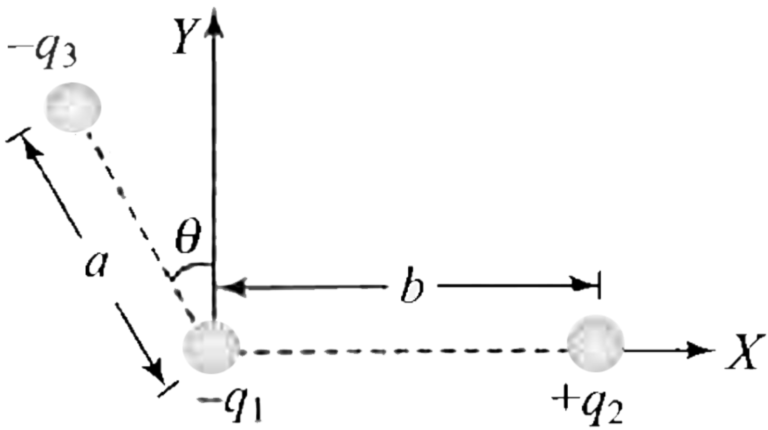
3. Three charges-q_1, $+q_2$ and $-q_3$ are placed as shown in the figure. The x-component of the force on $-q_1$ is proportional to



A. $\frac{q_2}{b^2} - \frac{q_3}{a^2}\cos\theta$

B. $\frac{q_2}{b^2} + \frac{q_3}{a^2}\sin\theta$

C. $\frac{q_2}{b^2} + \frac{q_2}{a^2}\cos\theta$

D. $\frac{q_2}{b^2} - \frac{q_2}{a^2}\sin\theta$

Answer: B

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4. Three equal charges q_1, q_2, q_3 are placed at the three corners ABC of a square ABCD. If the force between the charges at A and B (on q_1 and q_2) is F_{12} and that between A and C is F_{13} then the ratio of magnitudes F_{12} and F_{13} is

A. $1/2$

B. 2

C. $\frac{1}{1/\sqrt{2}}$

D. $\sqrt{2}$

Answer: B

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5. Equal charges Q are placed at the four corners A, B, C, D of a square of length a. The magnitude of the force on the charge at B will be

A. $\frac{3q^2}{4\pi\varepsilon_0 a^2}$

B. $\frac{4q^2}{4\pi\varepsilon_0 a^2}$

C. $\left[\frac{1+2\sqrt{2}}{2}\right]\frac{q^2}{4\pi\varepsilon_0 a^2}$

D. $\left[2+\frac{1}{\sqrt{2}}\right]\frac{q^2}{4\pi\varepsilon_0 a^2}$

Answer: C

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6. Electric charge of $1\mu C, \; -1\mu C$ and $2\mu C$ are placed in air at the corners A, B and C respectively of an equilateral triangle ABC having length of each side 10 cm. The resultant force on the charge at C is

A. $0.9N$

B. $1.8N$

C. $2.7N$

D. $3.6N$

Answer: B

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7. ABC is a right triangle in which AB = 3 cm, BC = 4 cm and right angle is at B. Three charges $+15\mu C + 12\mu C$ and $-20\mu C$ are placed respectively at A, B and C. The force acting on the charge at B is

A. $1250N$

B. $3500N$

C. $1200N$

D. $2250N$

Answer: D

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8. The charge on 500 cc of water due to protons will be

A. $6.1 \times 10^{27}C$

B. $2.67 \times 10^{-7}C$

C. $6 \times 10^{23}C$

D. $1.67 \times 10^{23} C$

Answer: B

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9. Three point charges Q_1, Q_2 and Q_3 in that order are placed equally spaced along a striaght line. Q_2 and Q_3 are equal in magnitude but opposite is sign. If the net force on Q_3 is zero, the value of Q_1 is

A. $Q_1 = |Q_3|$

B. $Q_1 = \sqrt{2}|Q_3|$

C. $Q_1 = 2|A_3|$

D. $Q_1 = 4|Q_2|$

Answer: D

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10. Calculate the ratio of electric and gravitational force between two protons. Charge of each proton is $1.6 \times 10^{-19} C$, mass is $1.672 \times 10^{-27} kg$ and $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

A. 1.23×10^{36}

B. 10^{20}

C. 10^{15}

D. $5N$

Answer: A

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11. Four equal charges $2.0 \times 10^{-6} C$ each are fixed at the four corners of a squae of side 5 cm. Find the coulomba force eperienced by one of the charges due to the rest three.

A. $10N$

B. $27.3N$

C. $15N$

D. $5N$

Answer: B

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12. Two similar metal spheres are suspended by silk threads from the same point. When the spheres are given equal charges of $2\mu C$

the distance between them becomes 6cm. If length of each thread is 5 cm, the mass of each sphere is (g=10 m/s2)

A. 4 kg

B. 3kg

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

D. $\frac{1}{3}$ kg

Answer: C

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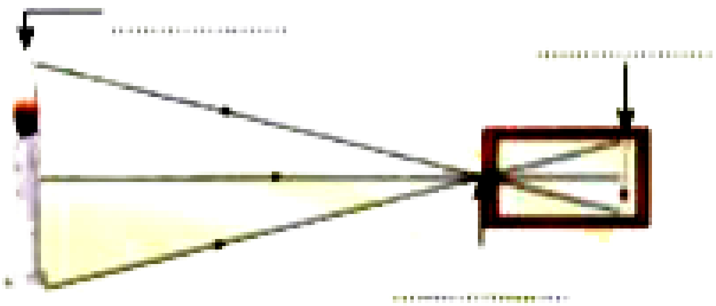
13. 

Label the figure.

A. $\dfrac{\left[\dfrac{Q^2 .2L}{4\pi\varepsilon_0 . mg}\right]^1}{3}$

B. $QLmg$

C. $\dfrac{QL}{mg}$

D. $\dfrac{Q^2L}{2\pi mg}$

Answer: A

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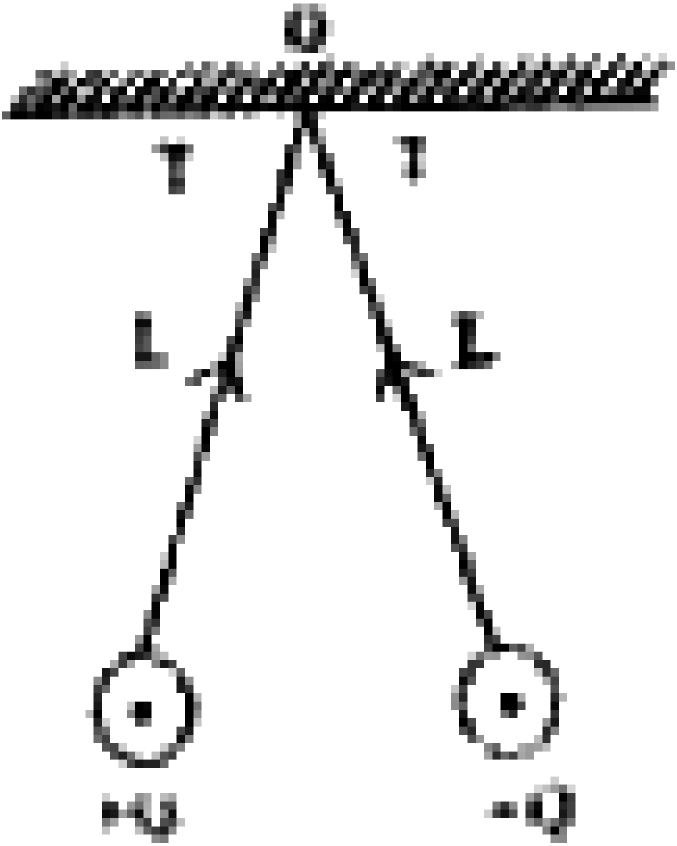
14. Two small spheres each having equal positive charge Q(Coulomb) on each are suspended by two insulating strings of equal length L (meter) from a rigid hook (shown in Fig.). The whole set up is taken into satellite where there is no gravity. The two balls are now held by electrostatic forces in horizontal position, the tension in each string is then



A. $\frac{Q^2}{16\pi\varepsilon_0 L^2}$

B. $\frac{Q^2}{8\pi e\pi s_0 L^2}$

C. $\frac{Q^2}{4\pi e\pi s_0 L^2}$

D. $\frac{Q^2}{2\pi\varepsilon_0 L^2}$

Answer: A

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15. A thin copper ring of radius 'a' is charged with q units of electricity. An electron is placed at the centre of the copper ring. If the electron is displaced a little, it will have frequency

A. $\frac{1}{2\pi}\sqrt{\frac{eq}{4\pi \in_0 ma^3}}$

B. $\frac{1}{2\pi}\sqrt{\frac{q}{4\pi \in_0 ema^3}}$

C. $\frac{1}{2\pi}\sqrt{\frac{eq}{4\pi \in_0 ma}}$

D. $\frac{1}{2\pi}\sqrt{\frac{q}{4\pi \in_0 ema^3}}$

Answer: D

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16. Two identical charged spheres suspended from a common point by two massless strings of length l are initially a distance $d(d < < l)$ apart because of their mutual repulsion. The charge begins to leak from both the spheres at a constant rate. As a result the charges approach each other with a velocity v. then, as a function of distance x between them

A. $v \alpha x^{-1}$

B. $v \alpha x^{1/2}$

C. $v \alpha x$

D. $v \alpha x^{-1/2}$

Answer: A

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17. Elctric charges having same magnitude of electric charge 'q' coulombs are placed at x = 1 m, 2m ,4m , 8m ..... So on . If any two consecutive charges have opposite sign but the first charge is necessarily positive, what will be the potential at x = 0 ?

A. $12 \times 10^4 N/C$

B. $24 \times 10^4 N/C$

C. $36 \times 10^4 N/C$

D. $48 \times 10^4 N/C$

Answer: C

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18. A body of mass 2 gm is projected horizontally from the top of tower of height 20m with a velocity 10 m/s. The charge on the body is 2C. Electric field is applied vertically downwards and of intensity 10-N/C. Find the time taken by the body to touch the ground (g = 10 m/s^2)

A. 1 sec

B. 1.414 sec

C. 2.828 sec

D. 2 sec

Answer: B

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19. An infinite number of charges each q are placed in the x-axis at distances of 1, 2, 4, 8, ...meter from the origin. If the charges are alternately positive and negative find the intensity of electric field at origin.

A. $\frac{1}{1-\pi \in_0}$ along + ve x-axis

B. $\frac{1}{10\pi \in_0}$ along $-ve$ x- axis

C. $\frac{1}{\pi \in_0}$ along $+ve$ x- axis

D. $\frac{1}{\pi \in_0}$ along $-ve$ x- axis

Answer: A

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20. An electric field is acting vertically upwards. A small body of mars 1 gm and charges -$1\mu C$ is projected with a velocity 10 m/s at an angle 45° with horizontal its horizontal range is 2m then the intensity of electric field is :(g = 10 m/s2)

A. $20, 000N/C$

B. $19, 000N/C$

C. $40,000 N/C$

D. $90,000 N/C$

Answer: C

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21. Eight dipoles of charges of magnitude e are placed inside a cube. The total electric flux coming out of the cube will be

A. $\frac{8e}{\varepsilon_0}$

B. $\frac{16e}{\varepsilon_0}$

C. $\frac{e}{\varepsilon_0}$

D. Zero

Answer: D

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22. A cone of base radius R and height h is located in a uniform electric field $\vec{E}$ parallel ot its base. The electric flux entering the cone is :

A. $\frac{1}{2}EhR$

B. $2EHR$

C. $4EhR$

D. Ehr

Answer: D

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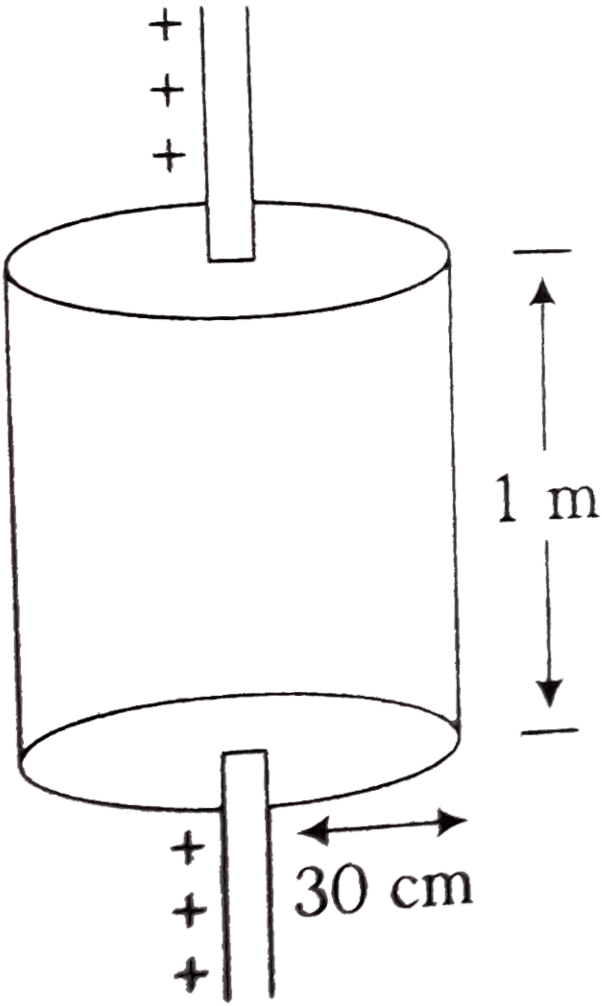
23. Electric charge is uniformly distributed along a long straight wire of radius 1 mm. The charge per centimetre length of the wire is Q coulomb. Another cylindrical surface of radius 50 cm and length 1 m symmetrically enclosed the wire as shown in the figure. The total electric flux passing through the cylindrical surface is



A. $\frac{Q}{\varepsilon_0}$

B. $\frac{100Q}{\varepsilon_0}$

C. $\frac{10Q}{(\pi\varepsilon_0)}$

D. $\frac{100Q}{(\pi\varepsilon_0)}$

Answer: B

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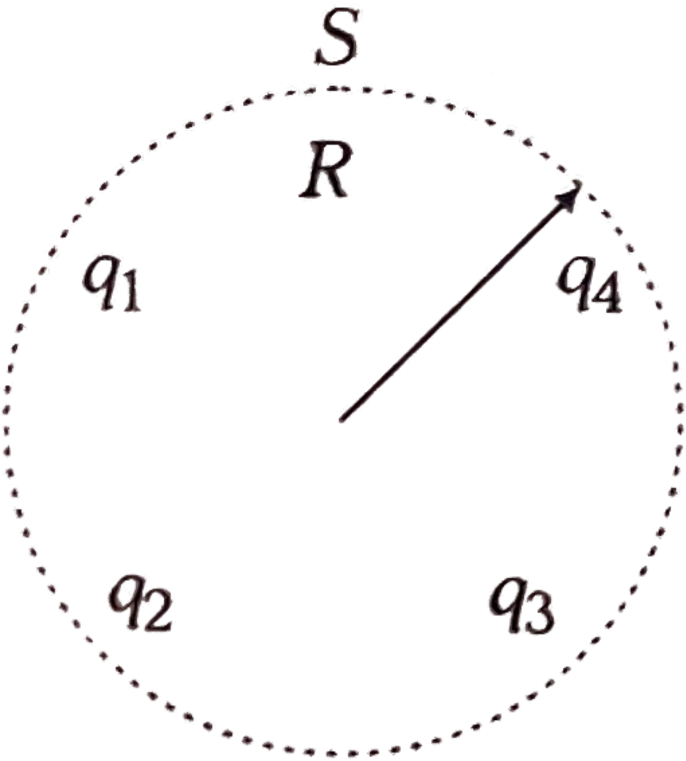
24. q_1, q_2, q_3 and q_4 are point charges located at points as shown in the figure and S is a spherical Gaussian surface of radius R. Which of the following is true according to the Gauss's law ?



A. $\oint\left(\vec{E}_1+\vec{E}_2+\vec{E}_3\right), d\vec{A} = \frac{q_1+q_2+q_3}{2\varepsilon_0}$

B. $\oint\left(\vec{E}_1+\vec{E}_2+\vec{E}_3\right). d\vec{A} = \frac{(q_1+q_2+q_3)}{\varepsilon_0}$

C. $\oint\left(\vec{E}_1+\vec{E}_2+\vec{E}_3\right). d\vec{A} = \frac{(q_1+q_2+q_3+q_4)}{\varepsilon_0}$

D. None of the above

Answer: B

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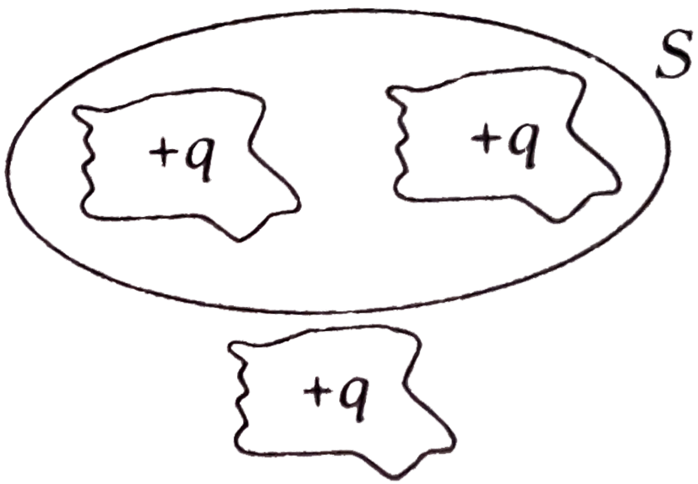
25. Figure shown below is a distribution of charges. The flux of electric field due to these charges through the surface S is



A. $3q / \varepsilon_0$

B. $2q / \varepsilon_0$

C. $q / epci_0$

D. Zero

Answer: B

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26. Figure shows three concentric thin spherical shells A, B and C of radii a, b, and c. The shells A and C are given charge q and -q, respectively, and shell B is earthed. Then,

A. charge on inner surface of shell C is $\frac{4}{3}q$

B. charge on outer surface of shell B is $-\frac{4}{3}q$

C. charge on outer surface of shell C is $\frac{2}{3}q$

D. all the above

Answer: D

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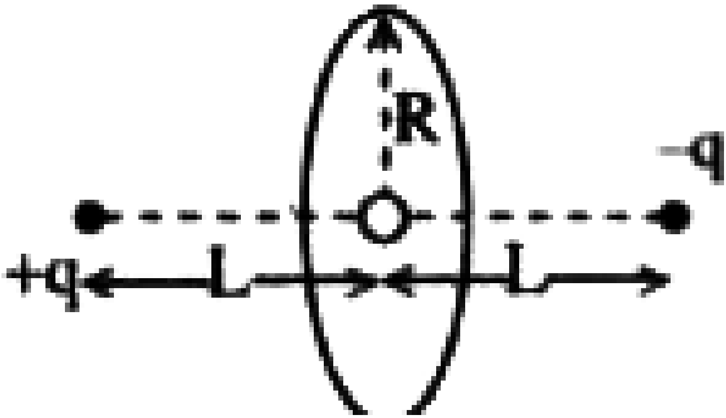
27. Two point charges q and - are separated by a distance 2L. Find the flux of the electric field vector across the circle of radius R is shown.



A. $\frac{q}{2 \in_0}\left\{1-\frac{d}{\sqrt{d^2+r^2}}\right\}$

B. $\frac{q}{\in_0}\left\{1-\frac{d}{\sqrt{d^2+r^2}}\right\}$

C. $\frac{2q}{\in_0}\left\{1-\frac{d}{\sqrt{d^2+r^2}}\right\}$

D. Zero

Answer: B

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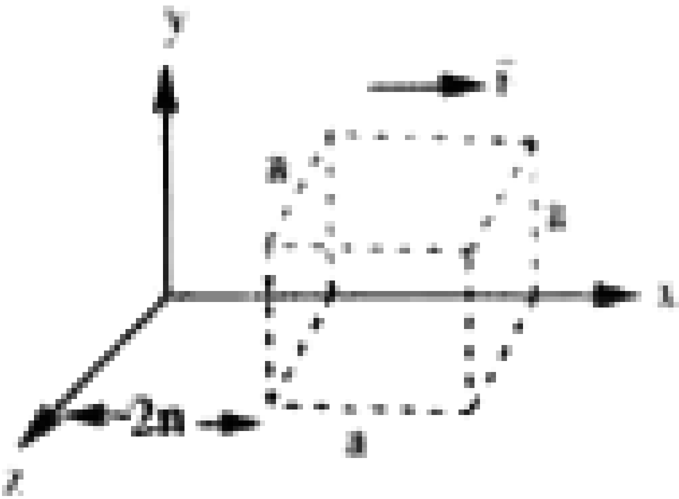
28. In a region, electric field depends on X-axis as E=$E_0 x^2$. There is a cube of edge a as shown. Then find the charge enclosed in that cube.



A. $5 \in_0 a^4 E_0$

B. $3 \in_0 a^4 E_0$

C. $4 \in_0 a^4 E_0$

D. Zero

Answer: A

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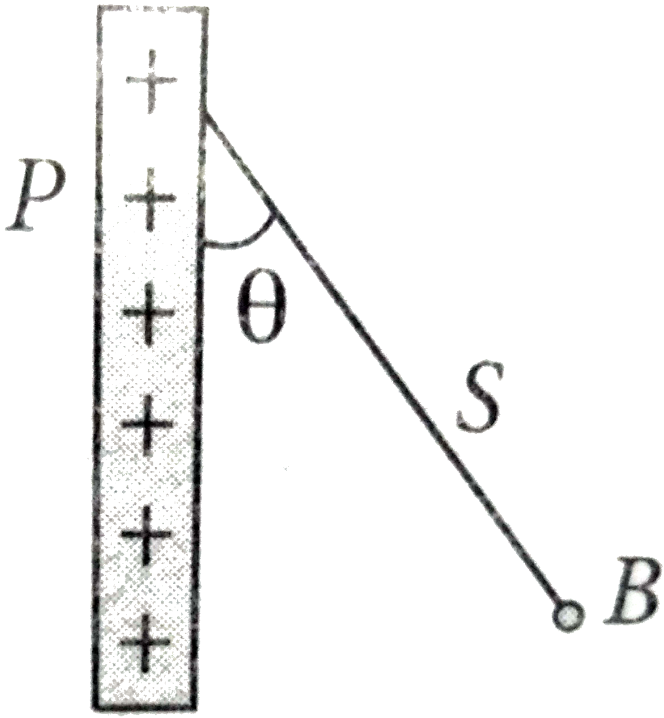
29. A charged ball B hangs from a silk thread S, which makes an angle θ with a large charged conducting sheet P as shown in the figure. The surface charge density of the sheet is proportional to



A. $\cos \theta$

B. $\cot \theta$

C. $\sin \theta$

D. $\tan \theta$

Answer: D

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30. Let $P(r) = \frac{Q}{\pi R^4} r$ be the charge desntiy distribution for a solid sphere of radius R and total charge Q. for a point 'p' inside the sphere at distance r_1 from the centre of the sphere, the magnitude of electric field is

A. $\frac{Q r_1^2}{3\pi e \pi s_0 R^4}$

B. $\frac{Q}{4\pi\varepsilon_0 r_1^2}$

C. $\dfrac{Qr_1^2}{4\pi e\pi s_0 R^4}$

D. 0

Answer: C

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31. Let there be a spherically symmetric charge distribution with charge density varying as $\rho(r) = \rho_0\left(\frac{5}{4} - \frac{r}{R}\right)$ upto $r = R$, and $\rho(r) = 0$ for $r > R$, where r is the distance from the origin. The electric field at a distance $r(r < R)$ from the origin is given by

A. $\dfrac{4\pi\rho_0 r}{3\varepsilon_0}\left(\frac{5}{3} - \frac{r}{R}\right)$

B. $\dfrac{\rho_0 r}{4\varepsilon_0}\left(\frac{5}{3} - \frac{r}{R}\right)$

C. $\dfrac{4\rho_0 r}{/(3\varepsilon_0)\left(\frac{5}{4} - \frac{r}{R}\right)}$

D. $\dfrac{\rho_0 r}{3\varepsilon_0}\left(\frac{5}{4} - \frac{r}{R}\right)$

Answer: B

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32. A spherically symmetric charge distribution is characterized by a charge density having the following variation : $\rho(r) = \rho\left(1 - \frac{r}{R}\right)f \text{ or } r < R\rho(r) = 0$ for r $\geq$ R. Where r is the distance from the centre of the charge distribution and`(rho_0) is a constant. The electric field at an internal point (r

A. $\frac{\rho_0}{\in_0}\left(\frac{r}{3} - \frac{r^2}{4R}\right)$

B. $\frac{\rho_0}{4 \in_0}\left(\frac{r}{3} - \frac{r^2}{4R}\right)$

C. $\frac{\rho_0}{3 \in_0}\left(\frac{r}{3} - \frac{r^2}{4R}\right)$

D. $\frac{\rho_0}{12 \in_0}\left(\frac{r}{3} - \frac{r^2}{4R}\right)$

Answer: A

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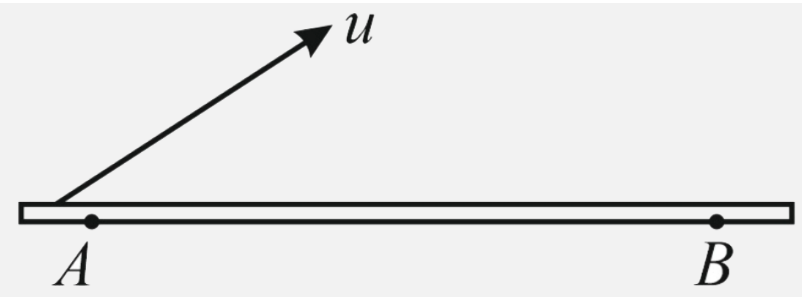
33. A large flat metal surface has a uniform charge density $(+\sigma)$. An electron of mass m and charge ρ leaves the surface at the point A with speed u and returns to it at point B. Disregarding gravity the maximum value of AB is



A. $\dfrac{vm \in_0}{\sigma e}$

B. $\dfrac{v^2 m \in_0}{e\sigma}$

C. $\dfrac{v^2 e}{\in_0 \sigma m}$

D. $\dfrac{v^2 \sigma e}{\in_0 m}$

Answer: B

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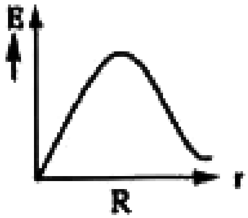
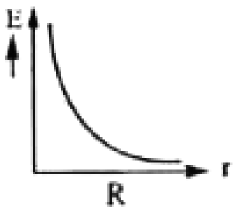
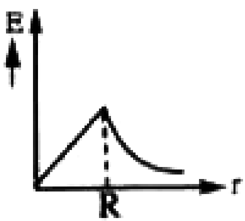
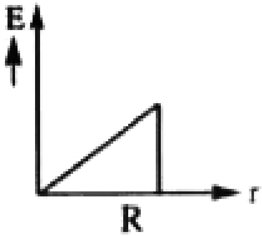
34. In a uniformly charged sphere of total charge Q and radius R, the electric field E is plotted as a function of distance from the centre. The graph which would correspond to the above will be

A. 

B. 

C. 

D. 

Answer: C

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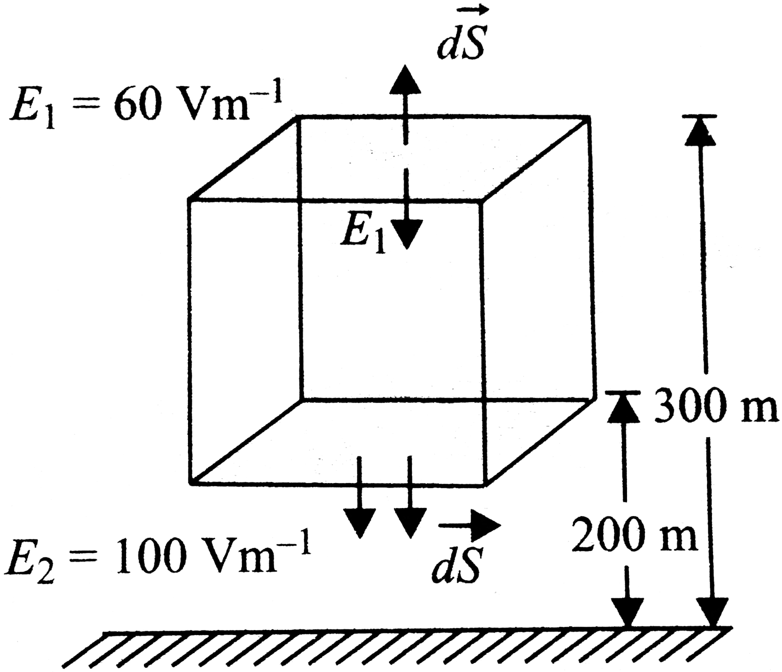
35. It has been experimentally observed that the electric field in a large region of earth's atmosphere is directed vertically down. At an altitude of 300 m, the electric field $60Vm^{-1}$. At an altitude of 200 m, the field is 100 V m^(-1), the field is $100Vm^{-1}$. Calculate the net amount of charge contained in the cube of 100 m edge, located between 200 and 300 m altitude.



A. $3.54\mu C$

B. $5.43\mu C$

C. $300\mu C$

D. $100\mu C$

Answer: A

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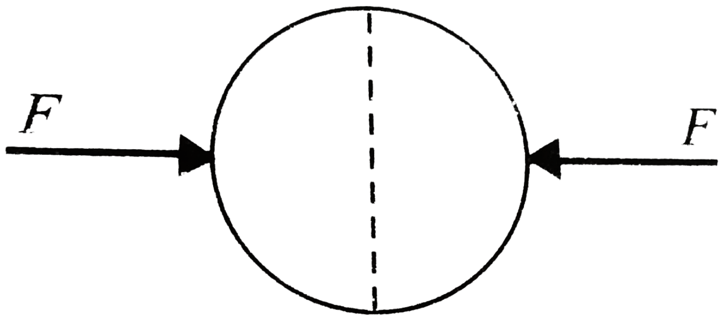
36. A uniformly charged thin spherical shell of radius R carries uniform surface charge density of σ per unit area. It is made of two hemispherical shells, held together by pressing them with force F. F is proportional to



A. $\frac{1}{\epsilon_0}\sigma^2 R^2$

B. $\frac{1}{\epsilon_0}\sigma^2 R$

C. $\frac{1}{\epsilon_0}\frac{\sigma^2}{R}$

D. $\frac{1}{\epsilon_0}\frac{\sigma^2}{R^2}$

Answer: A

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REVISION EXERCISE (ELECTRIC POTENTIAL & CAPACITANCE)

1. At y = 1 cm, y = 3 cm y = 9 cm, y = 27 cm ... and so on , an infinite number of charges equal to 5C are placed. At x = 1 cm, x = 2 cm, x = 4 cm, x = 8 cm .... And so on, an infinite number of charges equal to -5C are placed. Find the electirc potential at origin is volts . $\left(K=\frac{1}{4\pi\varepsilon_0}\right)$

A. 250 K

B. $-250K$

C. zero

D. $100K$

Answer: B

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2. Two point charges 4μC and 9μC are separated by 50 cm. The potential at the point between them where the field has zero strength is

A. $4.5 \times 10^5 v$

B. $9 \times 10^5 K$

C. $9 \times 10^4 V$

D. Zero

Answer: A

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3. Two charges 2 nano coulombs and -6 nano coulombs are separated by 16 cm in air. The resultant electric intensity at the zero potential point which lies in between them and on the line joining them is

A. $15000NC^{-1}$

B. $7500NC^{-1}$

C. $450NC^{-1}$

D. $1.5NC^{-1}$

Answer: A

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4. Two electric charges of 9μC and $-3\mu c$ are placed 0.16 m apart in air. There are two points A and B on the line joining the two charges at distances of (i) 0.04 m from-3μC and in between the charges and (ii) 0.08m from - 3μC and outside the two charges. The potentials at A and B

A. $0V, 0V$

B. $IV, 2V$

C. $3V, 4V$

D. $IV, 7V$

Answer: A

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5. Two opposite and equal chrages 4×10^{-8} coulomb when placed $2 \times 10^{-2} cm$ away, from a dipole. If dipole is placed in an external electric field 4×10^{8} newton/coulomb, the value of maximum torque and the work done in rotating it through 180° will be

A. $64 \times 10^{-4} Nm$ and $64 \times 10^{-4} J$

B. $32 \times 10^{-3} Nm$ and $32 \times 10^{-4} J$

C. $64 \times 10^{-4} Nm$ and $32 \times 10^{-4} J$

D. $32 \times 10^{-4} Nm$ and $64 \times 10^{4} J$

Answer: D

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6. The potential at a point due to an electri dipole wlll be maximum and minimum when the angles between the axis of the dipole and the line joining the point to the dipole are respectively.

A. 90° and 180°

B. 0° and 90°

C. 90° and 0°

D. 0° and 180°

Answer: D

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7. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in a uniform electric field E. If its dipole moment is along the direction of the field, the force on it and its potential energy are respectively :-

A. 2q.E and minimum

B. q.E and p.E

C. Zero and minimum

D. q.E and maximum

Answer: C

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8. Charge Q is uniformly distributed on a dielectric rod AB of length $2l$. The potential at P shown in the figure is equal to

A. $\frac{q}{4\pi \in_0 2l}$

B. $\frac{q}{4\pi \in_0 l} In(2)_3$

C. $\frac{q}{4\pi \in_0 2l} In(3)$

D. $\frac{2q}{4\pi \in_0 l} In(3)$

Answer: C

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9. Find the V_{ab} in an electric field $E = \left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)\frac{N}{C}$, where $r_a = \left(\hat{i} - 2\hat{j} + \hat{k}\right)m$ and $r_b = \left(2\hat{i} + \hat{j} - 2\hat{k}\right)m$

A. $-2V$

B. $-1V$

C. $-4V$

D. $-6V$

Answer: B

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10. If V_o be the potential at origin in an electric field $\vec{E} = E_x\hat{i} + E_y\hat{j}$, then the potential at point $P(x, y)$ is

A. $V_0 = xE_x - yE_y$

B. $V_0 + xE_x + y_y$

C. $xE_x + yE_y - V_0$

D. $\sqrt{x^2 + y^2}\sqrt{E_x^2 + E_y^2 - V_0}$

Answer: A

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11. Electric potential is given by

$$V = 6x - 8xy^2 - 8y + 6yz - 4z^2$$

Then electric force acting action on $2C$ point charge placed on origin will be

A. $2N$

B. $6N$

C. $8N$

D. $20N$

Answer: D

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12. An electric field is given by $E = \left(y\hat{i} + x\hat{k}\right)N/C$. Work done in moving a 1C charge from $r_A = \left(2\hat{i} + 2\hat{j}\right)m$ to $r_B = \left(4\hat{i} + \hat{j}\right)m$ is

A. $+4J$

B. $-4J$

C. $+8J$

D. zero

Answer: D

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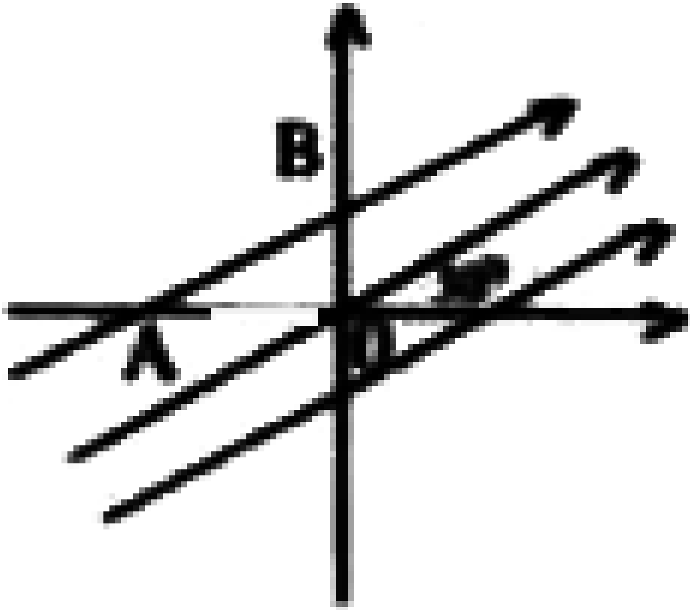
13. A field of 100Vm^{-1} is directed at 30° to positive x-axis. Find $(V_A - V_B)$ if OA = 2m and OB = 4m



A. A) $100(\sqrt{3}-2)V$

B. B) $-100(2+\sqrt{3})V$

C. C) $100(2-\sqrt{3})V$

D. D) $200(2+\sqrt{3})V$

Answer: B

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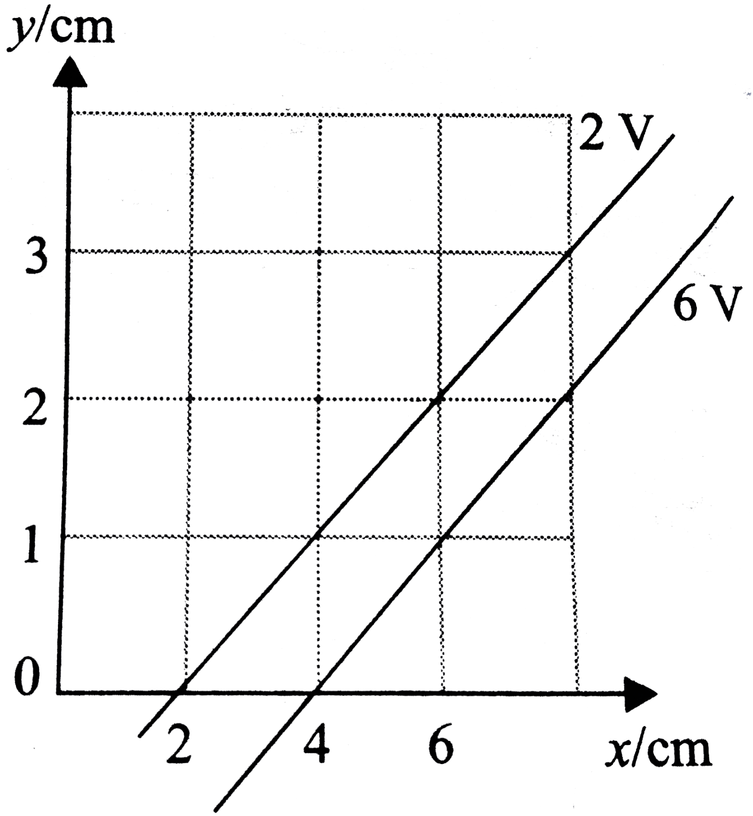
14. (Figure 3.141) shows two equipotential lines in the x plane for an electric field. The scales are marked. The x- component and y - component of the field in the space between these equipotential lines are, respectively.



A. $+100Vm^{-1}, \ -200Vm^{-1}$

B. $-100Vm^{-1}, \ +200Vm^{-1}$

C. $+200 V m^{-1}, \ +100 V m^{-1}$

D. $-200 V m^{-1}, \ -100 V m^{-1}$

Answer: B

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15. Two metal spheres have their surface areas in the ratio 9:16. They are put in contact with each other. A charge of 7×10^{-6}C is given to the system and now they are separated so that each exerts no influence on the other then the ratio of surface charge densities is

A. $4:3$

B. $5:2$

C. $2:5$

D. $7:3$

Answer: A

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16. Two isolated metallic solid spheres of radii R and 2R are charged such that both of these have same charge density σ. The spheres are located far away from each other and connected by a thin conducting wire. Find the new charge density on the bigger sphere.

A. 5σ

B. 6σ

C. $\frac{5}{6}\sigma$

D. 2σ

Answer: C

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17. A hollow charged metal sphere has radius r. If the potential difference between its surface and a point at a distance $3r$ from the centre is V, then electric field intensity at a distance $3r$ is

A. $\frac{V}{2R}$

B. $\frac{V}{3R}$

C. $\frac{V}{4R}$

D. $\frac{V}{6R}$

Answer: D

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18. The electric potential on the surface of a sphere of radius R and charge 3×10^{-6} C is 500 V The intensity of electric field on the surface of the sphere (inNC^{-1}) is

A. < 10

B. > 20

C. Between 10 and 20

D. > 5

Answer: A

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19. A metal sphere A of radius a is charged to potential V. What will be its potential if it is enclosed By a spherical conducting shell B of radius b and the two are connected by a wire ?

A. $\frac{a}{b}V$

B. $\frac{bV}{a}$

C. $\frac{a^2V}{b}$

D. $\frac{b^2 V}{a}$

Answer: A

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20. A solid conducting sphere, having a charge Q, is surrounded by an unchanged conducting hollow spherical shell. Let the potential difference between the surface of the solid sphere and that of the outer surface of the hollow shell be V. If the shell is now given a change of $-4Q$, the new potential difference between the same tow surface is :

A. V

B. $2V$

C. $4V$

D. $-2V$

Answer: A

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21. Two concentric spherical conducting shells of radii R and 2R are carrying charges q and 2q, respectively. Both are now connected by a conducting wire. Find the change in electric potential (inV) on the outer shell.

A. zero

B. $\frac{3KQ}{2R}$

C. $\frac{KQ}{R}$

D. $\frac{2KQ}{R}$

Answer: A

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22. A thibn spherical conducting shell of radius R has a charge q. Another charge Q is placed at the centr of the shell. The electrostatic potential at a point P a distance R/2 from the centre of the shell is

A. $\frac{2Q}{4\pi\varepsilon_0 R}$

B. $\frac{2Q}{4\pi\varepsilon_0} - \frac{2q}{4\pi\varepsilon_0 R}$

C. $\frac{2Q}{4\pi\varepsilon_9 R} + \frac{q}{4\pi\varepsilon_0 R}$

D. $\frac{(q+Q)}{4\pi\varepsilon_0}\frac{2}{R}$

Answer: C

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23. A charge .q. is distrubuted over two concertric hollow conducting sphere of radii r and R $(< r)$ such that their surface charge densite are equal. The potential at their common centre is

A. zero

B. $\frac{q}{4\pi \in_0} \frac{(r+R)}{(r^2+R^2)^2}$

C. $\frac{q}{4\pi \in_0} \left[\frac{1}{r} + \frac{1}{R}\right]$

D. $\frac{q}{4\pi \in_0} \left[\frac{r+R}{(r^2+R^2)}\right]$

Answer: D

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24. Two concentric sphere of radii r_1 and r_2 carry charges q_1 and q_2 respectively. If the surface charge density (σ) is same for both spheres, the electric potential at the common centre will be

A. $\frac{\sigma}{\in_0} \frac{r_1}{r_2}$

B. $\frac{\sigma}{\in_0} \frac{r_2}{r_1}$

C. $\frac{\sigma}{\in_0}(r_1 - r_2)$

D. $\frac{\sigma}{\in_0}(r_1 + r_2)$

Answer: D

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25. A hollow sphere of radius 2R is charged to V volts and another smaller sphere of radius R is charged to V/2 volts. Now the smaller sphere is placed inside the bigger sphere without changing the net charge on each sphere. The potential difference between the two spheres would be

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

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

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

D. V

Answer: B

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26. Two concentric, thin metallic spheres of radii R_1 and $R_2 (R_1 > R_2)$ charges Q_1 and Q_2 respectively Then the potential at radius r between R_1 and R_2 will be $(k = 1/4\pi \in)$

A. $k\left(\frac{Q_1 + Q_2}{r}\right)$

B. $k\left(\frac{Q_1}{r} + \frac{Q_2}{R_2}\right)$

C. $k\left(\frac{Q_2}{r} + \frac{Q_1}{R_1}\right)$

D. $k\left(\frac{Q_1}{R_1} + \frac{Q_2}{R_2}\right)$

Answer: C

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27. A point charge Q is placed inside a conducting spherical shell of inner radius 3R and outer radius 5R at a distance R from the centre of the shell. The electric potential at the centre of the shell will be

A. $\frac{1}{4\pi\varepsilon_0}\cdot\frac{Q}{R}$

B. $\frac{1}{4\pi\varepsilon_0},\frac{5Q}{6R}$

C. $\frac{1}{4\pi\varepsilon_0}\cdot\frac{13Q}{15Q}$

D. $\frac{1}{4\pi\varepsilon_0}\cdot\frac{7Q}{9R}$

Answer: C

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28. A point charge of magnitude $+1\mu C$ is fixed at $(0, 0, 0)$. An isolated uncharged spherical conductor, is fixed with its center at (4, 0, 0) cm. I'he potential and the induced electric field at the centre of the sphere is :

A. $1.8 \times 10^5 V$ and $-5.625 \times 10^6 V/m$

B. $0V$ and $0V/m$

C. $2.25 \times 10^5 V$ and $-5.625 \times 10^6 V/m$

D. $2.25 \times 10^5 V$ and $0V/m$

Answer: C

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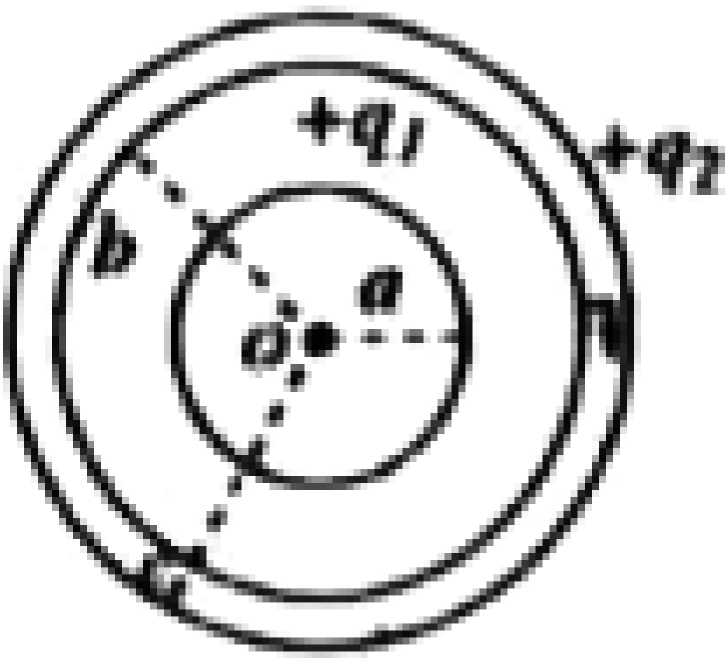
29. Assume three concentric, conducting spheres where charge q1, and q2, have been placed on inner and outer sphere where as middle sphere has been earthed. Find the charge on the outer surface of middle spherical conductor



A. $-\frac{b}{c}q_2$

B. $-q_1$

C. $-q_2$

D. $\frac{b}{a}q_1$

Answer: A

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30. There are three concentric thin spherical shells A, B and C of radii R, 2R, and 3R. Shells A and Care given charges q and 2q and shell B is earthed. Then which of the given is correct ?

A. charge on inner surface of shell C is $\frac{4}{3}$q

B. charge on outer surface of shell B is $-\frac{4}{3}$ q

C. charge on outer surface of shell C is $\frac{2}{3}q$

D. all the above

Answer: D

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31. A point charge q is placed at a distance of r from the centre O of an uncharged spherical shell of inner radius R and outer radius

2R.The distance $r < R$.The electric potential at the centre of the shell will be

A. $\left(\frac{1}{r} - \frac{1}{a} + \frac{1}{b}\right)$

B. $\left(\frac{1}{a} - \frac{1}{r} + \frac{1}{b}\right)$

C. $\left(\frac{1}{b} - \frac{1}{c} - \frac{1}{r}\right)$

D. $\left(\frac{1}{a} - \frac{1}{b} - \frac{1}{r}\right)$

Answer: A

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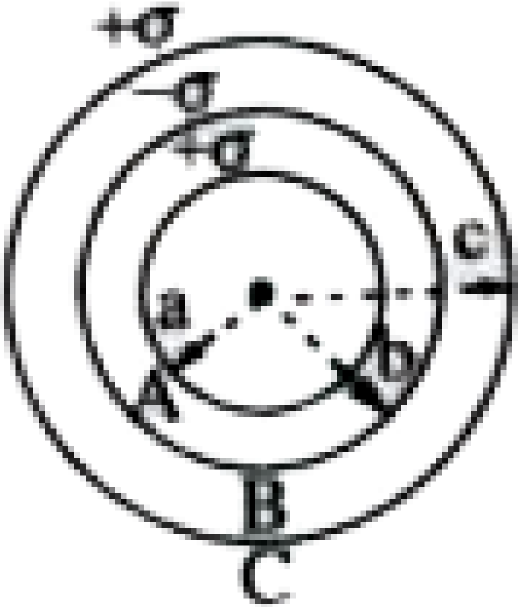
32. Three concentric spherical metal shells A.B.C of radii a,b,c $(c > b > a)$ have surface charge density $+\sigma, -\sigma$ and $+\sigma$

respectively. The potential of the middle shell is $\frac{\sigma}{\varepsilon_0}$ times



A. $\left(\frac{a^2}{b} - b + c\right)$

B. $(a - b + c)$

C. $\left(\frac{a^2 - b^2 + c^2}{C}\right)$

D. $\left(a - b + \frac{c^2}{B}\right)$

Answer: A

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33. Initially the spheres A & B are at potential V_A and V_B The potential of A when sphere B is earthed

A. V_A

B. V_B

C. $V_A - V_B$

D. $V_A + V_B$

Answer: C

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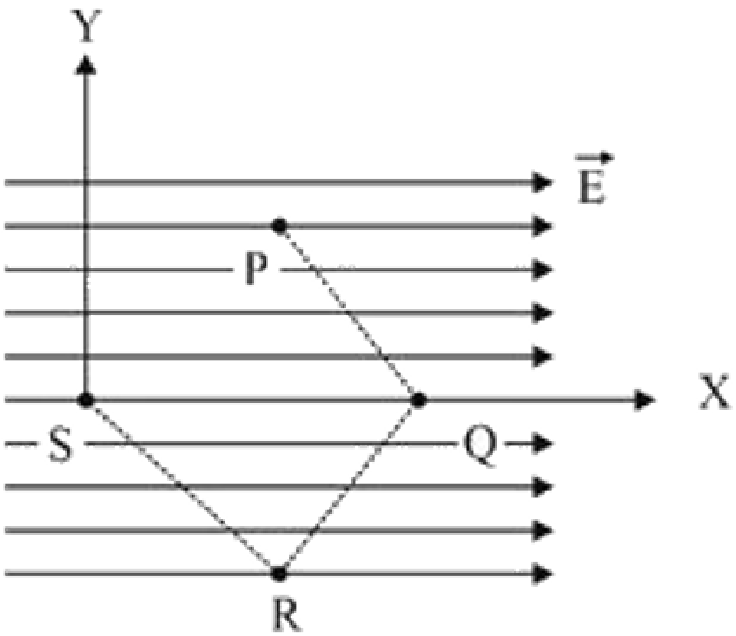
34. Point charge q moves from point P to point S along the path PQRS (figure shown) in a uniform electric field E pointing co-parallel to the positive direction of the x-axis. The coordinates of the points P, Q, R and S are $(a, b, 0), (2a, 0, 0), (a, -b, 0)$ and $(0, 0, 0)$ respectively. The work done by the field in the above process is given by the expression.



A. qEa

B. $-qEa$

C. $qEa\sqrt{2}$

D. $qE\sqrt{(2a)^2 + b^2}$

Answer: B

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35. From the initial point A(1,2,0), to the final point D(3,2,0), a charge of 2C is moved through the points B (2,2,0) and C (3, 1, 0) along the path ABCD. The electric field in that region is 4 $\vec{i}$ N/C. The work done is given by

A. $8J$

B. $-8J$

C. $16J$

D. $-4J$

Answer: C

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36. Three point charges $q, -2q$ and $-2q$ are plaed at the vertices of an equilateral triangle of side a. The work done by some external force to increase their separation to 2a will be

A. $\frac{1}{4\pi\varepsilon_0}$

B. $\frac{1}{8\pi \in_0}$

C. $\frac{1}{16\pi \in_0}$

D. 0

Answer: D

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37. The charges each of +Q and -Q coulomb are placed at corners A and B of an equilateral triangle ABC of side 'a'cm. 'D' is the mid point of AB. The work done if a charge of 'q' is moved from D to C is:

A. zero

B. $\dfrac{1}{4\pi e\pi s_0} \times qQ$

C. $\dfrac{Q}{4\pi e\pi s_0} \times \dfrac{\sqrt{3}}{2}q$

D. $\dfrac{Q}{4\pi\varepsilon_0} \times \sqrt{3}q$

Answer: A

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38. Two identical charges are placed at the two corner an equilateral triangle. The potential energy of the system is U. The work done in bringing an identical charge from infinty to the thrid vertex is xU. Find value of x

A. U

B. 2U

C. 3U

D. 4U

Answer: B

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39. Two equal point charges are fixed at x = -a and x = +a on the x-axis. Another point charge Q is placed at the origin. The change in the electrical potential energy of Q, when it is displaced by a small distance x along the x-axis, is approximately proportional to

A. x

B. x^2

C. x^3

D. $1/x$

Answer: B

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40. 10C and -10C are placed at y = 1 m and y=-1 m on y-axis 1c charge is placed on x-axis at x = +1. Now find the change in PE of system when 1 coulomb is displaced from x= +lm to x=-1 m keeping other two charges as fixed is

A. $10^9 J$

B. $21 \times 10^9 J$

C. $10 \times 10^9 J$

D. zero

Answer: D

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41. A body of mass 1 g and carrying a change $10^{-8}C$ passes from two points P and Q . P and Q are at electric potentials 600 V and 0 V respectively . The velocity of the body at Q is $20cms^{-1}$ its velocity in ms^{-1} at P is

A. $\sqrt{0.028}$

B. $\sqrt{0.056}$

C. $\sqrt{0.56}$

D. $\sqrt{5.6}$

Answer: A

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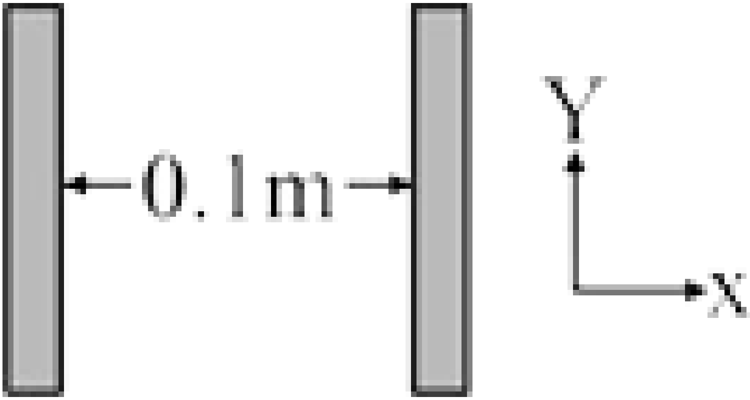
42. Two insulating plates are uniformly charged in such a way that the potential difference between them is $V_2 - V_1 = 20V$ (i.e. plate

2 is at a higher potential). The plates are separated by d = 0.1m and can be treated as infinitely large. An electron is released from rest on the inner surface of plate 1. What is its speed when it hits plate 2 ? (e=1.6xx10^9 C,m_0=9.11xx10^(-31)Kg)`



A. $2.65 \times 10^{6} m / s$

B. $7.02 \times 10^{12} m / s$

C. $1.87 \times 10^{6} m / s$

D. $32 \times 10^{-19} m / s$

Answer: A

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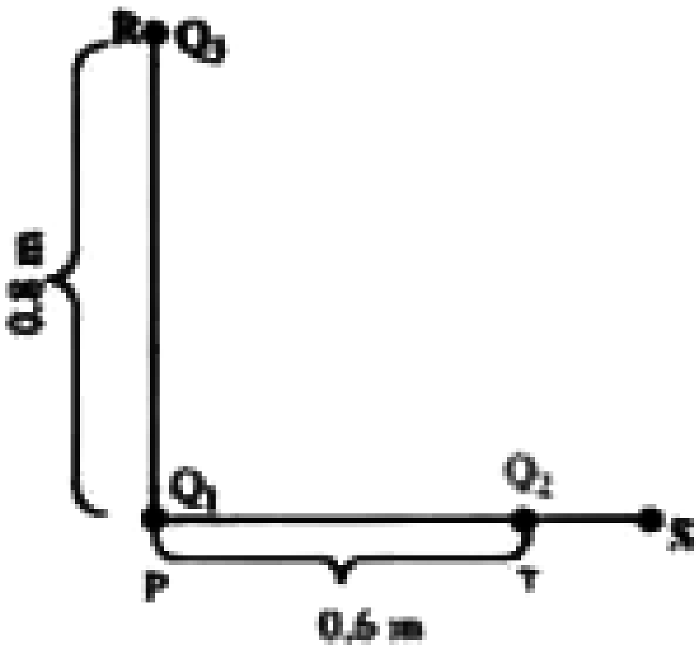
43. Two charges Q_1 and Q_2 Coulombs are shown in fig. A third charge Q_3coulomb is moved from point R to S along a circular path with P as centre. Change in potential energy is



A. A) $\dfrac{KQ_2Q_3}{4\pi \in_0}$

B. B) $\dfrac{Q_1Q_2}{\pi \in_0}$

C. C) $\dfrac{Q_1Q_2}{\pi \in_0}$

D. D) $\dfrac{4Q_1Q_2}{\pi \in_0}$

Answer: C

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44. A charge Q is kept at the centre of a circle of radius $'r'$ If permittivity of the free space is e, then work done in carrying a charge q along the diameter of the circle from one end to the other will be

A. A) $\dfrac{qQ}{4\pi \in_0 \in_r r}$

B. B) $\dfrac{qQ}{8\pi \in_0 r}$

C. C) $\dfrac{qQ}{2\pi \in_0}$

D. D) zero

Answer: D

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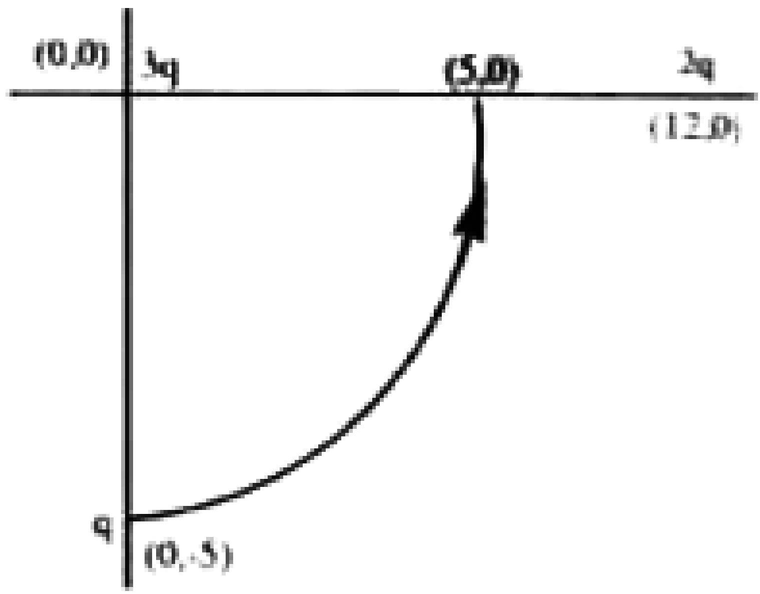
45. $2q$ and 3q are two charges separated by a distance 12 cm on X-axis. A third charge q is placed at 5 cm on yaxis as shown in figure. Find the change in potential energy of the system if q is moved from initial position to a point on X-axis in circular path



A. $\dfrac{q^2}{4\pi\varepsilon_0}$

B. $\dfrac{18q^2}{4\pi\varepsilon_0(91)}$

C. $\frac{12q^2}{(4\pi e\pi s_0(91))}$

D. $\frac{3q^2}{4\pi\varepsilon_0}$

Answer: C

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46. A positive charge .Q. is fixed at a point, A negatively charged of mass .m. and charge .q. is revolving in a circular path of radius radius r_1 with .Q. as the centre. The change in potential energy to change the radius of the circular path from r_1 and r_2 in joule is

A. zero

B. $\frac{1}{24\pi \in 0}Qq\left[\frac{1}{r_1} - \frac{1}{r_1}\right]$

C. $\frac{1}{\pi}Qq\left[\frac{1}{r_1} - \frac{1}{r_2}\right]$

D. $\frac{Qq}{4\pi}\left[\frac{1}{r_2} - \frac{1}{r_1}\right]$

Answer: B

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47. At a distance of 1 m from a fixed charge of 1 mC, a particle of mass 2 g and charge $1\mu C$ is held stationary. Both the charges are placed on a smooth horizontal surface. If the particle is made free to move, then its speed at a distance of 10 m from the fixed charge will be

A. $100m/s$

B. $30m/s$

C. $60m/s$

D. $45m/s$

Answer: B

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48. Two identical thin rings, each of radius R, are coaxially placed at a distance R. If Q_1 and Q_2 are respectively, the charges uniformly spread on the two rings, find the work done in moving a charge q from centre of ring having charge Q_1 to the other ring.

A. zero

B. $q(Q_1 - Q_2)(\sqrt{2} - 1) / \sqrt{(2)}4\pi\varepsilon_0 R$

C. $q\sqrt{2}(Q_1 + Q_2) / 4\pi\varepsilon_0 R$

D. $q(Q_1 + Q_2)(\sqrt{2} + 1) / \sqrt{(2)}4\pi\varepsilon_0 R$

Answer: B

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49. If identical charges $(-q)$ are placed at each corner of a cube of side b, then electric potential energy of charge $(+q)$ which is placed at centre of the cube will be

A. $\dfrac{8\sqrt{2}q^2}{4\pi\varepsilon_0 b}$

B. $\dfrac{-8\sqrt{2}q^2}{\pi\varepsilon_0 b}$

C. $\dfrac{-4\sqrt{2}q^2}{\pi e \pi s_0 b}$

D. $\dfrac{-4q^2}{\sqrt{3}\pi\varepsilon_0 b}$

Answer: D

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50. A charged sphere of radius 0.02 m has charge density of 1 cm-2. The work done when a charge of 40 nano coulomb is moved from infinity to a point that is at a distance of 0.04 m from the centre of the sphere

A. $1.44\pi J$

B. $2J$

C. $14.4\pi J$

D. $1.44J$

Answer: C

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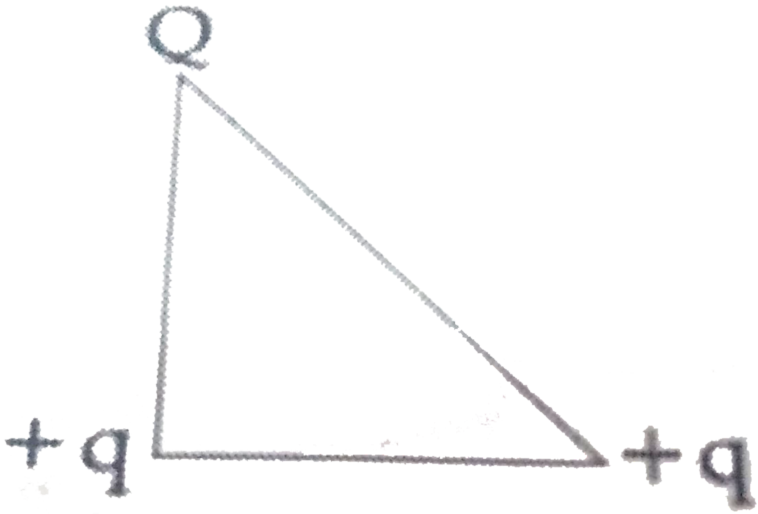
51. Three charges Q+q and + q are placed at the vertices of a right - angle isosceles triangle as shown below. The net eletrostatic energy of the configuration is zero if the value of Q is :



A. $\frac{+q}{2+\sqrt{2}}$

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

C. $\frac{+2q}{2+\sqrt{2}}$

D. $\frac{-2q}{2+\sqrt{2}}$

Answer: D

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52. A non-conducting ring of radius $0.5m$ carries a total charge of 1.11×10^{-10}C distributed non-uniformly on its circumference producing an electric field E everywhere is space. The value of the integral $\int_{l=\infty}^{l=0} - E.\, dI(l = 0$ being centre of the ring) in volt is

A. zero

B. 1V

C. 2V

D. 4V

Answer: C

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53. The radii of two metallic spheres are 5 cm and 10 cm and both carry equal charge of $75\mu C$. If the two spheres are shorted then charge will be transferred-

A. $25mC$

B. $50mC$

C. $75mC$

D. zero

Answer: A

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54. A parallel plate condenser of capacity 5μ F is kept connected to a battery of emf 10v. If the space between the plates is filled with a medium of dielectric constant 12, then the additional charge taken from the battery is

A. $400\mu c$

B. $450\mu C$

C. $500\mu C$

D. $550\mu C$

Answer: D

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55. The time in seconds required to produce a potential difference of 20V across a capacitor of 1000μ F when it is charged at the steady rate of $200\mu C$/s is

A. 50

B. 100

C. 150

D. 200

Answer: B

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56. The plates of a parallel plate condenser are being moved away with a constant speed v. If the plate separation at any instant of time is d then the rate of change of capacitance with time is proportional to-

A. $1/d$

B. $1/d^2$

C. d^2

D. d

Answer: B

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57. A parallel plate capacitor (condenser) has a certain capacitance (capacity). When 2/3 rd of the distance between the plates is filled with a dielectric, the (capacity) capacitance is found to be 2.25 times the initial capacitance. The dielectric constant of the dielectric

A. 1

B. 3

C. 7

D. 6

Answer: D

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58. A capacitor of capacitance $10\mu F$ is charged to a potential 50 V with a battery. The battery is now disconnected and an additional charge $200\mu C$ is given to the positive plate of the capacitor. The potential difference across the capacitor will be

A. 50V

B. 80 V

C. 70 V

D. 60 V

Answer: D

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59. A parallel plate capacitor has a capacity $80 \times 10^{-6} F$ when air is present between the plates. The volume between the plates is then completely filled with a dielectric slab of dielectric constant 20. The capacitor is now connected to a battery of 30 V by wires. The dielectric slab is then removed. Then, the charge that passes now through the wire is

A. $45.6 \times 10^{-3} C$

B. $25.3 \times 10^{-3} C$

C. $120 \times 10^{-3} C$

D. $12 \times 10^{-3} C$

Answer: A

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60. Two condensers of capacities C and 3C are connected in parallel and then connected in series with a third condenser of capacity 3C.

The combination is charged with a battery of 'V'volt. The charge on condenser of capacity C is (in coulomb)

A. $1/2(CV)$

B. $3CV/7$

C. $2CV$

D. $3/2(CV)$

Answer: B

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61. Three capacitances, each of $3\mu F$, are provided. These cannot be combined to provide the resultant capacitance of:

A. $1\mu F$

B. $2\mu F$

C. $6\mu F$

D. $4.5\mu F$

Answer: C

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62. To establish an instantaneous current of 2 A through a $1\mu F$ capacitor, the potential difference across the capacitor plates should be changed at the rate of

A. $2 \times 10^4 V / s$

B. $4 \times 10^6 V / s$

C. $2 \times 10^6 V / s$

D. $4 \times 10^4 V / s$

Answer: C

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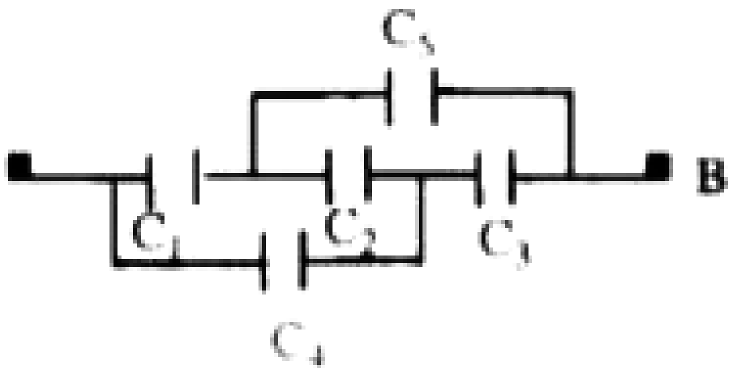
63. The equivalent capacity between A and B in the given circuit is

$(C_1 = 4\mu F, C_2 = 12\mu F, C_3 = 8\mu F, C_4 = 4\mu F C_5 = 8\mu F)$



A. $24\mu F$

B. $36\mu F$

C. $\frac{16}{3}\mu F$

D. $\frac{8}{3}\mu F$

Answer: C

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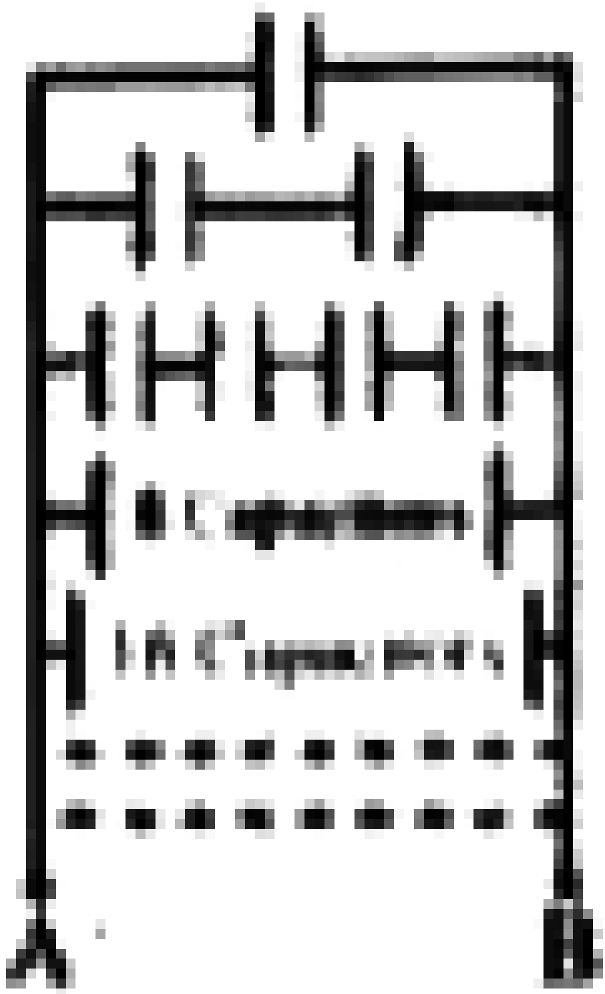
64. An infinite number of identical capacitors each of capacity I mF are connected as shown in the figure. The equivalent capacity between A and B



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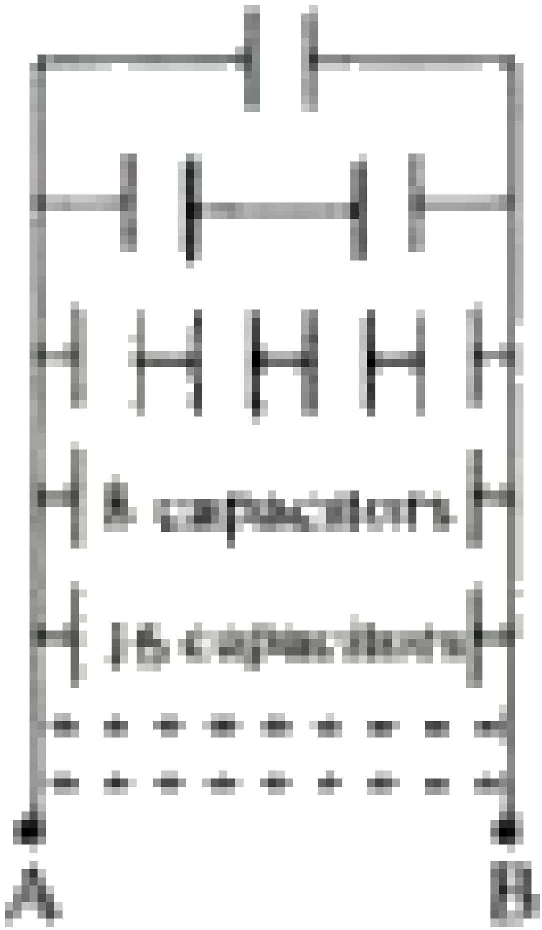
65. In the circuit, all capacitor are identical, each of capacity $2\mu F$ and they are infinite in number. If AB is connected to a battery of 10V then the charge drawn from the battery is :



A. $40\mu C$

B. $20\mu C$

C. $10\mu C$

D. $5\mu C$

Answer: A

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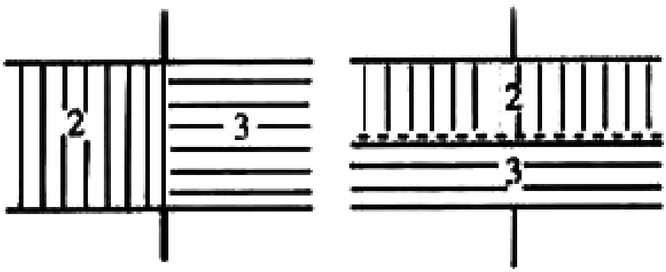
66. A capacitor is filled with two dielectrics of the same dimensions but of dielectric constants 2 and 3 as shown in figure (a) and in figure (b), the ratio of the capacitances in the two arrangements is



A. $25 : 24$

B. $24 : 25$

C. $12 : 13$

D. $13 : 12$

Answer: A

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67. Two identical condensers M and N are connected in series with a battery. The space between the plates of 'M' is completely filled with dielectric medium of dielectric constant 8 and a copper plate of thickness d/ 2 is introduced between the plates of N. (d = distance of separation of the plates). Then the potentials of M and N are respectively.

A. $1 : 4$

B. $4 : 1$

C. $3 : 8$

D. $1 : 6$

Answer: A

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68. Two parallel capacitors of capacitances C and $2C$ are connected in parallel and charged to a potential difference V. The battery is then disconnected, and the region between the plates of C is filled completely with a material of dielectric a constant K. The common potential difference arcoss the combination becomes.

A. V

B. $3V$

C. $3V / (K + 2)$

D. zero

Answer: C

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69. Two identical capacitors are connected in series. Charge on each capacitor is q_0. A dielectric slab is now introduced between the plates of one of the capacitors so as to fill the gap, the battery remaining connected. The charge in each capacitor will now be

A. $\dfrac{2q_0}{1+\frac{1}{K}}$

B. $\dfrac{q_0}{1+\frac{1}{K}}$

C. $\dfrac{2q_0}{1+K}$

D. $\dfrac{q_0}{1+K}$

Answer: A

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70. A $10\mu F$ capacitor and a $20\mu F$ capacitor are connected in series across a 200 v supply line. The charged capacitors are then disconnected from the line and reconnected such that those same polarities are connected to each other and no external voltage is applied. The potential difference across capacitors is

A. $\frac{800}{9}$ volt

B. $\frac{800}{3}$ volt

C. 400 volt

D. 200 volt

Answer: A

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71. Three capacitors with capacitances of $1\mu F, 2\mu F$ and $3\mu F$ are connected in series. Each capacitor gets punctured, if a potential difference just exceeding 100 volt is applied. If the group is connected across 220 volt circuit then the capacitor most likely to puncture first is

A. capacitance $1\mu F$

B. capacitance $2\mu F$

C. capacitance $3\mu F$

D. capacitance $1\mu F(\text{ or })2\mu F(\text{ or })3\mu F$

Answer: A

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72. Five equal capacitors connected in series have a resultant capacitance 4uF. What is the ratio of energy stored when the capacitors are connected in series and then parallel and connected to the same source of emf in both the cases is

A. $1:5$

B. $5:1$

C. $1:25$

D. $25:1$

Answer: C

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73. A number of capacitors, each of capacitance $1\mu F$ and each one of which gets punctured if a potential difference just exceeding

500 volt is applied are provided. Then an arrangement suitable for giving a capacitor of capacitance $3\mu F$ across which 2000 V may be applied requires at least

A. 4 component capacitors

B. 96 component capacitors

C. 48 component capacitors

D. 3 component capacitors

Answer: C

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74. A parallel plate capcitor of capcitance 5 μF and plate separation 6 cm is connected to a 1 V battery and charged. A dielectric of dielectric constant 4 and thickness 4 cm is introduced between the plates of the capacitor. The additional charge that flows into the capacitor from the battery is

A. $2\mu C$

B. $3\mu C$

C. $5\mu C$

D. $10\mu C$

Answer: C

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75. A dielectric slab of length l, width b, thickness d and dielectric constant K fills the space inside a parallel plate capacitor. At t = 0, the slab begins to be pulled out slowly with speed y. At time t, the capacity of the capacitor is

A. $\dfrac{\varepsilon_0 b}{d}[Kl - (k-1)vt]$

B. $\frac{\varepsilon_0 b}{b}[Kl + K + vt]$

C. $\frac{\varepsilon_0 b}{b}[(kl + l)vt]$

D. $\frac{\varepsilon_0 b}{d}[l + (k - 1)vt]$

Answer: A

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76. A parallel plate capacitor having a separation between the plates d, plate area A and material with dielectric constant K has capacitance C_0 . Now one-third of the material is replaced by another material with dielectric constant 2K, so that effectively there are two capacitors one with area $\frac{1}{3}$ A, dielectric constant 2K and another with area $\frac{2}{3}$ A and dielectric constant K. If the capacitance of this new capacitor is C then C/C_0 is :

A. 1

B. $\frac{4}{3}$

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

D. $\frac{1}{3}$

Answer: B

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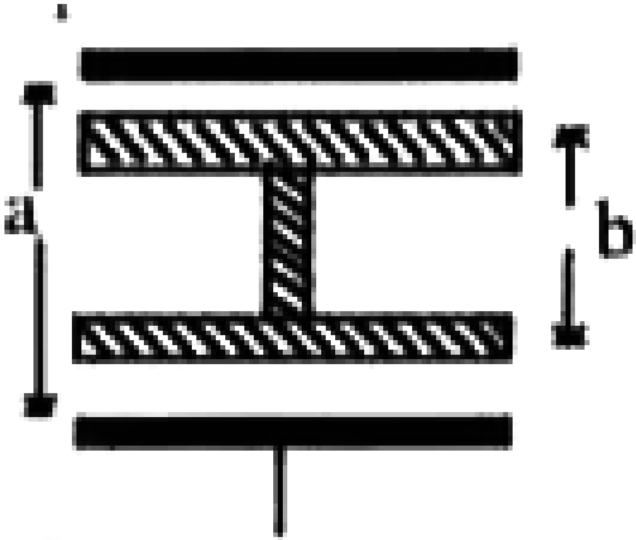
77. If metal section of shape H is inserted in between two parallel plates as shown in figure and A is the area of each plate then the equivalent capacitance is



A. $\frac{A \in_0}{a} - \frac{A \in_0}{b}$

B. $\frac{A \in_0}{a+b}$

C. $\frac{A \in_0}{a} + \frac{A \in_0}{b}$

D. $\frac{A \in_0}{a-b}$

Answer: D

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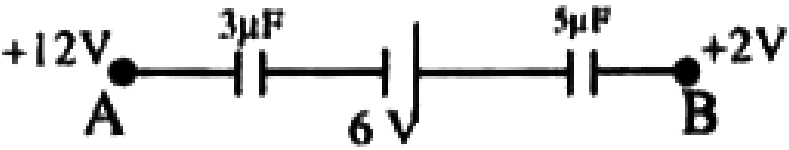
78. A and B are two points in a closed circuit. The potential difference across the condenser of capacity $5\mu F$ is



A. $6V$

B. $10V$

C. $16V$

D. $4V$

Answer: A

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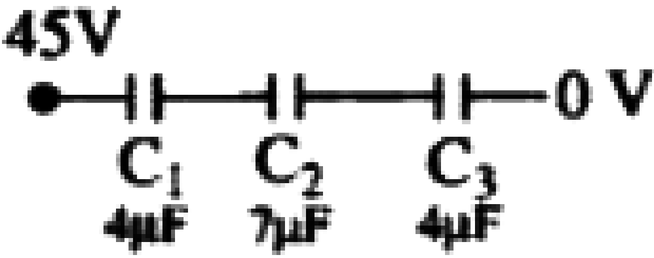
79. Three condensers are connected as shown in series. If the insulated plate of C_1 is at 45V one plate of C_3 is earthed, find the p.d between the plates of C_2



A. $10V$

B. $20V$

C. $30V$

D. $45V$

Answer: A

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80. A capacitor 1mF withstands a maximum voltage of 6KV while another capacitor 2mF withstands a maximum voltage of 4KV. If the capacitors are connected in series, the system will withstand a maximum voltage of

A. $2KV$

B. $4KV$

C. $6KV$

D. $9KV$

Answer: D

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81. A battery of emf 20V is connect to two capacitors $1\mu F$ and $3\mu F$ in series. $1\mu F$ capacitor withstands a maximum of 9V and $3\mu F$

withstands a maximum voltage of 6V then

A. $1 \mu F$ capacitors break

B. $2 \mu F$ capacitors break

C. both will break

D. no capacitor will break

Answer: A

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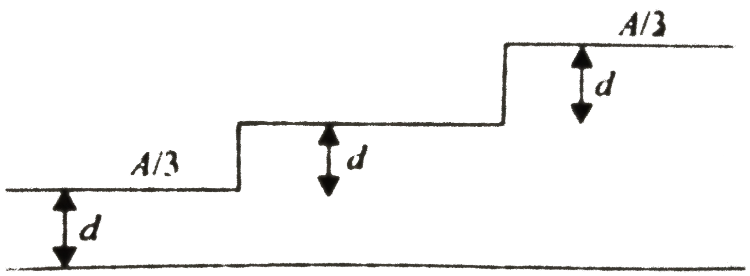
82. A capacitor is made of a flat plate of area A and B second plate having a stair-like structure as shown in. The area of each stair is $A / 3$, and the height is

d. Find the capacitance of this arrangement.



A. $\dfrac{2A \in_0}{3(d+b)}$

B. $\dfrac{A \in_0 \left(3d^2 + 6bd + 2b^2\right)}{3d(b+d)(d+2b)}$

C. $\dfrac{A \in_0 \left(d^2 + 2bd + b^2\right)}{3d(d+b)(d+2b)}$

D. $\dfrac{2A \in_0 \left(d^2 + 2bd + b^2\right)}{3d(d+b)(d+2b)}$

Answer: B

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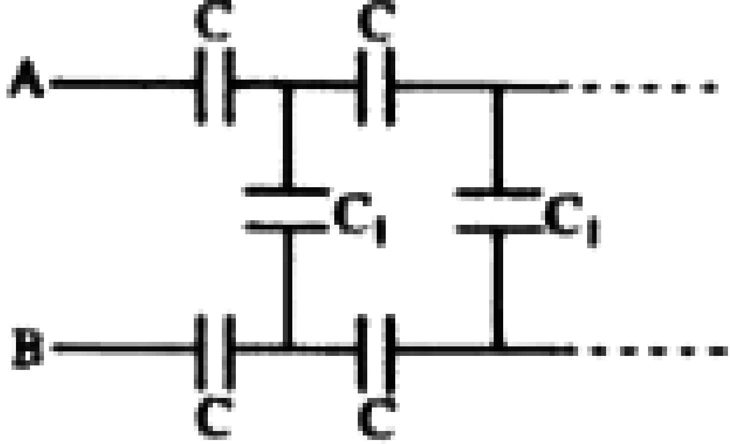
83. If in the infinite series circuit,$C = 9\mu F$ and $C1 = 6\mu F$ then the capacity across AB is



A. $1.25\mu F$

B. $6\mu F$

C. $3\mu F$

D. $12\mu F$

Answer: C

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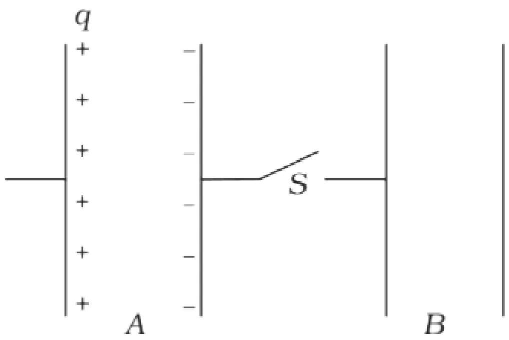
84. Consider the situation shown in the figure. The capacitor A has a charge q on it whereas B is uncharged. The charge appearing on the capacitor B a long time after the switch is closed is:



A. zero

B. $q/2$

C. q

D. $2q$

Answer: A

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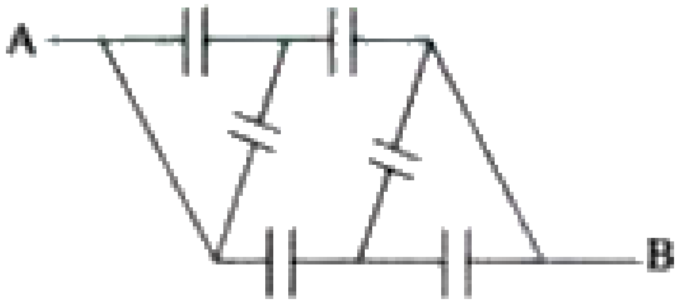
85. The capacity of each condenser in the following fig. is .C.. Then the equivalent capacitance across A and B is



A. $C/4$

B. $3C/4$

C. $4C/3$

D. $3C$

Answer: C

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86. Four identical capacitors each rates as $10\mu F - 10V$ are supplied to you to obtain capacitor of $10\mu F - 20V$, we should connect them in

A. two rows each containing 2 condensers

B. four rows each containing 1 condenser

C. one row containing four condensers

D. all the above

Answer: A

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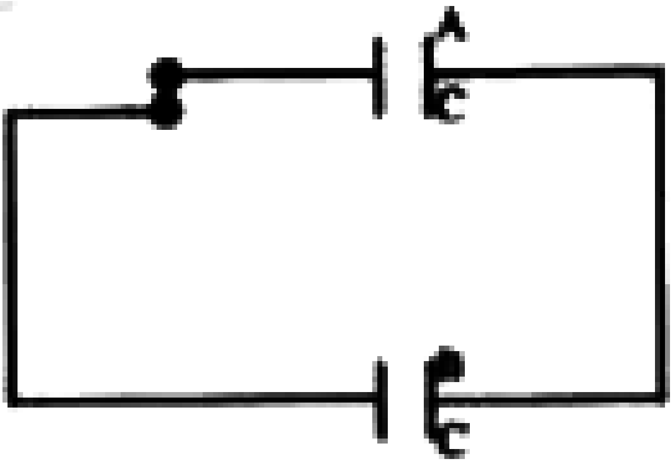
87. Consider the situation shown in the figure. The capacitor A has a charge q on it where as B is uncharged. The charge appearing on the capacitor B a long time after the switch S is closed is



A. A) Zero

B. B) $q/2$

C. C) q

D. D) $2q$

Answer: B

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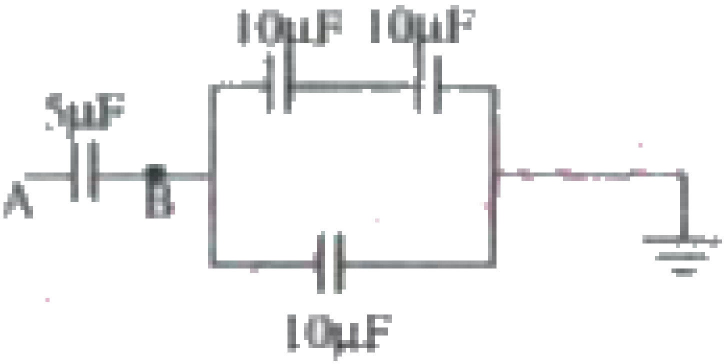
88. If the potential at A is 2000V the potential at B is



A. 1500V

B. 1000V

C. 500V

D. 400V

Answer: C

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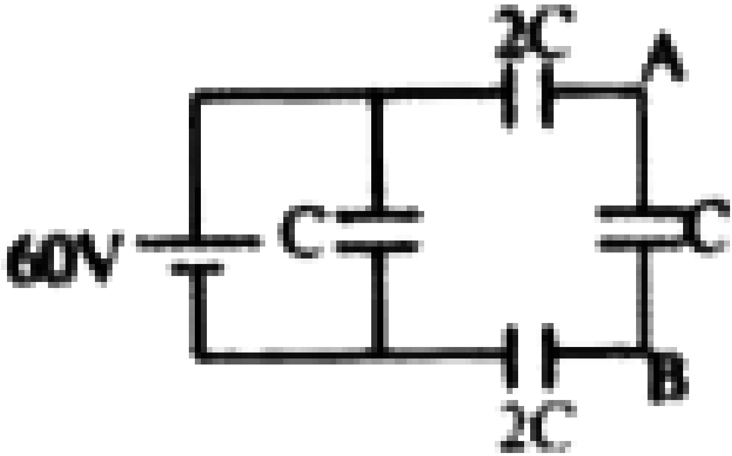
89. The P.D between the points A and B is



A. 60V

B. 45V

C. 40V

D. 30V

Answer: D

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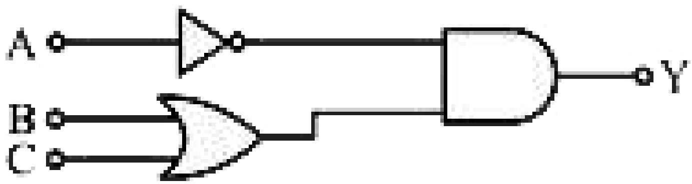
90. The Boolean equation for the given circuit is



A. A is at high potential

B. B is at high potential

C. A and B are at the same potential

D. A and B are at zero potential

Answer: B

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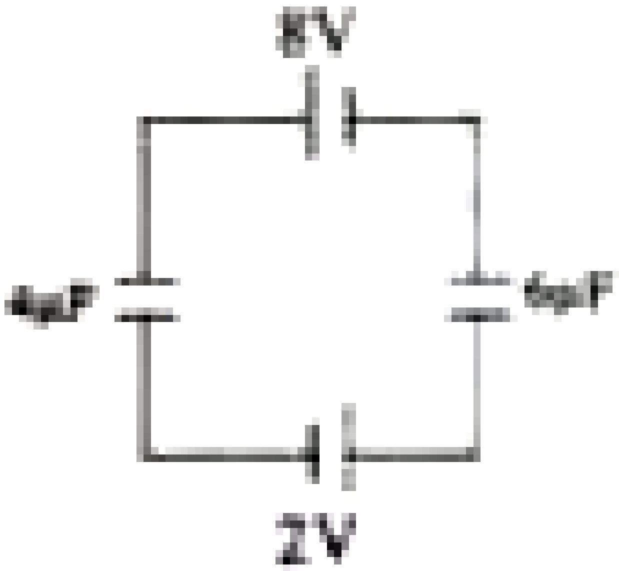
91. Two condensers of capacities 4mF and 6mF are connected to two cells as shown. Then



A. P.D. of 6μF condenser is 4V

B. charge of 4μ F condenser is 24μC

C. both of the above are true

D. none of the above is true

Answer: C

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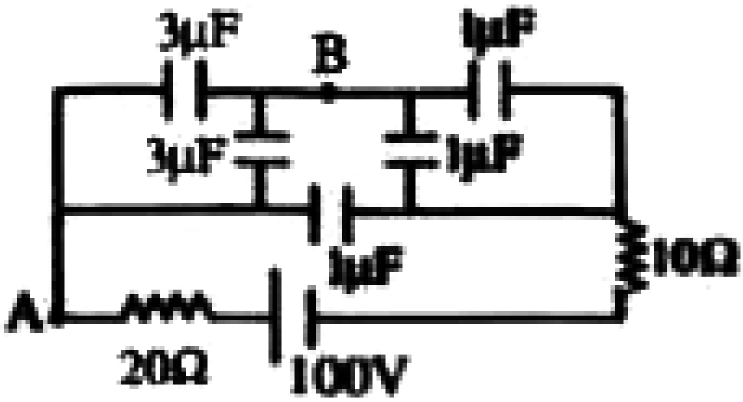
92. In the given circuit P.D. between A and B in the steady state is



A. $25V$

B. $50V$

C. $75V$

D. $45V$

Answer: A

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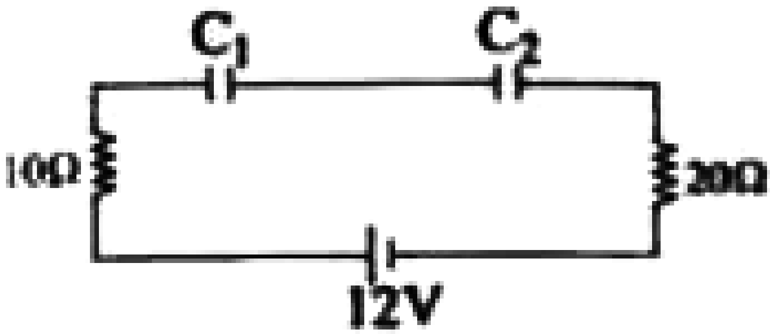
93. In the given circuit in the steady state $(C_1 = 2mF \text{ and } C_2 = 6mF)$



A. A) $V_1 = V_2 = 6V \text{ and } Q_1 = Q_2 = 18mC$

B. B) $V_1 = 9V \text{ and } Q_1 = 18mC$

C. C) $V_2 = 9V \text{ and } Q_2 = 18mC$

D. D) $V_1 = V_2 = 3V \text{ and } Q_1 = Q_2 = 9mC$

Answer: B

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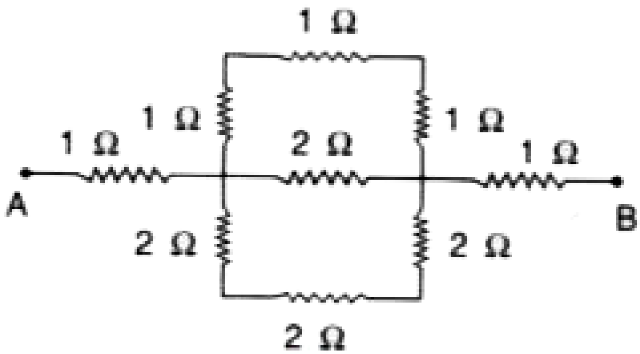
94. Calculate the effective resistance between the points A and B in the circuit shown in Fig.



A. $20\mu F$

B. $5\mu F$

C. $30\mu F$

D. $10\mu F$

Answer: B

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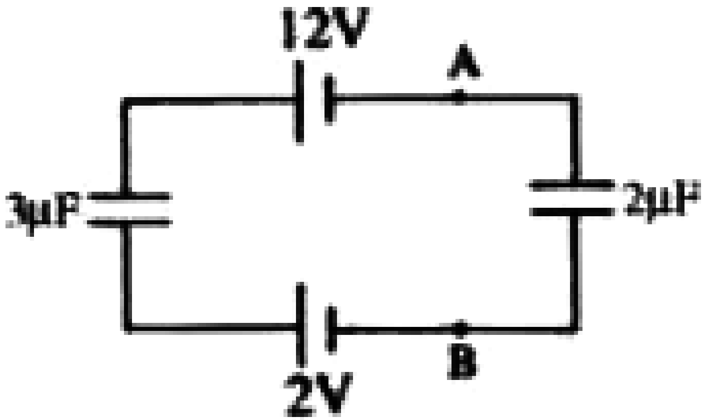
95. The P.D between the points A and B is



A. $6V$

B. $2V$

C. $10V$

D. $14V$

Answer: A

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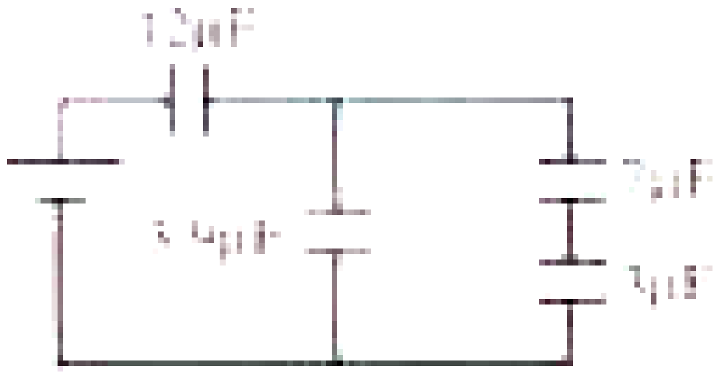
96. The potential drop across $7\mu F$ capacitor is 6V. Then



A. potential drop across $3\mu F$ capacitor is 10V

B. charge on $3\mu F$capacitor is $21\mu F$

C. emf of the cell is 30V

D. P.D across 12μF capacitor is 5V

Answer: C

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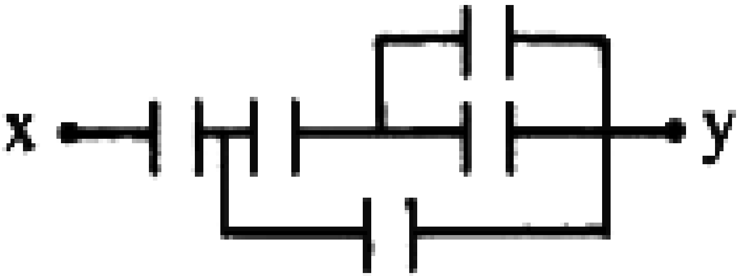
97. If the capacity of each condenser is 10 μ F, the equivalent capacity between x and y is



A. $10\mu F$

B. $\frac{25}{4}\mu F$

C. $30\mu F$

D. $\frac{15}{4}\mu F$

Answer: B

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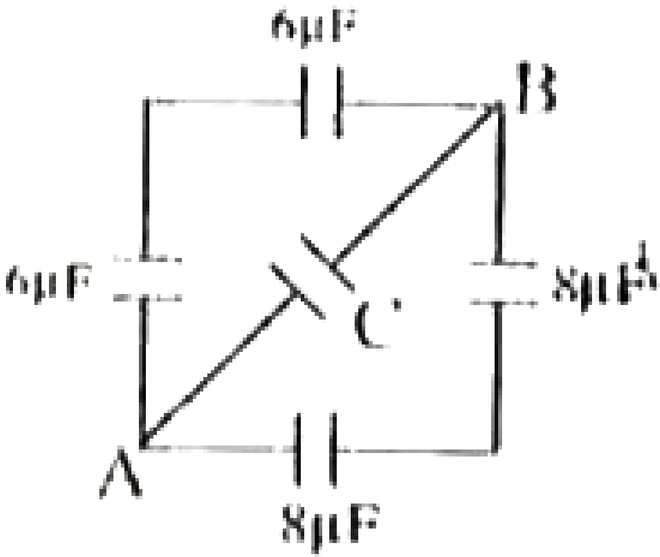
98. If the equivalent capacity between A and B in the circuit is $12\mu F$, the capacity C is



A. $5\mu F$

B. $3\mu F$

C. $4\mu F$

D. $8\mu F$

Answer: A

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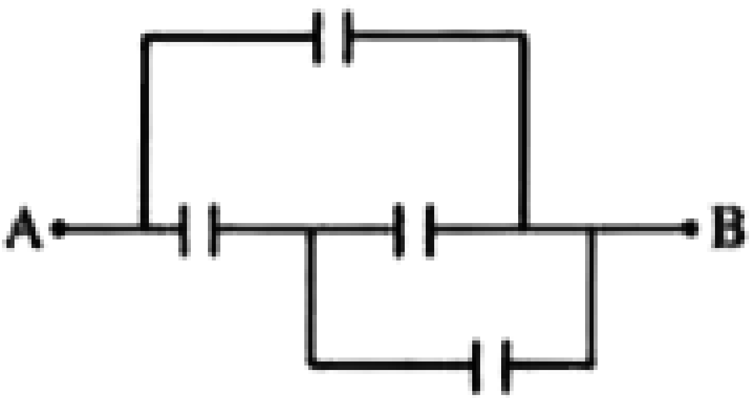
99. In the circuit shown in the figure, each capacitor has a capacity of 3 μ F. The equivalent capacity between A and B is



A. $3/4\mu F$

B. $3\mu F$

C. $6\mu F$

D. $5\mu F$

Answer: D

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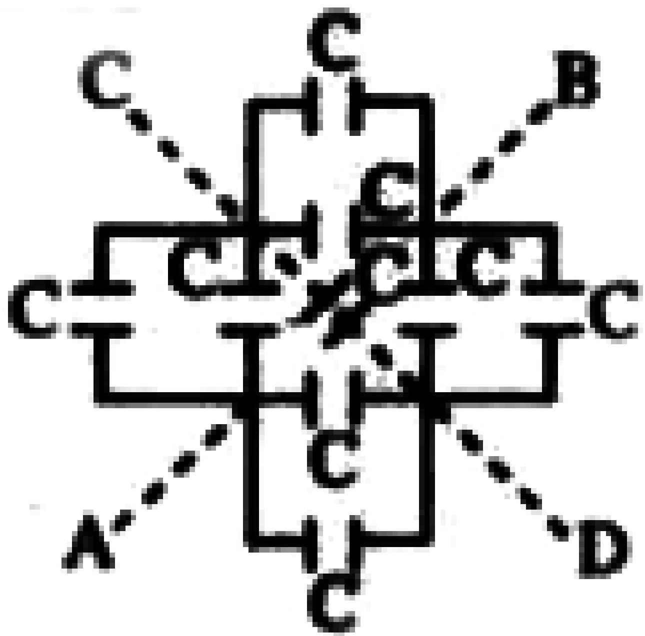
100. The equivalent capacity between the points A and B in the adjoining circuit will be



A. C

B. $2C$

C. $3C$

D. $4C$

Answer: B

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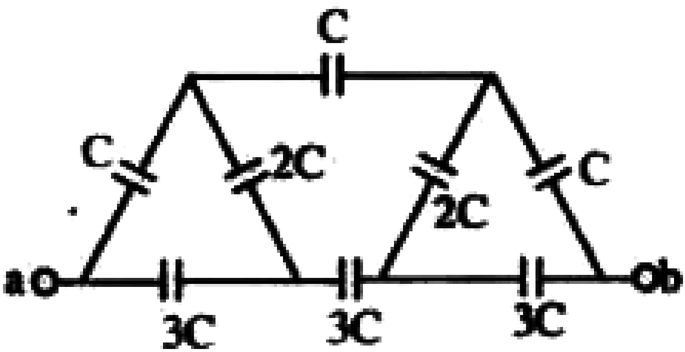
101. Find the effective capacitance between the terminals a and b shown in figure.



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

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

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

D. $\frac{5C}{3}$

Answer: A

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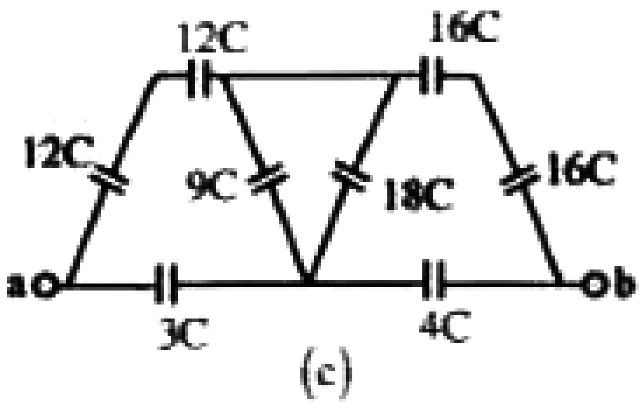
102. Find the effective capacitance between the terminals a and b shown in figure.



A. $\frac{8C}{27}$

B. $\frac{26C}{7}$

C. $\frac{36C}{7}$

D. $\frac{19C}{7}$

Answer: C

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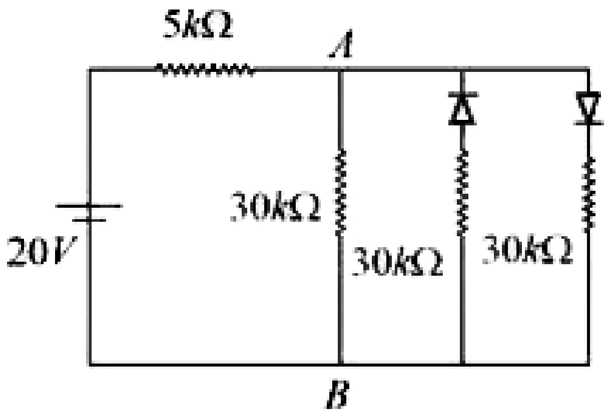
103. In the figure, potential difference between A & B is



A. $14V$

B. $4V$

C. $6V$

D. $8V$

Answer: B

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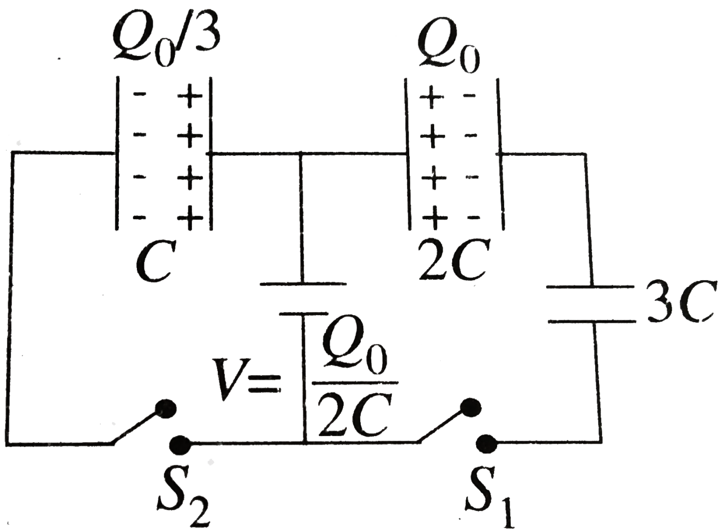
104. In the given circuit, the initial charges on the capacitors are shown in the figure. The charge flown through the switches S_1 and S_2, respectively after closing the switches are



A. No charge flows in (a) but charge flows from L to R in (b)

B. Charge flows from L to R in (a) but charge flows from R to L in (b)

C. Charges flow from R to L in (a) and from L to R in (b)

D. Charges flow from L to R in both (a) and (b)

Answer: B

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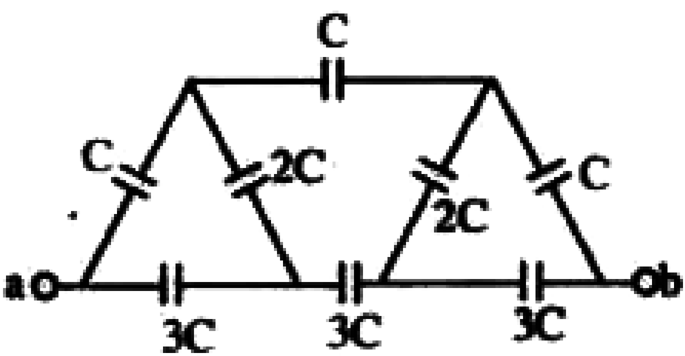
105. Find the effective capacitance between the terminals a and b shown in figure.



A. $3C$

B. $\frac{7C}{6}$

C. $\frac{6C}{7}$

D. $5C$

Answer: B

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106. A body of capacity 4u Fis charged to 80V and another body of capacity 6 μ F is charged to 30V. When they are connected the energy lost by 4 $\mu F$is

A. A) $7.8mJ$

B. B) $4.6mJ$

C. C) $3.2mJ$

D. D) $2.5mJ$

Answer: A

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107. Two parallel plates capacitors A and B having capacitance of $1\mu F$ and $5\mu F$ are charged separately to the same potential of 100 V. Now, the positive plate of A is connected to the negative plate of B and the negative plate of A to the positive plate of B. Find the final charges on each capacitors.

A. final charge on A and B are $\frac{200\mu C}{3}$ and $\frac{100\mu C}{3}$

B. the loss of energy is $1.63 \times 10^{-2}J$

C. both 1 and 2 are correct

D. both 1 and 2 are wrong

Answer: C

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108. A condenser of capacity 2mF charges to a potential 200V is connected in parallel with a condenser of same capacity but charged to a potential 100V. The percentage loss of energy of system is

A. $50\ \%$

B. $35\ \%$

C. $20\ \%$

D. $10\ \%$

Answer: D

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109. Two capacitors are in parallel and when connected to a source of 3000 V, store 250 J of energy. When they are connected in series to the same source, the energy stored decreases by 190 J for the same potential. Their capacities are in the ratio

A. $3:2$

B. $2:7$

C. $4:3$

D. $3:5$

Answer: A

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110. A parallel plate capacitor of capacity $100\mu F$ is charged by a battery of 50 volts. The battery remains connected and if the plates of the capacitor are separated so that the distance between them becomes double the original distance, the additional energy given by the battery to the capacitor in joules is

A. A) 62.5×10^{-3}

B. B) 12.5×10^{-3}

C. C) 1.25×10^{-3}

D. D) 0.125×10^{-3}

Answer: A

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111. A parallel - plate capacitor of plate area A and plate separation d is charged to a potential difference V and then the battery is disconnected . A slab of dielectric constant K is then inserted between the plate of the capacitor so as to fill the space between the plate .Find the work done on the system in the process of inserting the slab.

A. $\frac{\varepsilon_0 A V^2}{d}\left(1-\frac{1}{K}\right)$

B. $\frac{\varepsilon_0 A V}{3d}\left(\frac{1}{K}-1\right)$

C. $\frac{\varepsilon_0 A V^2}{2d}\left(\frac{1}{K}-1\right)$

D. $\frac{\varepsilon_0 A V^2}{2d}\left(1-\frac{1}{K}\right)$

Answer: C

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112. The capacity of a parallel plate condenser with air as dielectric is $2\mu F$. The space between the plates is filled with dielectric slab with K = 5. It is charged to a potential of 200V and disconnected from cell. Work done in removing the slab from the condenser completely

A. $0.8J$

B. $0.6J$

C. $1.2J$

D. $1.6J$

Answer: A

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113. A parallel plate air capacitor of capacitance C is connected to a cell of emf V and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air of the capacitor, is now inserted in it. Which of the following is incorrect?

A. Charge on plates becomes KC_0V

B. The energy stored in the capacitor becomes K times

C. The change in energy $\frac{1}{2}C_0V^2(k-1)$

D. The change in energy $\frac{1}{2}C_0V^2(1/K-1)$

Answer: D

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114. A parallel plate capacitor has plate area A and separation d. It is charged to a potential difference V. The charging battery is disconnected and the plates are pulled apart to three times the initial separation. The work required to separate the plates is

A. A) $\frac{3\varepsilon_0 A V_0^2}{d}$

B. B) $\frac{\varepsilon_0 A V_0^2}{2d}$

C. C) $\frac{\varepsilon_0 A V_0^2}{3d}$

D. D) $\frac{\varepsilon_0 A V_0^2}{d}$

Answer: D

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115. Two capacitors of capacity $4\mu F$ and $6\mu F$ are connected in series and a battery is connected to the combination. The energy stored is E_1 If they are connected in parallel and if the same battery is connected to this combination the energy stored is E_2 The ratio $E_1 : E_2$ is

A. A) $4 : 9$

B. B) $9 : 14$

C. C) $6 : 25$

D. D) $7 : 12$

Answer: C

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116. A parallel plate capacitor of capacity C_0 is charged to a potential V_0, E_1 is the energy stored in the capacitor when the battery is disconnected and the plate separation is doubled, and E_2 is the energy stored in the capacitor when the charging battery is kept connected and the separation between the capacitor plates is dounled. find the ratio E_1 / E_2.

A. 4

B. $3/2$

C. 2

D. $1/2$

Answer: A

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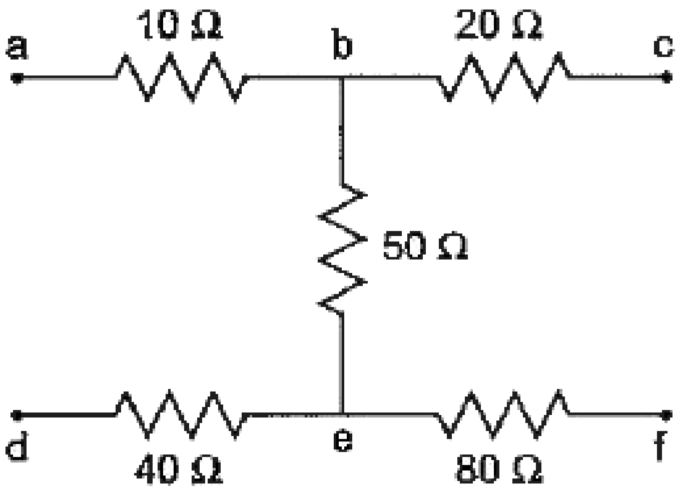
117. The equivalent resistance between points a and f of the network shown in figure below is



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

B. $2E$

C. $\frac{E}{18}$

D. $\frac{5E}{18}$

Answer: C

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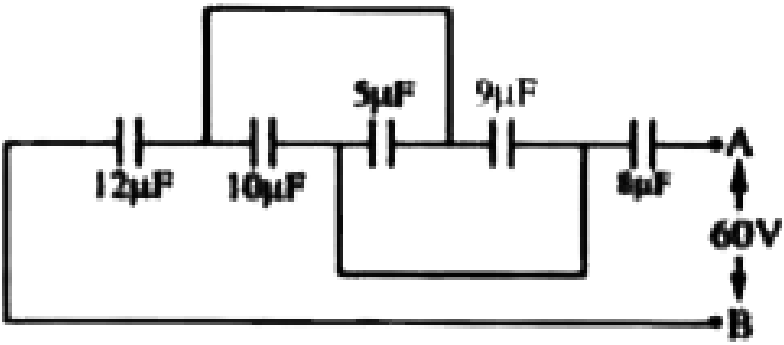
118. The energy stored in $5\mu F$ and $8\mu F$ capacitors are



A. $250 \times 10^{-6} J, 36 \times 10^{-4} J$

B. $250 \times 10^{-6} J, 240 \times 10^{-4} J$

C. $250 \times 10^{-6} J, 240 \times 10^{-4} J$

D. $250 \times 10^{-6} K, 50 \times 10^{-4}$J

Answer: A

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119. A fully charged capacitor has a capacitance C. It is discharged through a small coil of resistance wire embedded in a thermally insulated block of specific heat capacity s and mass m. If the temperature of the block is raised by ΔT, the potential difference V across the capacitance is:

A. $\sqrt{\frac{2mC\Delta T}{s}}$

B. $\frac{mC\Delta T}{s}$

C. $\frac{ms\Delta T}{C}$

D. $\sqrt{\frac{2ms\Delta T}{C}}$

Answer: D

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120. A series combination of n_1 capacitors, each of value C_1 is charged by a source of potential difference 4 V. When another parallel combination of n_2 capacitors, each of value C_2, in charged by a soure of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2, in terms of C_1 is, then

A. $\dfrac{16C_1}{n_1n_2}$

B. $16\dfrac{n_2}{n_1}$

C. $\dfrac{2C_1}{n_1n_2}$

D. $2\dfrac{n_2}{n_1}C_1$

Answer: A

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121. A spherical drop of capacitance $1\mu F$ is broken into eight drop of equal radius. Then, the capacitance of each small drop is

A. $\frac{1}{8}\mu F, 0.2 \text{ and } 20mJ$

B. $\frac{1}{4}\mu F, 4V \text{ and } 2mJ$

C. $\frac{1}{2}\mu F, 1V \text{ and } 2mj$

D. $\frac{1}{2}\mu F, 2V \text{ and } 2mJ$

Answer: C

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122. When a number of liquid drops each of surface charge density σ and energy E combine, a large drop is formed. If the charge density of the large drop is 3 σ , its energy is

A. $81E$

B. $3E$

C. $27E$

D. $243E$

Answer: D

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123. n identical condensers are joined in parallel and are charged to potential so that energy stored in cach condenser is . If they are seperated and joined in series, then the total energy and total potential difference of the combination will be

A. nE and $\frac{V}{n}$

B. n^2E and nV

C. $\frac{E}{n^2}$ and $\frac{V}{n^2}$

D. nE and nV

Answer: D

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124. A condenser of capacity C_1 is charged to a potential V_0 the electrostatic energy stored in it is U_0. It is connected to another uncharged condenser of capacity C_2 in parallel. The energy dissipated in the process is

A. $\left(\frac{C_2}{C_1 + C_2}\right)U_0$

B. $\left(\frac{C_1}{C_1 + C_2}\right)U_0$

C. $\left(\frac{C_1 - C_2}{C_1 + C_2}\right)U_0$

D. $\left(\frac{C_1 C_2}{2(C_1 + C_2)}\right)U_0^2$

Answer: A

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125. A parallel plate capacitor is filled with a dielectric of dielectric constant (relative permittivity) 5 between its plates and is charged to acquire an energy E. Then it is isolated (disconnected from the battery) and the dielectric is replaced by another dielectric of dielectric constant (relative permittivity) 2. The new energy stored in the capacitor

A. A) E

B. B) $2.5E$

C. C) $5E$

D. D) $10E$

Answer: B

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126. A parallel -plate capacitor with the plate area $100cm^2$ and the separation between the plate 1.0cm is connected across a battery of emf 24 volts .Find the force of attraction between the plates.

A. $1.0 \times 10^{-7} N$

B. $2.5 \times 10^{-7} N$

C. $4 \times 10^{-5} N$

D. $1.6 \times 10^{-5} N$

Answer: B

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127. A parallel plate capacitor has a uniform electric field E in the space between the the plates. If the distance between the plates is d and area of each plate is A, the energy stored in the capacitor is

A. $0.5N$

B. $0.05N$

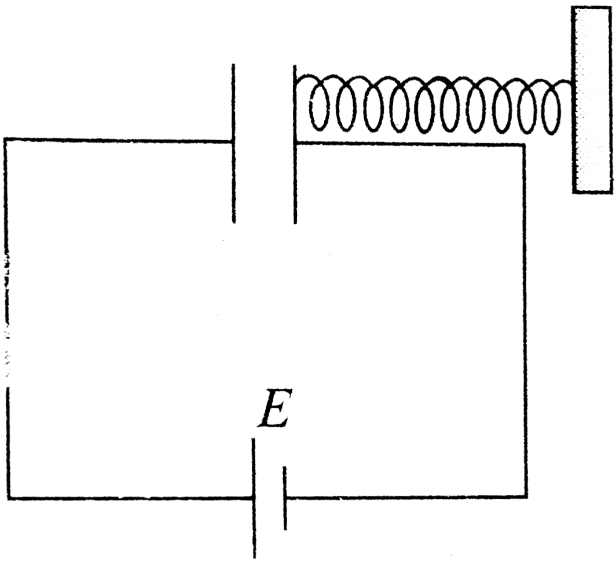
C. $0.005N$

D. None of these

Answer: B

Watch Video Solution

128. One plate of a capacitor is fixed, and the other is connected to a spring as shown in. Area of both the plates is A In strady state (equilibrium), separation between the plates is $0.8d$ (spring was unstretched , and the distance between the plates was d when capacitor was uncharged). The force conntant of the spring is approximately.



A. $5\frac{\varepsilon_0 AE^2}{2d^3}$

B. $\frac{65}{32}\frac{\varepsilon_0 AE^2}{d^3}$

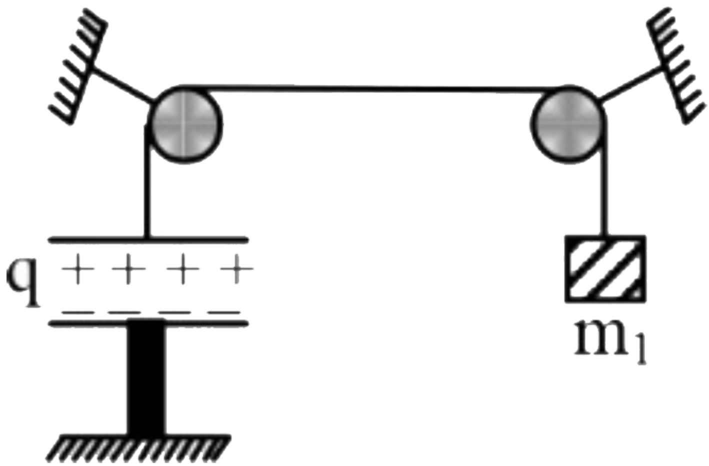
C. $\frac{125}{16}\frac{\varepsilon_0 AE^2}{d^3}$

D. $\frac{125}{32}\frac{\varepsilon_0 AE^2}{d^3}$

Answer: D

Watch Video Solution

129. In the given system a capacitor of plate area A is changed up to charge q . The mass of each plate is m_1 The lower plate is rigidly fixed . Find the value of m_2 so that the system is in equilibrium –



A. $m_2 + \frac{q^2}{\epsilon_0 Ag}$

B. m_2

C. $2m_2$

D. $\frac{q^2}{2\epsilon_0 Ag} + m_2$

Answer: D

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130. Identify A and B:

A. $10V, 0V$

B. $6V, \ -4V$

C. $4V, \ -6V$

D. $5V, \ -5V$

Answer: B

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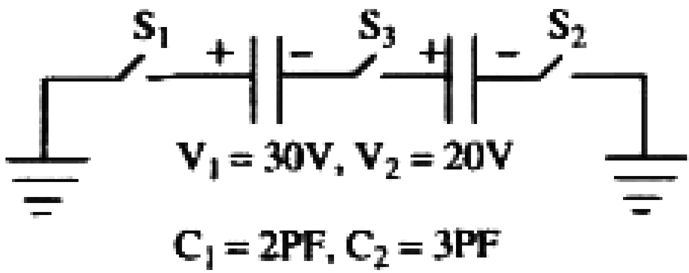
131. In the given circuit which of the following statement(s) is/are true ?



A. with S_1 closed ,$V_1 = 15V$, $V_2 = 20V$

B. with S_3closed, $V_1 = 25V$, $V_2 = 25V$

C. with $S_1 \& S_2$ closed, $V_1 = 0V$, $V_2 = 0V$

D. with $S_1 \& S_3$ closed, $V_1 = 30V$, $V_2 = 20V$

Answer: D

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132. A capacitor of capacitance $10(\mu)F$ is connected to a battery of emf 2V.It is found that it takes 50 ms for the charge on the capacitor to become $12.6(\mu)C$. find the resistance of the circuit.

A. $2.3mJ$

B. $1.15mJ$

C. $4.6mJ$

D. $9.2mJ$

Answer: C

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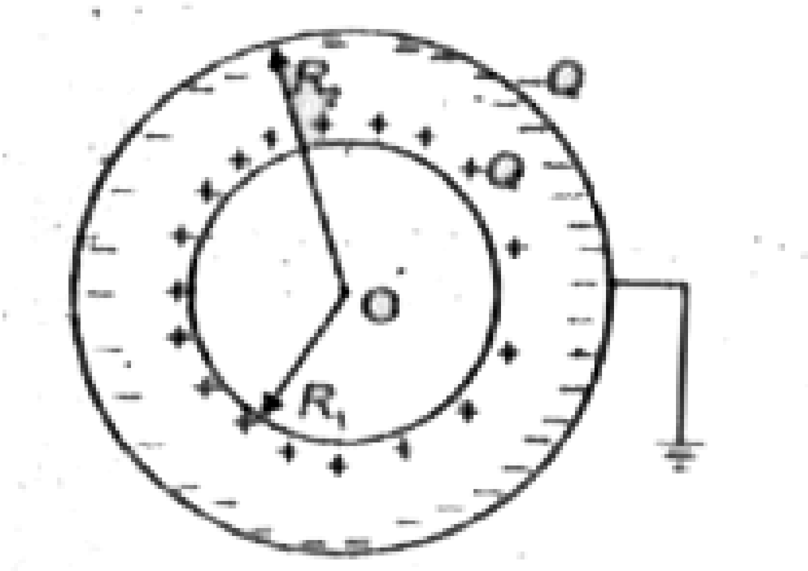
133. For a spherical capacitor shown at which points the electric field will be zero ? (r is the distance of point from centre O)



A. At point $r > R_2$

B. At point $r > R_1$

C. At points between R_1 and R_2

D. None of the above

Answer: A

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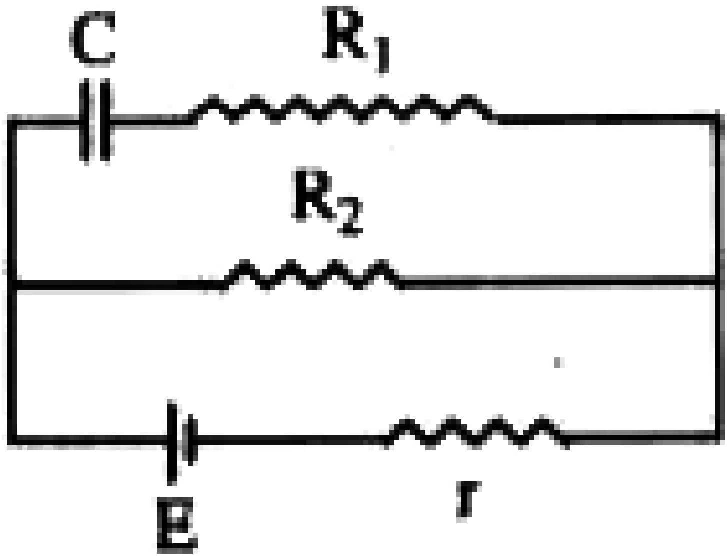
134. The numerical value of the charge on either plates of capacitor 'C' as shown in the figure is



A. CE

B. $\frac{CER_1}{R_1 + r}$

C. $\frac{CER_2}{R_2 + r}$

D. $\frac{CER_1}{R_2 + r}$

Answer: C

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135. The charge on $4\mu F$capacitor in the given circuit is $(\text{in}\mu C)$

A. $18\mu C$

B. $4\mu C$

C. $8\mu C$

D. Zero

Answer: C

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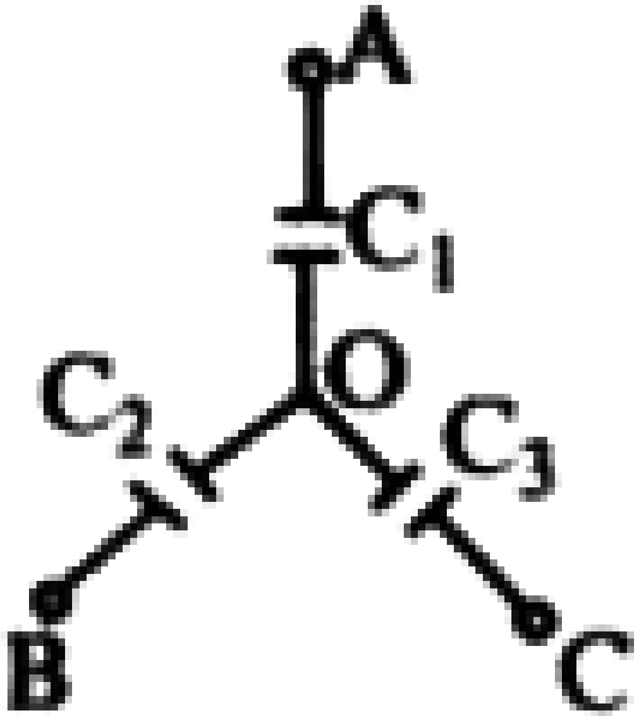
136. Three uncharged capacitors of capacities C_1, C_2 and C_3 are connected as shown in the figure to one another and the point. A, B and C are at potentials $V_1, V_2,$ and V_3, respectively. Then the potential at O will be



A. $\frac{V_1C_1 + V_2C_2 + V_3C_3}{C_1 + C_2 + C_3}$

B. $\frac{V_1 + V_2 + V_3}{C_1 + C_2 + C_3}$

C. $\frac{V_1(V_2 + V_3)}{C_1(C_2 + C_3)}$

D. $\frac{V_1V_2V_3}{C_1C_2C_3}$

Answer: A

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137. In the given figure capacitor of plate area A is changed upto charge q. The ratio of elongation (neglect force of gravity) in spring C and D at equilibrium position is

A. $\frac{k_1}{k_2}$

B. $\frac{k_2}{k_1}$

C. $\sqrt{\frac{K_1}{k_2}}$

D. $k_1 k_2$

Answer: B

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138. Space between the plates of a parallel plate capacitor is filled with a dielectric whose dielectric constant varies with distance as per the relation: $K(X) = K_0 + \lambda X$,

($\lambda =$ constant, $K_0 =$ constant, X is perpendicular distance from one plate to a point inside dielectric). The capacitance C_1 of this capacitor, would be related to its vacuum capacitance C_0 per the relation (d = plate separation):

A. $C = \dfrac{\lambda}{d.\, In(1 + k_0 \lambda d)} C_0$

B. $C = \dfrac{\lambda d}{In(1 + \lambda d / K_0)} C_0$

C. $C = \dfrac{\lambda}{d.\, In(1 + K_0 / \lambda d)} C_0$

D. $C = \dfrac{\lambda d}{In(1 + K - 0 \lambda d)} C_0$

Answer: B

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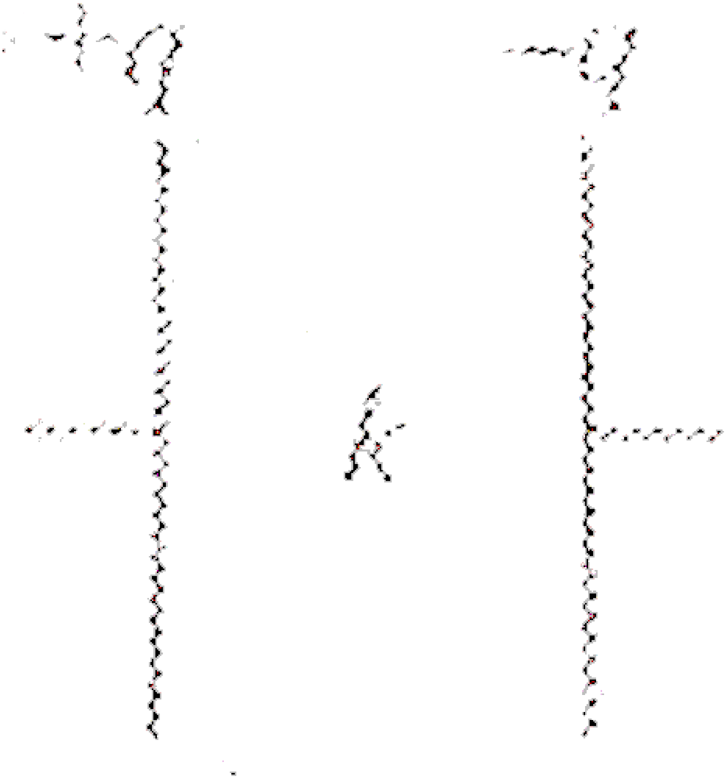
139. Force of attraction between the plates of area A of a parallel palte capacitor is



A. $\dfrac{\varepsilon_0(\varepsilon_2 - \varepsilon_1)A}{[dIn(\varepsilon_2/\varepsilon_1)]}$

B. $\dfrac{\varepsilon_0 A}{[dIn\varepsilon_2/\varepsilon_1]}$

C. $\dfrac{\varepsilon_0(\varepsilon_2 + \varepsilon_1)A}{2d}$

D. $\dfrac{\varepsilon_0(\varepsilon_2 + \varepsilon_1)A}{d}$

Answer: A

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140. An insulating solid sphere of radius R has a uniform positive charge density ρ . As a result of this uniform charge distribution, there is a finite value of electric potential at the centre of the sphere, at the surface of the sphere and also at a point outside the sphere. The electric potential at infinity is zero.

When a charge q is taken from the centre the surface of the sphere, its potential energy changes by $\frac{qp}{3\varepsilon o}$

The electric field at a distance r (r < R) from the centre of the sphere is `(rhor)/(3varepsilono):

A. S-1 is true, S-2 is true, S-2 is not the correct explanation of statement - 1

B. S-1 is true S-2 is fals

C. S-1 is false, S-2 is true

D. S-1 is true, S-2 is true, S-2 is the correct explanation of statement-1

Answer: C

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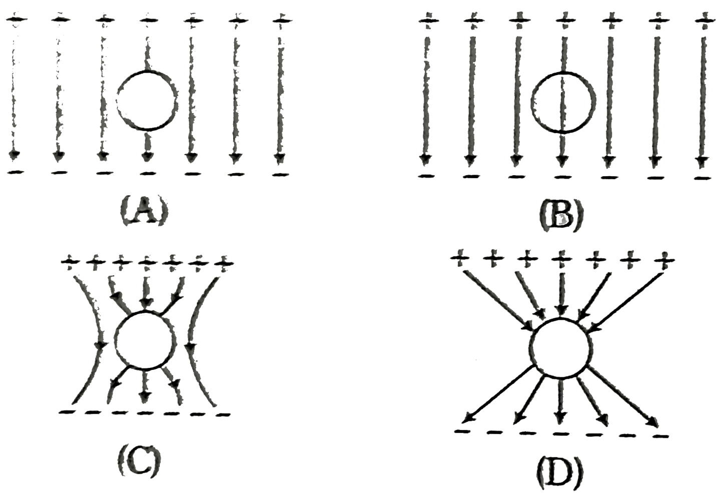
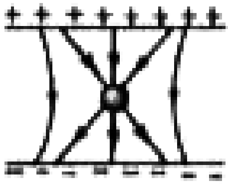
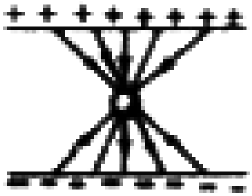
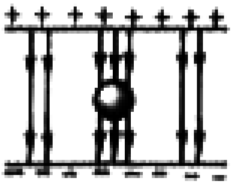
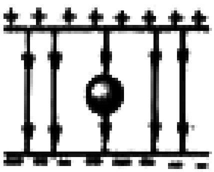
141. An ucharged sphere of metal is placed in between two charged plates as shown. The lines of force look like



A. 

B. 

C. 

D. 

Answer: A

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142. A parallel plate capacitor is made of two circular plates separated by a distance of 5 mm and with a dielectric of dielectric constant 2.2 between them. When the electric field in the dielectric is$3 \times 10^4 V/m$, the charge density of the positive plate will be close to :

A. $6 \times 10^{-7} C/m^2$

B. $3 \times 10^{-7} C/m^2$

C. $3 \times 10^4 C/m^2$

D. $6 \times 10^4 C/m^2$

Answer: A

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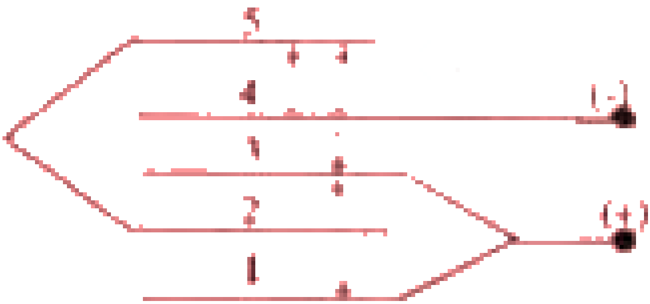
143. Five identical conducting plates 1,2,3,4 and 5 are fixed parallel to and equidistant from each other as shown in figure. Plate 2 and 5 are connected by a conductor while 1 and 3 are joined by another conductor . The junction of 1 and 3 and the plate 4 are connected to a source of constant emf V_0.

Match the following :



COLUMN - I	COLUMN - II
A) Charge on plate - 3	p) $+\frac{CV_0}{3}$
B) Charge on plate - 5	q) $\frac{2\epsilon_0 AV_0}{3d}$
C) Charge on plate - 1	r) $-\frac{5\epsilon_0 AV_0}{3d}$
D) Charge on plate - 4	s) $\frac{4}{3}\frac{\epsilon_0 AV_0}{d}$

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REVISION EXERCISE (CUTTENT ELECTRICITY)

1. If α-particle $\left({}_{2}He^{4}\right)$ is revolving in a circular orbit of radius 3.14 A with speed of $8 \times 10^{6} \frac{m}{s}$. Then the equivalent current is

A. $6.\ 4 \times 10^{-12} A$

B. $12.8 \times 10^{-4} A$

C. $12.810^{-16} A$

D. $6.4 \times 10^{-9} A$

Answer: B

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2. In hydrogen discharge tube, it is observed that through a given cross - section 3.13×10^{15} electrons are moving from right to left and 3.12×10^{15} protons are moving from left to right per second. The current in the discharge tube (in mA) will be

A. $1.6\mu A$ towards left

B. $1.6\mu A$ towards right

C. $1mA$ towards left

D. $1mA$ towards right

Answer: D

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3. An electron of mass m,moves around the nucleus in a circular orbit of radius 'r' under the action of centripetal force 'F'. The equivalent electric current is

A. $\frac{e}{2\pi}\sqrt{\frac{F}{mr}}$

B. $2\pi Sqrt\left(\frac{F}{mr}\right)$

C. $\frac{e}{\pi}\sqrt{\frac{F}{mr}}$

D. $\frac{e}{2\pi}\sqrt{\frac{mr}{F}}$

Answer: A

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4. The current in a conductor varies with time 't' as I = 3t + $4t^2$. Where I in amp and t in sec. The electric charge flows through the section of the conductor between t = 1s and t = 3s

A. $\frac{14}{3}C$

B. $\frac{3}{14}C$

C. $\frac{140}{3}C$

D. $\frac{3}{140}C$

Answer: C

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5. A copper conductor of area of cross- section 40 mm^2 on a side carries a constant current of $32 \times 10^{-6} A$. Then the current density is (in amp/m^2)

A. 1.6

B. 0.8

C. 0.4

D. 3.2

Answer: B

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6. A wire carrying a current of 16A and its cross-sectional area $10^{-5}m^2$. If the free electron density in wire is $4 \times 10^{28}m^{-3}$, the drift velocity is ----x10^{-4}(in m/s)

A. 1.6

B. 2.5

C. 6.4

D. 3.2

Answer: B

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7. In a wire of circular cross-section with radius 'r' free electrons travel with a drift velocity v, when a current I flows through the wire. 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. $\frac{I}{2}$

D. $\frac{I}{4}$

Answer: C

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8. An ionization chamber with parallel conducting plates as anode and cathode has 5×10^7 electrons and the same number of singly-charged positive ions per cm^3. The electrons are moving at $0.4m/s$. The current density from anode to cathodes $4\mu A/m^2$. The velocity of positive ions moving towards cathode is

A. $0.4ms^{-1}$

B. Zero

C. $1.6ms^{-1}$

D. $0.1ms^{-1}$

Answer: D

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9. A straight conductor of uniform cross section carries a time varying current, which varies at the rate $di/dt = I$. If s is the specific charge that is carried by each charge carrier of the conductor and l is the length of the conductor, then the total force experienced by all the charge carrier per unit length of the conductor due to their drift velocities only is

A. $\frac{q}{ts}$

B. $\left(\frac{q}{ts}\right)^2$

C. $\sqrt{\frac{q}{ts}}$

D. qts

Answer: A

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10. A wire 50 cm long and 1 mm^2 in cross-section carries a current of 4 A when connected to a 2 V battery. The resistivity of the wire is

A. 1×10^{-6}

B. 4×10^{-7}

C. 3×10^{-7}

D. 2×10^{-7}

Answer: A

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11. Two wires A and B made of same material and having their lengths in the ratio $6:1$ are connected in series The potential difference across the wire $3V$ and $2V$ respectively. If r_A and r_B are the radii of A and B respectively, then $\frac{r_B}{r_A}$ is

A. $1/4$

B. $1/2$

C. 3

D. 2

Answer: B

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12. Three resistors of 2Ω, 3Ω and 4Ω are connected in series

A. $20V$

B. $10V$

C. $5V$

D. $15V$

Answer: B

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13. Three resistance 4Ω, 6Ω and 10Ω are connected in series and a p.d. of 20V is applied across the terminals of combination. The p.d. across6Ωresistance is

A. $10A$

B. $5A$

C. $15A$

D. $20A$

Answer: B

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14. Two wires of the same material and same length have radii 1 mm and 2 mm respectively. Compare :

their resistances,

A. $5V$

B. $13.5V$

C. $27V$

D. $10V$

Answer: B

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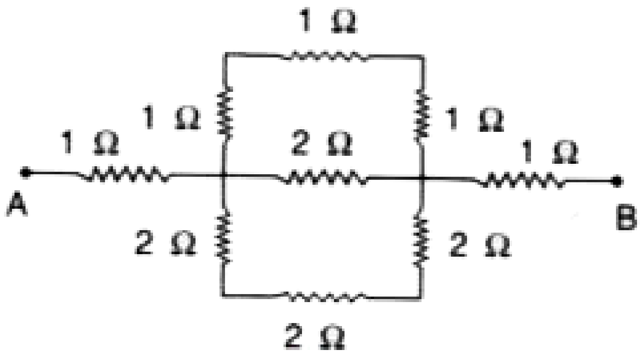
15. Calculate the effective resistance between the points A and B in the circuit shown in Fig.



A. $2A$

B. $\frac{1}{3}A$

C. $1A$

D. $1.5A$

Answer: D

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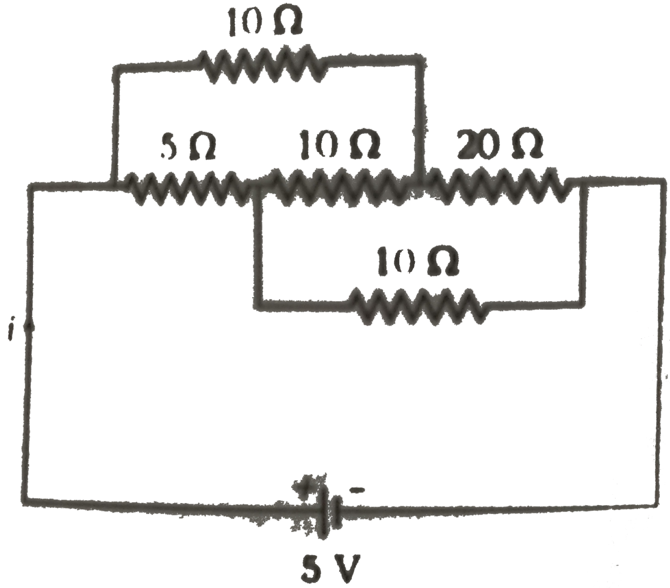
16. The current i drawn from the 5 V source will be



A. $0.5A$

B. $0.33A$

C. $0.67A$

D. $0.17A$

Answer: A

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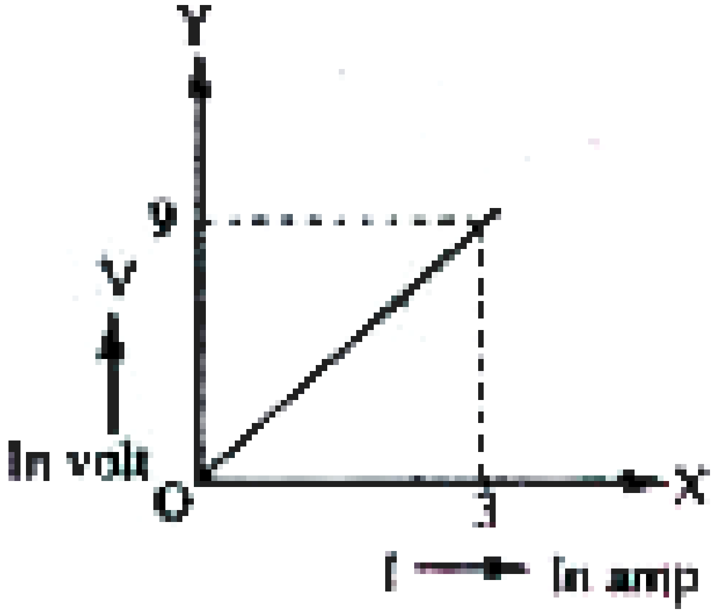
17. The variation of current and voltage in a conductor has been shown in figure. The resistance of the conductor is



A. 4Ω

B. 2Ω

C. 3Ω

D. 1Ω

Answer: C

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18. Two resistances of 400Ω and 800Ω are connected in series with 6 V battery of negligible internal resistance.A voltmeter of resistance 10000Ω is used to measure the potential difference across 400Ω.The error in the measurement of potential difference in volts approximately is

A. 0.01

B. 0.02

C. 0.03

D. 0.05

Answer: D

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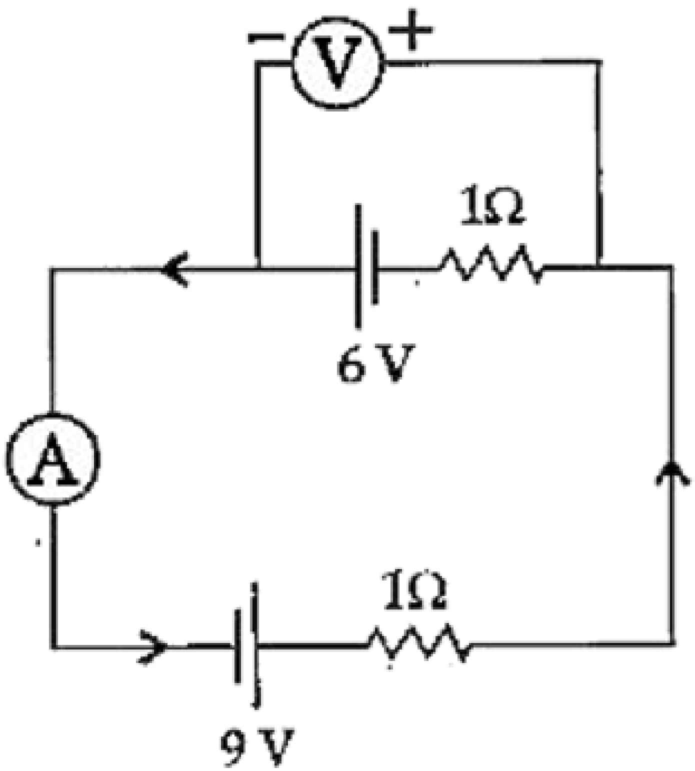
19. In the following circuit, determine the reading of ideal voltmeter (V) and ideal ammeter (A).



A. $\frac{3}{8}A, \frac{1}{8}A$

B. $\frac{1}{8}A, \frac{1}{8}A$

C. $2A, \frac{2}{3}A$

D. $2A, \frac{1}{8}A$

Answer: A

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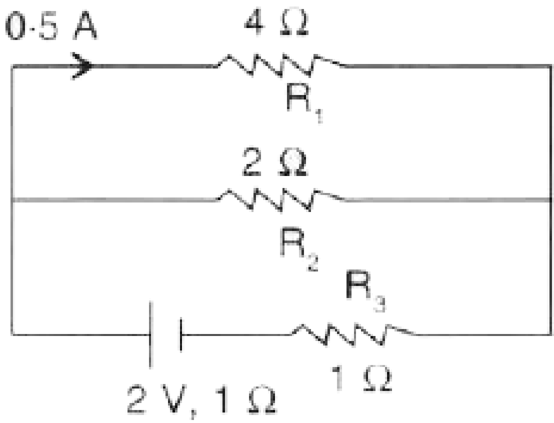
20. In an electric circuit shown alongside, find



current in resistor 2Ω

A. $1.6A$

B. $0.25A$

C. $2.5A$

D. $0.67A$

Answer: D

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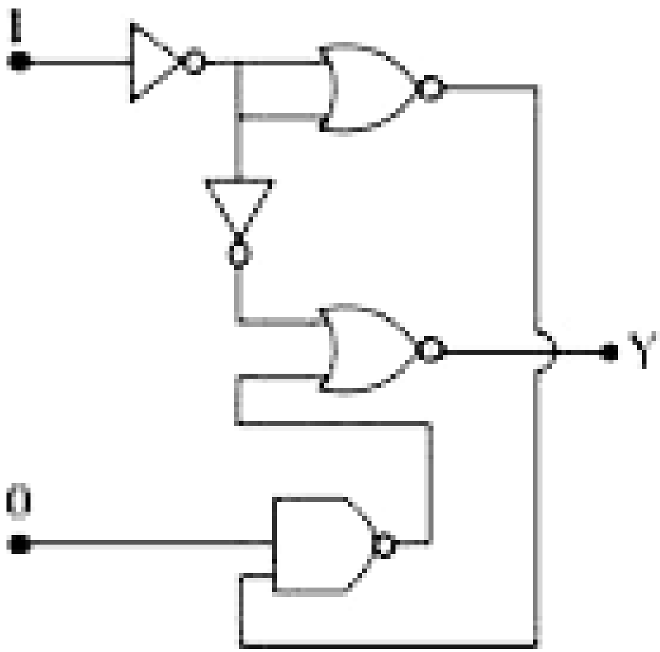
21. In the given circuit, value of Y is:



A. 200Ω

B. 100Ω

C. 400Ω

D. 300Ω

Answer: D

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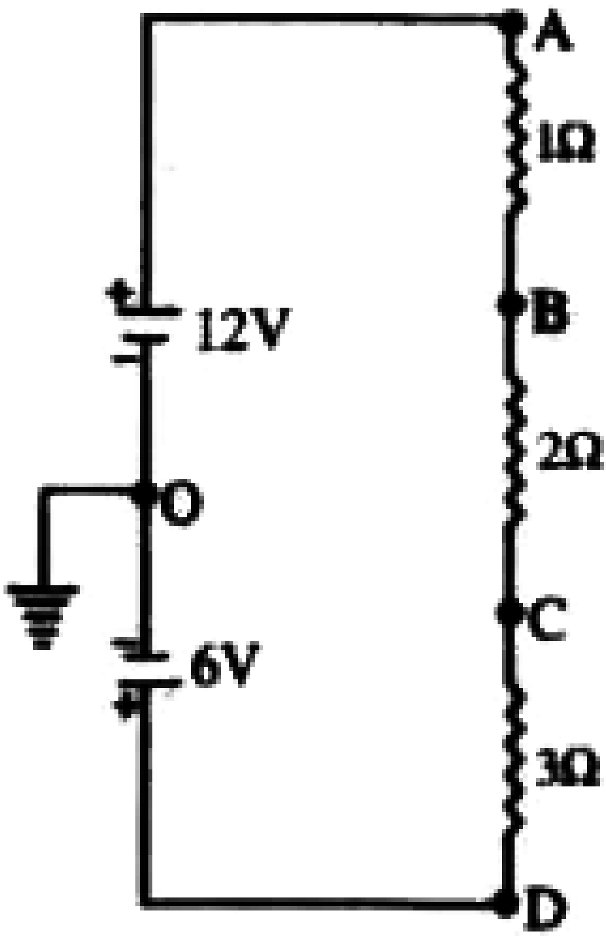
22. In the circuit shown in figure, the potentials of B, C and D are:



A. $V_B = 6V, V_C = 9V, V_D = 11V$

B. $V_B = 11C, V_C = 9V V_D = 6V$

C. $V_B = 9V, V_C = 11V, V_D = 6V$

D. $V_B = 9V, V_C = 6V, V_D = 11V$

Answer: B

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23. The specific resistance of the material of a wire is $'\rho'$ and its volume is $3m^3$ and its resistance is 3Ω. The length of the wire will be

A. $\frac{1}{(\sqrt{\rho})}$

B. $\frac{3}{\sqrt{(\rho)}}$

C. $\frac{\sqrt{3}}{\rho}$

D. $\frac{\rho}{\sqrt{3}}$

Answer: B

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24. A hollow cylinder $(\rho = 2.2 \times 10^{-8} \Omega - m)$ of length 3 m has inner and outer diameters are 2 mm and 4 mm respectively. The resistance of the cylinder is

A. $0.35 \times 10^{-3} \Omega$

B. $3 \times 10^{-3} \Omega$

C. $7 \times 10^{-3} \Omega$

D. $3.1 \times 10^{-3} \Omega$

Answer: C

Watch Video Solution

25. A rectangular block has dimensions 5 cm $\times$ 5 cm $\times 10 cm$. Calculate the resistance measured between (a) two square ends and (b) the opposite rectanglar ends specific resistance of the material is $3.5 \times 10^{-5}\ \Omega$ m

A. 3

B. 4

C. 2

D. 1

Answer: B

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26. The wires of same dimension but resistivities ρ_1 and ρ_2 are connected in series . The equivalent resistivity of the combination is

A. $\dfrac{\rho_1 X_1 \rho_2 X_2}{X_1 + X_2}$

B. $\dfrac{\rho_1 X_2 + \rho_2 X_1}{x_1 - X_2}$

C. $\dfrac{\rho_1 X_2 + \rho_2 X_1}{X_1 + X_2}$

D. $\dfrac{\rho_1 X_1 + \rho_2 X_2}{X_1 - X_2}$

Answer: A

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27. Two wires of the same dimensions but resistivities p_1 and p_2 are connected in series. The equivalent resistivity of the combination is

A. $\dfrac{n(n-1)}{2}$

B. $\dfrac{(n+1)}{2}$

C. $\dfrac{(n+1)}{2n}$

D. $\dfrac{2n}{n+1}$

Answer: B

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28. Two rods are joined end to end. Both have a cross - sectional area of $0.01cm^2$. Each is 1 meter long . One rod is a copper with a resistivity of 1.7×10^{-6} ohm- centimeter ,the other is of iron with a resistivity 10-5 ohm-centimeter.

How much voltage is required to produce a current of 1 ampere in the rods ?

A. $4.7 \times 10^{-2}\Omega$

B. $13.2 \times 10^{-2}\Omega$

C. $8.8 \times 1^{-2}\Omega$

D. $7 \times 10^{-2}\Omega$

Answer: A

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29. Resistance of a wire is 8Ω. It is drawn in such away that it experiences a longitudinal strain of 400 %. The new resistance is

A. 100Ω

B. 200Ω

C. 300Ω

D. 400Ω

Answer: B

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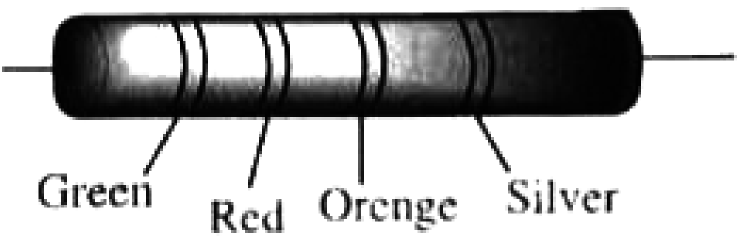
30. Find the value of colour coded resistance shown is fig



A. $520 \pm 10\%$

B. $520 \pm 1\%$

C. $52000 \pm 10\%$

D. $52000 \pm 1\%$

Answer: C

Watch Video Solution

31. The colour coded resistance of corbon resistance is (Initial three bands are red and fourth band is silcer)

A. $222. \Omega \pm 10\%$

B. $2200\Omega \pm 10\%$

C. $333\Omega \pm 5\%$

D. $33000\Omega \pm 10\%$

Answer: B

Watch Video Solution

32. The colour coded carbon resistance has three bands. the bands from left are blue, yellow and red the resistance is

A. $6400\Omega \pm 20\%$

B. $642 \pm 20\%$

C. $6420 \pm 10\%$

D. $4600 \pm 5\%$

Answer: A

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33. The third band in colour coded resistance represents

A. Third digit of resistance

B. Number of zeros after two digits

C. Number of zeros after one digit

D. Percentage of tolerence of resistance

Answer: B

Watch Video Solution

34. The resistance of the wire is 121 ohm. It is divided into 'n' equal parts and they are connected in parallel, then effective resistance is 1'ohm. The value of 'n' is

A. 12

B. 13

C. 11

D. 3

Answer: C

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35. When two resistance 10Ω and 20Ω are connected in series and 6 such sets are connected in parallel then the total resistance is

A. 2.5Ω

B. 7.5Ω

C. 5Ω

D. 3.5Ω

Answer: C

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36. When two resistances are connected in series. The effective resistance is found to be 48Ω. Their resistances if their values are in the ratio 3:1.

A. 24Ω and 24Ω

B. 36Ω and 12Ω

C. 12Ω and 48Ω

D. 36Ω and 36Ω

Answer: B

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37. The resultant resistance of two resistance in series is $50\Omega$and it is 12Ω, when they are in parallel. The individual resistances are

A. 20Ω and 15Ω

B. 15Ω and 30Ω

C. 20Ω and 30Ω

D. 10Ω and 15Ω

Answer: C

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38. A uniform wire is cut into 10 segments of increasing length. Each segment is having a resistace of 8 Ω more than that of previous segment. If the resistance of shortest segment is R and largest segment is 2 R. The original resistance of wrie in ohm.

A. 72

B. 144

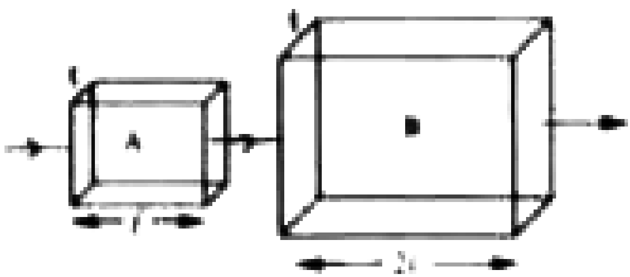
C. 720

D. 1080

Answer: D

Watch Video Solution

39. Two square metal plates A and B are of the same thickness and material. The side of B is twice that of A. these are conncetedasshown in series. If the resistances of A and B are denoted by R_A and R_B then (R_A / R_B) is :



A. $1/2$

B. $2/1$

C. $1/1$

D. $4/1$

Answer: C

Watch Video Solution

40. Three unequal resistors in parallel are equivalent to a resistance 1Ω. If two of them are in the ratio $1:2$ and if no resistance value is fractional, then the largest of the three resistances in ohms is

A. 4

B. 6

C. 8

D. 12

Answer: B

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41. When 16 wires which are identical are connected in series, the effective resistance exceeds that when they are in parallel by $31\frac{7}{8}\Omega$ Then the resistance of each wire is

A. 0.5Ω

B. 1Ω

C. 2Ω

D. 8Ω

Answer: C

Watch Video Solution

42. A uniform conductor of resistance R is cut into 20 equal pieces. Half of them are joined in series and the remaining half of them are connected in parallel. If the two combinations are joined in series, then the effective resistance of all the pieces is

A. R

B. $\frac{R}{2}$

C. $\frac{101R}{200}$

D. $\frac{201R}{200}$

Answer: C

Watch Video Solution

43. A conductor of resistance 3Ω is stretched uniformly till its length is doubled . The wire is now bent in the form of an equilateral triangle . The effective resistance between the ends of any side of the triangle in ohms is

A. $\frac{9}{2}\Omega$

B. $\frac{8}{3}\Omega$

C. 2Ω

D. 1Ω

Answer: B

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44. Four resistance $10\Omega, 5\Omega, 7\Omega$ and 3Ω are connected so that they form the side of a rectangle AB,BC,CD and DA respectively.

Another resestance of 10Ω is connected across the diagonal AC. The equivalent resistance between A and B is

A. 5Ω

B. 2Ω

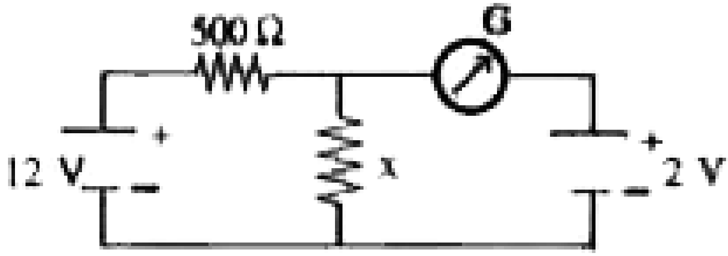
C. 7Ω

D. 10Ω

Answer: A

Watch Video Solution

45. If the galvanometer reading is zero, in the given circuit. Then the value of 'X' will be



A. 200Ω

B. 1000Ω

C. 500Ω

D. 100Ω

Answer: D

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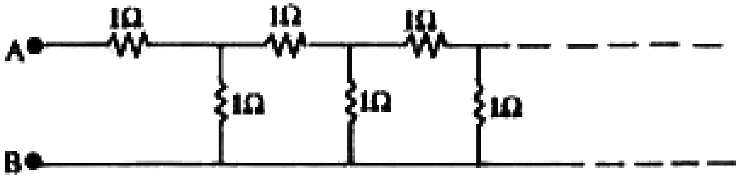
46. Th equivalent resistance between points A and B of an infinite network of resistance each of 1Ω connected as shown is



A. inifinite

B. 2Ω

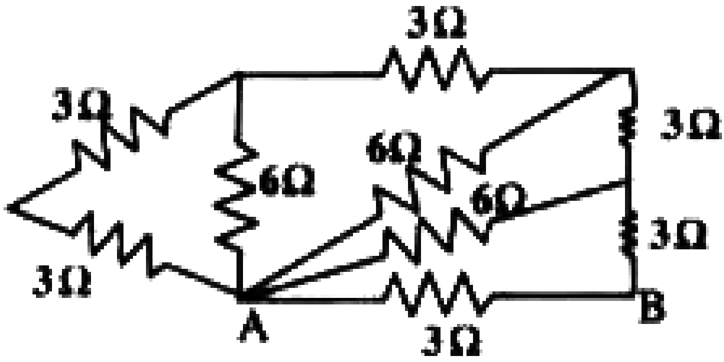
C. zero

D. $\left(\frac{1+\sqrt{5}}{2}\right)$

Answer: D

Watch Video Solution

47. The effective resistance between A and B is the given circuit is



A. 2Ω

B. 3Ω

C. 9Ω

D. 6Ω

Answer: A

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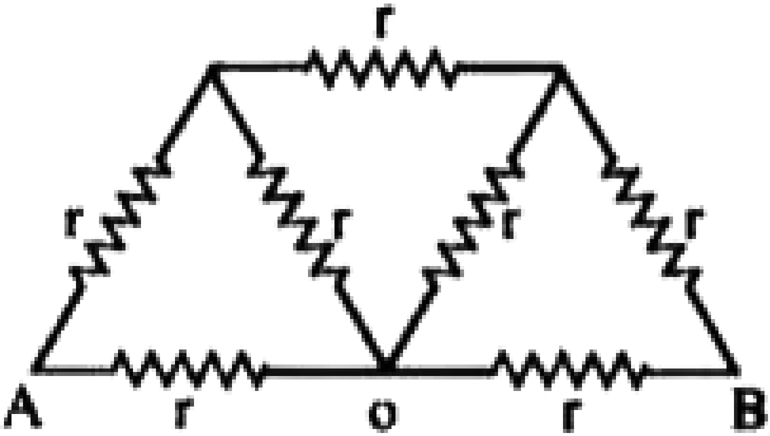
48. Equivalent resistance across A and B in the given circuit is



A. $7r$

B. $8r/7$

C. $4r/7$

D. $7r/8$

Answer: B

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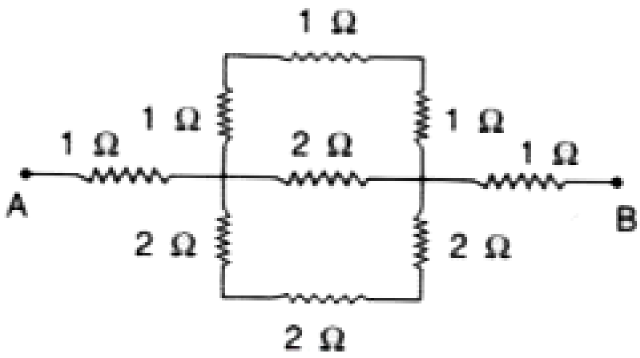
49. Calculate the effective resistance between the points A and B in the circuit shown in Fig.



A. $6r$

B. r

C. $2r$

D. $r/2$

Answer: D

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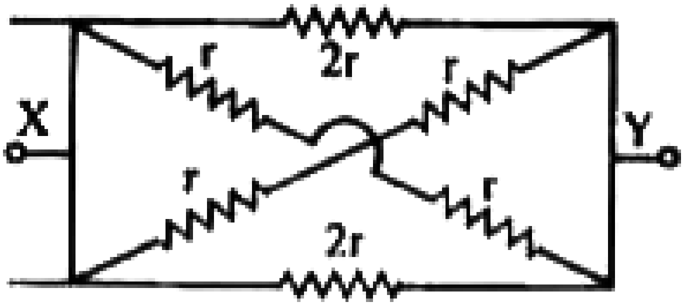
50. The equivalent resistance across XY is



A. r

B. $2r$

C. $r/2$

D. $r/4$

Answer: C

Watch Video Solution

51. An aluminium$\left(\alpha_{Al} = 4 \times 10^{-3} / {}^{0}C\right)$ wire resistance R_1' and carbon wire $\left(\alpha_c = -0.5 \times 10^{-3} / {}^{\circ}C\right)$ resistance R_2' are connected in series to have a resultant resistance of 18 ohm at all temperatures. The values of R_1 and R_2 in ohms

A. $2, 16$

B. $12, 6$

C. $13, 5$

D. $14, 4$

Answer: A

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52. A carbon filament has resistance of 120Ω at $0^{\circ}C$ what must be the resistance of a copper filament connected in series with carbon so that combi-nation has same resistance at all temperatures

$(\alpha_{carbon} = -5 \times 10^{-4} /{}^{0} C, \alpha_{copper} = 4 \times 10^{-3} /{}^{0} C)$

A. 120Ω

B. 15Ω

C. 60Ω

D. 210Ω

Answer: B

Watch Video Solution

53. The resistance of a metal wire is 10Ω. A current of 30 mA is flowing in it at 20°C. If p.d. across its ends is constant, then its temperature is increased to $120^{\circ} C$, then the current flowing in the wire will be in mA$\left(\alpha = 5 \times 10^{-3 / {}^{0}} C\right)$

A. A) 20

B. B) 15

C. C) 10

D. D) 40

Answer: A

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54. The maximum voltage that can be applied to 5 KΩ and 8W resistor without exceeding its heat dissipating capacity is

A. A) 100 v

B. B) 400V

C. C) 160V

D. D) 200 V

Answer: D

Watch Video Solution

55. Three equal resistors connected in series across a source of emf together dissipate $10W$ of power. What will be the power dissipated in watt if the same resistors are connected in parallel across the same source of emf?

A. $30W$

B. $\frac{10}{3}W$

C. $10W$

D. $90W$

Answer: D

Watch Video Solution

56. Same mass of copper is drawn into 2 wires of 1 mm thick and 3mm thick. Two wires are connected in series and current is passed. Heat produced in the wires is the ratio of

A. $3:1$

B. $9:1$

C. $81:1$

D. $1:81$

Answer: C

Watch Video Solution

57. Masses of three wires are in the ratio 1:3:5. Their lengths are in the ratio 5:3:1. When they are connected in series to an external source, the amounts of heats produced in them are in the ratio

A. A) $125 : 15 : 1$

B. B) $1 : 15 : 125$

C. C) $5 : 3 : 1$

D. D) $1 : 3 : 5$

Answer: A

Watch Video Solution

58. The specification on a heater coil is $250V$, $500W$. Calculate the resistance of the coil. What will be the resistance of a coil of $1000W$ to operate at the same voltage?

A. $100S$

B. $150S$

C. $200S$

D. $210S$

Answer: D

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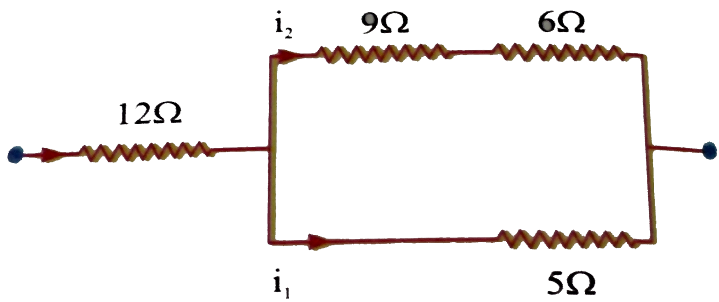
59. 

In the following circuit, 5Ω resistor develops 45 J/s due to current flowing through it. The power developed across 12Ω resistor is

A. 16 W

B. 192W

C. 36W

D. 64W

A. $16W$

B. $192W$

C. $36W$

D. $36W$

Answer: B

Watch Video Solution

60. In a large building, there are 15 bulbs of 40 W, 5 bulbs of 100 W, 5 fans of 80 W and 1 heater of 1 kW. The voltage of electric mains is 220 V. The minimum capacity of the main fuse of the building will be :

A. $8A$

B. $10A$

C. $12A$

D. $14A$

Answer: B

Watch Video Solution

61. Two wires A and B of the same material and mass have their length in the ratio $1:2$. On connecting them to the same source, the ratio of heat dissipation in B is found to be 5W. The rate of heat dissipation in A is

A. $10W$

B. $5W$

C. $20W$

D. None of these

Answer: C

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62. Two wires 'A' and 'B' of the same material have their lengths in the ratio $1:2$ and radii in the ratio $2:1$. The two wires are connected in parallel across a battery. The ratio of the heat produced in 'A' to the heat produced in 'B' for the same time is

A. $1:2$

B. $2:1$

C. $1:8$

D. $8:1$

Answer: D

Watch Video Solution

63. When two identical cells are connected either in series or in parallel across a 4 ohm resistor, they send the same current through it. The internal resistance of the cell in ohm is

A. 1.2

B. 2

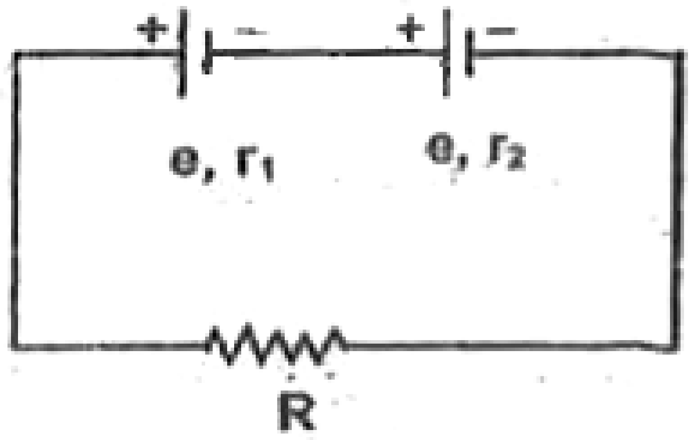
C. 4

D. 4.8

Answer: C

Watch Video Solution

64. Two cells of the same e.mf. e but different internal resistances r_1 and r_2 are connected in series with an external resistance 'R'. The potential drop across the first cell is found to be zero. The external resistance Ris



A. $\sqrt{r_1 r_2}$

B. $r_1 + r_2$

C. $r_1 - r_2$

D. $\frac{r_1 + r_2}{2}$

Answer: C

Watch Video Solution

65. The p.d. across the terminals of a battery is 50 V when 11 A are drawn and 60 V when 1A is drawn. The emf and internal resistance of the battery are

A. A) $62BV, 2\Omega$

B. B) $62V, 1\Omega$

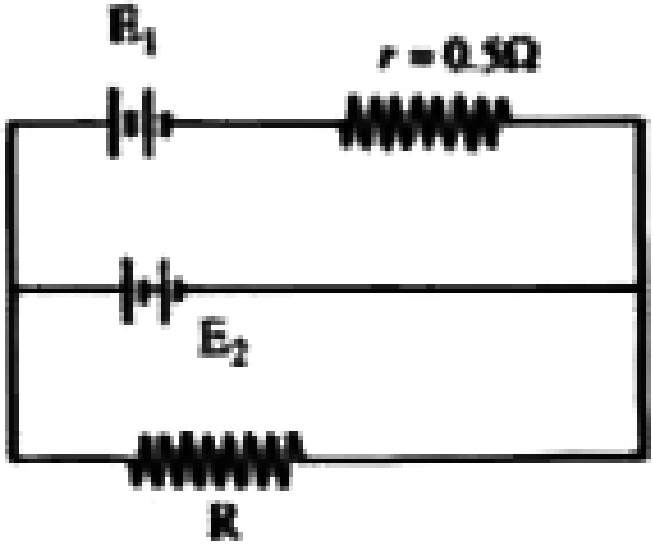
C. C) $61V, 1\Omega$

D. D) $64V, 2\Omega$

Answer: C

Watch Video Solution

66. A dc source of emf $E_1 = 100V$ and internal resistance r $=0.5\Omega$,a storage battery of emf $E_2 = 90$ V and an external resistance R are connected as shown in figure. For what value of R no current will pass through the battery ?



A. A) 5.5Ω

B. B) 3.5Ω

C. C) 4.5Ω

D. D) 2.5Ω

Answer: C

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67. A 6V cell with 0.5Ω internal resistance and 10V cell with 1Ω internal resistance and a 12Ω external resistance are connected in parallel. The current in amp through the 10V cell is

A. 0.6

B. 2.27

C. 2.87

D. 5.14

Answer: C

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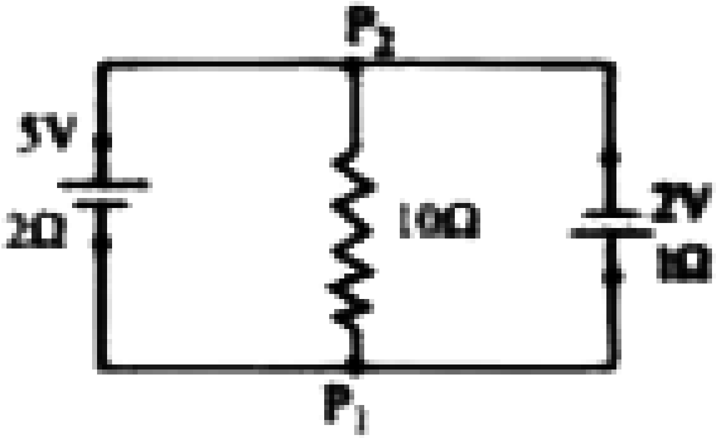
68. A 5V battery with internal resistance 2Ω and a 2V battary with internal resistance 1Ω are connected to as 10Ω resistor as shown in the figure. The current in the 10Ω resistor is



A. $0.27AP_2$to P_1

B. $0.03AP_3$toP_2

C. $0.03AP_2$toP_1

D. $0.27AP_1$toP_2

Answer: C

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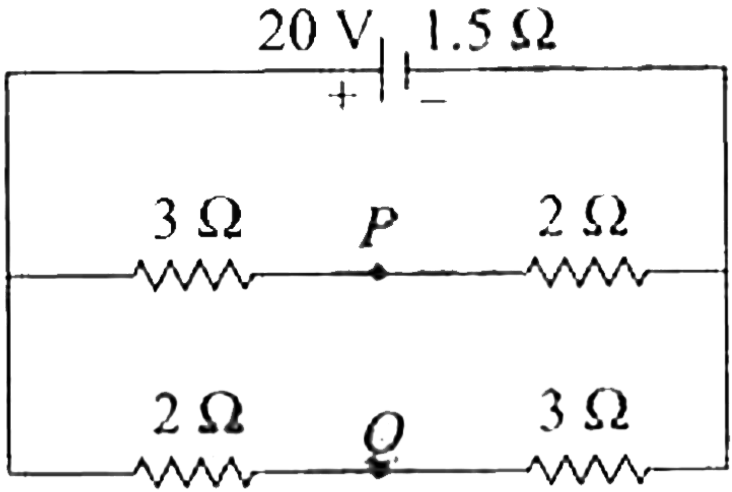
69. If in the circuit shown below, the internal resistnace of the battery is 1.5Ω and V_P and V_Q are the potentials at P and Q respectively, What is the potential difference between the points P and Q



A. Zero

B. $4V\left(V_p > V_Q\right)$

C. $4V\left(V_Q > V_P\right)$

D. $2.5V\left(V_Q > V_p\right)$

Answer: D

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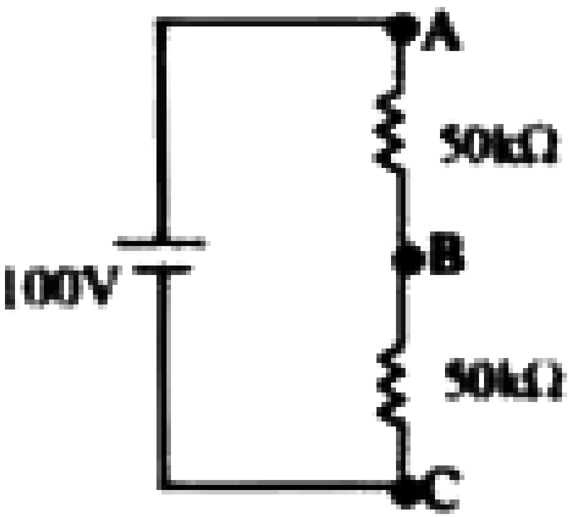
70. In the circuit shown, a voltmeter of internal resistance 'R' when connected across B and C, reads $\frac{100}{3}$ volts. Neglecting the internal resistance of the cell, the value of 'R' is



A. $100k\Omega$

B. $75k\Omega$

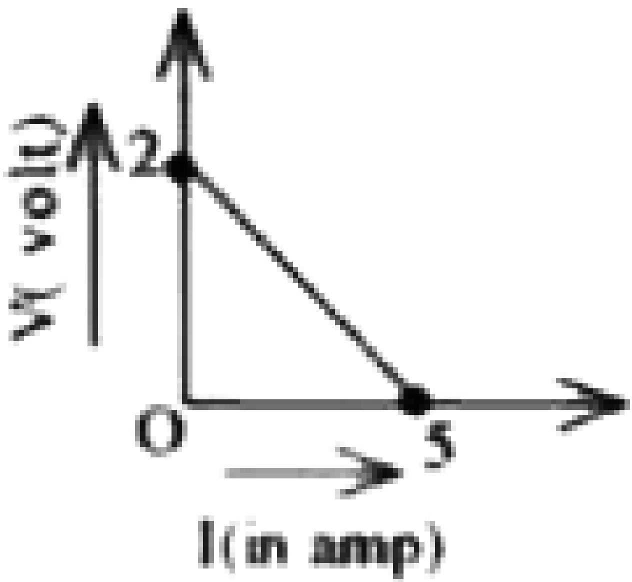
C. $50k\Omega$

D. $25k\Omega$

Answer: C

Watch Video Solution

71. For a cell, the graph between the p.d.(V) across the terminals of the cell and the current I drawn from the cell is shown in the fig. the emf and the internal resistance of the cell is E and r respectively.



A. E = 2 V,r= 0.5Ω

B. $E = 2V, R = 0.4\Omega$

C. $E > 2, r = 0.5\Omega$

D. $e > 2V, r = 0.4\Omega$

Answer: B

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72. When two cells of different emf's are connected in series to an external resistance the current is 5A. When the poles of one cell are interchanged, the current is 3A. The ratio of emf's of two cell is

A. A) $2:1$

B. B) $1:3$

C. C) $4:1$

D. D) $5:1$

Answer: C

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73. How many cells each marked (6V-12A) should be connected in mixed grouping so that it may be marked (24V-24 A)

A. 4

B. 8

C. 12

D. 6

Answer: B

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74. Find the minimum number of cells required to produce an electric current of 1.5 A through a resistance of 30Ω. Given that the emf of each cell is 1.5 V and internal resistance 1.0Ω.

A. 30

B. 120

C. 40

D. 60

Answer: B

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75. A d.c main supply of e.m.f 220 V is connected across a storage battery of e.m.f 200 V through a resistance of 1Ω. The battery terminals are connected to an external resistance R. The minimum value of R so that a current passes through the battery to charge it is:

A. Zero

B. 7Ω

C. 9Ω

D. 11Ω

Answer: D

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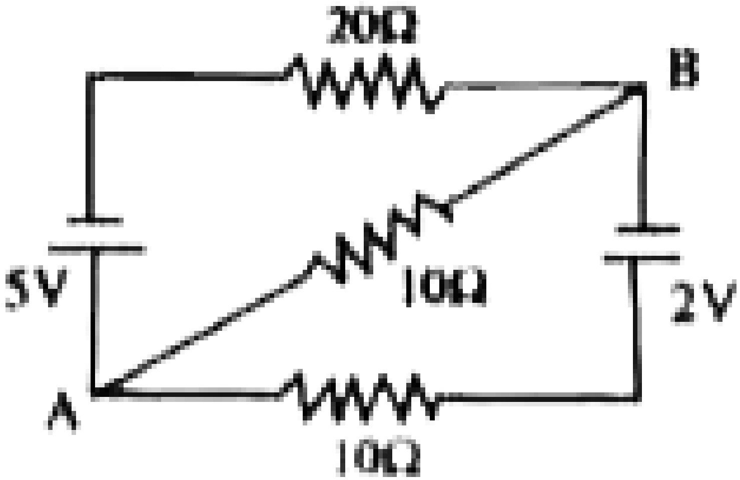
76. The P.d between the terminals A&B is



A. $2V$

B. $3V$

C. $3.6V$

D. $1.8V$

Answer: D

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77. A wire of length L and three identical cell of negligible internal resistance are connected in series. Due to the current, the temperature of wire is raised by ΔT in a time t. A number N of similar cells is now connected in series with a wire of the same material and cross section but of length 2L. The temperature of wire is raised by the same amount ΔT in the same time t. The value of N is

A. 4

B. 6

C. 8

D. 9

Answer: B

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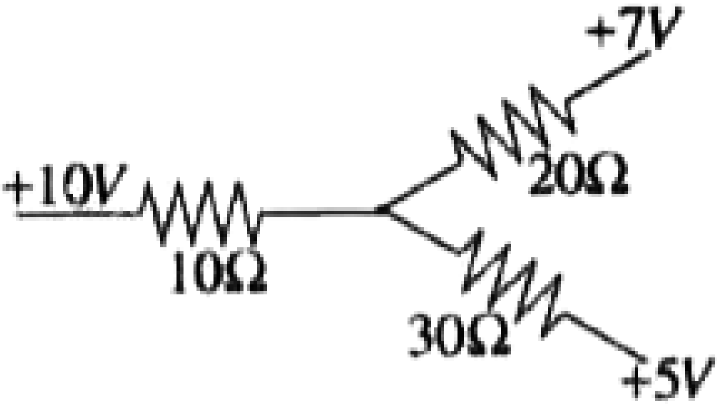
78. The current through 10Ωresister in the figure is approximately



A. $0.1A$

B. $0.172A$

C. $0.3A$

D. $0.4A$

Answer: B

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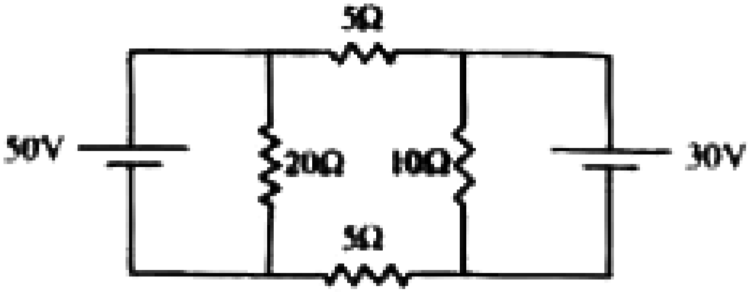
79. In the circuit shown, current (in A) through the 50 V and 30V batteries are, respectively :



A. 3 and 2.5

B. 2.5 and 3

C. 4.5 and 1

D. 3.5 and 2

Answer: C

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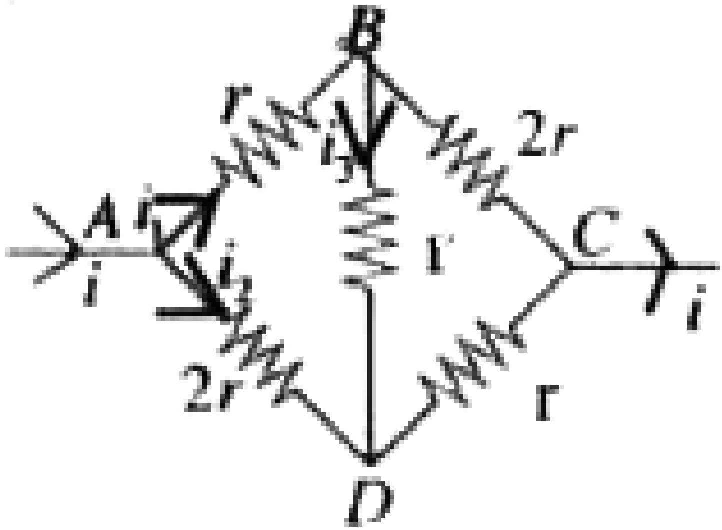
80. The value of current i_1 in the given circuit is



A. $\frac{i}{5}$

B. $\frac{2i}{5}$

C. $\frac{3i}{5}$

D. $\frac{4i}{5}$

Answer: C

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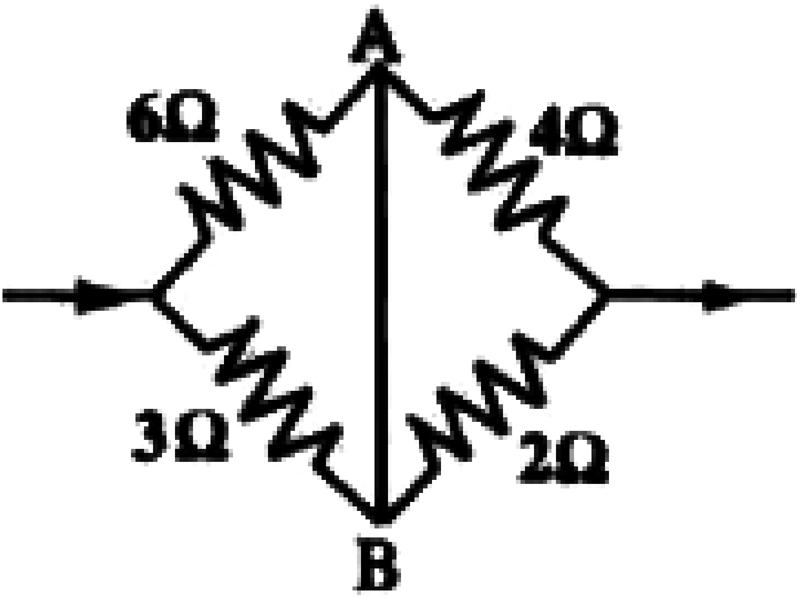
81. A current of 3A flows in a circuit the potential difference between points A and B is



A. $1V$

B. $2V$

C. $4V$

D. $1.5V$

Answer: C

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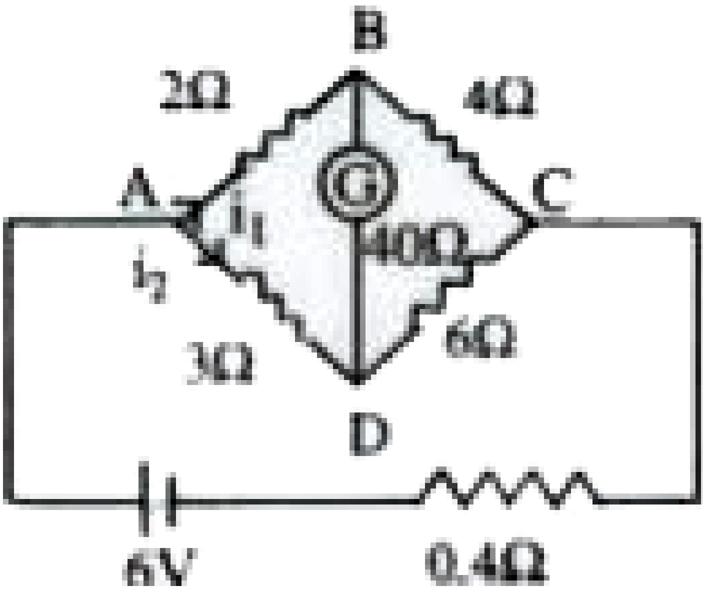
82. A balanced wheatstone bridge is shown the values of currents i_1 and i_2 are



A. 0.9A,0.6A

B. 0.34,0.2A

C. 0.5A,0.7A

D. 0.7A,0.6A

Answer: A

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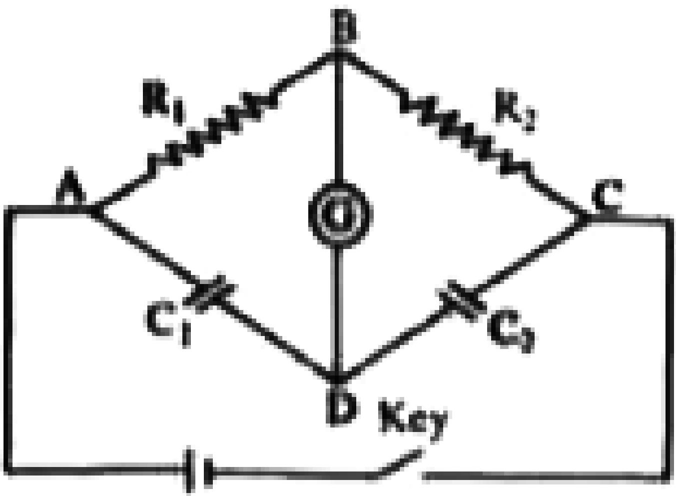
83. In Wheat stone's bridge shown in the adjoining figure galvanometer gives no deflection on pressing the key, the balance condition for the bridge is:



A. $\frac{R_C}{R_2}=\frac{C_1}{C_2}$

B. $\frac{R_1}{R_2} = \frac{C_2}{C_1}$

C. $\frac{R_1}{R_1 + R_2} = \frac{C_1}{C_1 - C_2}$

D. $\frac{R_1}{R_1 - R_2} = \frac{C_1}{C_1 + C_2}$

Answer: B

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84. The resistance in the left and right gaps of a balanced meter bridge are R_1 and R_2. The balanced point is $50cm$. If a resistance of 24Ω is connected in parallel to R_2, the balance point is $70cm$. The value of R_1 or R_2 is.

A. 2Ω

B. 8Ω

C. 12Ω

D. 32Ω

Answer: D

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85. A metallic conductor at $10^\circ C$ connected in the left gap of meter bridge gives balancing length 40 cm. When the conductor is at 60°C, the balancing point shifts by ---cm, (temperature coefficient of resistance of the material of the wire is (1/220)/$^\circ$C)

A. 4.8

B. 10

C. 15

D. 7

Answer: A

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86. When a conducting wire is connected in the right gap and known resistance in the left gap, the balancing length is 60cm. The balancing length becomes 42.4 cm when the wire is stretched so that its length increases by

A. $10\ \%$

B. $20\ \%$

C. $25\ \%$

D. $42.7\ \%$

Answer: B

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87. Two unkonwn resistances X and Y are connected to left and right gaps of a meter bridge and the balancing point is obtained at 80cm from left. When a 10Ω resistance is connected to parallel to X,the balancing point is 50 cm from left. The values of X and Y respectively are

A. $40\Omega, 9\Omega$

B. $30\Omega, 7.5\Omega$

C. $20\Omega, 6\Omega$

D. $10\Omega, 3\Omega$

Answer: B

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88. In a metere bridge, the balance length from left end (standard resistance of 1Ω is in theright gap) is found to be 20cm the length of resistance in left gap is 1/2 m and radius is 2mm its specific resistance is

A. $\pi \times 10^{-6} ohm - m$

B. $2\pi \times 10^{-6} ohm - m$

C. $\frac{\pi}{2} \times 10^{-6} ohm - m$

D. $3\pi \times 10^{-6} ohm - m$

Answer: B

Watch Video Solution

89. In a meter bridge 30Ω resistance is connected in the left gap and a pair of resistance 20Ω and Q in (Ohm) are in right gap and they are connected in series, then the balanceing length is 50 cm. When they were connected in parallel the balanceing length will be

A. 20 cm

B. 40 cm

C. 60 cm

D. 81.81 cm

Answer: D

Watch Video Solution

90. In a meter bridge, the left and right gaps are closed by resistances 2 ohm and 3 ohm respectively. The value of shunt to be connected to 3 ohm resistor to shift the balancing point by 22.5 cm is

A. 3 ohm

B. 1.7 ohm

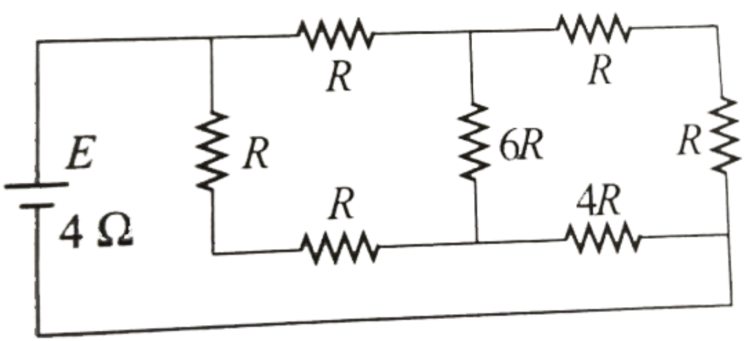
C. 1 ohm

D. 2 ohm

Answer: D

Watch Video Solution

91. A battery of internal resistance 4Ω is connected to he network of resistances as shown in Fig. 7.40. In order that the maximum power can be delivered to the network , the value of R in Ω should be



A. $4/9$

B. 2

C. $8/3$

D. 18

Answer: B

Watch Video Solution

92. A resistance of 2Ω is connected across one gap of a meter bridge (the length of the wire is $100cm$) and an unknown resistance, greater than $2\Omega$is conneted across the other gap. When these resistances are interchanged, the balance point shifts by $20cm$. Neglecting any corrections,the unknown resistance is

A. 3Ω

B. 4Ω

C. 5Ω

D. 6Ω

Answer: C

Watch Video Solution

93. A student finds the balancing length to be 'l' with a cell of constant emf in the secondary circuit. Another student connects the same cell in the secondary circuit of potentiometer of double the length but with a cell of half the emf in the primary circuit. The balancing length will be [cell in primary is ideal and no series resistance is present in primary circuit.]

A. $4l$

B. $l/4$

C. $2l$

D. $l/2$

Answer: A

Watch Video Solution

94. In an experiment with potentiometer to measure the internal resistance of a cell, when the cell is shunted by 5Ω, the null point is obtained at 2m. when cell is shunted by 20Ω the null point is obtained at 3m.The internal resistance of cell is

A. 2Ω

B. 4Ω

C. 6Ω

D. 8Ω

Answer: B

Watch Video Solution

95. A potentiometer wire of length 100cm has a resistance of 10Ω. It is connected in series with a resistance and a cell of emf 2V and of negligible interal resistance. A source of emf 10mV is balanced against a length of 40cm of the potentiometer wire. What is the value of external resistance?

A. 540Ω

B. 195Ω

C. 190Ω

D. 990Ω

Answer: B

Watch Video Solution

96. A 1Ω resistance in series with an ammeter is balanced by 75 cm of potentiometer wire. A standard cell of emf 1.02 V is balanced by 50 cm. The ammeter shows a reading of 1.5 A. Then the error in ammeter reading is:

A. $0.002A$

B. $0.03A$

C. $1.01A$

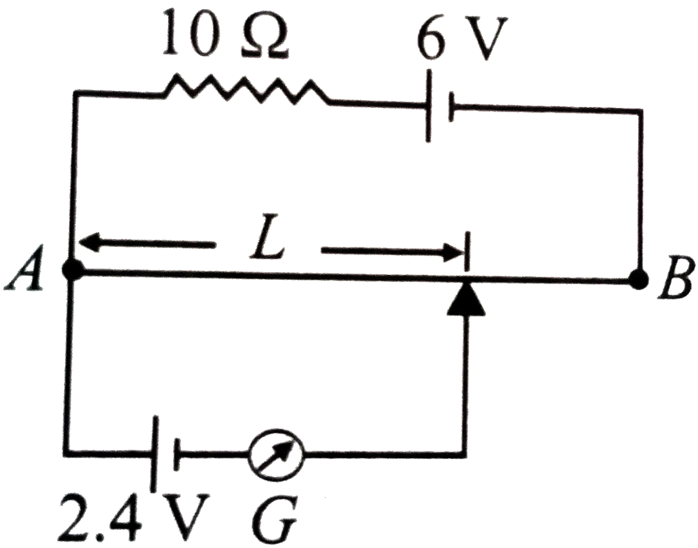
D. no error

Answer: B

Watch Video Solution

97. A potentiometer wire of length 200cm has a resistance of 20Ω It is connected in series with a resistance of $10Oemga$ and an accumulator of emf of 6V having negligible resistance. A source of

2.4V is balanced against a length L of the potentiometer wire. The value of L is



A. increased by 2m

B. decreased by 2m

C. increased by 1.2m

D. decreased by 1.2m

Answer: C

Watch Video Solution

98. In an experiment for calibration of voltmeter, a standard cell of emf 1.5V is balanced at 300cm length of potentiometer wire. The P.D across a resistance in the circuit is balancedat 1.25m. If a voltmeter is connected across the same resistance. It reads 0.65V. The errorin the volt meter is

A. $0.05V$

B. $0.025V$

C. $0.5V$

D. $0.25V$

Answer: B

Watch Video Solution

99. A potentiometer wire of length 10m and resistance 30 ohm is connected in series with a battery of emf 2.5V, internal resistance 5 ohm and external resistance R. If the fall of potential along the potentiometer wire is 50mV/m, the value of R is ohms is

A. 115

B. 80

C. 50

D. 100

Answer: A

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100. A potentiometer wire of 5m length and having 20Ωresistance is connected in series with a battery and a resistance of 3980Ω. A cell of emf 1.1V is balanced across the potential difference of the external resistance. If the emf of the thermocouple is 2.2mV, the corresponding balancing length is

A. $2mV$

B. $4mV$

C. $3mV$

D. $1mV$

Answer: C

Watch Video Solution

101. In the primary circuit of a potentiometer, a cell of E.M.F 1 V and a rheostat of 15Ω are connected in series. If the resistance of the potentiometer wire is 10Ω the minimum voltage at the ends of the wire (in V) will be

A. 0.0045V

B. 0.045V

C. 0.45V

D. 4.5V

Answer: A

Watch Video Solution

102. A potentiometer wire of length 1.0 m has a resistance of 15Ω. It is connected to a 5V battery in series with a resistance of 5Ω. Determine the emf of the primary cell which gives a balance point at 60cm.

A. thermo emf is balanced

B. thermo emf is not balanced

C. data is insufficient

D. balancing is independent of temperature

Answer: B

Watch Video Solution

103. A potentiometer wire of 5m length and having 20Ωresistance is connected in series with a battery and a resistance of 3980Ω. A cell of emf 1.1V is balanced across the potential difference of the external resistance. If the emf of the thermocouple is 2.2mV, the corresponding balancing length is

A. 398cm

B. 200cm

C. 450cm

D. 306cm

Answer: B

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104. A thermocouple has its junctions at $0^\circ C$ and $100^\circ C$. It produces 0.022mV/K. Find the balancing length on a potentiometer wire of 10m length and resistance 10Ω connected in series with a resistance box consisting of a resistance of 1990Ω. Given emf of cell in the primary circuit as 2 volt

A. 110cm

B. 220cm

C. 330cm

D. 440cm

Answer: B

Watch Video Solution

105. A cell of emf 1.6 V is connected across a potentiometer wire of length 500 cm. The cell has negligible resistance. A thermo couple whose cold junction is at 0°C and hot junction at $80^{\circ}C$ is connected in the secondary circuit. The balancing length is found to be 125 cm. Find the thermo emf per degree centigrade difference of temperature of the junctions.

A. $0.005V/^{\circ}C$

B. $0.05V/^{\circ}C$

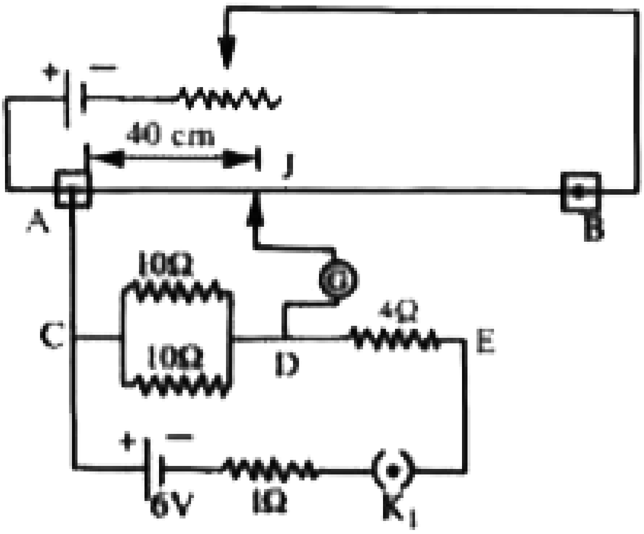
C. $0.5V/^{\circ}C$

D. $5V/^{\circ}C$

Answer: A

Watch Video Solution

106. In the circuit shown in fig., the potential difference between the points C and D is balanced against 40cm length of potentiometer wire of total length 100cm. In order to balance the potential difference between the points D and E. The jockey be pressed on potentiometer wire at a distance of



A. 16cm

B. 32cm

C. 56cm

D. 80cm

Answer: B

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107. The length of potentiometer wire is 1m and its resistance is 4Ω. Acurrent of 5mA is flowing in it. An unknown emf is balanced on 40 cm length of this wire. The unknown emf is x mv. What is the value of .x. ?

A. 8v

B. 80v

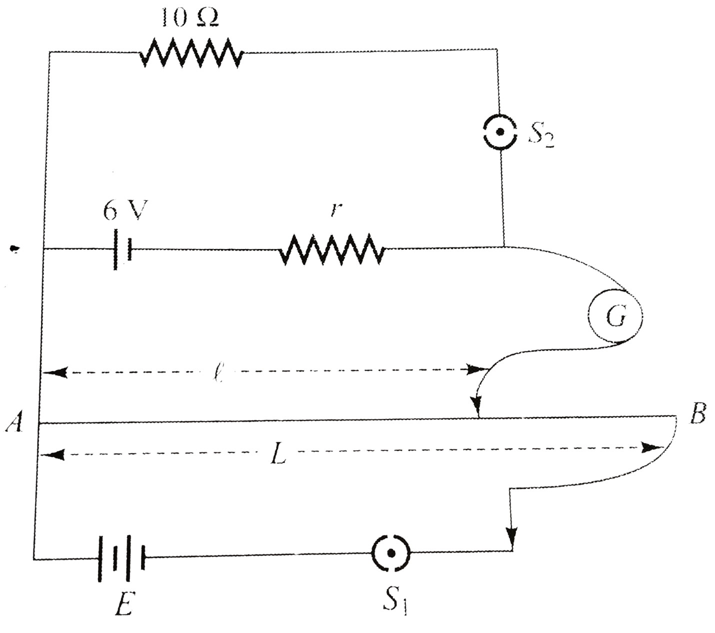
C. 8mv

D. 0.8v

Answer: C

Watch Video Solution

108. In the arrangement shows in fig. , when the switch S_2 is open, the galvanometer shows no deflection for $l = L/2$. When the switch S_2 is closed, the galvanometer shows no deflection for $l = 5/12L$. The internal resistance (r) of 6 V cell and the emf E of the other battery are, respectively



A. 3Ω, $8V$

B. 2Ω, $12V$

C. 2Ω, $24V$

D. $3\Omega, 12V$

Answer: B

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REVISION EXERCISE (MOVING CHANGES & MEGNETISM)

1. A proton, a deuteron and an α particle having same momentum enter a uniform magnetic field at right angles to the field. Then the ratio of their angular momenta during their motion in the magnetic field is

A. $2:2:1$

B. $2:1:3$

C. $4:1:2$

D. $4:2:1$

Answer: A

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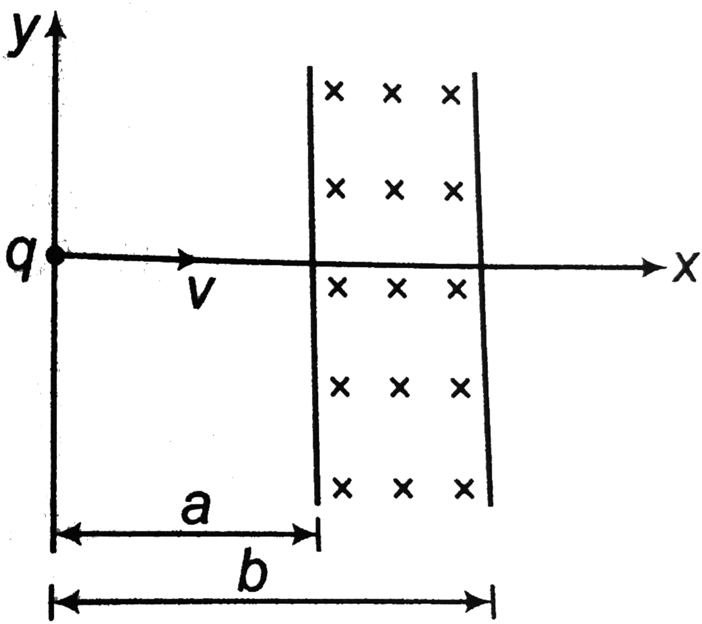
2. In the figure shown a charge q moving with a velocity v along the x-axis enter into a region of uniform magnetic field. The minimum value v so that the charge q is able to enter the region $x > b$



A. $\frac{qbB}{m}$

B. $\frac{q(b-a)B}{m}$

C. $\frac{qaB}{m}$

D. $\frac{q(b+a)B}{2m}$

Answer: B

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3. An electron accelerated through a potential difference V passes through a uniform tranverses magnetic field and experiences a force F. If the accelerating potential is increased to 2V, the electron in the same magnetic field will experience a force:

A. F

B. $F/2$

C. $\sqrt{2}F$

D. $2F$

Answer: C

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4. A 2MeV proton is moving perpendicular to a uniform magnetic field of 2.5 Tesla. The force on the proton is

A. $10 \times 10^{-12} N$

B. $8 \times 10^{-11} N$

C. $2.5 \times 10^{-10} N$

D. $8 \times 10^{-12} N$

Answer: D

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5. A charged particle of charge 4 mC enters a uniform magnetic field of induction $\overrightarrow{B} = 3\bar{i} + 6\bar{j} + 6\bar{k}$ tesla with a velocity $\bar{v} = 4\bar{i} - x\bar{j} + y\bar{k}$. If the particles continues to move undeviated, then the magnitude of velocity of the particle is

A. 10 m/s

B. 15 m/s

C. 12 m/s

D. 8 m/s

Answer: C

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6. An electron in the beam of a TV picture tube is accelerated by a potential difference of $2.00kV$. Then, it passes through region of transverse magnetic field, where it moves in a circular arc with radius $0.180m$. what is the magnitude of the field?

A. $\frac{2mV}{\sqrt{er}}$

B. $\sqrt{\frac{2mv}{er^2}}$

C. $\sqrt{\frac{2mV}{r}}$

D. $\sqrt{\frac{2mVr}{e}}$

Answer: B

Watch Video Solution

7. A current of 10 A is maintained in a conductor of cross-section $1cm^2$. If the free electron density in the conductor is $9 \times 10^{28} m^{-3}$, then drift velocity of free electrons is

A. $4 \times 10^{-7} ms^{-1}$

B. $4 \times 10^6 ms^{-1}$

C. $2 \times 10^{-7} ms^{-1}$

D. $2 \times 10^6 ms^{-1}$

Answer: C

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8. A charged particle is accelerated thrught a potential difference of 12 kV and acquires a speed of $1.0X10^6 ms^{-1}$. It is then injected perpendiuclarly into a magnetic field of strenght 0.2 T. find the radius of the circle described by it.

A. 2cm

B. 4cm

C. 8cm

D. 12 cm

Answer: D

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9. A particle of mass m and charge q is projected into a region having a perpendicular uniform magnetic field B of width d. Find the angle of deviation θ of the particle as it comes out of the magnetic field.

A. $\frac{\sqrt{2K}}{qmd}$

B. $\frac{\sqrt{2Km}}{qd}$

C. $\frac{\sqrt{2Kd}}{qm}$

D. $\frac{\sqrt{2kq}}{md}$

Answer: B

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10. A charge partilce with velocity $V = x\hat{i} + y\hat{j}$ moves in a magnetic field $B = y\hat{i} + x\hat{j}$. The magnitude of magnetic force acting on the particle is F. Which one of the following statement(s) is/are correct ?

A. a and b are true

B. a and care true

C. b and d are true

D. c can d d are true

Answer: B

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11. A cyclotron's oscillator frequency is $10 MHz$. What should be the operating magnetic field fro accelerating protons? If the radius of its dees is $60 cm$, what is the kinetic energy (in MeV) of the proton beam produced by the acceleration?

$(e - 1.60 \times 10^{-19} C, m_p = 1.67 \times 10^{-27} kg, 1 MeV = 1.6 \times 10^{-13} J)$

A. $12 \times 10^{-12} J$

B. $6 \times 10^{-19} J$

C. $1.2 \times 10^{-10} J$

D. $0.6 \times 10^{-10} J$

Answer: A

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12. A semi circular current loop is placed in an uniform magnetic field of 1 tesla as shown. If the radius of loop is 1 m, the magnetic force on the loop is

A. 4N

B. $8N$

C. $8/\pi N$

D. Zero

Answer: B

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13. A straight wire of length $30cm$ and mass $60mg$ lies in a direction 30° east of north.The earth's magnetic field at this is horizontal and has a magnitude of $0.8G$.What current must be passed through the wire,so that it may float in air ?

A. $5A$

B. $25A$

C. $50A$

D. $75A$

Answer: C

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14. A horizontal rod of mass 10 g and length 10 cm is placed on a smooth plane inclined to the horizontal at 60° with the length of rod parallel to the edge of the inclined plane. A uniform magnetic field B is applied vertically downwards. If the current through the rod is 1.73 A, find the value of B for which rod remain stationary on the inclined plane.

A. $3T$

B. $1/3T$

C. $1/\sqrt{3}T$

D. $\sqrt{3}T$

Answer: C

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15. A straight horizontal wire of mass 10mg and length 1.0 cm carries a current of 2.0 A. what minimum megnetic field B should be applied in the region so that the magnetic force on the wire may balance its weight?

A. $4.9 \times 10^{-5} T$

B. $9.8 \times 10^{-5} T$

C. $1.96 \times 10^{-5} T$

D. $3.92 \times 10^{-5} T$

Answer: A

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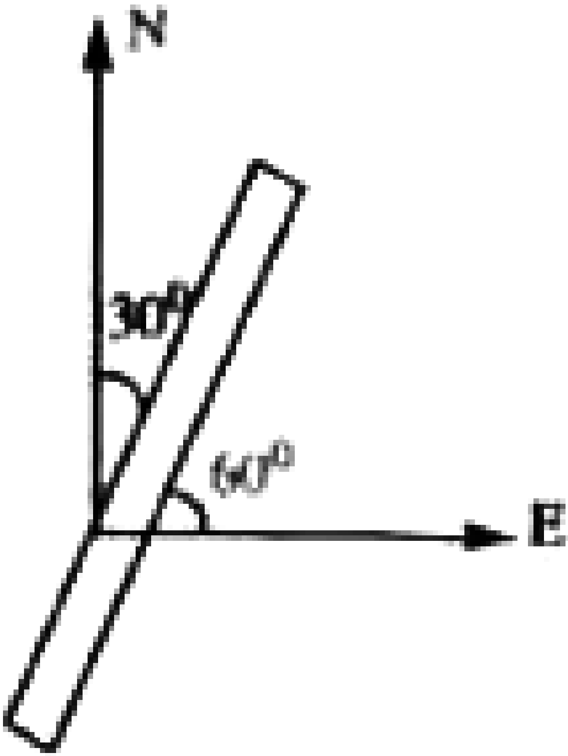
16. A conductor of length 20cm and mass 18 mg lies in a direction of 60° N of E. If the horizontal component of earth's magnetic field is36μT , the current to be passed in the conductor so that it is suspended in air is (g = 10 ms^{-2})



A. $20A$

B. $50A$

C. $40A$

D. $10A$

Answer: B

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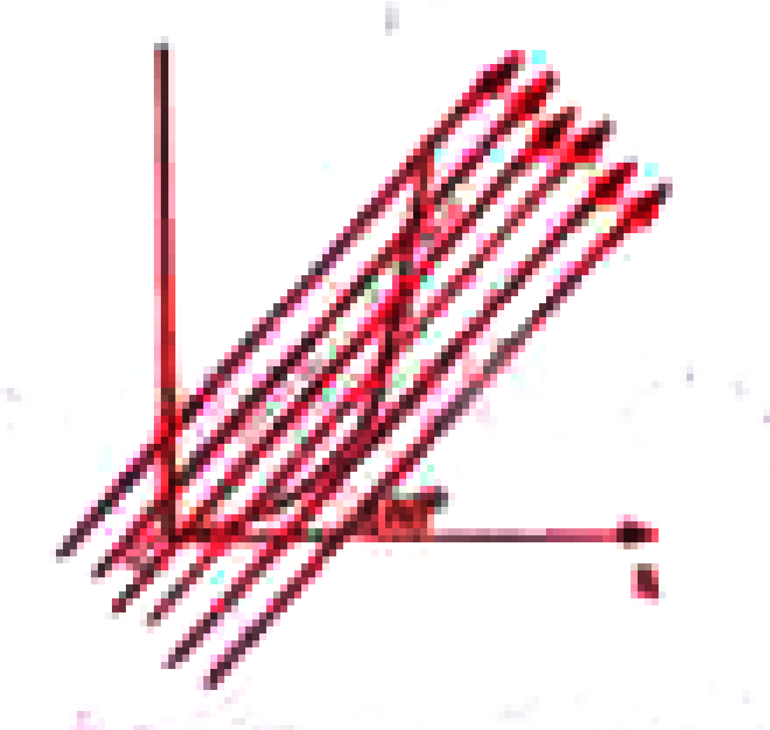
17. A parabolic section of wire, as shown in figure is located in the X-Y plane and carries a current of 12A. A uniform magnetic field B = 0.4T making an angle of 60° wihath X-axis exists throughout the plane. The total force acting on a wite between the origin and the point x = 0.25m, y = 1.00 m.



A. $0.68\hat{k}N$

B. $-0.68\hat{k}N$

C. $1.36\hat{k}N$

D. $-1.36\hat{k}N$

Answer: D

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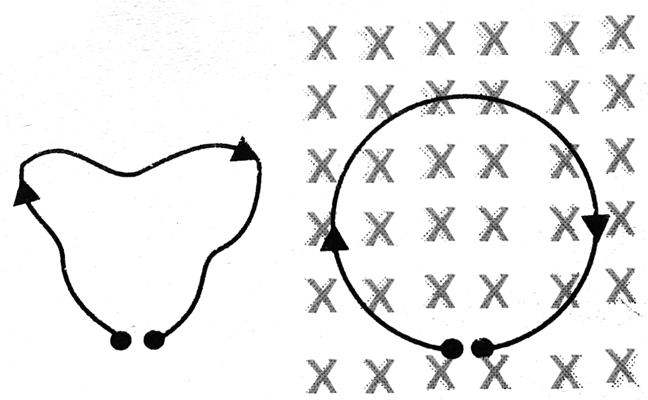
18. A thin flexible wire of length L is connected to two adjacent fixed points and carries a current I in the clockwise direction, as shown in Fig. When the system is put in a uniform magnetic field of strength B going into the plane of the paper, the wire takes the shape of a circle. The tension in the wire is



A. IBL

B. $\frac{IBI}{\pi}$

C. $\frac{IBI}{2\pi}$

D. $\frac{IBI}{4\pi}$

Answer: C

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19. A current I flows in an infinitely long wire with cross section in the form of a semicircular ring of radius R. The magnitude of magnetic induction along its axis is

A. $\frac{\mu_0 I}{2\pi^2 R}$

B. $\frac{\mu_0 I}{2\pi R}$

C. $\frac{\mu_0 I}{4\pi^2 R}$

D. $\frac{\mu_0 I}{\pi^2 R}$

Answer: D

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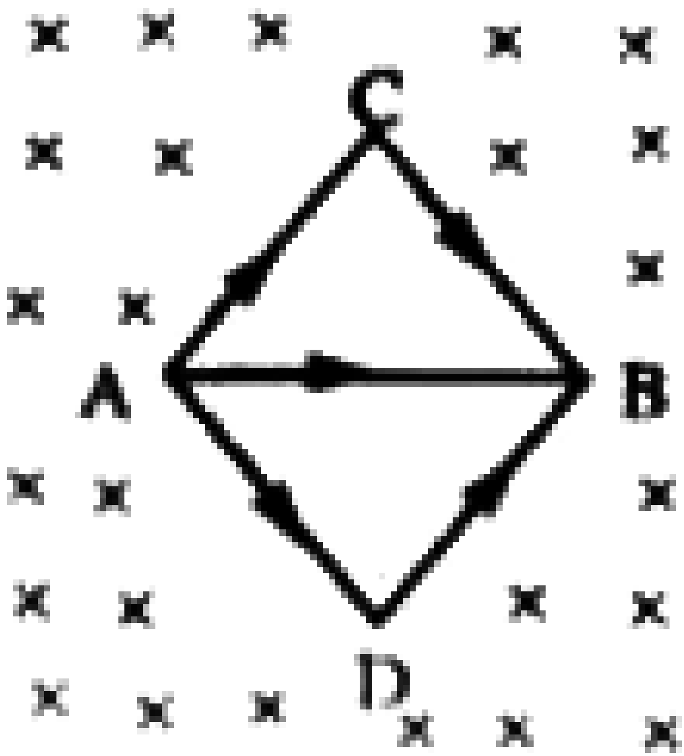
20. A current of 2A flows in a network containing two equilateral triangles of side 1 m as shown. The magnetic force acting on the frame is (magnetic field is 4T into the plane of paper)



A. $24N$

B. $16N$

C. 8N

D. 0

Answer: A

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21. A particle of charge -16×10^{-18} coulomb moving with velocity $10ms^{-1}$ along the $x-$ axis , and an electric field of magnitude $10^4 / (m)$ is along the negative $z-$ axis. If the charged particle continues moving along the x- axis , the magnitude of B is

A. $16 \times 10^3 Wbm^{-2}$

B. $2 \times 10^3 Wbm^{-2}$

C. $1 \times 10^3 Wbm^{-2}$

D. $4 \times 10^3 Wbm^{-2}$

Answer: C

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22. A wire carrying current I is tied between points P and Q and is in the shape of a circular arc of radius R due to a uniform magnetic field B (perpendicular to the plane of the paper, shown by xxx) in the vicinity of the wire. If the wire subtends an angle $2\theta_0$ at the centre of the circle (of which it forms an arc) then the tension in the wire is:

A. $\frac{IBR}{2\sin\theta_0}$

B. $\frac{IBR_0}{\sin\theta_0}$

C. $\frac{IBR}{\sin\theta_0}$

D. IBR

Answer: D

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23. A proton (mass m) accelerated by a potential difference V flies through a uniform transverse magnetic field B. The field occupies a region of space by width d. If α be the angle of deviation of proton from initial direction of motion (see figure), the value of sin α will be

A. $qV\sqrt{\frac{pd}{2m}}$

B. $Bd\sqrt{\frac{q}{2mV}}$

C. $\frac{B}{d}\sqrt{\frac{q}{2mV}}$

D. $\frac{B}{2}\sqrt{\frac{qd}{mv}}$

Answer: B

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24. A positive charge 'q' of mass 'm' is moving along the +x axis. We wish to apply a uniform magnetic field B for time Δt so that the charge reverses its direction crossing the y axis at a distance d. Then :

A. $b = \frac{mv}{2qd}$ and $\Delta t = \frac{\pi d}{2v}$

B. $B = \frac{mv}{qd}$ and $\Delta t = \frac{\pi d}{v}$

C. $B = \frac{2mv}{qd}$ and $\Delta t = \frac{\pi d}{v}$

D. $B = \frac{2mv}{qd}$ and $\Delta t = \frac{\pi d}{2v}$

Answer: A

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25. An electric current flows in a wire from east to west- What will be the direction of the magnetic field due to this wire at a point north of the wire? South of the wire?

A. $\frac{1}{2}\left[\frac{IBI}{m} - 2g\right]t^2$

B. $\frac{1}{2}\left[\frac{IBI}{m} \times \frac{1}{\cos\theta} - 2g\sin\theta\right]t^2$

C. $\frac{1}{2}\left[\frac{IBI}{m} - 2g\sin\theta\right]t^2$

D. $\frac{1}{2}\left[\frac{IBI}{m}\frac{\cos 2\theta}{\cos\theta} - 2g\sin\theta\right]t^2$

Answer: D

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26. The ratio of the magnetic field at the centre of a current carrying circular coil to its magnetic moment is x. If the current and radius both are doubled the new ratio will become

A. 2x

B. $\frac{x}{2}$

C. x

D. $\frac{x}{8}$

Answer: C

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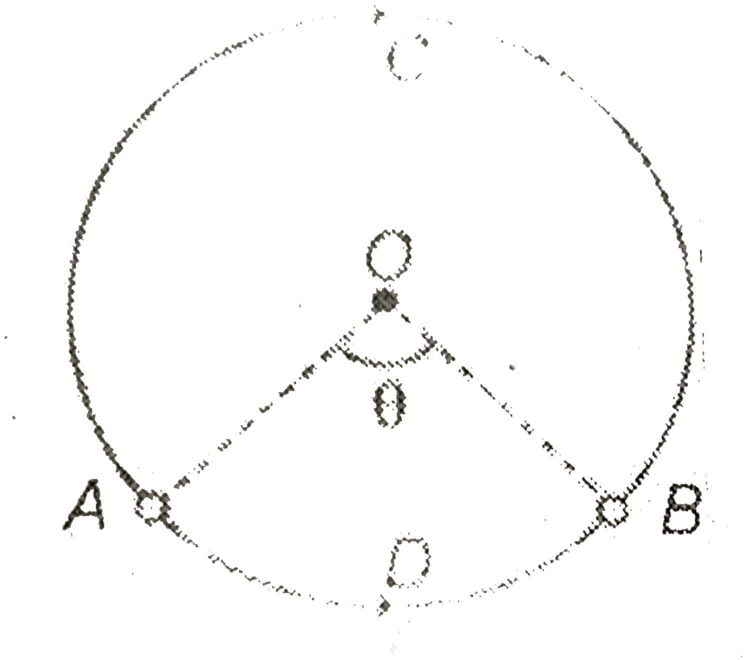
27. Equal current i flow in two segment of a circular loop in the direcation shown in figure . Radius of the loop is a. Mgentic field at the centre of the loop is



A. zero

B. $\left(\frac{\pi - \theta}{\pi}\right)\frac{\mu_0 i}{2a}$

C. $\left(\frac{2\pi - \theta}{\pi}\right)\frac{\mu_0 i}{2a}$

D. $\left(\frac{\theta}{2\pi}\right)\frac{\mu_0 i}{2a}$

Answer: B

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28. Two wires A and B are of lengths 40 cm and 30 cm. A is bent into a circle of radius r and B into an arc of radius r. A current i_1 is passed through A and i_2 through B. To have the same magnetic induction at the centre, the ratio of $i_1 : i_2$ is

A. $3:4$

B. $3:5$

C. $2:3$

D. $4:3$

Answer: A

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29. A circular coil of radius 2R is carrying current 'i' . The ratio of magnetic fields at the centre of the coil and at a point at a distance

6R from the centre of the coil on the axis of the coil is

A. 10

B. $10\sqrt{10}$

C. $20\sqrt{5}$

D. $20\sqrt{10}$

Answer: B

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30. The magnetic field due to a current carrying circular loop of radius 3 cm at a point on the axis at a distance of 4 cm from the centre is $54\mu T$. what will be its value at the centre of the loop?

A. $250\mu T$

B. $150\mu T$

C. $125\mu T$

D. $75\mu T$

Answer: A

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31. The field due to a wire of n turns and radius r which carries a current I is measure on the axis of the coil at a small distance h form the centre of the coil. This is smaller than the field at the centre by the fraction:

A. $\frac{3}{2}\frac{h^2}{r^2}$

B. $\frac{2}{3}\frac{h^2}{r^2}$

C. $\frac{3}{2}\frac{r^2}{h^2}$

D. $\frac{2}{3}\frac{r^2}{h^3}$

Answer: A

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32. The magnetic induction at the centre of a circular coil of radius 10 cm is $5\sqrt{5}$ times the magnetic induction at a point on its axis. The distance of the point from the centre of the coil, in cm is:

A. 5

B. 10

C. 20

D. 25

Answer: C

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33. A current carrying circular coil of radius 11 cm is placed with its plane in magnetic meridian. The resultant magnetic induction at the centre of the coil is (Given current in the coil is 7A and $B_H = 0.4$Gauss]

A. $3 \times 10^{-5} T$

B. $4 \times 10^{-5} T$

C. $4\sqrt{2} \times 10^{-5} T$

D. 0

Answer: C

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34. A piece of wire carrying a current of 6.00 A is bent in the form of a circular arc of radius 10.0 cm, and it subtends an angle of 120°

at the centre. Find the magnetic field B due to this piece of wire at the centre.

A. $0.5 \times 10^{-5} T$

B. $1.26 \times 10^{-5} T$

C. $2.4 \times 10^{-5} T$

D. $3.2 \times 10^{-5} T$

Answer: B

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35. A particle of charge q and mass m moves in a circular orbit of radius r with angular speed ω. The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on

A. ω and q

B. $\omega, q \text{ and } m$

C. $q \text{ and } m$

D. $\omega \text{ and } m$

Answer: C

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36. An electron of charge e is going around in an orbit of radius R meters in a hydrogen atom with velocity v m/sec. The magnetic flux density associated with it at its centre is

A. πner^2

B. $\frac{\pi nr^2}{e}$

C. $\frac{\pi ne}{r^2}$

D. $\frac{\pi er^2}{n}$

Answer: A

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37. Two circular coils are made from a uniform copper wire. Radii of circular coils is in the ratio 3:4 and number of turns in the ratio 3:5. If they are connected in series across a battery.

Statement (A) : Ratio between magnetic field inductions at their centers is 4 : 5

Statement (B) : Ratio between effective magnetic moments of the two coils is 16 : 15

A. Both statements are wrong

B. Both statements are correct

C. Statement A alone is correct

D. Statement B alone is correct

Answer: C

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38. A wire of length 1 metre is to be wound in the form of a coil have maximum magnetic moment. The suitable number of turns among the following is

A. 1

B. 1000

C. independent of no of turns

D. none

Answer: A

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39. A coil of 100 turns, radius 5cm carries a current of 0.1A. It is placed in a magnetic field of 1.5T initially with its plane perpendicular to the field. The work done to rotate it through on angle of 180° is... $\times 10^{-3}$' J

A. 25π

B. 50π

C. 75π

D. 20π

Answer: C

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40. A straight wire is first bent into a circle of radius 'r' and then into a square of side 'x' each of oneturn. If currents flowing through them are in the ratio 4 : 5, the ratio of their effective magnetic moments is

A. $\frac{\pi}{8}$

B. $\frac{12}{\pi}$

C. $\frac{16}{5\pi}$

D. $\frac{8}{5\pi}$

Answer: C

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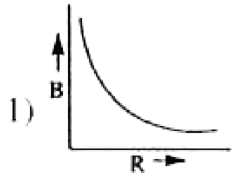
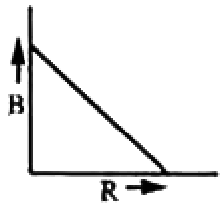
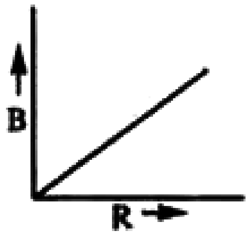
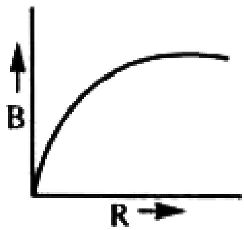
41. A charge Q is uniformly distributed over the surgace of non conducting disc of radius R. The disc rotates about an axis perpendicular to its plane and passing through its centre with an angular velocity ω. As a result of this rotation a magnetic field of induction B is obtained at the centre of the disc. If we keep both the amount of charge placed on the disc and its angular velocity to be constant and vary the radius of the disc then the variation of the magnetic induction at the centre of the disc will be represented by the figure

A. 

B. 

C. 

D. 

Answer: A

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42. Two wires of same length are made into a circle and square respectively. Currents are passed in then such that their magnetic moments are equal. Then the ratio of the magnetic field at their respective centres (circle:square) is

A. $\frac{\sqrt{2}\pi^3}{32}$

B. $\frac{\sqrt{2}\pi^3}{64}$

C. $\frac{\sqrt{2}\pi^3}{16}$

D. $\frac{\sqrt{2}\pi^3}{8}$

Answer: A

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43. A long straight wire carrying current of $30A$ is placed in an external uniform magnetic field of induction $4 \times 10^{-4}T$. The magnetic field is acting parallel to the direction of current. The magnitude of the resultant magnetic induction in tesla at a point $2.0cm$ away from the wire is

A. 10^{-4}

B. 3×10^{-4}

C. 5×10^{-4}

D. 6×10^{-4}

Answer: C

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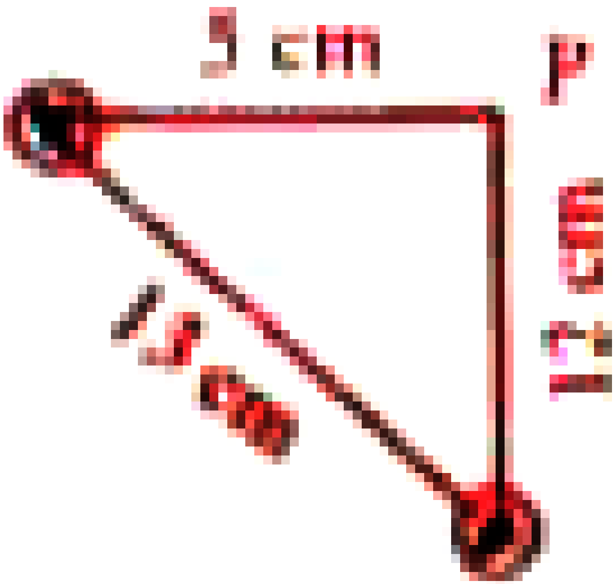
44. Two long parallel conductors cany currents $i_1 = 3A$ and $i_2 = 3A$ both are directed into the plane of paper. The magnitude of resultant magnetic field at point 'P, is



A. $12\mu T$

B. $5\mu T$

C. $13\mu T$

D. $7.2\mu T$

Answer: C

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45. Current 'i' is flowing in heaxagonal coil of side a. The magnetic induction at the centre of the coil will be

A. $\frac{3\sqrt{3}\mu_0 i}{\pi a}$

B. $\frac{\mu_0 i}{3\sqrt{3}\pi a}$

C. $\frac{\mu_0 i}{\sqrt{3}\pi a}$

D. $\frac{\sqrt{3}\mu_0 i}{\pi a}$

Answer: D

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46. A straight wire of length (π^2) metre is carrying a current of 2 A and the magnetic field due to is measured at a point distance 1cm from it. If the wire is to be bent into a circle and is to carry the same current as before, the ratio of the magnetic field at its centre to that obtained in the first case would be

A. $50:1$

B. $1:50$

C. $100:1$

D. $1:100$

Answer: B

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47. A long straight wire of radius a carries a steady current is uniformly distribution across its cross-section.Find the ratio of the magnetic field at $\frac{a}{2}$ and 2a

A. 1

B. 44198

C. 44200

D. 4

Answer: A

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48. Two striaght long conductors AOB and COD are pendicular to each other and carry currents i_1 and i_2 . The magnitude of the magnetic induction at a point P at a distance a from the point O in a direction perpendicular to the plane ACBD is

A. $\frac{\mu_0}{2\pi a}(I_1 + I_2)$

B. $\frac{\mu_0}{2\pi a}(I_1 - I_2)$

C. $\frac{\mu_0}{2\pi a}\left(I_1^2 + I_2^2\right)^{1/2}$

D. $\frac{\mu_0}{2\pi a}\left(\frac{I_1 I_2}{I_1 + I_2}\right)$

Answer: C

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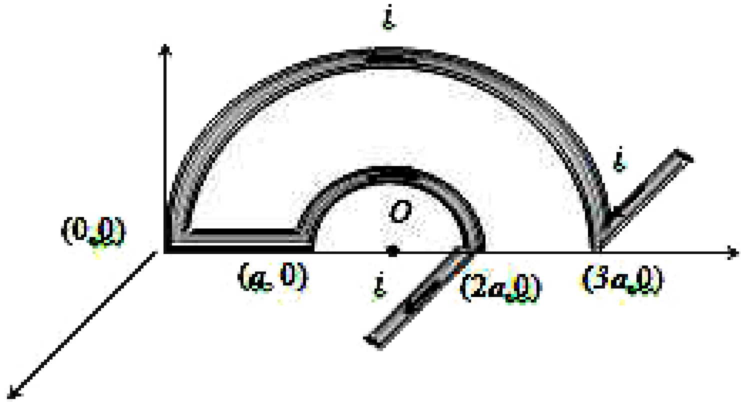
49. In the given figure net magnetic field at O will be



A. $\dfrac{\mu_0 i}{4}\left[\dfrac{1}{r_1}-\dfrac{1}{r_2}\right]$

B. $\dfrac{\mu_0 i}{4}\left[\dfrac{1}{r_1}+\dfrac{1}{r_2}\right]$

C. $\dfrac{\mu_0 i}{2}\left[\dfrac{1}{r_1}-\dfrac{1}{r_2}\right]$

D. $\dfrac{\mu_0 i}{2}\left[\dfrac{1}{r_1}+\dfrac{1}{r_2}\right]$

Answer: A

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50. The total magnetic induction at point O due to curved portion and straight portion in the following figure, will be

A. $\frac{\mu_0 I}{2\pi r}[\pi - \phi + \tan\phi]$

B. $\frac{\mu_0 I}{2\pi r}$

C. 0

D. $\frac{\mu_0 i}{\pi r}[\pi - \phi + \tan\phi]$

Answer: A

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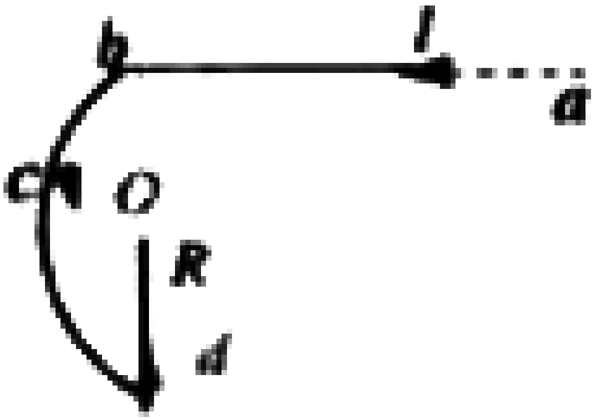
51. An infinitely long wire is bent in the form of a semicircle at the end as shown in the figure. It carries current I along abcdo. If radius of the semicircle be R, then the magnetic field at 'O' which is the centre of the circular part is



A. A) $\frac{\mu_0}{4\pi}\frac{2I}{R}(\pi+1)$

B. B) $\frac{\mu_0}{4\pi}\frac{2I}{R}(\pi-1)$

C. C) $\frac{\mu_0}{4\pi}\frac{1}{R}(\pi+1)$

D. D) $\frac{\mu_0}{4\pi}\frac{1}{R}(\pi-1)$

Answer: C

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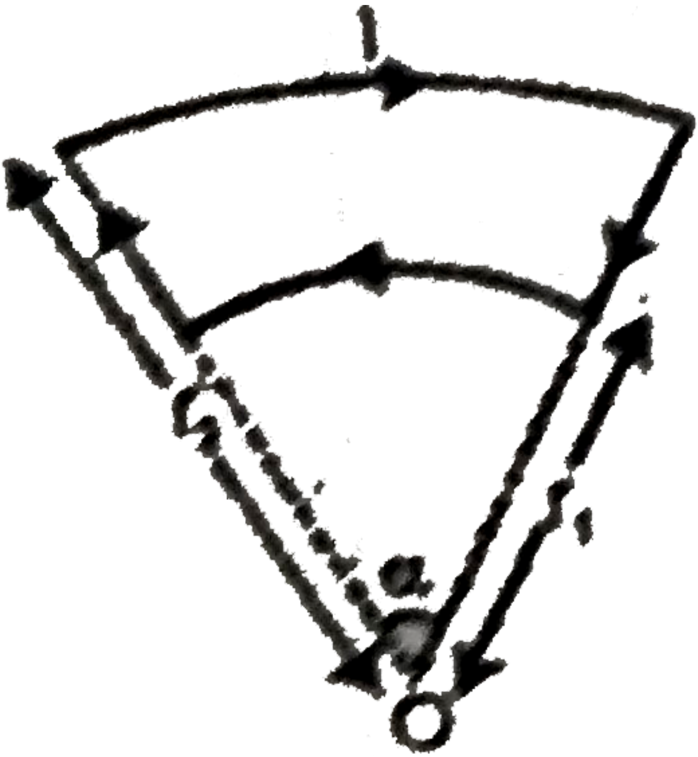
52. The magnetic induction at centre O in the following figure will be



A. $\frac{\mu_0 I}{4r}\left[\frac{3}{2}-\frac{1}{\pi}\right]\odot$

B. $\frac{\mu_0 I}{4r}\left[\frac{3}{2}-\frac{1}{\pi}\right]\otimes$

C. $(\mu_0 I)/(4r)\left[\frac{3}{2}+\frac{1}{\pi}\right]\odot$

D. $\frac{\mu_0 I}{4r}\left[\frac{3}{2}+\frac{1}{\pi}\right]\otimes$

Answer: B

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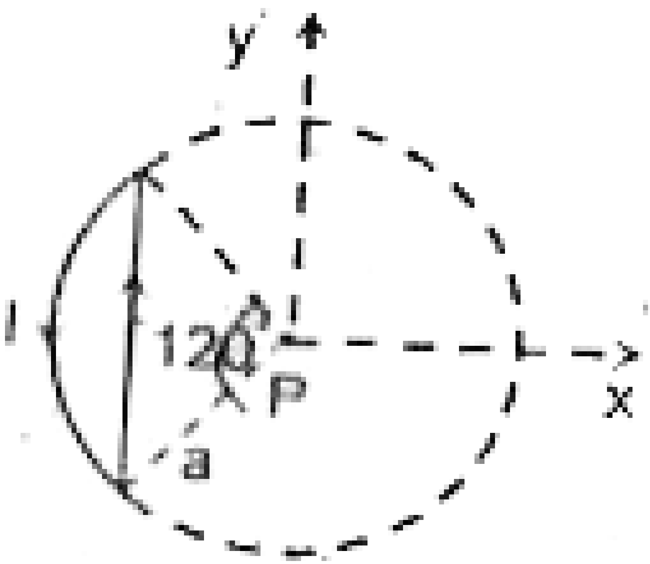
53. A wire loop carrying current I is placed in the x-y plane as shown. Magnetic induction at P is



A. $\frac{\mu_0 I}{2a}\left(\frac{\sqrt{3}}{\pi}-\frac{1}{3}\right)\otimes$

B. $\frac{\mu_0 I}{2a}\left(\frac{\pi}{\sqrt{3}}-\frac{1}{3}\right)\odot$

C. $\frac{\mu_0 I}{a}\left(\frac{1}{3}-\frac{\sqrt{3}}{\pi}\right)\otimes$

D. $\frac{\mu_0 I}{2a}\left(\frac{\sqrt{3}}{\pi}-\frac{1}{3}\right)\odot$

Answer: A

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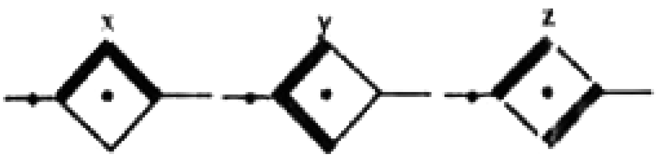
54. Thick and thin wires give rise to 3 different squares x,y and z as shown in figure. The magnetic field at the centre of



A. x, y and z is zero

B. x and z is zero

C. y and z is zero

D. x only is zero

Answer: C

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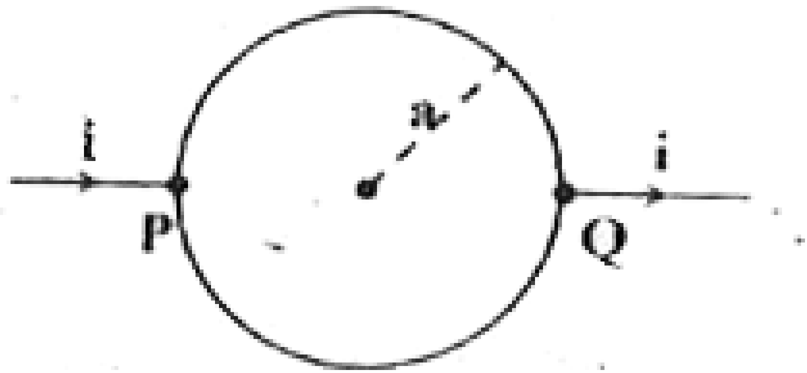
55. If the resistance of the upper half of a rigid loop is twice of that of the lower half, the magnitude of magnetic induction at the centre is eual to



A. zero

B. $\frac{\mu_0 I}{4a}$

C. $\frac{\mu_0 I}{8a}$

D. $\frac{\mu_0 I}{12a}$

Answer: D

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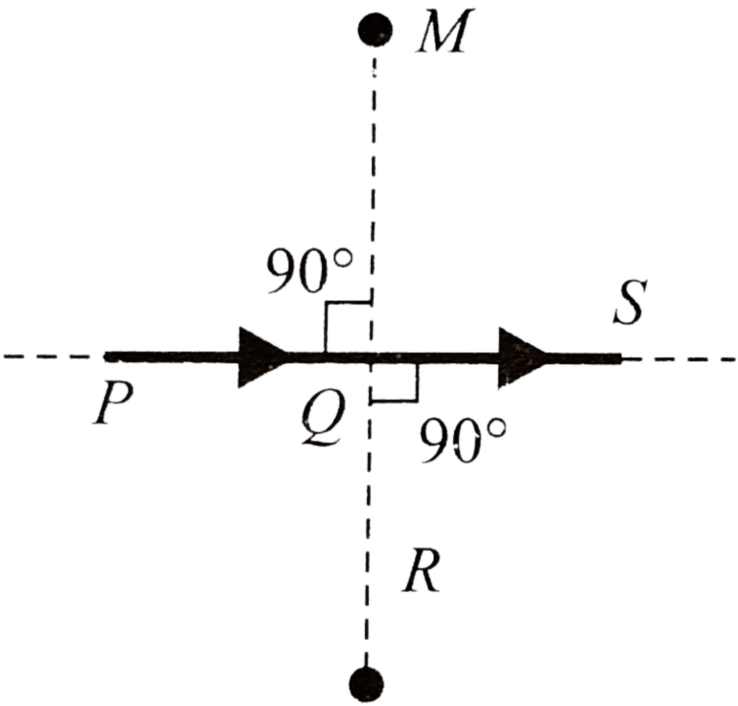
56. An infinitely long conductor PQR is bent to form a right angle as shown. A current I flows through PQR. The magnetic field due to this current at the point $M is B_1$. Now, another infinitely long straight conductor QS is connected at Q so that the current is $I/2$ in QR as well as in QS, the current in PQ remaining unchanged. The magnetic field at M is now $B_2 = 4mT$. Find the value of $B_1(\text{in} mT)$

.



A. $1/2$

B. 1

C. $2/3$

D. 2

Answer: C

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57. A straight conductor of length 32 cm carries a current of 30A. Magnetic induction at a point which is in air at a perpendicular distance of 12cm from the mid point of the conductor is

A. 0.2 gauss

B. 0.3 gaus

C. 0.4 gauss

D. 0.5 gauss

Answer: C

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58. Two parallel long wires carry currents 18A and 3A. When the currents are in the same direction, the magnetic field at a point midway between the wire is B_1. If the direction of i_2 is reversed, the field becomes B_2. Then the value of B_1 / B_2 is

A. $5:7$

B. $7:5$

C. $3:5$

D. $5:3$

Answer: A

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59. Due to straight current carrying conductor, a null point occurred at p on east of the conductor. The net magnetic induction at a point Q which is half the distance of 'p on north of the conductor is

A. zero

B. B_H

C. $\sqrt{2}B_H$

D. $\sqrt{5}B_H$

Answer: D

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60. A long straight wire along the Z-axis carries a current I in the negative z-direction. The magnetic vector field B at a point having coodinates (x, y) in the z = 0 plane is

A. $\dfrac{\mu_0 I\left(y\hat{i} - x\hat{j}\right)}{2\pi(x^2 + y^2)}$

B. $\dfrac{\mu_0 I\left(x\hat{i} + y\hat{j}\right)}{2\pi(x^2 + y^2)}$

C. $\dfrac{\mu_0 i\left(x\hat{j} - y\hat{i}\right)}{2\pi(x^2 + y^2)}$

D. $\dfrac{\mu_0 I\left(xI - y\hat{j}\right)}{2\pi(x^2 + y^2)}$

Answer: A

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61. A wire carrying a current i is first bent in the form of a square of side a and placed at right angle to a uniform magnetic field of induction B. The work done in changing its shape into a circle is

A. A) $ia^2B(\pi + 2)$

B. B) $ia^2B(\pi - 2)$

C. C) $ia^2B\left(\frac{4}{\pi} - 1\right)$

D. D) $ia^2B\left(1 - \frac{4}{\pi}\right)$

Answer: C

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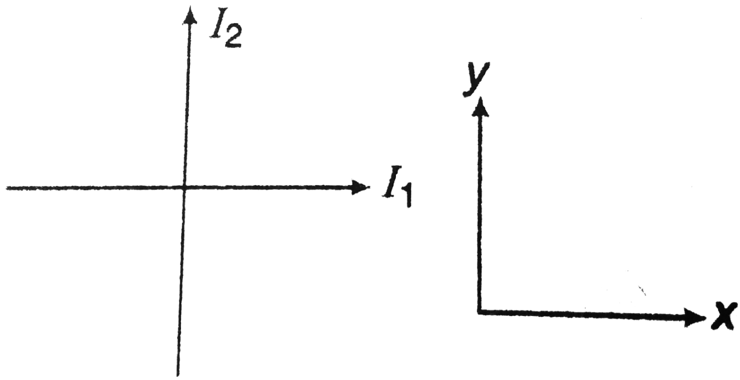
62. Two long mutually perpendicular conductors carrying currents I_1 and I_2 lie in one plane, Find the locus of points at which the magnetic induction is zero.



A. $x = \frac{i_1}{i_2} y$

B. $y = \frac{i_1}{i_2} x$

C. $y = \frac{i_2^2}{i_1} x$

D. $x^2 + y^2 = \frac{i_1}{i_2}$

Answer: B

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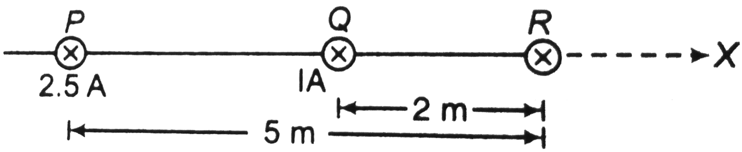
63. Two long parallel wires carrying currents $2.5A$ and I (ampere) in the same directon (directed into the plane of the paper) are held at P and Q, respectively such that they are perpendicular to the plane of paper. The points P and Q are located at distance of $5m$ and $2m$ respectively from a collinear point R (see figure).



a. An electron moving with a velocity of 4×10^5 m/s along the positive x-directionn experieces a force of magnitude 3.2×10^{-20} N at the point R. Find the volume of I.

b. Find all the positions at which a third long parallel wire carrying a current of magnitude $2.5A$ may be placed, so that the magnetic induction at R is zero.

A. $4A$

B. $6A$

C. $8A$

D. $1A$

Answer: A

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64. A toroid has a core (non-ferromagnetic) of inner radius 25 cm and outer radius 26 cm, around which 3500 turns of a wire are wound. If the current in the wire is 11 A, what is the magnetic field (a) outside the toroid, (b) inside the core of the toroid, and (c) in the empty space surrounded by the toroid.

A. $0, 3 \times 10^{-2} T, 0$

B. $3 \times 10^{-2} T, 0, 0$

C. $0, 0, 3 \times 10^{-2} T$

D. $3 \times 10^{-2}T, 0, 3 \times 10^{-2}T$

Answer: A

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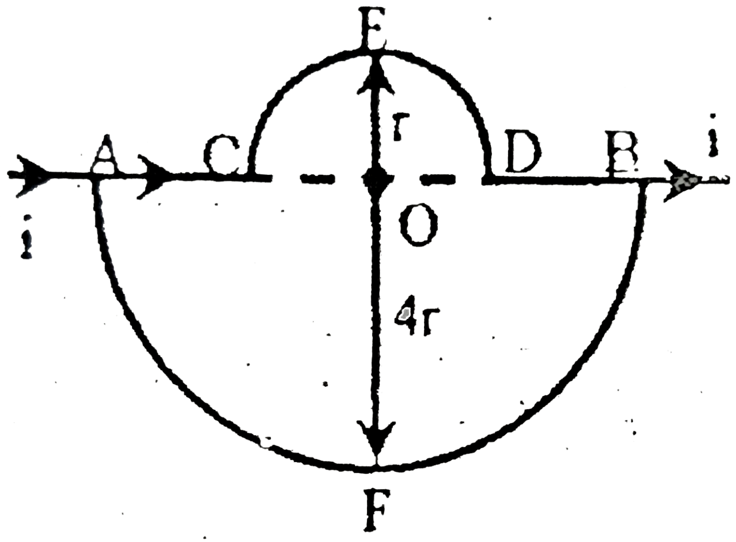
65. In the shown in the figure AC and BD are straight lines and CED and AFB are semicircular with radii r and $4r$, respectively. The centre setip is lying in the same plane. If i is current entering at A what fraction of i will flow in the $ACEDB$ such that resultant magnetic field at O is zero.



A. $\frac{i}{5}$

B. $\frac{4i}{5}$

C. $\frac{3i}{5}$

D. no current through bigger semicircular part

Answer: A

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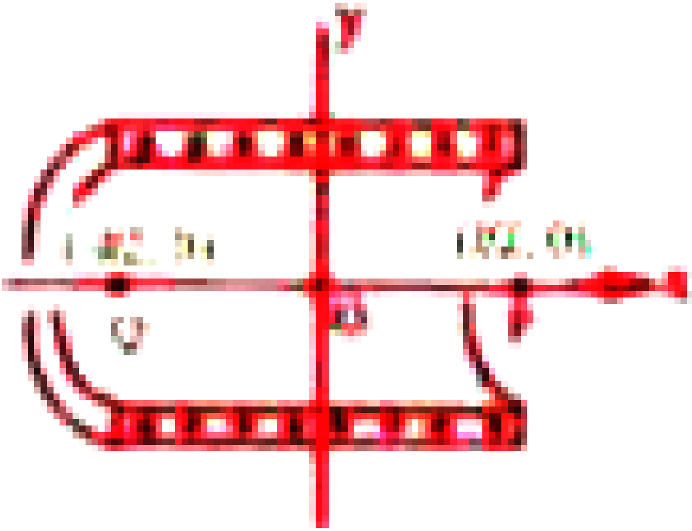
66. A solenoid of length 'l' has N turns of wire closely spaced, each turn carrying a current i. If R is cross sectional radius of the solenoid, the magnetic induction at 'P'(only axial component).



A. $\frac{\mu_0 IN}{2}\sqrt{R^2+I^2}\Big)$

B. $\frac{\mu_0 iN}{2\sqrt{I^2+4R^2}}$

C. $\frac{\mu_0 Ni}{2R^2+I^2}$

D. $\frac{\mu_0 Ni}{4\sqrt{R^2+I^2}}$

Answer: A

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67. A 3.0 cm wire carrying a current of 10 A is placed inside a solenoid perpendicular to its axis. The magnetic field inside the solenoid is given to be 0.27 T. What is the magnetic force on the wire?

A. $8.1 \times 10^{-2} N$

B. $1.8 \times 10^{-2} N$

C. $18 \times 10^{-2} N$

D. $81 \times 10^{-2} N$

Answer: A

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68. A closely wound solenoid of 800 turns and area of cross-section $2.5 \times 10^4 m^2$ carries a current of 3.0A. Explain the sense in which the solenoid acts like a bar magnet. What is its associated magnetic moment?

A. $0.5J/T$

B. $0.3J/T$

C. $0.6J/T$

D. $0.8J/T$

Answer: C

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69. If a solenoid of magnetic moment $0.6JT^{-1}$ is free to turn about the vertical direction and a uniform horizontal magnetic field of 0.25 T is applied, what is the magnitude of torque on the solenoid when its axis makes an angle of 30° with the direction of applied field?

A. $6.5 \times 10^{-2} J$

B. $4.5 \times 10^{-2} J$

C. $4.8 \times 10^{-2} J$

D. $7.5 \times 10^{-2} J$

Answer: D

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70. A solenoid of 1000 turns is wound uniform on a glass tube of 50cm long and 10 cm in diameter. Find the strength of magnetic field at the centre of solenoid when 0.1 amp current is flowing through it

A. 200 amp-turns/meter

B. 50 amp

C. 10 amp-turns/meter

D. 200 amp

Answer: A

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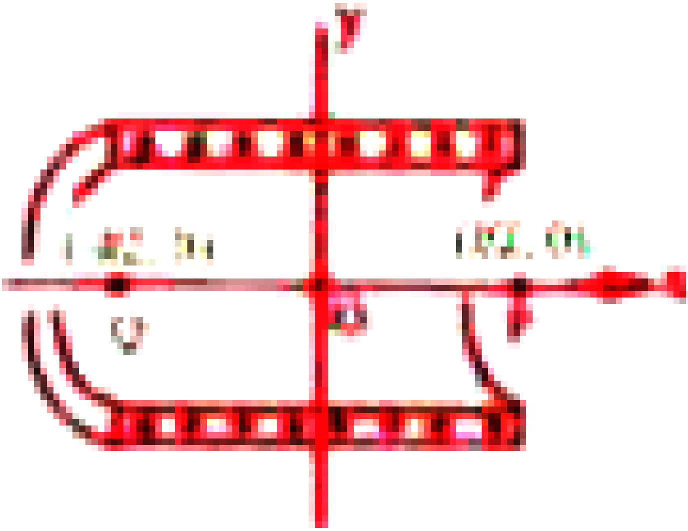
71. A solenoid of length 'l' has N turns of wire closely spaced, each turn carrying a current i. If R is cross sectional radius of the solenoid, the magnetic induction at 'P'(only axial component).



A. $\frac{\mu_0 i N}{2\sqrt{R^2 + I^2}}$

B. $\frac{\mu_0 i N}{2\sqrt{I^2 + 4R^2}}$

C. $\frac{\mu_0 N i}{2R^2 + I^2}$

D. $\frac{\mu_0 N i}{4\sqrt{R^2 + I^2}}$

Answer: B

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72. A closely would solenoid of 2000 turns and area of cross-section $1.6 \times 10^{-4} m^2$. Carrying a current of 4.0A. Is suspended through its centre allowing it to turn in a horizontal plane.

(a) What is the magnetic moment associated with the solenoid?

(b) What is the force and torque on the solenoid if a uniform horizontal mangetic field of $7.5 \times 10^{-2} T$ is set up at an angle of 30° the axis of the solenoid?

A. $1.28 Am^2, 0.042 Nm$

B. $1.28 Am^2, 0.048 Nm$

C. $2.28 Am^2, 0.038 Nm$

D. $1.28 Am^2, 0.0038 Nm$

Answer: B

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73. A Rowland ring of mean radius 15 cm has 3500 turns of wire wound on a ferromagnetic core of relative permeability 800. What is the magnetic field B in the core for a magnetising current of 1.2 A?

A. 2.5 T

B. 5.45 T

C. 4.48 T

D. 1.56 T

Answer: C

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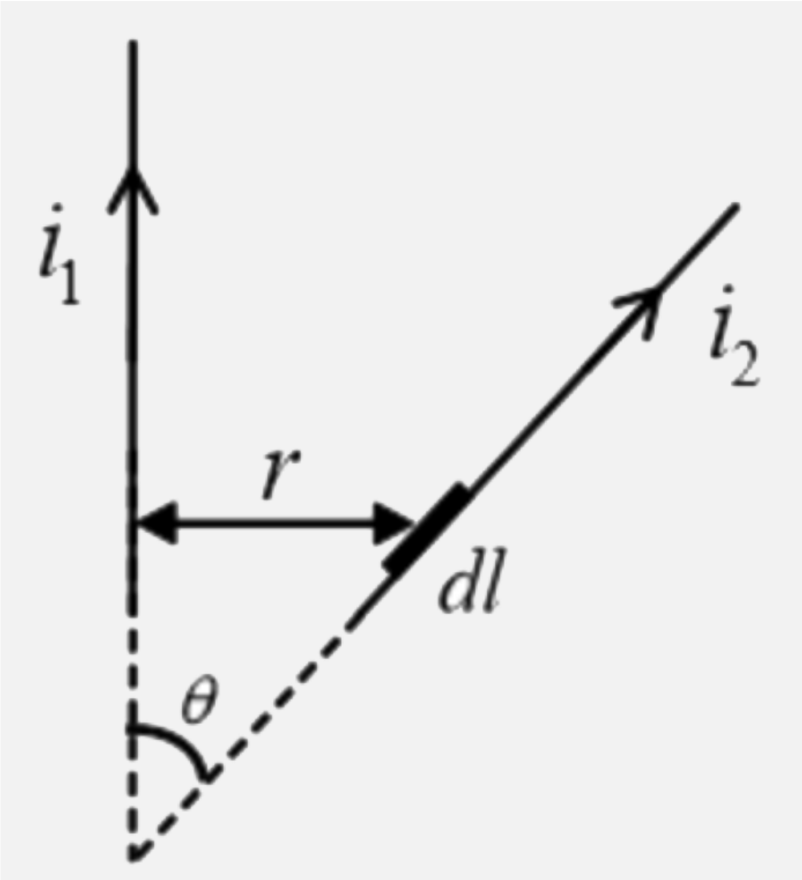
74. Wires 1 and 2 carrying currents i_1 and i_2 respectively are inclined at an angle θ to each other. What is the force on a small element dl of wire 2 at a distance of r from wire 1 (as shown in the figure) due to the magnetic field of wire 1 ?



A. $\frac{\mu_0}{2\pi r} i_1 i_2 d \tan\theta$

B. $\frac{\mu_0}{2\pi r} i_1 i_2 dl \sin\theta$

C. $\frac{\mu_0}{2\pi r} i_1 i_2 dl \cos\theta$

D. $\frac{\mu_0}{4\pi r} i_1 i_2 dl \sin\theta$

Answer: C

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75. Currents of 10 A and 2A are passed through two parallel wires A and B respectuvely, in opposite direction.If the wire A is infinitely long on the wire B is 2 2m then the find the force acting on the conductor B which is situated at 10 cm distance from A

A. $8 \times 10^{-5} N$

B. $4 \times 10^{-5} N$

C. $4 \times 10^{-7} N$

D. $4\pi \times 10^{-7} N$

Answer: A

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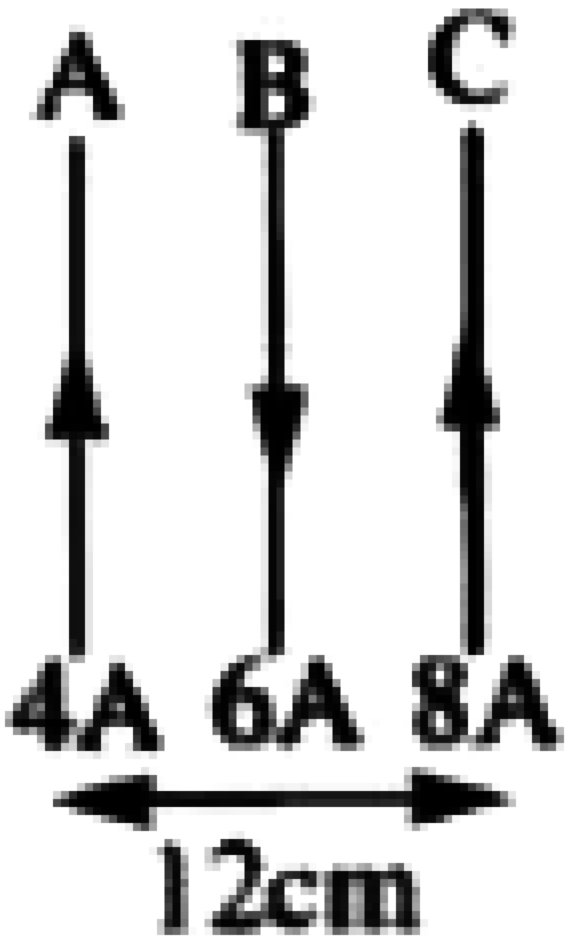
76. Three long straight and parallel wires carrying currents are arranged as shown in fig. The wire 'B' which carries a current of 6A is placed so that it experiences no force. The distance of wire 'B' from A is then



A. 8cm

B. 4cm

C. 6cm

D. 2cm

Answer: B

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77. Two parallel horizontal conductors are suspended by two light vertical threads each 75 cm long. Each conductor has a mass of $40gm$, and when there is no current they are 0.5 cm apart. Equal current in the two wires result in a separation of 1.5 cm. Find the values and directions of currents. Take $g = 9.8ms^{-2}$.

A. 14 A in same direction

B. 14 A in opposite direction

C. 196 A in same direction

D. 196 A in opposite direction

Answer: B

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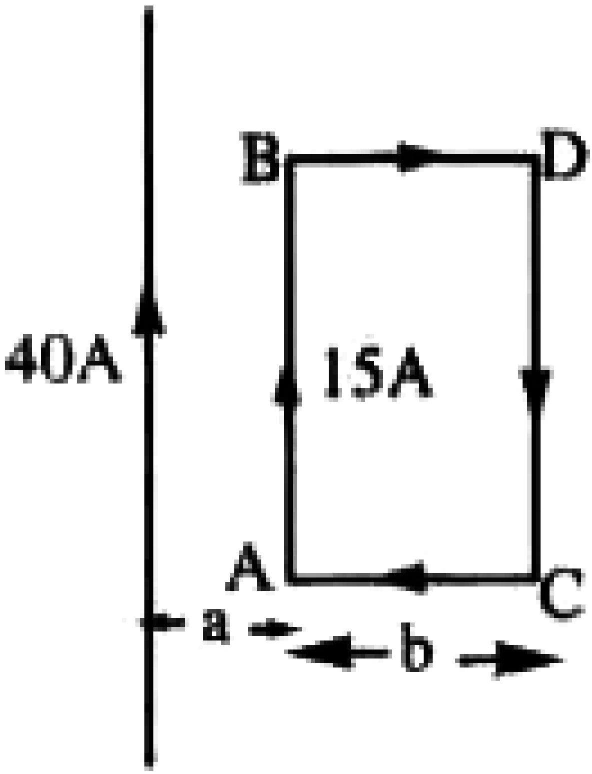
78. Along wire carrying a current of 40A as shown in figure. The rectangular loop carries a current of 15A. The resultant force acting on the loop is assume that a = 1cm, b = 80cm and l = 30cm]



A. 3.6×10^{-3}N directed towards wire

B. 3.6×10^{-3}N directed away from wire

C. $6.4 \times 10^{-3} N$directed towards wire

D. $6.4 \times 10^{-3} N$directed away from wire

Answer: A

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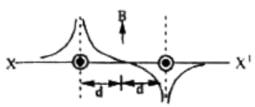
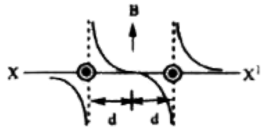
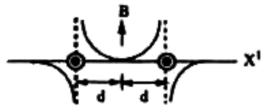
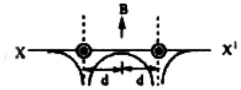
79. Two long parallel wires are at a distance 2d apart. They carry steady equal current flowing out of the plane of the paper as shown. The variation of the magnetic field along the line xx' is given by :

A. 

B. 

C. 

D. 

Answer: B

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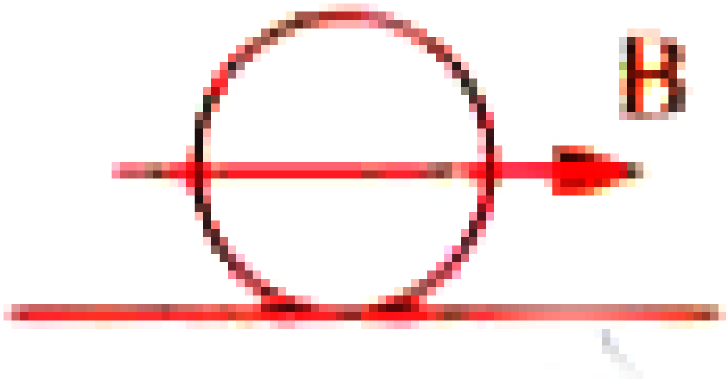
80. A conducting ring of mass 2kg, radius 0.5m carries a current of 4A. It is placed on a smooth horizontal surface. When a horizontal magnetic field of 10 T parallel to the diameter of the ring is applied, the initial acceleration is (in rad/sec^2)



A. 5π

B. 20π

C. 40π

D. 10π

Answer: C

Watch Video Solution

81. A wire fo length l is bent in the from of a circular coil of some turns . A current i flow thoughteh coil . The coil is placed in a unifrom magnetic field B . The maxffimum troque on the coil can be

A. zero

B. iBI^2

C. $4\pi IBI^2$

D. $\frac{iI^2B}{4\pi}$

Answer: D

Watch Video Solution

82. A rectangular coil 6 cm long and 2 cm wide is placed in a magnetic field of 0.02 T. If the loop contains 200 turns and carries a current of 50 mA, the torque on the coil (with loop face parallel to the field) is

A. A) $2.4 \times 10^{-4} Nm$

B. B) $2.4 Nm$

C. C) $0.24 Nm$

D. D) $0.024 Nm$

Answer: A

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83. A circular coil of 20 turns and radius 10 cm is placed in uniform magnetic field of 0.10 T normal to the plane of the coil. If the current in coil is 5 A, then the torque acting on the coil will be

A. 30°

B. 45°

C. 37°

D. 53°

Answer: D

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84. A moving coil galvanometer 'A' has 200 turns and a resistance of 100Ω. Another meter 'B' has 100 turns resistance 400 . All the other quantities are same in both the cases. The current sensitivity of A is

A. 5

B. 2

C. 0.2

D. 0.4

Answer: B

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85. A tangent galvanometer has 66 turns and the diameter of its coil is 22cm. It gives a deflection of $45^{\circ}f$ or 0.10 A current. What is the value of the horizontal component of the earth's magnetic field?

A. $300mA$

B. $228mA$

C. $158mA$

D. $130mA$

Answer: B

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86. A galvanometer has a resistance of 3663Ω. A shunt S is connected across it such that $(1/34)$ of the total current passes through the galvanometer. Then the value of the shunt is

A. $\frac{3}{11}$

B. $\frac{3}{5}$

C. $\frac{2}{7}$

D. $\frac{1}{3}$

Answer: A

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87. A galvanometer having a resistance of 50Ω, gives a full scale deflection for a current of 0.05A. The length in metre of a resistance wire of area of cross - section $2.97 \times 10^{-2} cm^2$ that can be used to convert the galvanometer into an ammeter which can read a maximum of 5A current is (Specific resistance wire $= 5 \times 10^{-7} \Omega - m$)

A. 9

B. 6

C. 3

D. 1.5

Answer: C

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88. A galvanometer has a resistance G and current I_a flowing in it. Produces full scale deflection. If S_1 is the value of shunt which converts it into an ammeter of range 0-0i and S_2 is the value of the shunt for the range 0.2 i, then the ratio $\frac{S_1}{S_2}$ will be:

A. $\frac{1}{2}\left(\frac{I-I_g}{2I-I_g}\right)$

B. $\frac{2I-I_g}{I-I_g}$

C. $1/2$

D. 2

Answer: B

Watch Video Solution

89. The deflection of a galvanometer falls to $1/10^{th}$ when a resistance of 5Ω is connected in parallel with it. If an additional resistance of 2Ω is connected in parallel to the galvanometer, the deflection is

A. $\frac{1}{6}th$

B. $\frac{1}{16}th$

C. $\frac{2}{65}th$

D. $\frac{3}{36}th$

Answer: C

Watch Video Solution

90. A moving coil galvanometer has 150 equal divisions. Its current sensitivity is 10 divisions per milliampere and vlotage sensitivity is 2 divisions per millivolt. In order that each division reads 1 V the resistance in ohm needed to be connected in series with the coil will be

A. 99995

B. 9995

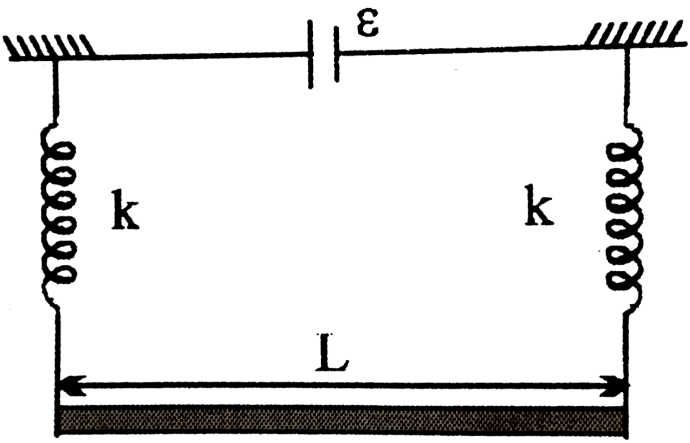
C. 10^3

D. 10^5

Answer: B

Watch Video Solution

91. A straight rod of mass m and lenth L is suspended from the identical spring as shown in the figure The spring stretched by a distance of x_0 due to the weight of the wire The circuit has total resistance R When the magnetic field perpendicular to the plane of the paper is switched on, springs are observed to extend further by the same distance The magnetic field strength is



A. $\frac{mgR_0}{E}$

B. $\frac{mgR_0}{LE}$

C. $\frac{mgR_0}{2LE}$

D. $\frac{2mgR_0}{2LE}$

Answer: B

Watch Video Solution

92. A rigid circular loop of radius r and mass m lies in the xy-plane on a flat table and has a current I flowing in it. At this particular place the earth's magnetic field is $B = B_x\hat{i} + B_z\hat{k}$. The value of I, so that the loop starts tilting is

A. $\dfrac{mg}{\pi r\sqrt{B_x^2 + B_z^2}}$

B. $\dfrac{mg}{\pi r B_z}$

C. $\dfrac{mg}{\pi r B_x}$

D. $\dfrac{mg}{\pi r B_z B_x}$

Answer: C

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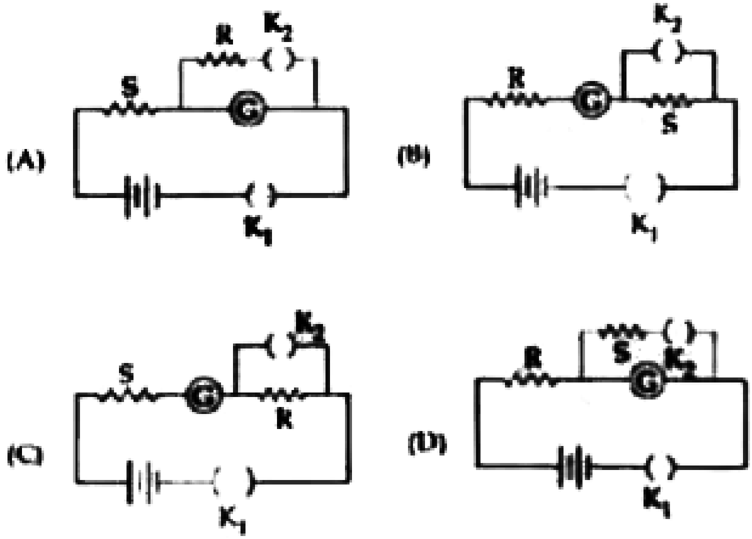
93. In the circuit diagrams (A,B,C and D) shown below, R is a high resistance and S is a resistance of the order of galvanometer resistance G. The correct circuit, corresponding to the half deflection method for finding the resistance and figure of merit of the galvanometer, is the circuit labeled as:



A. Circuit A with $G = \frac{RS}{(R - S)}$

B. Circuit D with $G = \frac{RS}{R - S}$

C. Circuit B with $G = S$

D. Circuit C with G=S

Answer: A

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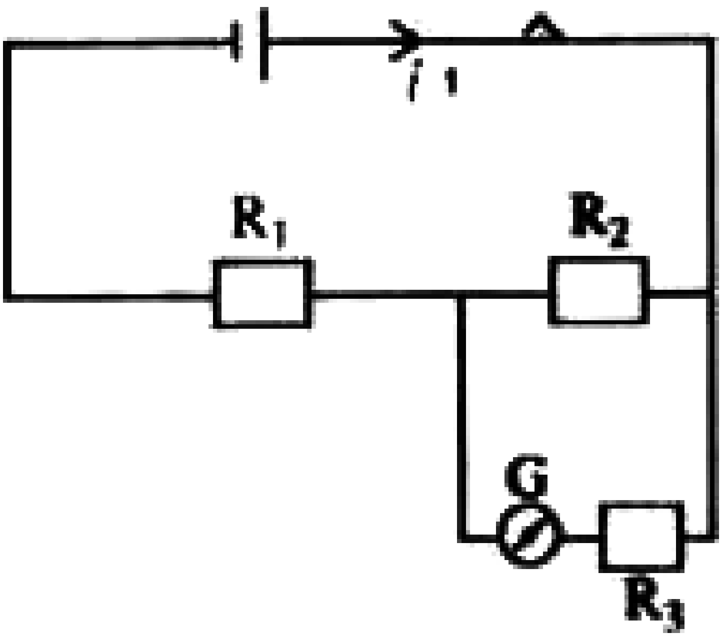
94. To find the resistance of a galvanometer by the half deflection method the following circuit is used with resistances $R_1 = 9970\Omega$, $R_2 = 30\Omega$ and $R_3 = 0$. The deflection in the galvanometer is d. With $R_3, = 107\Omega$ the deflection changed to $\frac{d}{2}$ the galvanometer resistance is approximately:



A. 107Ω

B. 137Ω

C. $107/2\Omega$

D. 77Ω

Answer: D

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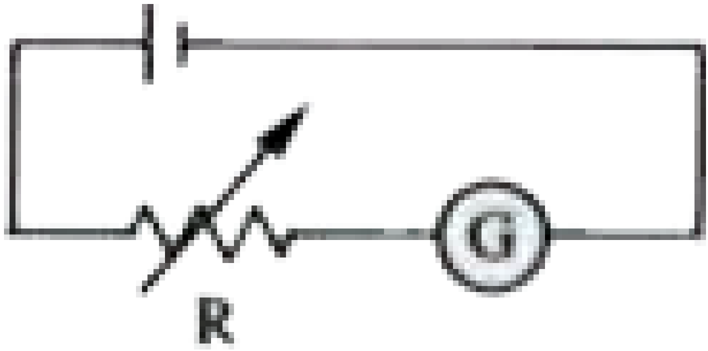
95. Deflection of galvanometer in the circuit is 71 divisions. A shunt of 15Ω is connected parallel to galvanometer and value of R is adjusted such that main current ramains the same. If the deflection in the galvanometer falls to 15 divisions then the resistance G of galvanometer in (in ohm)



A. 5.5 ampere

B. 0.5 ampere

C. 0.004 ampere

D. 0.045 ampere

Answer: D

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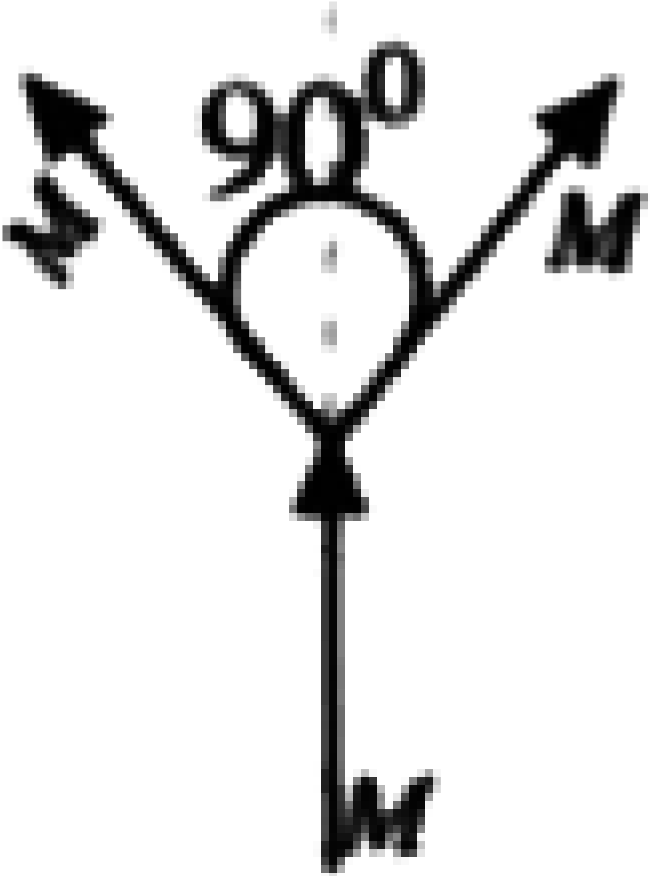
REVISION EXERCISE (MAGNETISM AND MATTER)

1. Find the resultant magnetic moment for the following arrangement



A. $\sqrt{2}M$

B. $\left(\sqrt{2}+1\right)M$

C. $(\sqrt{2}-1)M$

D. M

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2. A bar magnet of magnetic moment M_1 is axically cut into two equal parts. If these two pieces ar earranged perpendicular to each other, the resultant magnetic moment is M_2. Then, the value of $\frac{M_1}{M_2}$ IS

A. $\frac{1}{2\sqrt{2}}$

B. 1

C. $\frac{1}{\sqrt{2}}$

D. $\sqrt{2}$

Watch Video Solution

3. An iron rod of length L and magnetic moment M is bent in the form of a semicircle. Now its mangnetic moment will be

A. $\frac{2M}{\pi}$

B. $2M$

C. $\frac{M}{\pi}$

D. Zero

Watch Video Solution

4. The force between two short magnets is 'F'. When the pole strengths of the magnets are tripled and the distance between them is also doubled, the force between them is (Take magnets to be parallel to each other)

A. 24F and 2300%

B. 24F and 2400%

C. $\frac{3}{2}$ F and 150%

D. 2F and 100%

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5. The force between two poles is reduced to P newton, when their original separation is increased to x times, it is increased to Q newton, when their separation is made 1/xth of their original value. Then the relation between P and Q is

A. Q = XP

B. Q=X^2P

C. Q=X^3P

D. Q=X^4P

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6. Two identical spheres each of mass M and Radius R are separated by a distance 10R. The gravitational force on mass m placed at the midpoint of the line joining the centres of the spheres is

A. 6.64 amp $\times$ m

B. 2 amp $\times$ m

C. 10.25 amp $\times$ m

D. None of these

Watch Video Solution

7. The distance between a north pole of strength 6×10^{-3}Am and a south pole of strength 8×10^{-3} Am is 10 cm. The poles are separated in air. Find the force between them.

A. $2ms^{-2}$

B. $4ms^{-2}$

C. $5ms^{-2}$

D. $10ms^{-2}$

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8. Two north poles each of pole strength m and a south pole of pole strength m are placed at the three corners equilateral triangle of side a. The intensity of magnetic induction field strength at the centre of the triangle is

A. zero

B. $\frac{\mu_0 m^2}{4\pi d^2}$

C. $\left[\frac{2\sqrt{2}+1}{2}\right]\frac{\mu_0}{4\pi}\frac{m^2}{d^2}$

D. $\left[\frac{2\sqrt{2}-1}{2}\right]\frac{\mu_0}{4\pi}\frac{m^2}{d^2}$

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9. The magnetic induction at a distance 'd' from the magnetic pole of unknown strength 'm' is B. If an identical pole is now placed at a distance of 2d from the first pole, the force between the two poles is

A. mB

B. $\frac{mB}{2}$

C. $\frac{mB}{4}$

D. $2mB$

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10. The force between two short magnets is 'F'. When the pole strengths of the magnets are tripled and the distance between them is also doubled, the force between them is (Take magnets to be parallel to each other)

A. 0.5625F

B. 2.25F

C. 0.375F

D. 0.75F

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11. The poles of a horse-shoe magnet cach of pole strength 2A-m are at 4cm apart. The magnetic induction at the mid point between the poles is

A. $0.25 \times 10^{-3} T$

B. $0.5 \times 10^{-3} T$

C. $0.125 \times 10^{-3} T$

D. $10^{-3} T$

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12. Two poles of a horse shoe magnet each of pole strength 2 Am are 8 cm apart. Find the magnetic field intensity at the midpoint of the line joining the poles.

A. $1.54 \times 10^{-5} T$

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

C. $15 \times 10^{-4} T$

D. $15 \times 10^{-6} T$

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13. The length of a magnet of moment $5Am^2$ is 14cm. The magnetic induction at a point, equidistant from both the poles is

$3.2 \times 10^{-5} wb/m^2$. The distance of the point from each pole is

A. 5cm

B. 10cm

C. 25cm

D. 15cm

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14. A magnet of length 10cm and magnetic moment 1 Am^2 is placed along the side AB of an equilateral triangle ABC. If the length of the side AB is 10cm, the magnetic induction at the point C is

A. $10^{-9}T$

B. $10^{-7}T$

C. $10^{-5}T$

D. $10^{-4}T$

Watch Video Solution

15. Two identical magnetic poles each of strength 'm' are placed at the vertices of an equilateral triangle of side 'd' then resultant magnetic induction at the third vertex is

A. $\frac{\mu_0}{4\pi}\frac{m}{d^2}$

B. $\sqrt{2}\frac{\mu_0}{4\pi}\frac{m}{d^2}$

C. $\sqrt{3}\frac{\mu_0}{4\pi}\frac{m}{d^2}$

D. Zero

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16. The pole strength of a 12cm long bar magnet is 20Am. The magnetic induction at a point 10cm away from the centre of the magnet on its axial line is

A. $1.1 \times 10^{-3} T$

B. $2.2 \times 10^{-3} T$

C. $1.1 \times 10^{-2} T$

D. $2.2 \times 10^{-2} T$

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17. Two short bar magnets of magnetic moments m each are arranged at the opposite corners of a square of side d such that their centres coincide with thecorners and their axes are parallel. If the like poles are in the same direction, the magnetic induction at any of the other corners of the square is

A. $\frac{\mu_0}{4\pi}\frac{M}{d^3}$

B. $\frac{\mu_0}{4\pi}\frac{2M}{d^3}$

C. zero

D. $\frac{\mu_0}{4\pi}\frac{3M}{d^3}$

Watch Video Solution

18. The pole strength of a 12cm long bar magnet is 20Am. The magnetic induction at a point 10cm away from the centre of the magnet on its axial line is

A. 10T south and ST west

B. 5T south and 10T west

C. 20T south and 10T west

D. 10T south and 20T west

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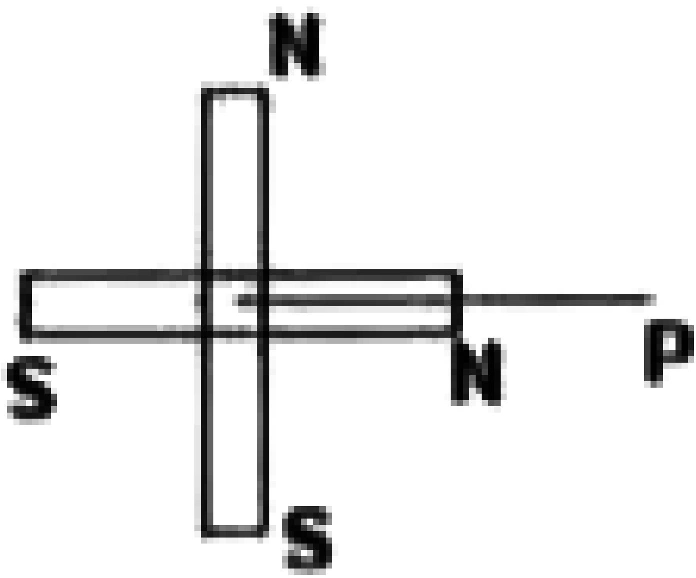
19. Two short magnets each of moment M are placed one over the other at right angles. The resultant magnetic induction at a point 'P', that lies at a distance 'd' from the common centre is



A. $\frac{\mu_0}{4\pi}\frac{3M}{d^3}$

B. $\sqrt{3}\frac{\mu_0}{4\pi}\frac{3M}{d^3}$

C. $\sqrt{5}\frac{\mu_0}{4\pi}\frac{M}{d^3}$

D. $\frac{\mu_0}{4\pi}\frac{M}{d^3}$

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20. A short bar magnet of magnetic movement $5.25 \times 10^{-2} JT^{-1}$ is placed with its axis perpendicular to the earth's field direction. At what distance from the centre of the magnet, the resultant field is inclined at 45° with earth's field on (a) its normal bisector and (b) its axis. Magnitude of the earth's field at the place is given to be 0.42 G. Ignore the length of the magnet in comparison to the distances involved.

A. 2.8 cm, 5 cm

B. 2 cm, 5 cm

C. 8 cm, 1.2 cm

D. 5 cm, 6.3 cm

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21. Two solenoids acting as short bar magnets P and Q are arranged such that their centres are on the X-axis and are separated by a large distance. The magnetic axes of P and Q are along X and Y-axes, respectively. At a point R, midway between their centres, if B is the magnitude of induction due to Q , then the magnitude of total induction at R due to the magnitude is

A. 3B

B. $\sqrt{5}B$

C. $\frac{\sqrt{5}}{2}B$

D. B

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22. Find the magnetic field due to a dipole of magnetic moment $1.2Am^2$ at a point $1m$ away from it in a direction making an angle of 60° with the dipole-axis`.

A. $1.6 \times 10^{-7}T$

B. $6 \times 10^{-7}T$

C. $1 \times 10^{-7}T$

D. $16 \times 10^{-7}T$

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23. Two magnets of moments M_1 and M_2 are rigidly fixed together at their centres so that their axes are inclined to each other. This system is suspended in a magnetic field of induction 'B' so that M_1 makes an angles θ_1 and M_2 makes an angles θ_2 with the field direction and unlike poles on either side of the field direction. The resultant torque on the rigid system is

A. A) $B(M_1 \sin\theta_1 + M_2 \sin\theta_2)$

B. B) $B(M_1 \cos\theta_1 + M_2 \cos\theta_2)$

C. C) $B(M_1 \sin\theta_2 + M_2 \sin\theta_1)$

D. D) $B(M_1 \cos\theta_2 + M_2 \cos\theta_1)$

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24. A short bar magnet of magnetic moment $0.32JT^{-1}$ is placed in a uniform magnetic field 0.15T. If the bar magnet is free to rotate in the plane of the field, which orientation would corespond to its (i) stable and (ii) unstable equilirium? What is the potential energy of the magnet in each case?

A. $-4.8 \times 10^{-2}J, 4.8 \times 10^{-2}J$

B. $-4.2 \times 10^{-2}, \ +4.8 \times 10^{-3}J$

C. $+4.2 \times 10^{-2}J, \ -2.8 \times 10^{-3}J$

D. $+4.8 \times 10^{-2}J, \ -2.8 \times 10^{-3}J$

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25. A magnet is suspended in the magnetic meridian with an untwisted wire. The upper end of wire is rotated through 181° to deflect magnet by 37° from magnetic meridian. Now this magnet is replaced by another magnet and upper end of wire has to be rotated by 273° to deflect magnet by 53° from magnetic meridian. The ratio of magnetic moment of the two magnets respectively is

A. $3:4$

B. $1:2$

C. $4:7$

D. $5:8$

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26. A magnet of magnetic moment $5Am^2$ is freely suspended in a uniform magnetic field of strength 2T. Find the work done in rotating the magnet through an angle of 60°.

A. A) 257°

B. B) 252°

C. C) 275°

D. D) 127°

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27. A magnetic dipole is acted upon by two magnetic fields which are inclined to each other at an angle of 75°. One of the fields has a magnitude of 15 mT. The dipole attains stable equilibrium at an angle of 30° with this field. The magnitude of the other field (in mT) is close to:

A. $1.5 \times 10^{-2} T$

B. $1.5\sqrt{2} \times 10^{-2} T$

C. $\frac{1.5}{\sqrt{2}} \times 10^{-2} T$

D. $(1.5)2\sqrt{2}) \times 10^{-2} T$

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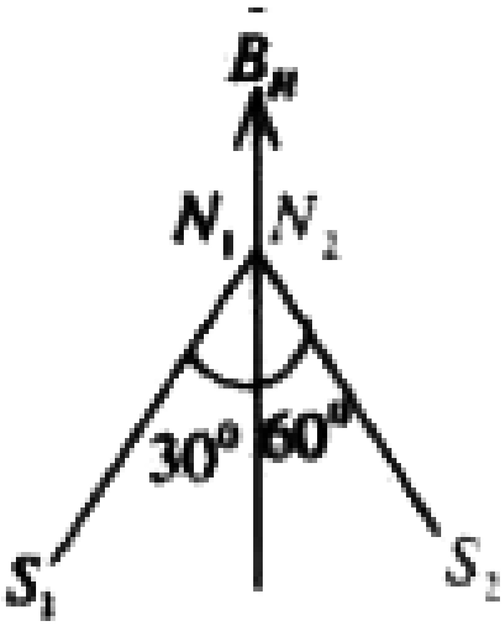
28. Two small magnets X and Y of dipole moments M_1 and M_2 are fixed perpendicular to each other with their north poles in contact. This arrangement is placed on a floating body so as to move freeely in earth's magnetic field as shown in figure then the ratio of magnetic moment is



A. $1:\sqrt{3}$

B. $2:\sqrt{3}$

C. $\sqrt{3}:2$

D. $\sqrt{3}:1$

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29. If 'W' Joule is the work done in rotating the magnet from the field direction to a position that makes an angle 60° with the direction of the field, the torque required to hold the magnet in that direction is

A. $\frac{W}{2}N-m$

B. $\frac{W}{\sqrt{3}}N-m$

C. W N-m

D. $\sqrt{3}WN-m$

Watch Video Solution

30. A magnetic needle lying parallel to a magnetic field requires W units of work to turn through 60°. The external torque required to maintain the magnetic needle in this position is

A. $\sqrt{3}W$

B. $\frac{\sqrt{3}}{2}W$

C. $w/2$

D. $2W$

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31. A bar magnet of magnetic moment $2.0Am^2$ is free to rotate about a vertical axis through its centre. The magnet is released from rest from the east-west position. Find the kinetic energy of the magnet as it takes the north-south position. The horizontal component of the earth's magnetic field is $B = 25\mu T$.

A. $25\mu J$

B. $50\mu J$

C. $100\mu J$

D. $12.5\mu J$

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32. A short bar magnet placed with its axis at 30° with a uniform external magnetic field of 0.16T experiences a torque of magnitude 0.032Nm. If the bar magnet were free to rotate, its P.E when it is in stable and unstable equilibrium are respectively.

A. A) $-0.064J, \ +0.064J$

B. B) $-0.032J, \ +0.032J$

C. C) $+0.064J, \ -0.064J$

D. D) $+0.032J, \ -0.032J$

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33. A bar magnet takes π/10 seconds to complete one oscillation in uniform magnetic field. The moment of inertia of the magnet about the axis of rotation is $1.2 \times 10^{-4} kgm^2$ and the earth's horizontal magnetic field is 30μ T. The magnetic moment of the magnet is

A. $1200 Am^2$

B. $800 Am^2$

C. $1600 Am^2$

D. $1800 Am^2$

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34. A small magnet of moment 4.8×10^{-2} J/T is suspended freely in the plane of a uniform magnetic field of magnitude 3×10^{-2} T. If the magnet is slightly displaced from its stable equilibrium and released then the angular frequency of its oscillations in rad/sec. (Moment of inertia of the magnet about the axis of rotation is $2.25 \times 10^{-5} kgm^2$)

A. A) 8

B. B) 4

C. C) 3

D. D) 2

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35. A short bar magnet used in a vibration magnetometer is heated so as to reduce its magnetic moment by 36%, then the frequency of magnet is (Neglecting the Changes in the dimensions of the magnet)

A. Increase by 36%

B. Decreases by 36%

C. Increase by 20%

D. Decreases by 20%

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36. A compass needle makes 10 oscillations per minute in the earths horizontal field. A bar magnet deflects the needle by 60° from the magnetic meridian. The frequency of oscillation in the deflected position in oscillations per minute is (field due to magnet is perpendicular to B_H)

A. 15 oscillations/minute

B. $10\sqrt{2}$ oscillations/minute

C. 18 oscillations/minute

D. Zero

Watch Video Solution

37. The magnetic needle of a vibration magnetometer makes 12 oscillations per minute in the horizontal component of Earth's magnetic field. When an external short bar magnet is placed at some distance along the axis of the needle in the same line, it makes 15 oscillations per minute. If the poles of the bar magnet are interchanged, the number of oscillations it makes per minute is

A. $\sqrt{61}$

B. $\sqrt{63}$

C. $\sqrt{65}$

D. $\sqrt{67}$

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38. A combination of two identical bar magnets are placed one over the other such that they are perpendicular and bisect each other. The time period of oscilla-tion in a horizontal magnetic field is $2^{5/4}$ seconds. One of the magnets is removed and if the other magnet oscillates in the same field, then the time period in seconds is

A. $2^{1/4}$

B. $2^{1/2}$

C. 2

D. $2^{5/4}$

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39. A small magnetic needle performs 10 oscillations/minute in the earth's horizontal magnetic field . When a bar magnet is placed near the small magnet in same position , frequency of oscillations becomes $10\sqrt{2}$ oscillations/minute . If the bar magnet be turned around end to end , the rate of oscillation of small magnet will become

A. $4.5Am^2$

B. $0.45Am^2$

C. $0.75Am^2$

D. $0.225Am^2$

Watch Video Solution

40. The time period of oscillation of a magnet in a vibration magnetometer is 1.5 sec. The time period of oscillation of another magnet similar in size and mass but having one-fourth the magnetic moment than that of the first magnet oscillating at the same place will be

A. $16Hz$

B. $4\sqrt{3}Hz$

C. $16\sqrt{3}Hz$

D. $4Hz$

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Watch Video Solution

41. A small magnetic needle performs 10 oscillations/minute in the earth's horizontal magnetic field . When a bar magnet is placed near the small magnet in same position , frequency of oscillations becomes $10\sqrt{2}$ oscillations/minute . If the bar magnet be turned around end to end , the rate of oscillation of small magnet will become

A. $4:7$

B. $7:4$

C. $5:4$

D. $4:5$

Watch Video Solution

42. Two short bar magnets of magnetic moments m each are arranged at the opposite corners of a square of side d such that their centres coincide with thecorners and their axes are parallel. If the like poles are in the same direction, the magnetic induction at any of the other corners of the square is

A. $1:7:5$

B. $1:\sqrt{7}:\sqrt{5}$

C. $1:\sqrt{7}:\sqrt{7/5}$

D. $1:7/5\big):\sqrt{14/5}$

Watch Video Solution

43. A small magnetic needle performs 10 oscillations/minute in the earth's horizontal magnetic field . When a bar magnet is placed near the small magnet in same position , frequency of oscillations becomes $10\sqrt{2}$ oscillations/minute . If the bar magnet be turned around end to end , the rate of oscillation of small magnet will become

A. $5\sqrt{2}$

B. $20\sqrt{2}$

C. $10\sqrt{2}$

D. 10

Watch Video Solution

44. A deflection magnetometer is adjusted in the usual way . When a magnet is introduced , the deflection observed is $\theta = 60^\circ$ and the period of oscillation of the needle in magnetometer is T . When the magnet is removed the time period of oscillation is T_0 . The relation between T and T_0 is

A. $T^2 = T_0^2 \cos\theta$

B. $T = T_0 \cos\theta$

C. $T = \dfrac{T}{\cos\theta}$

D. $T^2 = \dfrac{T_0^2}{\cos\theta}$

Watch Video Solution

45. A short magnet oscillates in an oscillation magnetometer with a time period of 0.10s where the earth's horizontal magnetic field is $24\mu T$. A downward current of $18A$ is established in a vertical wire placed 20cm east of the magnet. Find the new time period.

A. 4Hz

B. 2.5Hz.

C. 9Hz

D. 5Hz

Watch Video Solution

46. Two magnets are held in a viberation magnetometer and are allowed to oscillate in the earth's magnetic field with likes poles together. 12 Oscillation per minutes are made but for imlike poles together only 4 oscillations per minute are executed. The ratio of thier magnetic moments is

A. $7:25$

B. $25:7$

C. $25:16$

D. $16:25$

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Watch Video Solution

47. With a standard rectangular bar magnet, the time period of a vibration magnetometer is 4 s. The bar magnet is cut parallel to its length into four equal pieces. The time period of vibration magnetometer when one piece is used (in second) (bar magnet breadth is small) is

A. 16

B. 8

C. 4

D. 2

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48. A magnet makes 40 oscillations per minute at a place having magnetic field induction of $0.1 \times 10^{-5} T$. At another place. It takes 2.5 s to complete one vibration. The value of earth's horizontal field at that place is

A. $\frac{25}{\sqrt{3}}$

B. $\sqrt{3}$

C. $25\sqrt{3}$

D. 25

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49. Obtain the earth's magnetisation, assuming that the earth's field can be approximated by a giant bar magnet of magnetic moment $8.0 \times 10^{22} Am^2$. Radius of earth = 6400km.

A. $62.8Am^{-1}$

B. $52.8Am^{-1}$

C. $72.88Am^{-1}$

D. $82.8Am^{-1}$

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50. The plane of a dip circle is set in the geographic meridian and the apparent dip is ∂_1. It is then set in vertical plane perpendicular to the geographic meridian. The appartent dip angle is δ_2. The declination θ at the plane is

A. $\tan\alpha = \sqrt{\tan\theta_1 \tan\theta_2}$

B. $\alpha = \sqrt{\tan^2\theta_1 \tan^2\theta_2}$

C. $\tan\alpha = \dfrac{\tan\theta_1}{\tan\theta_2}$

D. $\tan\alpha = \dfrac{\tan\theta_2}{\tan\theta_1}$

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51. A dip circle lying initially in the magnetic meridian is rotated through angle θin the horizontal plane. The ratio of tangent of apparent angle of dip to true angle of dip is

A. $\cos\theta : 1$

B. $\sin\theta : 1$

C. $1 : \cos\theta$

D. $1 : \sin\theta$

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52. If θ_1 and θ_2 be the apparent angles of dip observed in two verticle planes at right angles to each other, then the true angle of dip θ is given by

A. $\cos^2\phi = \cos^2\phi_1 + \cos^2\phi_2$

B. $\sec^2\phi = \sec^2\phi_1 + \sec^2\phi_2$

C. $\tan^2\phi = \tan^2\phi_1 + \tan\phi_2$

D. $\cot^2\phi = \cot^2\phi_1 + \cot^2\phi_2$

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