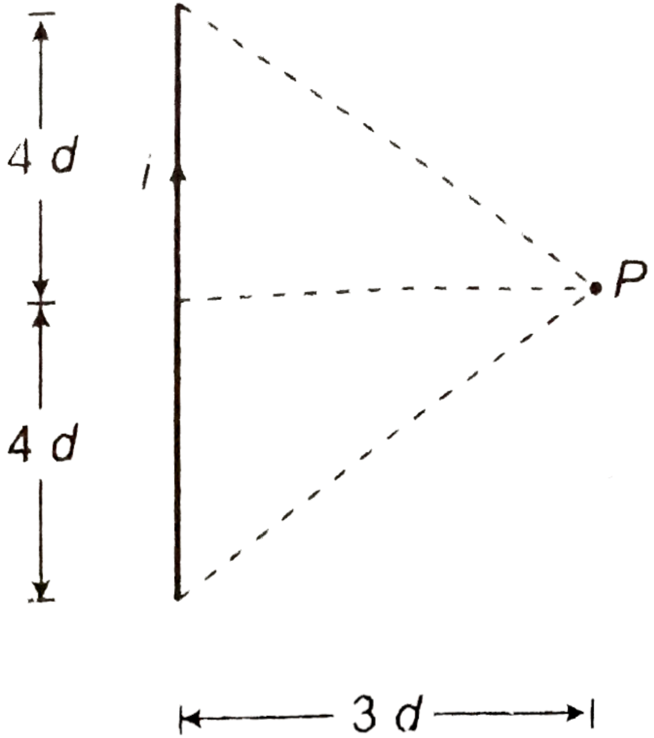
PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

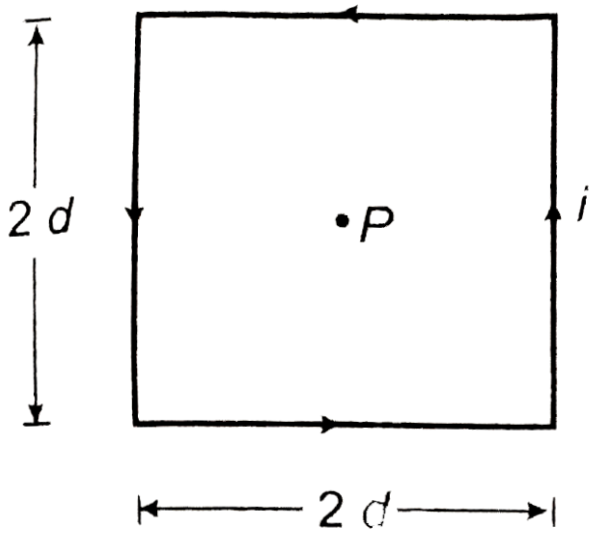
MAGNETIC FIELD

Example

1. Find magnitude and direction of magnetic field at point P in the following cases.

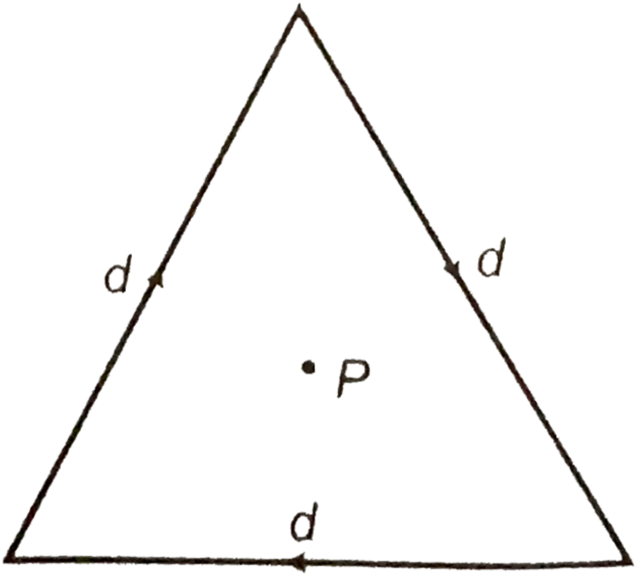


(a)



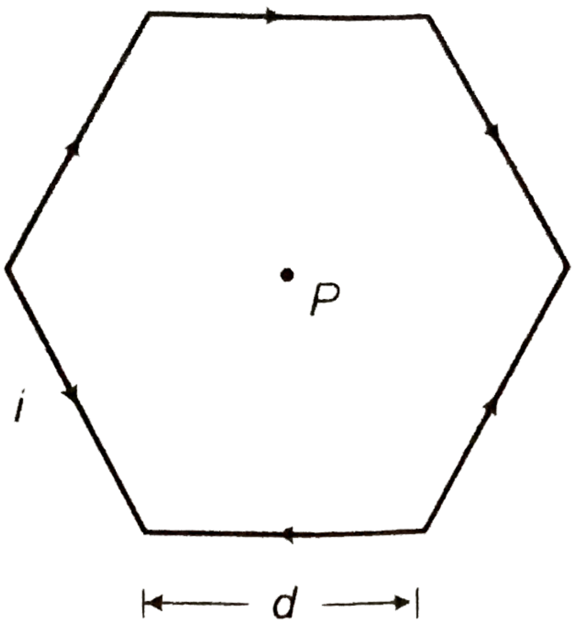
(b)

P is the centre of square.



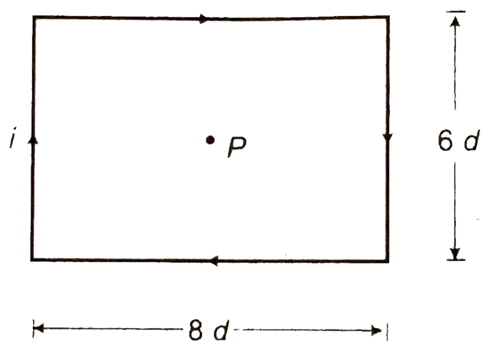
(c)

P is the centre of equilateral triangle.



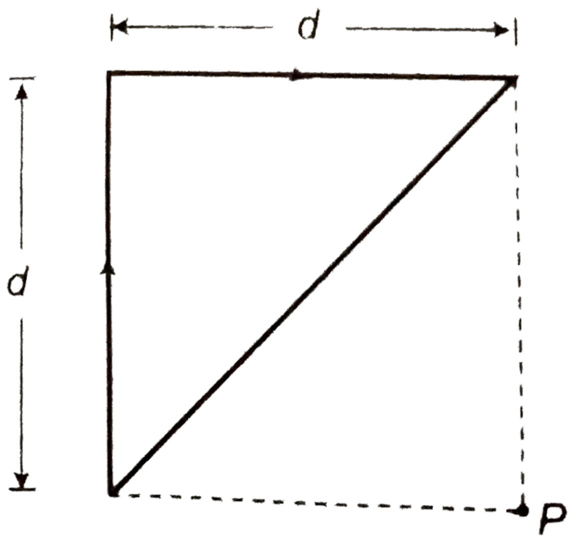
(d)

P is the centre of regular hexagon.



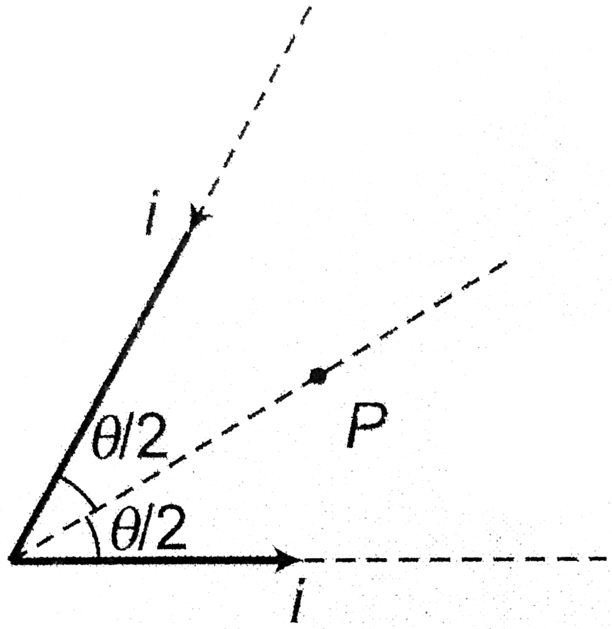
(e)

P is the centre of rectangular loop.



(f)

(g) A long wire carrying a current i is bent to from a plane angle θ. Find magnetic field at a point on the bisector of this angle is situated at a distance d from vertex.



(h) A long, straight wire carriers a current i. Let B_1 be the magnetic field at a point P at a distance d from the wire. consider a section of length l of this wire such that the point P lies on a perpendicular bisector of the sector. Let B_2 be the magnetic field at this point due to this section only. find the value of d/l so that B_2 differes from B_1 by 1% .

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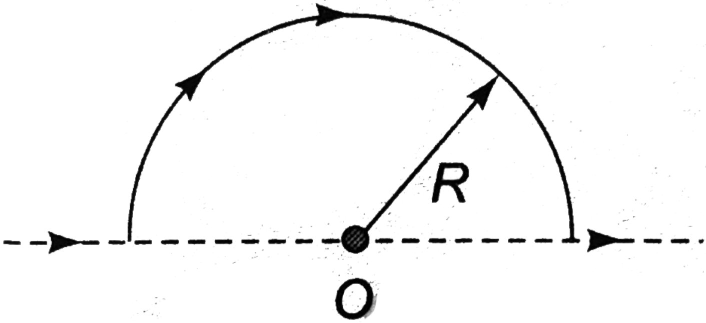
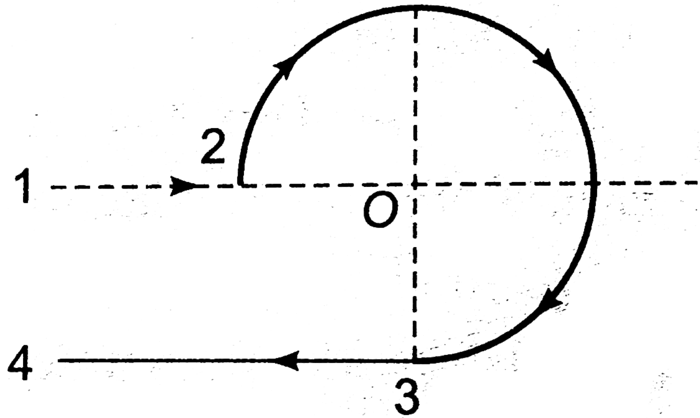
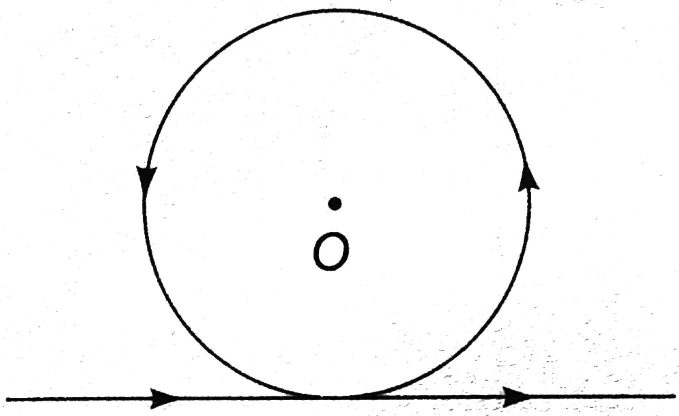
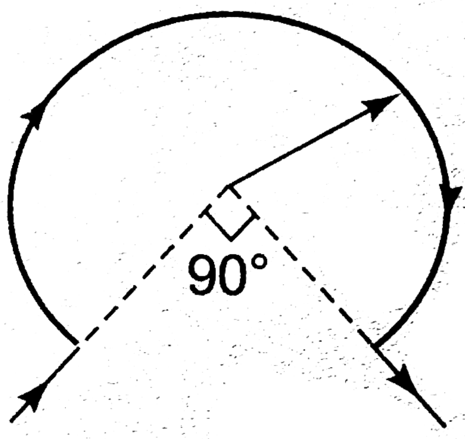
2. Calculate the magnetic field at point O in each of the following cases:

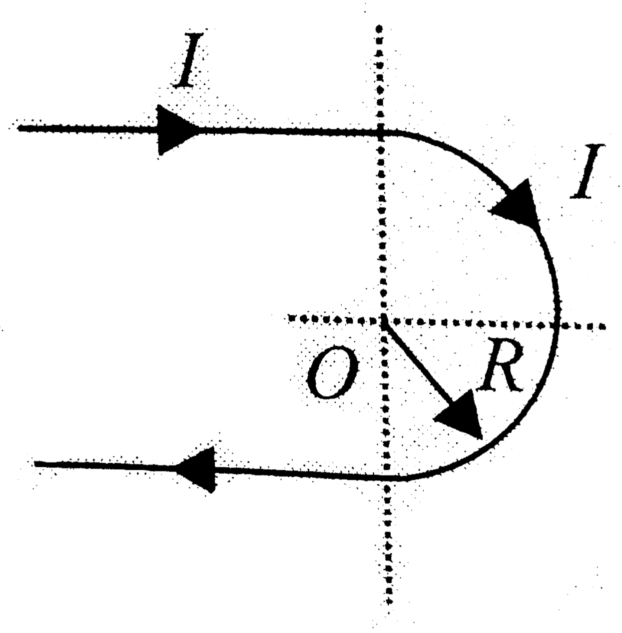

R
O


2
1
O
4
3


O


90°

e.



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3. (a) If BCD is in the plane of AB and DE, find the magnetic induction at centre O due to a current i in the conductors.

(b) The loop is made of same wire and uniform in cross-section. Find magnetic field at O.

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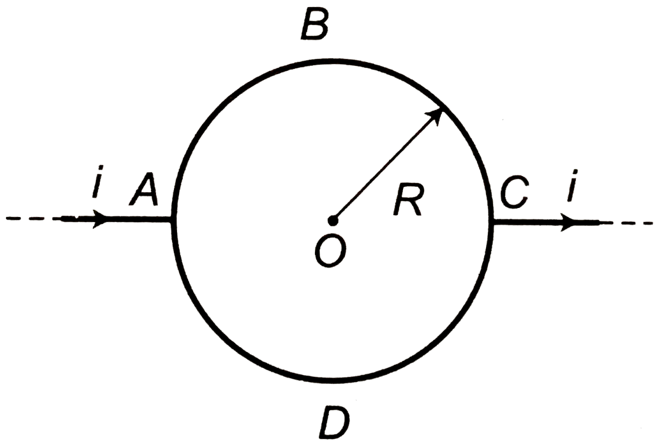
4. The resistance of wire ABC is double of resistance of wire ADC. The magnetic field at

O is



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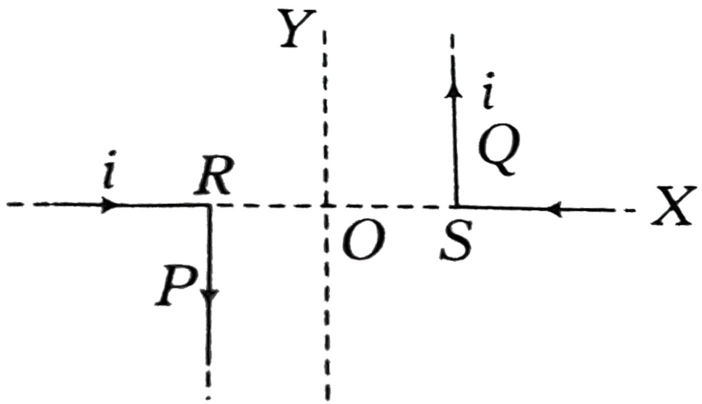
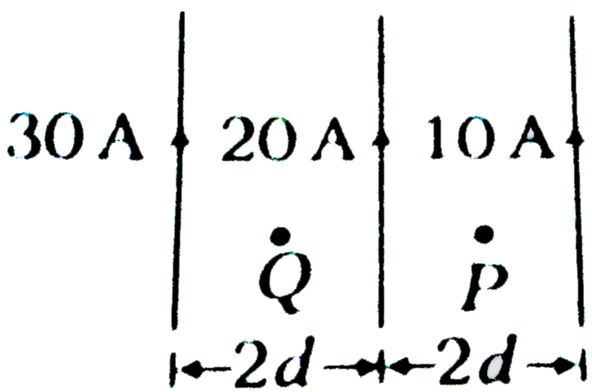
5. (i) A pair of stationary and infinitely long bent wires are placed in the XY- plane as shown.The wires carry currents 10 A each. The segment P and Q are parallel to the Y-axis such as OS =OR = 0.02 m. Find the magnitude field at the origin O



(ii) Three long wires carrying currents $10A$, $20A$ and $30A$ are placed parallel to each other as shown. Find the magnetic field at P and Q



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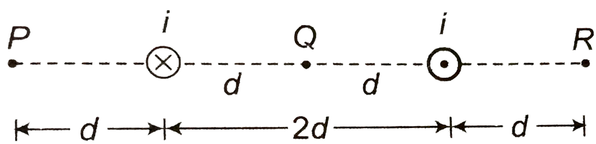
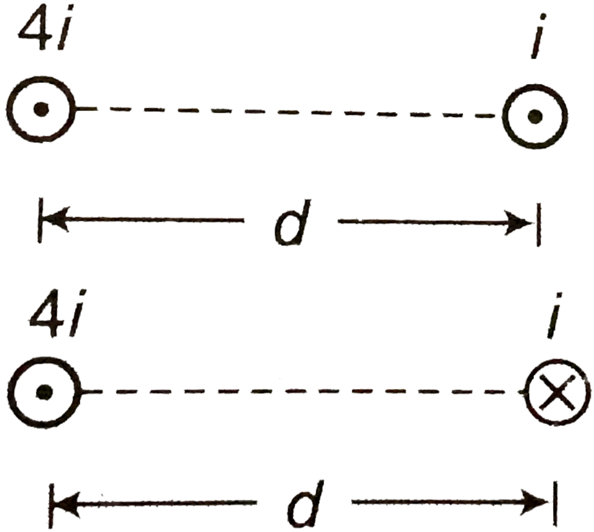
6. Two long parallel wires are carrying currents as shown

(a)

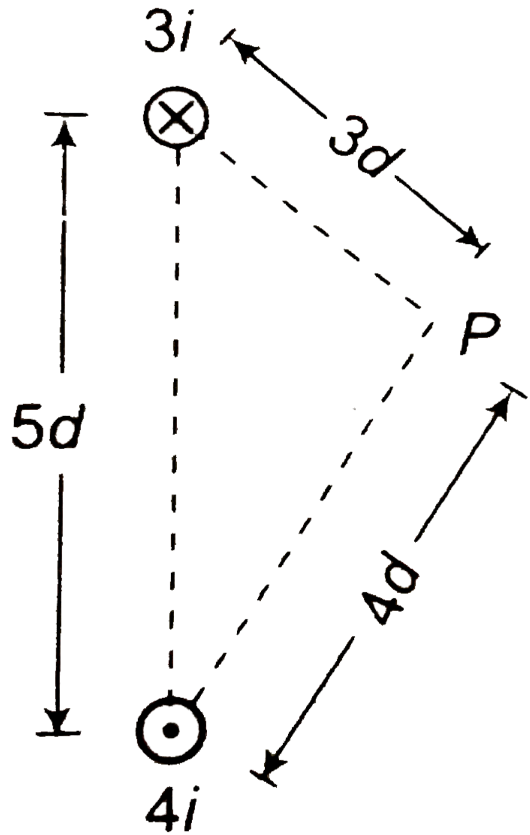


Find magnitude and direction of magnetic field at P, Q and R.



(b) (i)

(c)



(ii)

At what distance from left wire, magnetic field is zero on the line joining the wires.

Find magnitude of magnetic field at P.

(d) Two straight infinitely long and thin parallel wires are spaced d distance apart and carry a current i each. find the magnetic field at a point distance d from both wires when the currents are in the (i) same and (ii) opposite directions.

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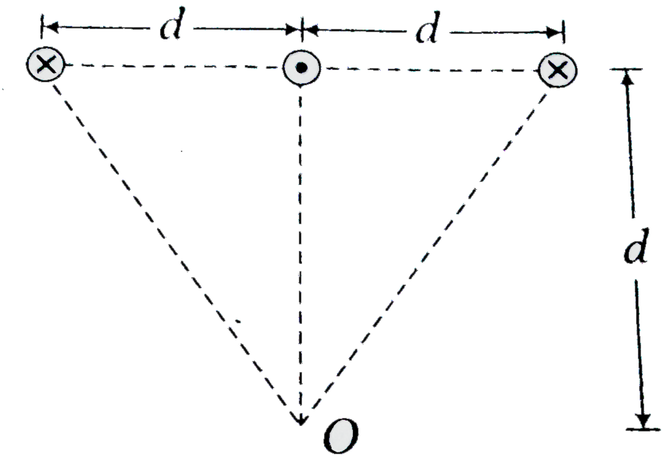
7. (i) A very long wire carrying a current I is bent at right angles .Find magnetic field at a point lying on a perpendicular to the wire , drawn through the point of bending at a distance d from it

(ii) Three long wires carrying same currect are placed as shown Find magnetic field at O.



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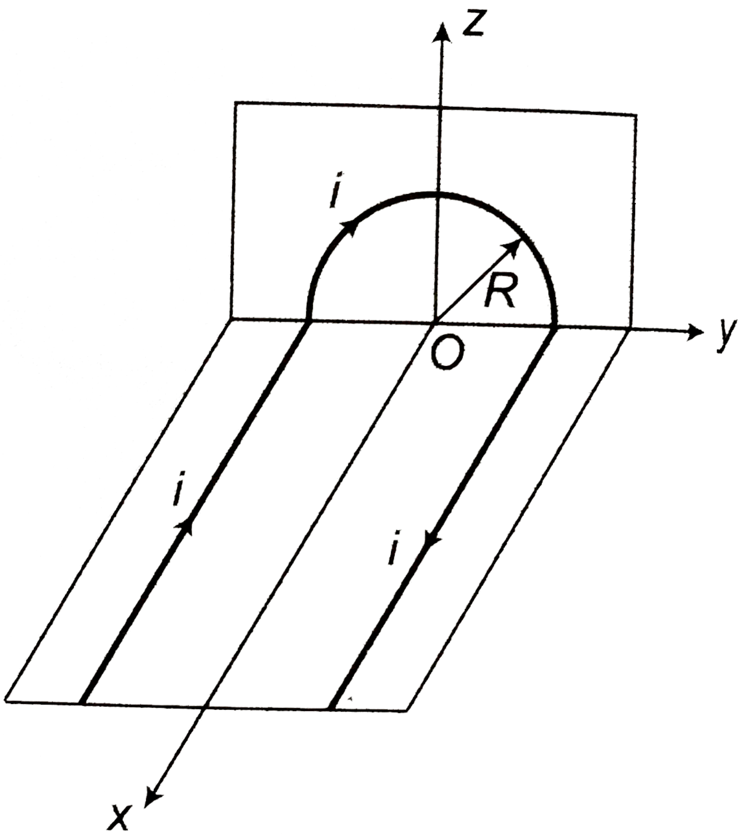
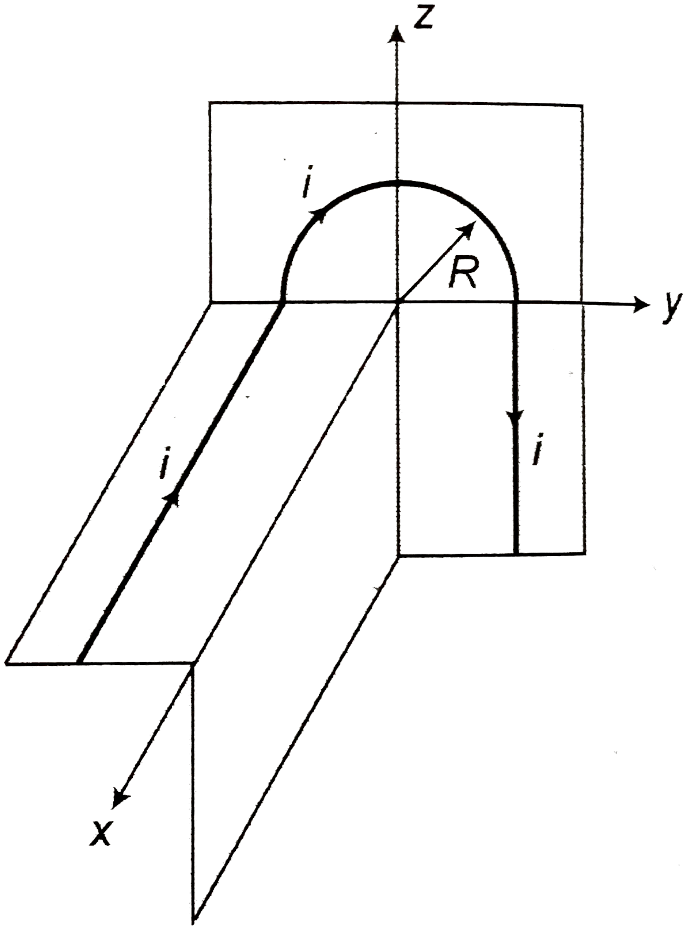
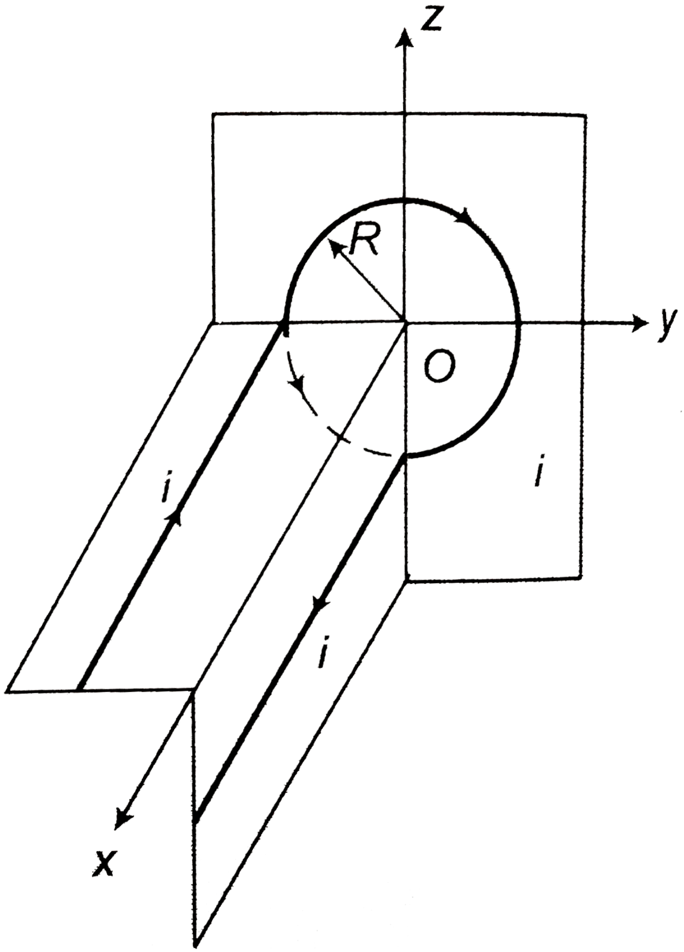
8. (a) Find the magnetic field at the point O if the wire carrying a current i has the shape shown. The radius of the current part of the wire is R, the linear parts of the wire are very long.



(i)



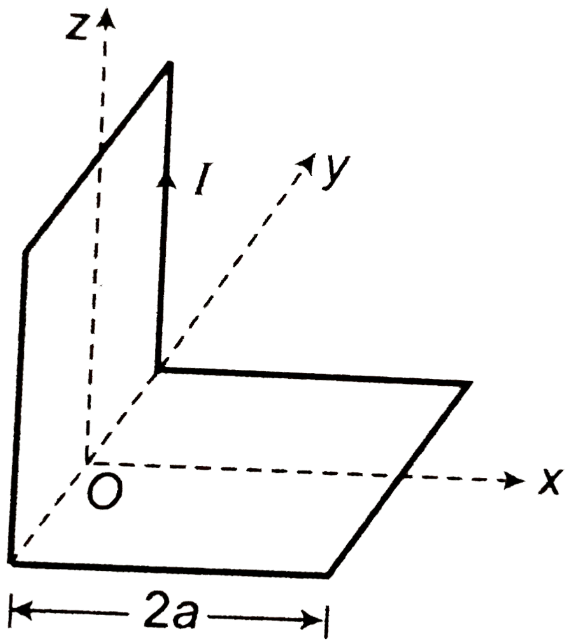
(ii)



(iii)

(b) A long straight wire along the z-axis carriers a current i in negative z-direction. Find magnetic field in vector from at a point having co-ordinates (x, y) on $z = 0$ plane.

(c) A non-coplaner loop of conducting wire carrying a current I is placed as shown in the figure. Each of the straight sections of the loop of length $2a$. find unit vector along magnetic field magnetic filed at the point $P(a, 0, a)$.



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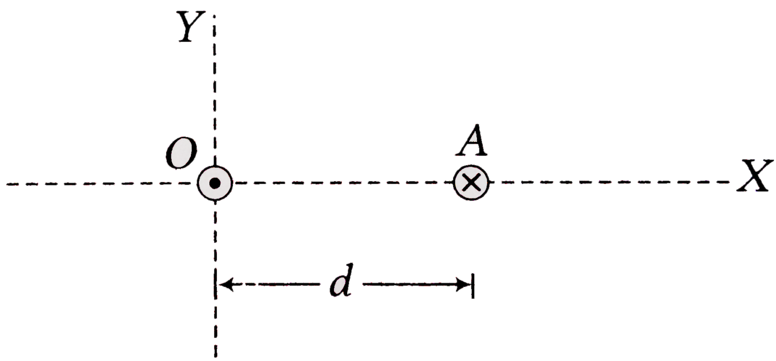
9. Two long wires carrying same currents in opposite directions are placed at separation D as shown.Predict variation of magnetic field as one moves from the point O and A



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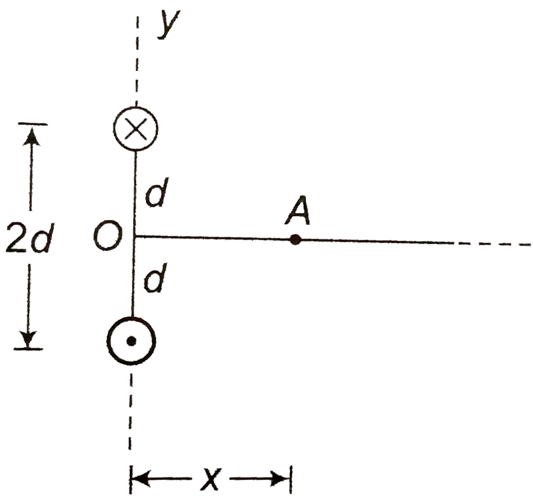
10. (a) Two long wires at a distance $2d$ apart carry equal, antiparallel current i. Find magnitude and direction of magnetic field at point A as shown.For what value of x, magnetic field is maximum? Also calculate maximum magnetic field. Sketch B versus x graph.



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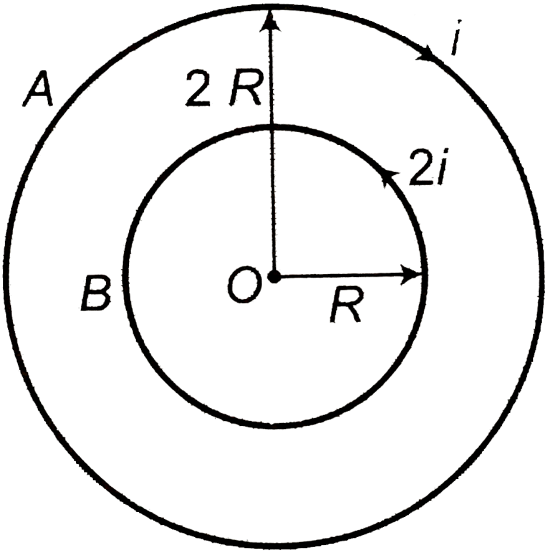
11. (a) A circular current carrying coil has a radius R. Find magnetic field (a) at centre and (b) along the axis of coil distant $\sqrt{3}R$ from centre. The coil is having N turns and carriers a current i.

(b) Two concentric coil A and B, having current i and $2i$ and radii $2R$ and R are placed as shown. Find magnetic field at common centre.



(c) In previous problem, if planes of coil are perpendicular to each other, find magnetic field at common centre.

(d) A charge q distributed uniformely over a circular ring of radius R. The ring rotates about its axis with an angular velocity ω. find the magnetic field (a) at centre and (b) at distance $\sqrt{3}R$ from centre, along the axis.

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12. A current I flows radius along a lengthy thin-walled tube of radisu R with longiitual slit of width h. Find the induction of the magnietic field inside the tube under the condition $h < < R$

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13. A current I flows through a thin wire shaped as regular polygon of n sides which can be inscribed in a circle of radius R. The magnetic fiedl induction at the center of polygon due to one side of the polygon is

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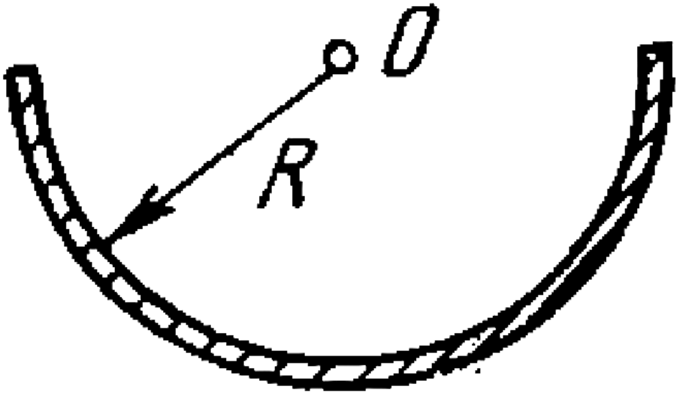
14. A current I flows in a long straight wire with cross-section haviing the form of a thin half-ring of radius R (Fig). Find the induction of the magnitude field at the point O.



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15. A long, cylindrical tube of inner and outer radii a and b carries a current i distributed uniformly over its cross section. Find the magnitude of the magnetic field at a point (a) just inside the tube (b) just outside the tube.

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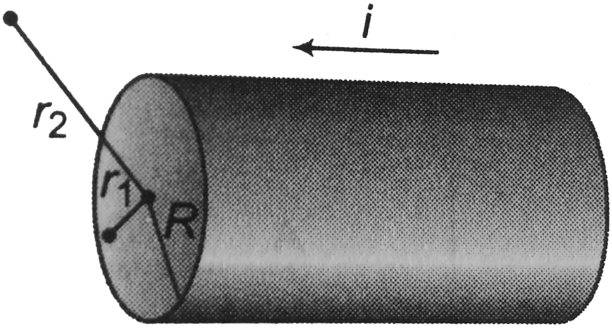
16. A long cylidrical conductor of radius R carries a current i as shown in figure. The current desity J is a function of radius according to $J = br$, where b is a constant. Find an expression for the magnetic field B



a. at a distasnce $r_1 < R$ and

b.at a distance $r_2 > R$, measured from the axis.

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17. (a) Find magnetic field inside a long solenoid, carrying current $(1/\pi)$ A and having number of turns per unit length 10. Also calculate magnetic field at ends.

(b) A long solenoid is fabricated by closely winding a wire of diameter $10mm$ over a cylinderical non-magnetic frame so that the successive turns nearly touch each other. Find magnetic field at the centre and ends of solenoid if it carriers a current $(4/\pi)\ A$?

(c) A single-layer coil (solenoid) has length l and cross-section radius R. The number of turns per unit length is equal to n. Find the magnetic induction at the centre of the coil when a current i flows through it.

(d) A solenoid of length $0.4m$ and diameter $0.6m$ consists of a single layer of 1000 turns of the fine wire carrying a current of $5mA$. Calculate the magnetic field on the axis at the middle and at the ends of the solenoid.

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18. A charge of $\left(3.14 \times 10^{-6}\right)$ C is distributed uniformly over a circular ring of radius 20.0 cm. The ring rotates about its axis with an angular velocity of 60.0 $rads^{-1}$. Find the ratio of the electric field to the magnetic field at a point on the axis at a distance of 5.00 cm from the centre.

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Exercise

1. The magnetic field at the origin due to a current element $I\overrightarrow{dl}$ placed at position r is

(i) $\left(\frac{\mu_0 i}{4\pi}\right)\left(\frac{d\overrightarrow{l}\times\overrightarrow{r}}{r^3}\right)$

$$-\left(\frac{\mu_0 i}{4\pi}\right)\left(\frac{d\overrightarrow{l} \times \overrightarrow{r}}{r^3}\right)$$

(iii) $\left(\frac{\mu_0 i}{4\pi}\right)\left(\frac{\overrightarrow{r} \times d\overrightarrow{l}}{r^3}\right)$

$$-\left(\frac{\mu_0 i}{4\pi}\right)\left(\frac{\overrightarrow{r} \times d\overrightarrow{l}}{r^3}\right)$$

A. (i),(ii)

B. (ii),(iii)

C. (i),(ii)

D. (iii),(iv)

Answer: B

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2. Consider three quantities $x=\frac{E}{B}, y=\sqrt{\frac{1}{\mu_0 \varepsilon_0}}$ and $z=\frac{1}{RC}$, Here, $l$is the length of a wire, C is capacitance and R is a resistance. All other symbols have standard meanings.

A. x, y have the same dimensions

B. y, z have the same dimensions

C. z, x have the same dimensions

D. x, y and $z$have the same dimensions

Answer: A

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3. If C the velocity of light, which of the following is correct?

A. $\mu_0 \varepsilon_0 = c$

B. $\mu_0 \varepsilon_0 = c^2$

C. $\mu_0 \varepsilon_0 = \frac{1}{c}$

D. $\mu_0 \varepsilon_0 = \frac{1}{c^2}$

Answer: D

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4. A vertical wire carriers a current upwards. The magnetic field at a point due north of the wire is directed

A. upward

B. due south

C. due west

D. due east

Answer: C

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5. A moving charge produces

A. electric field only

B. magnetic field only

C. both of them

D. none of them

Answer: C

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6. A circular loop is kept in that vertical plane which contains the north- south direction. It carries a current that is towards north at the topmost point. Let A be a point on the axis of the circle to the east of it and B a point on this axis to the west of it. The magnetic field due to the loop.

A. towards east and $A$and at B upwards

B. towards west and $A$and towards eats at B

C. towards east at both A and B

D. towards west at both A and B

Answer: D

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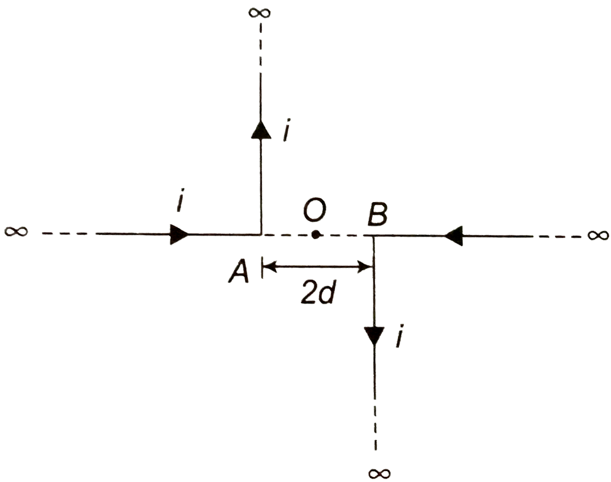
7. O is mid-point of AB. The magnetic field at O is



A. $\frac{\mu_0 i}{2\pi d}, \otimes$

B. $\frac{\mu_0 i}{\pi d}, \odot$

C. $\frac{2\mu_0 i}{\pi d}, \otimes$

D. $\frac{4\mu_0 i}{\pi d}, \otimes$

Answer: A

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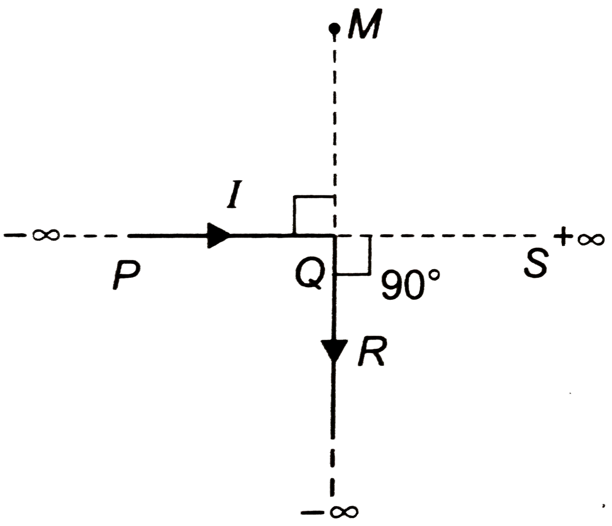
8. An infinetely long conductor PQR is bent to from a right angle as shown. A current I flows through PQR. The magnetic field due to this current at the point M is H_1.Now, another infinitely long straight conductor QS is connected at Q so that the current is $I/2$ in QR as well as in QS, the current in PQ remaining unchanged. The magnetic field at

M is now H_z, the ratio H_1 / H_2 is given by



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

B. 1

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

D. 2

Answer: C

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9. A long straight wire carries the current along +ve x-direction. Consider four points in space $A(0, 1, 0), B(0, 1, 1), C(1, 0, 1), \text{ and } D(1, 1, 1)$. Which of the pairs will have the same magnitude of magnetic field?

A. (i),(ii)

B. (ii),(iii)

C. (i),(ii)

D. (iii),(iv)

Answer: D

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10. A straight section PQ of a circuit lise along the X-axis from $x = -\frac{a}{2}$ to $x = \frac{a}{2}$ and carriers a steady current i. The magnetic field due to the section PQ at a point $X = +a$ will be

A. proportional to a

B. proportional to a^2

C. proportional to $1/a$

D. zero

Answer: D

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11. A horizontal overheadpowerline is at height of $4m$ from the ground and carries a current of $100A$ from east to west. The magnetic field directly below it on the ground is

$(\nu_0 = 4\pi \times 10^{-7} TmA^{-1}$

A. $5 \times 10^{-6} T$north ward

B. $5 \times 10^{-6} T$ south ward

C. $2.5 \times 10^{-7} T$ north ward

D. $2.5 \times 10^{-7} T$ south ward

Answer: B

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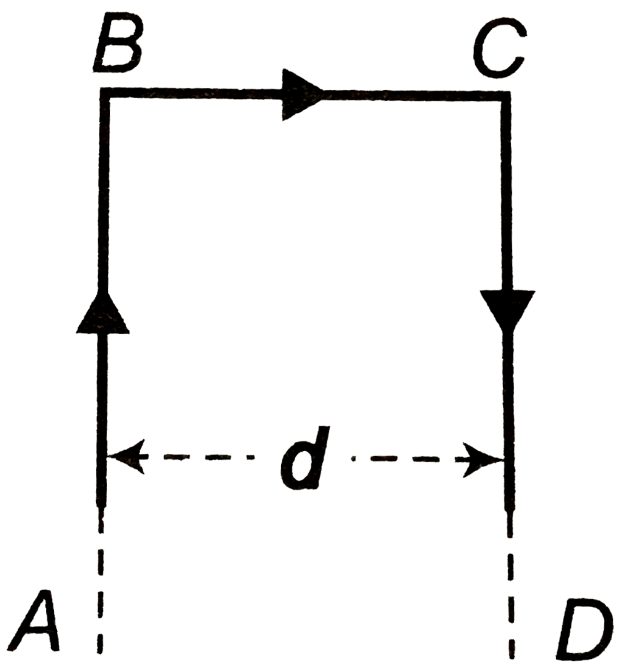
12. AB and CD are long staright conductors, distance d apart, carrying a current I. The magnetic field on BC due to the currents in AB and CD



A. is zero at all points

B. is zero at this midpoint

C. has different magnitudes at different points

D. is maximum at its midpoints

Answer: C

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13. A straight conductor carriers a current alon the z-axis Consider the points $A(a,0,0), B(0,-a,0), C(-a,0,0)$ and $D(0,a,0)$

(i) All four points have magnetic fields of the same magnitude.

(ii) All four points have magnetic fields of the different direction.

(iii) The magnetic fields at A and C are in opposite directions

(iv) The magnetic fields at A and B are mutually perpendicular

A. (i),(ii)

B. (ii),(iii)

C. (i),(ii)

D. all

Answer: D

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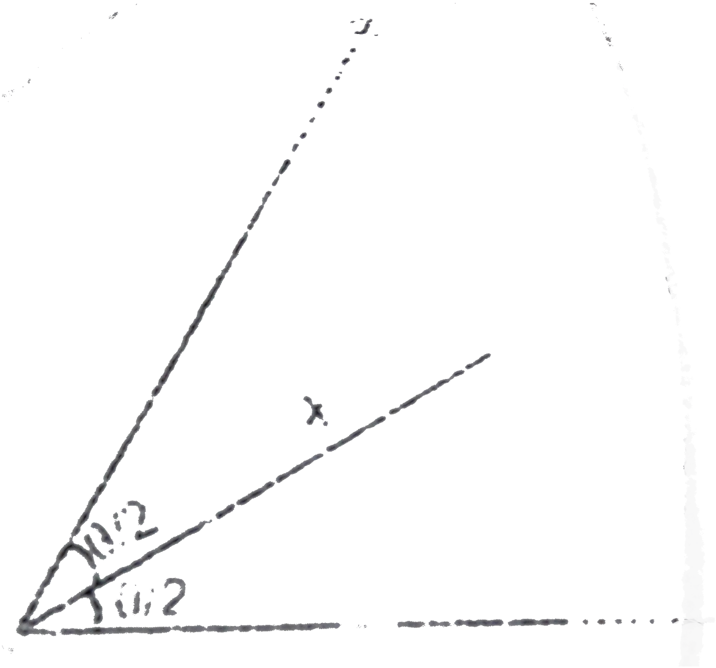
14. A long wire carrying i is bent to form a plane angle θ.Find the magnetic field B at a point on the bisector of this angle situated at a distance x from the vertex is written in the form of $K\frac{\cot\theta}{4}$ Tesla.Then, find the value of K.



A. $\frac{\mu_0 i}{\pi d}\cot\left(\frac{\theta}{4}\right)$,

B. $\frac{\mu_0 i}{2\pi d}\cot\left(\frac{\theta}{4}\right)$,

C. $\frac{\mu_0 i}{4\pi d}\cot\left(\frac{\theta}{2}\right)$,

D. $\frac{\mu_0 i}{4\pi d}\cot\left(\frac{\theta}{4}\right)$, $\odot$

Answer: B

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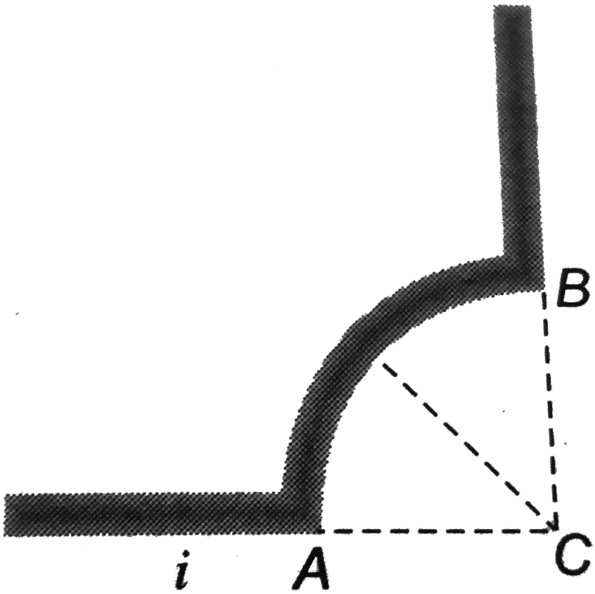
15. A wire carrying current I is shaped as shown. Section AB is a quarter circle of radius

r. The magnetic field is directed



A. along the bisector of the anlge ACB, away from AB

B. along the bisector of the angle ACB, towards AB

C. perpendicular to the plane of the paper, directed into the paper

D. at an angle $\pi/4$ in the plane of the paper

Answer: C

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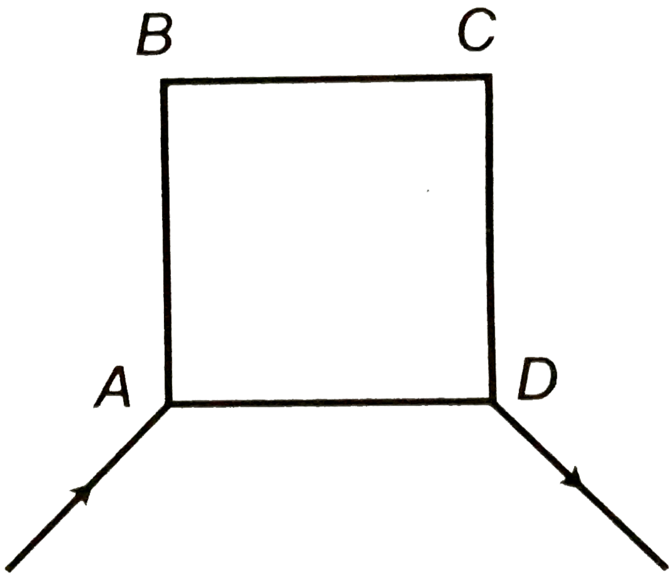
16. $ABCD$ is a square loop made of a uniform conducting wire. A current enters the loop at

A and leaves at D. The magnetic field is



A. zero only at the centre of the loop

B. maximum at the centre of the loop

C. zero at all point outside the centre loop

D. zero at all points inside the loop

Answer: C

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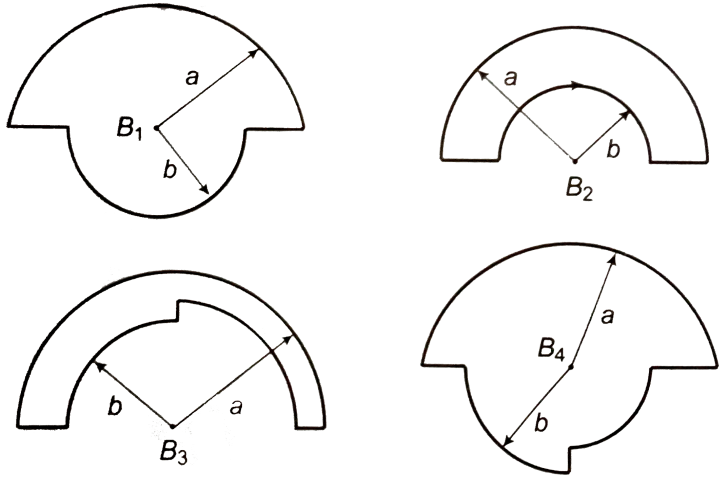
17. In the loop shown, all curved sections are either semicircles or quarter circles. All the loops carry the same current. The magnetic fields at the centres have magnitudes B_1, B_2, B_3 and B_4



(i)B_(4)

$is \max i\mu m(ii)$B_(3)$is \min i\mu m(iii)$

B_(4)gtB_(1)gtB_(2)gtB_(3)(iv)

B_(1)gtB_(4)gtB_(3)gtB_(2)`

A. (i),(ii),(iii)

B. (ii),(iii)

C. (i),(ii)

D. (ii),(iv)

Answer: A

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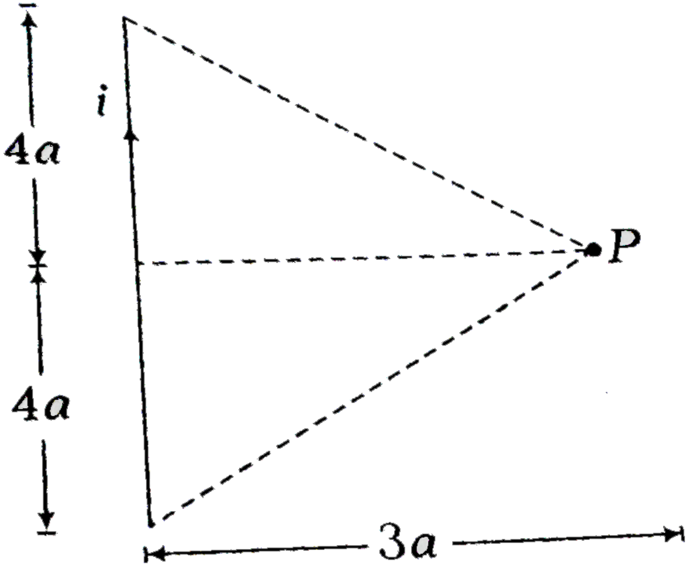
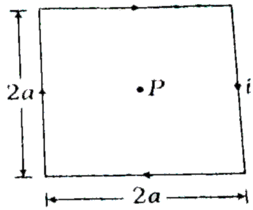
18. Evaluate magnitude and direction of magnetic field at a point P in the following cases

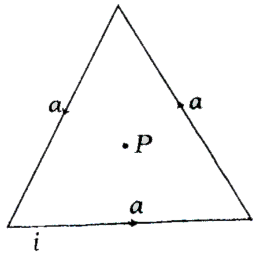

4a
i
4a
P
3a

(ii)



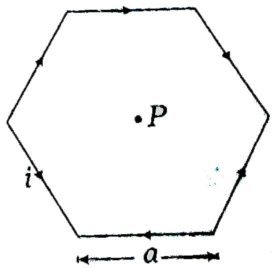
P is the centre of square.

(iii)



P is the centre of equilateral triangle.

(iv)



A. (i),(ii)

B. (ii),(iii)

C. (i),(iii)

D. all

Answer: D

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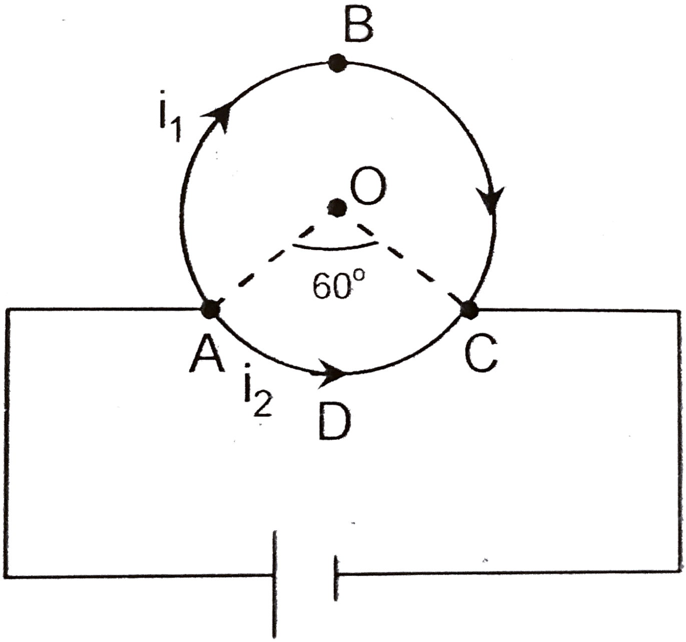
19. A cell is connected between the point A and C of a circular conductor ABCD of centre $O, \angle AOC = 60^\circ$. If B_1 and B_2 are the magnitude of magnetic fields at O due to the currents in ABC and ADC respectively, the ratio of B_1 / B_2 is.



A. 0.2

B. 6

C. 1

D. 5

Answer: C

Watch Video Solution

20. A battery is connected between two points A and B on the circumference of a uniform conducting ring of radius r and resistance R. One of the arcs AB of the ring subtends an angle θ at the centre. The value of the magnetic induction at the centre due to the current in the ring is

A. proportional to $2(180^\circ - \theta)$

B. inversely proportional to r

C. zero, only if $\theta = 180^\circ$

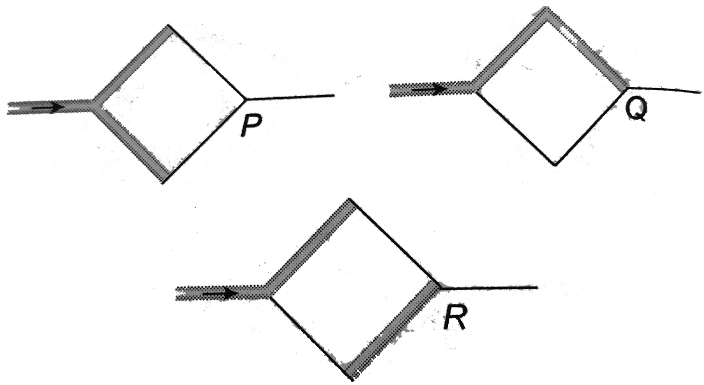
D. zero for all values of θ

Answer: D

Watch Video Solution

21. Two thick wires and two thin wires, all of the same materais and same length from a square in the three differenct ways, P, Q and

R as shwon in figure with current connection shown, the magneitc feidl at the centre of the square is zero in cases.



A. In P only

B. In P and Q only

C. In Q and R only

D. P and R only

Answer: D

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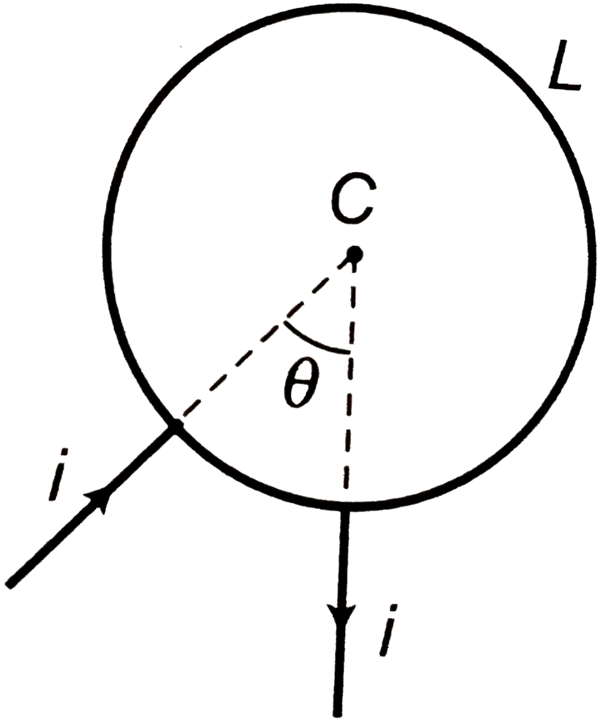
22. L is a circular ring made of a uniform wire, currents enters and leaves the ring through straight conductors which, if produces, would have passed through the centre C of ring. The magnetic field at C



(i) due to the straight conductors is zero

(ii) due to the loop is zero

(iii) due to the loop is proportional to θ

(iv) due to loop is proportional to $(\pi - \theta)$

A. (i),(ii)

B. (ii),(iii)

C. (i),(iii)

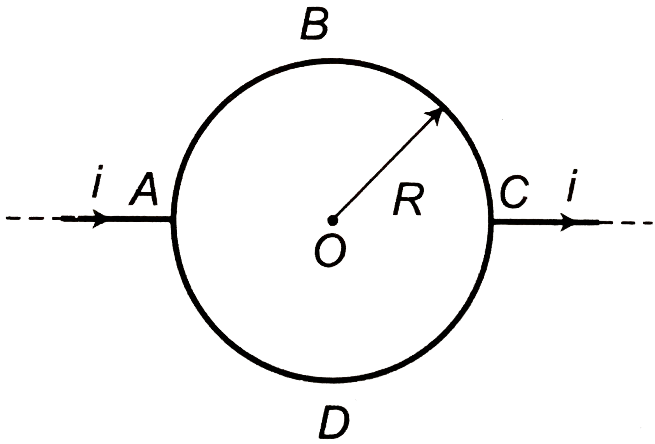
D. all

Answer: A

Watch Video Solution

23. The resistance of wire ABC is double of resistance of wire ADC. The magnetic field at

O is



A. $\dfrac{\mu_0 i}{12R}, \odot$

B. $\dfrac{\mu_0 i}{6R}, \odot$

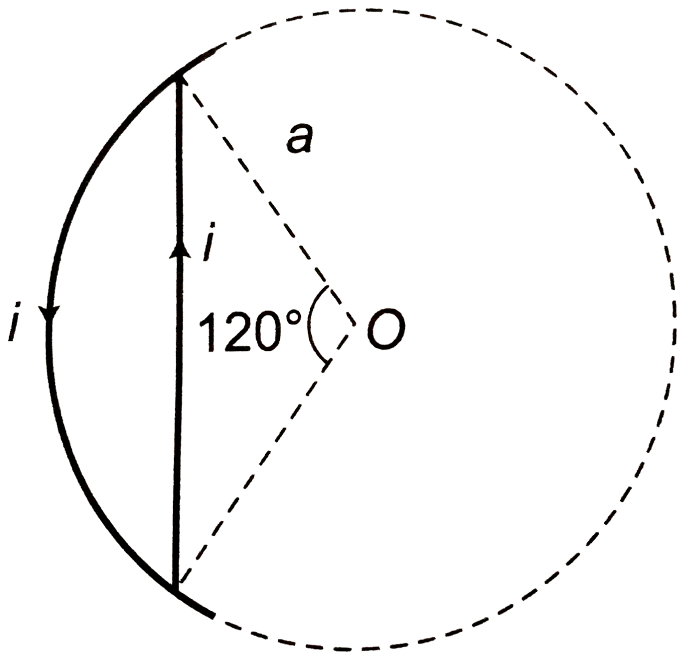
C. $\dfrac{\mu_0 i}{3R}, \odot$

D. $\dfrac{\mu_0 i}{2R}, \odot$

Answer: A

Watch Video Solution

24. The magnetic field at O is



A. $\dfrac{\mu_0 i}{2\pi}\left(\dfrac{\sqrt{3}}{\pi}-\dfrac{1}{3}\right)$

B. $\dfrac{\mu_0 i}{2a}\left(\dfrac{\sqrt{2}}{\pi}-\dfrac{1}{2}\right)$

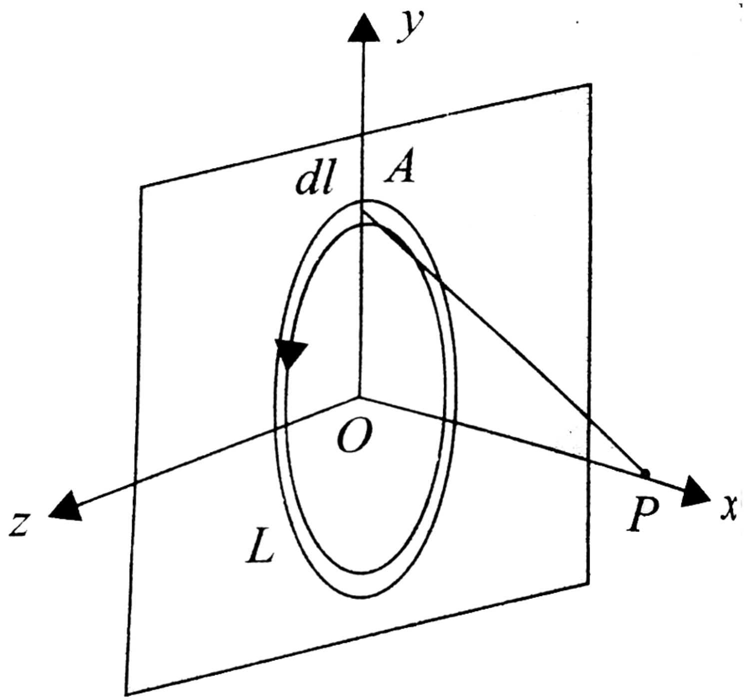
C. $\dfrac{\mu_0 i}{a}\left(\dfrac{\sqrt{3}}{\pi}-\dfrac{1}{3}\right)$

D. $\dfrac{\mu_0 i}{4a}\left(\dfrac{\sqrt{3}}{\pi}-\dfrac{1}{3}\right)$

Answer: A

Watch Video Solution

25. L is a circular loop (in y-z plane) carrying an anticlockwise current. P is a point on its axis OX dl is an element of length on the loop at a point A on it. The magnetic field at P



A. (i),(ii)

B. (ii),(iii)

C. (i),(iii)

D. (i),(iv)

Answer: D

Watch Video Solution

26. A circular current-carrying coil has a radius R. The distance from the centre of the coil, on the axis, where B will be $1/8$ of its value at the centre of the coil is

A. $\frac{R}{\sqrt{3}}$

B. $\sqrt{3}R$

C. $2\sqrt{3}R$

D. $\frac{2R}{\sqrt{3}}$

Answer: B

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27. A circular coil of radius R carriers an electric current. The magnetic field due to the coil at a point on the axis of the coil located at a distance r from the centre of the coil, such that $r > > R$, varries as

A. $\frac{1}{r}$

B. $\frac{1}{r^{3/2}}$

C. $\frac{1}{r^2}$

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

Answer: D

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28. The field normal to the plane of a wire of n turns and radis r which carriers i is measured on the axis of the coil at a small distance h

from the centre of the coil. This is smaller than the field at the centre by the fraction.

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

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

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

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

Answer: A

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29. If we double the radius of the coil keeping the current through it unchanged, the magnetic field on its axis at very very far away points

A. double

B. three times

C. four times

D. one fourth

Answer: B

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30. A charge q coulomb moves in a circle at n revolution per second and the radius of the circle is r metre. Then magnetic feild at the centre of the circle is

A. $\frac{2\pi q}{nr} \times 10^{-7}$

B. $\frac{2\pi q}{r} \times 10^{-7}$

C. $\frac{2\pi nq}{r} \times 10^{-7}$

D. $\frac{2\pi rn}{q} \times 10^{-7}$

Answer: C

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31. Two long straight wires, each carrying a current I in opossite directions asre separated by a distasnce R. The magnetic induction at a point mid way between the wire is

A. $\frac{\mu_0 I}{\pi r}$

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

C. $\frac{\mu_0 I}{2\pi r}$

D. zero

Answer: B

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32. Two parallel wires carrying equal currents i_1 and i_2 with $i_1 > i_2$. When the current are in the same direction, the $10mT$. If the direction of i_2 is reversed, the field becomes $30mT$. The ratio i_1 / i_2 is

A. 4

B. 3

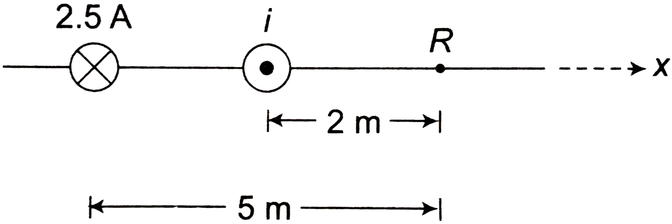
C. 2

D. 1

Answer: C

Watch Video Solution

33. The values of i so that magnetic field at R is zero



A. $1A$

B. $2A$

C. 3A

D. 4A

Answer: A

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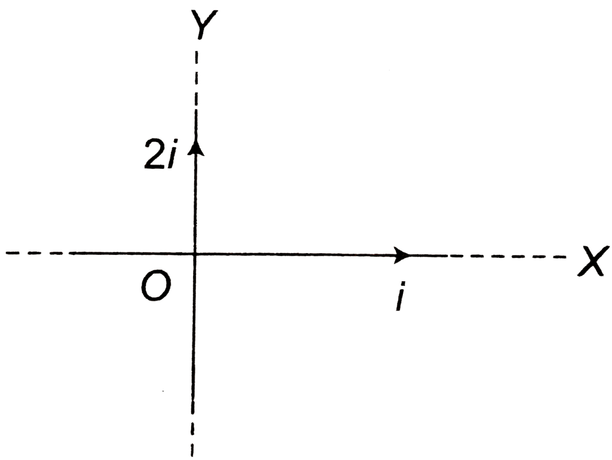
34. Two long wire carrying current $2i$ and i are placed along co-ordinate axes x and y respectively. The locus of point where magnetic field is zero is



A. $2y - x = 0$

B. $x - 2y = 0$

C. $y - x = 0$

D. $y = 0$

Answer: A

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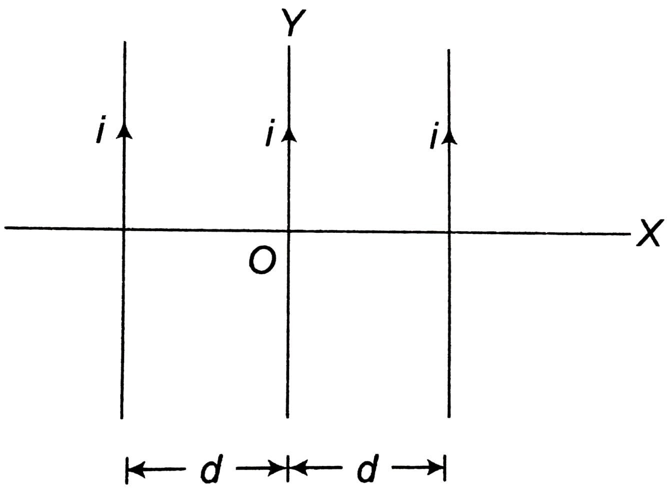
35. Three long wires, each carrying current i are placed as shown. The middle wire is along Y-axis. The locus of point on the X-axis where magnetic field is zero is



A. $x = 0$

B. $x = \frac{d}{\sqrt{3}}$

C. $x = -\frac{d}{\sqrt{3}}$

D. all

Answer: D

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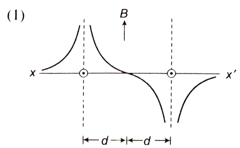
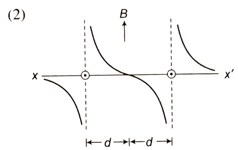
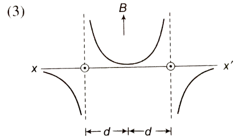
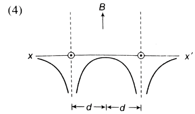
36. Two long parallel wires are at a distance $2d$ apart. They carry steady equal currents flowing out of the plane of the paper , as shown. The variation of the magnetic field B along the line XX is given by

A. 

B. 

C. 

D. 

Answer: B

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37. A staright wire of length (π^2) meter is carrying a current of $2A$ and the magnetic field due to it is measured at a point distant $1cm$ from it. If the wire is to be bent into a circles 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. $:50$

C. $100:1$

D. $1:100$

Answer: B

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38. A length of wire carries a steady current I. It is bent first to form a circular plane coil of one turn. The same length is now bent more sharply to give double loop of smaller radius. If the same current I is passed, the ratio of the magnitude of magnetic field at the centre with its first value is:

A. a quarter of its first value

B. unaltered

C. four times of its first value

D. a half of its first value

Answer: C

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39. Two concentric coils carry the same current in opposite directions. The diameter of the inner coil is equal currents. The outer coil. If the magnetic field produced by the outer coil at the common centre are $1T$, the net field at the centre is

A. $1T$

B. $2T$

C. $3T$

D. $4T$

Answer: A

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40. Two identical coils have a common centre and their planes are at right angles to each other. They carry equal currents. If the magnitude of the magnetic field at the centre due to one of the coils is B then that due to the combination is

A. B

B. $\sqrt{2}B$

C. $\frac{B}{\sqrt{2}}$

D. $2B$

Answer: B

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41. Two similar coils of radius R are lying concentriclaly with their planes at right angels to each other. The currents flowing in them are I and $2I$ respectively. The resulant magntic field induction at the centre will be

A. $\frac{\sqrt{5}\mu_0 I}{2R}$

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

C. $\frac{\mu_0 I}{2R}$

D. $\frac{\mu_0 I}{R}$

Answer: A

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42. Two concentric coplanar circular loops of radii r_1 and r_2 carry currents of respectively i_1 and i_2 in opposite direction (one clockwise and the other anticlockwise). The magnetic induction at the centre of the loops is half that due to i_1 alone at the centre. if $r_2 = 2r_1$. the value of i_2 / i_1 is

A. 2

B. $1/2$

C. $/4$

D. 1

Answer: D

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43. Two similar coils are kept mutually perpendicular such that their centres coincide. At the centre, find the ratio of the magnetic field due to one coil and the resultant magnetic field by both coils, if the same current is flown

A. $1 : \sqrt{2}$

B. $1 : 2$

C. $2 : 1$

D. $\sqrt{3} : 1$

Answer: A

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44. A current loop consists of two identical semicircular parts each of radius R, one lying in the x-y plane and the other in x-y plane. If the current in the loop is i, the resultant magnetic field due to two semicircular parts at their common centre is

A. $\dfrac{\mu_0 i}{2\sqrt{2}R}$

B. $\dfrac{\mu_0 i}{2R}$

C. $\dfrac{\mu_0 i}{4R}$

D. $\dfrac{\mu_0 i}{\sqrt{2}R}$

Answer: A

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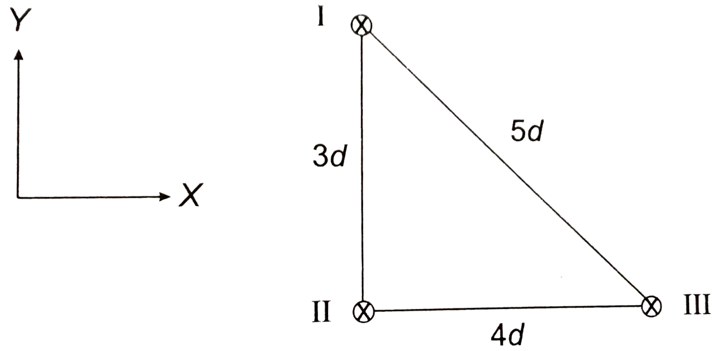
45. Three long wires, each carrying current i are placed parallel to each other. The distance between I and II is $3d$, between II and III is $4d$ and between III and I is $5d$. Magnetic field at site of wire II



A. $\dfrac{5\mu_0 i}{24\pi d}$

B. $\dfrac{10\mu_0 i}{24\pi d}$

C. $\dfrac{15\mu_0 i}{24\pi d}$

D. $\dfrac{20\mu_0 i}{24\pi d}$

Answer: A

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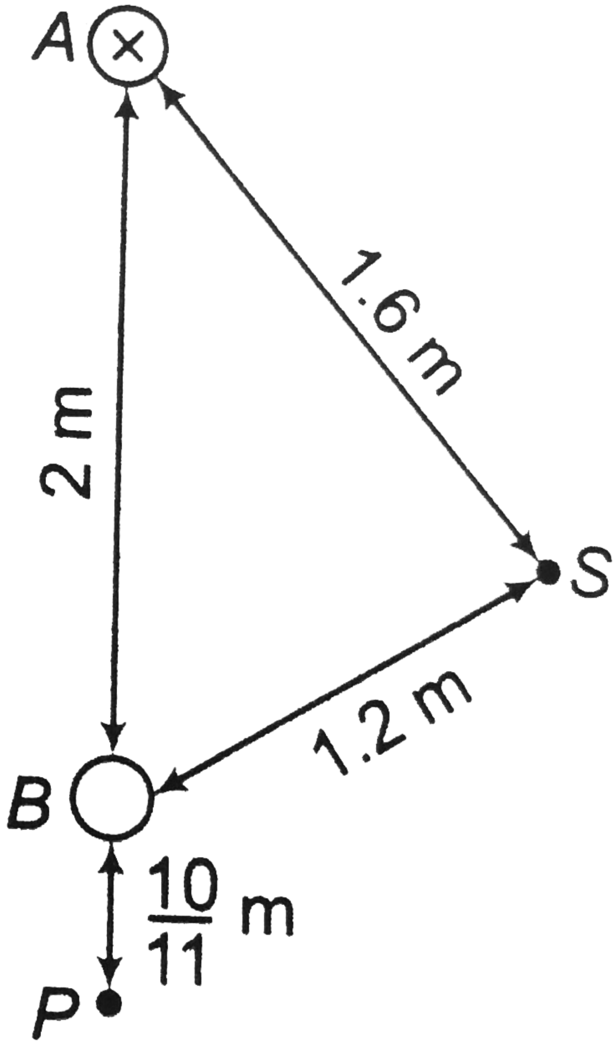
46. Two long straight parallel wieres are $2m$ apart, perpendicular to the plane of the paper. The wire A carries a current of $9.6A$, directed into the plane of the paper. The wire B carries a current such that the magnetic field of induction at the point P, at a distance of $\frac{10}{11}$ m from the wire B, is zero. find

a. the magnitude and directiion of the current in B.

b. the magnitude of the magnetic field of induction of the pont S.

c. the force per unit length on the wire B.



A. $1A$

B. $2A$

C. $3A$

D. $4A$

Answer: C

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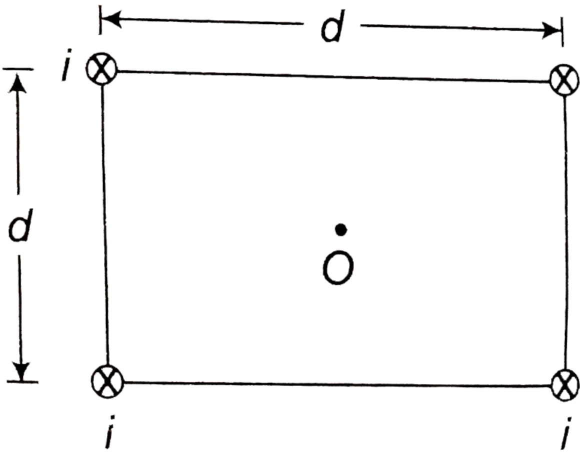
47. The magnetic field at O is



A. zero

B. 1

C. 2

D. 3

Answer: A

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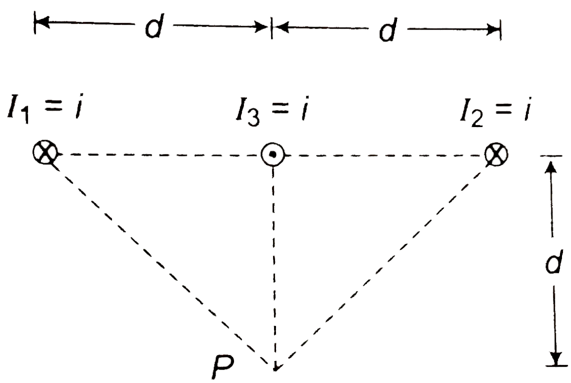
48. Find the Net Magnetic field at point P due to the current I_1, I_2, I_3.



A. zero

B. 1

C. 2

D. 3

Answer: A

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49. A long wire carrying a current i is bent to form a plane angle. The magnitude of magnetic field at height d, above the point of bending

A. $\dfrac{\sqrt{2}\mu_0 i}{4\pi d}$

B. $\dfrac{3\sqrt{2}\mu_0 i}{4\pi d}$

C. $\dfrac{5\sqrt{2}\mu_0 i}{4\pi d}$

D. $\dfrac{7\sqrt{2}\mu_0 i}{4\pi d}$

Answer: A

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50. Two straight long conductors AOB and COD are perpendicular to each other and carry currents I_1 and I_2. The magnitude of the magnetic induction at a point P at a distance d from the point o in a direction perpendicular to the plane $ABCD$ is :

A. $\frac{\mu_0}{2\pi d}(i_1 + i_2)$

B. $\frac{\mu_0}{2\pi d}(i_1 - i_2)$

C. $\frac{\mu_0}{2\pi a}\left(i_1^2 + i_2^2\right)^{1/2}$

D. $\frac{\mu_0}{2\pi a}\frac{i_1 i_2}{(i_1 + i_2)}$

Answer: C

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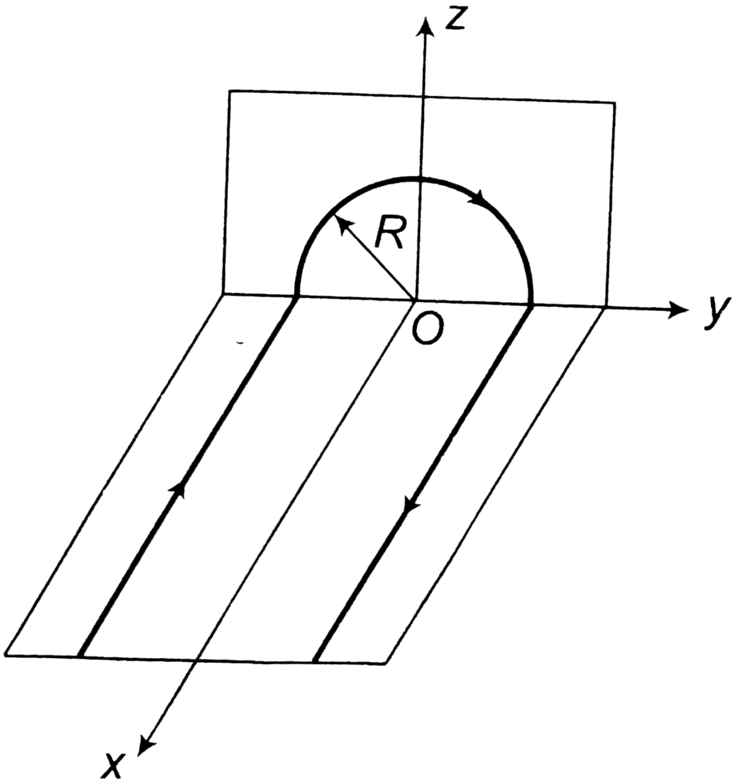
51. The magnetic field at O is



A. $\dfrac{\mu_0 I}{2R}\sqrt{\left(\dfrac{1}{4}+\dfrac{1}{\pi^2}\right)}$

B. $\dfrac{\mu_0 I}{2R}\sqrt{\left(\dfrac{1}{2}+\dfrac{1}{\pi^2}\right)}$

C. $\dfrac{\mu_0 I}{R}\sqrt{\left(\dfrac{1}{4}+\dfrac{1}{\pi^2}\right)}$

D. $\frac{\mu_0 I}{R}\sqrt{\left(\frac{1}{4}+\frac{1}{\pi}\right)}$

Answer: A

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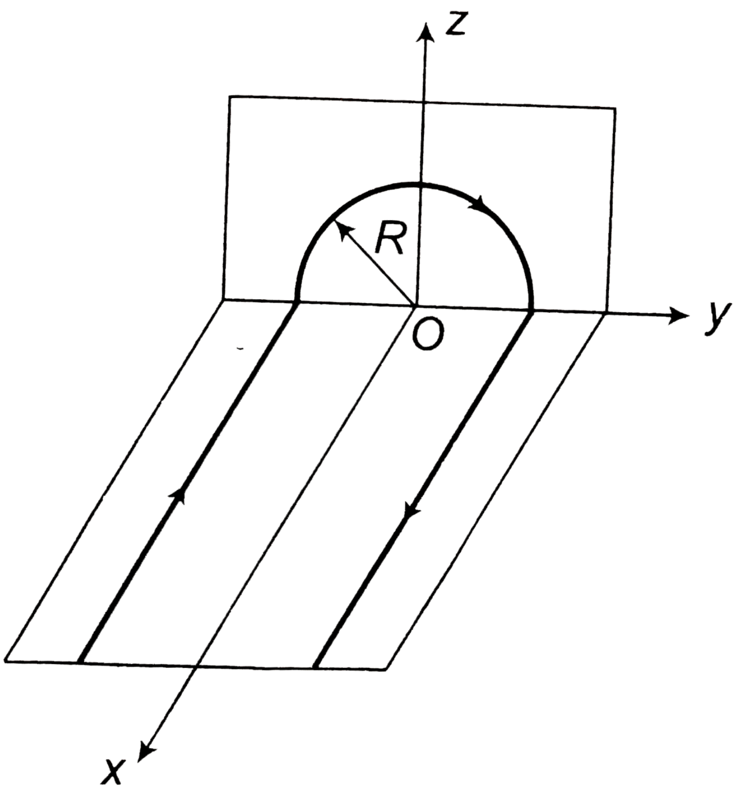
52. The magnetic field at O is



A. $\left(\frac{\mu_0 I}{4R}\right)\sqrt{1+\frac{2}{\pi^2}+\frac{2}{\pi}}$

B. $\left(\frac{\mu_0 I}{2R}\right)\sqrt{1+\frac{2}{\pi^2}+\frac{2}{\pi}}$

C. $\left(\frac{\mu_0 I}{4R}\right)\sqrt{1+\frac{1}{\pi^2}+\frac{1}{\pi}}$

D. $\left(\frac{\mu_0 I}{R}\right)\sqrt{1+\frac{2}{\pi^2}+\frac{2}{\pi}}$

Answer: A

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53. A long straight wire along the z- axis carries a current I in the negative $z - direction$. The magnetic vector field $\overrightarrow{B}$ at a point having coordinates (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. $\dfrac{\mu_0 I\left(x\hat{i} - y\hat{j}\right)}{2\pi(x^2 + y^2)}$

D. $\dfrac{\mu_0 I\left(x\hat{i} - y\hat{j}\right)}{2\pi(x^2 + y^2)}$

Answer: A

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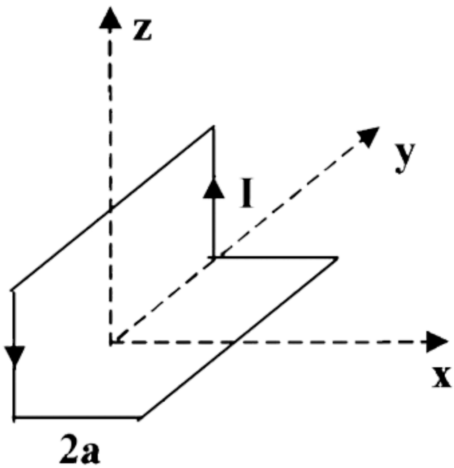
54. A non - popular loop of conducting wire carrying a current I is placed as shown in the figure . Each of the straighrt sections of the loop is of the length $2a$. The magnetic field due to this loop at the point $P(a, 0, a)$ points in the direction



A. $\frac{1}{\sqrt{2}}\left(-\hat{j}+\hat{k}\right)$

B. $\frac{1}{\sqrt{3}}\left(-\hat{j}+\hat{k}+\hat{i}\right)$

C. $\frac{1}{\sqrt{3}}\left(\hat{j}+\hat{k}+\hat{i}\right)$

D. $\frac{1}{\sqrt{2}\left(\hat{i}+\hat{k}\right)}$

Answer: D

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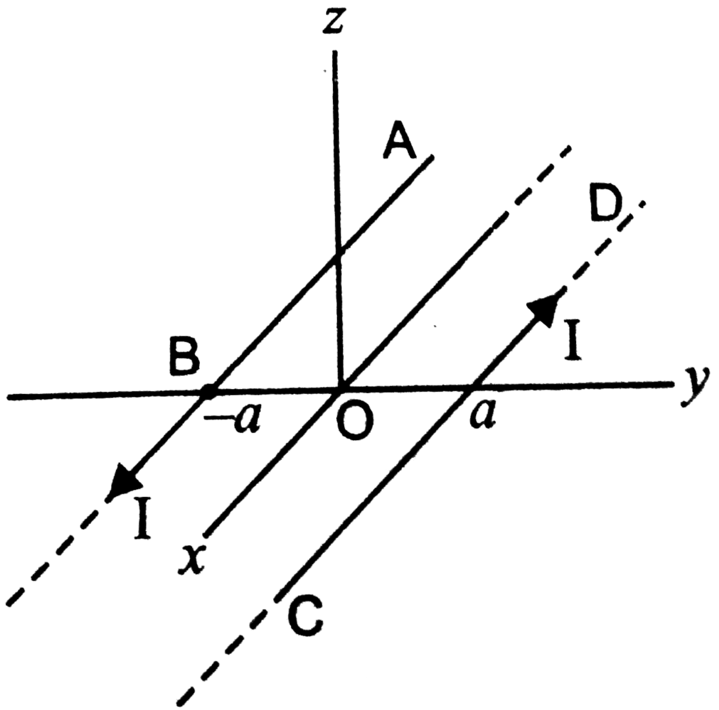
55. Two long parallel wires, AB and CD, carry equal currents in opposite directions. They lie in the x-y plane, parallel to the x-axis, and pass through the points (0,-a,0) and (0,a,0) respectively, Figure. The resultant magnetic field is:



A. (i),(ii)

B. (ii),(iii)

C. (i),(ii)

D. (ii),(iv)

Answer: D

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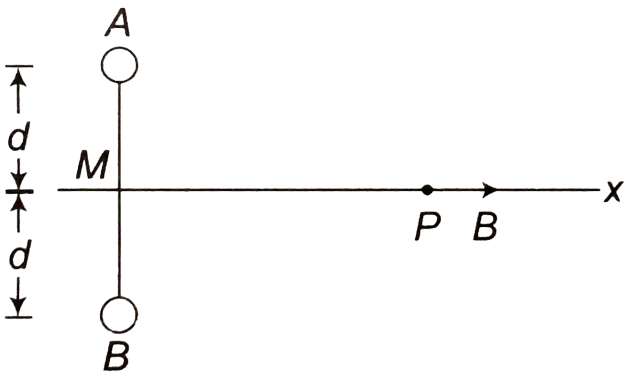
56. Due to currents in infinite long wire at A and B, magnetic field is maximum at M and at

P, magnetic field as shown. Then



A. Current is A and B is equal in magnitude and outside the plane of paper

B. Current is A and B is equal in magnitude and inside the plane of paper

C. Current in A and B is equal in magnitude, in A outside, in B inside

D. Current in A and B is equal in magnitude, in A inside, in B inside

Answer: C

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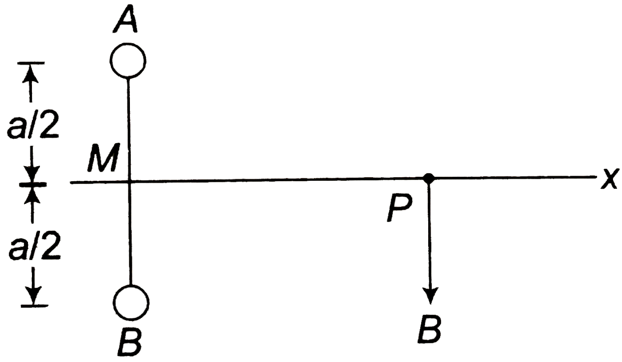
57. The magnetic field is zero at mid point of AB and at P as shown



A. The current is equal in both wires and

inside

B. The magnetic field of M in upward

C. The magnetic field is maximum at

$x = \pm \frac{a}{2}$

D. All options are correct

Answer: D

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58. A long, straight wire of radius R carries a current distributed uniformly over its cross section. The magnitude of the magnetic field is

A. (i),(ii)

B. (ii),(iii)

C. (i),(iii)

D. (i),(iv)

Answer: B

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59. A solid metallic cylinder carriers a direct current. The magnetic field produce by it exists

A. outside the cylinder only

B. inside the cylinder only

C. both inside and outside the cylinder

D. neither inside and outside the cylinder

Answer: C

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60. A hollow tube is carrying an electric current along its length distributed uniformly over its surface. The magnetic field

A. (i),(ii)

B. (ii),(iii)

C. (i),(ii)

D. (ii),(iv)

Answer: B

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61. Current flows through a straight cylindrical conductor of radius r. The current is distributed uniformly over its cross-section. The magnetic field at a distanace x from the axis of the conductor has magnitude B:

A. (i),(ii)

B. (ii),(iii),(iv)

C. (i),(ii),(iii)

D. all

Answer: D

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62. In a coaxial, straight cable, the central conductor and the outer conductor carry equal currents in opposite directions. The magnetic field is zero.

A. outside the cable

B. outside the cable

C. inside the inner conductor

D. in between the two conductors

Answer: A

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63. A current I flows along the length of an infinitely long, straight , thin - walled pipe. Then

A. The magnetic field at all points inside the pipe is zero same but not zero

B. The magnetic field at any point inside the pipe is zero

C. The magnetic field is zero on the axis of the pipe

D. The magnetic field is different at different points inside the pipe

Answer: B

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64. A long straight wire of radius a carries a steady current i. The current is uniformly distributed across its cross section. The ratio of the magnetis field at $(a)/(2)$ and $(2a)$ is

A. $1/4$

B. 4

C. 1

D. $1/2$

Answer: C

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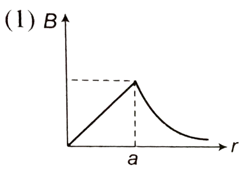
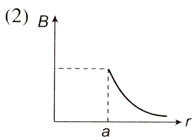
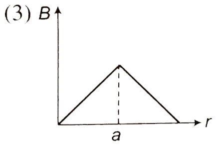
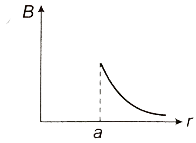
65. The magnetic field due to a conductor fo unifrom cross section of radius a and carrying a steady current is represented by

A. 

B. 

C. 

D. 

Answer: A

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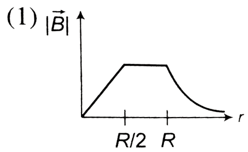
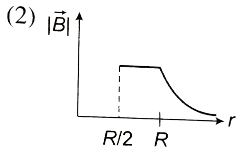
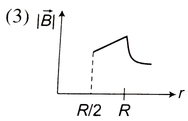
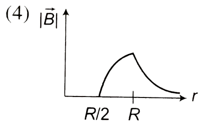
66. An infinitely long hollow conducting cylinder with inner radius $\frac{r}{2}$ and outer radius R carries a uniform current ra density along its length . The magnitude of the magnetic field , $\left|\overrightarrow{B}\right|$ as a function of the radial distance r from the axis is best represented by

A. 

B. 

C. 

D. 

Answer: D

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67. A coaxial cable consists of a thin inner conductor fixed along the axis of a hollow outer conductor. The two conductor carry equal currents in opposite directions. Let B_1 and B_2 be the magnetic fields in the region between the conductors and outside the conductor, respectively. Then,

A. $B_1 \neq 0, B_2 \neq 0$

B. $B_1 = B_2 = 0$

C. $B_1 \neq , B_2 = 0$

D. $B_1 = 0, B_2 \neq 0$

Answer: C

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68. In previous question, if both conductors carry equal currents in the same direction

A. $B_1 \neq 0, B_2 \neq 0$

B. $B_1 = B_2 = 0$

C. $B_1 \neq , B_2 = 0$

D. $B_1 = 0, B_2 \neq 0$

Answer: A

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69. let B be the magnetic field at a point between the two conductors, at a distance x from the axis. Let B_2 be the magnetic field at a point outside conductor, at a distance $2x$ from the axis

A. $B_1 = B_2$

B. $B_1 = 2B_2$

C. $B_2 = 2B_1$

D. $B_2 = 4B_1$

Answer: A

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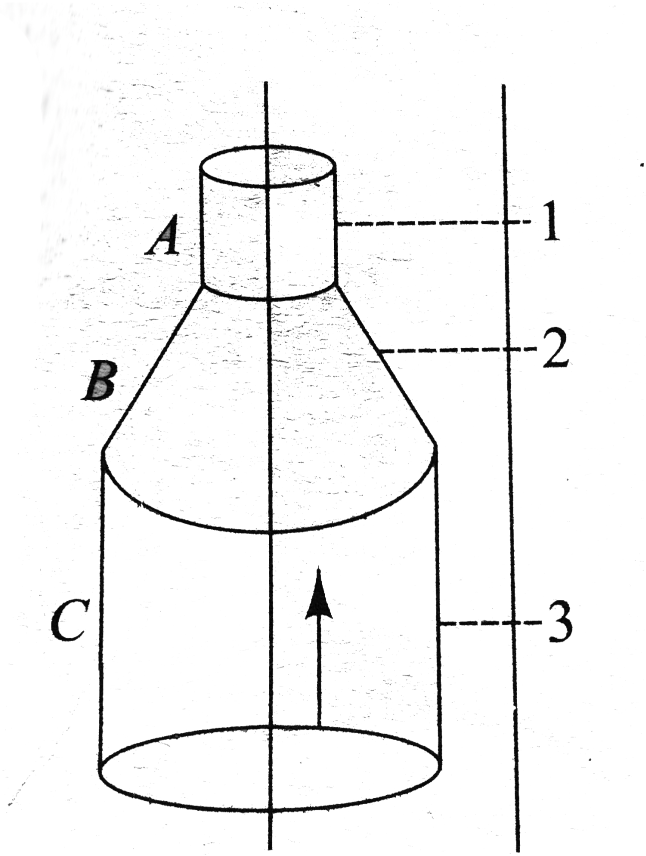
70. A long, straight, hollow conductor (tube) carrying a current has two sections A and C of unequal cross sections joined by a conical section B. 1,2 and 3 are points on a line parallel to the axis of the conductor. The magnetic fields at 1,2 and 3 have magnitudes B_1, B_2 and B_3. Then,



A. $B_1 = B_2 = B_3$

B. $B_1 = B_2 \neq B_3$

C. $B_1 < B_2 < B_3$

D. B_2 cannot be found unless the dimensions of the section B are known

Answer: A

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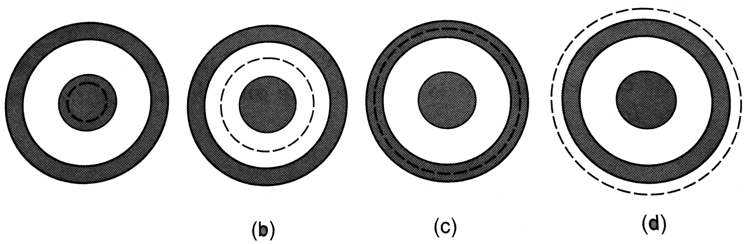
71. Consider a coaxial cable which consists of an inner wire of radius a surrounded by an outer shell of inner and outer radii b and c respectively. The inner wire carries an electric current i_0 and the outer shell carries an equal current in opposite direction. Find the magnetic field at a distance x from the axis where (a) $x < a$, (b) $a < x < b$, (c) $b < x < c$ and (d)$x > c$. Assume that the current density is uniform in the inner wire and also uniform in the outer shell.



A. for $x < a$, $B = \dfrac{\mu_0 I x}{2\pi a^2}$

B. for $a < x < b$, $B = \dfrac{\mu_0 I}{2\pi x}$

C. for $b < x < c$, $B = \dfrac{\mu_0 I\left(C^2 - x^2\right)}{2\pi x\left(c^2 - b^2\right)}$

D. all

Answer: D

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72. A long solenoid is fabricated by closely winding a wire of radius 0.5 mm over a cylindrical nonmagnetic frame so that the successive turns nearly touch each other.

What would be the magnetic field B at the centre of the solenoid if it carries a current of 5 A?

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

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

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

D. $2\pi \times 10^{-5} T$

Answer: B

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73. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is doubled and the number of turns per cm is halved, the new vlaue of the magnetic field is

A. B

B. $2B$

C. $4B$

D. $B / 2$

Answer: D

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74. There are 50 turns of a wire in every cm langth of a long solenoid. If 4 ampere current is flowing in the solenoid, the approximate value of magnetic field along its axis at an internal point and at one end will be respectively

A. $12.6 \times 10^{-3} Wb/m^2, 6.3 \times 10^{-3} Wb/m^2$

B.

$$12.6 \times 10^{-3} Wb/m^2, 25.1 \times 10^{-3} Wb/m^2$$

C.

$$25.1 \times 10^{-3} Wb/m^2, 12.6 \times 10^{-3} Wb/m^2$$

D.

$$25.1 \times 10^{-5} Wb/m^2, 6.3 \times 10^{-5} Wb/m^2$$

Answer: C

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75. A coil having N turns is would tightly in the form of a spiral with inner and outer radii a and b respectively. When a current I passes through the coil, the magnetic field at the centre is.

A. $\dfrac{\mu_0 NI}{b}$

B. $\dfrac{2\mu_0 NI}{a}$

C. $\dfrac{\mu_0 NI}{2(b-a)} \ln\left(\dfrac{b}{a}\right)$

D. $\dfrac{\mu_0 I}{2(b-a)} \ln\left(\dfrac{b}{a}\right)$

Answer: C

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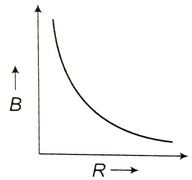
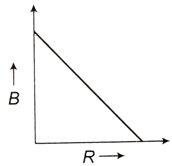
76. A charge Q is uniformly distributed over the surface of non - conducting disc of radius R. The disc rotates about an axis perpendicular to its plane and passing through its centre with an angular to its plane and passing through its centre of the disc. If we keep both the amount of charge placed 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 br represented by the figure:

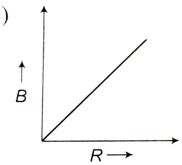
A. (1)



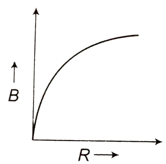
B. (2)



C. (3)



D. (4)



Answer: A

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77. Two identical conducting wires AOB and COD are placed at right angles to each other. The wire AOB carries an electric current I_1 and COD carries a current I_2. The magnetic field on a point lying at a distance d from O, in a direction perpendicular to the plane of the wires AOB and COD, will be given by

A. $\frac{\mu_0}{2\pi d}(I_1 + I_2)$

B. $\frac{\mu_0}{2\pi d}\left(i_1^2+I_2^2\right)$

C. $\frac{\mu_0}{2\pi d}\left(I_1^2+I_2^2\right)^{1/2}$

D. $\frac{\mu_0}{2\pi d}\left(\frac{I_1}{I_2}\right)$

Answer: C

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