ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

SOLUTION TO WORK SHEET 19

Subject : PHYSICS

20.6.20

CLASS : XII

Chapter : Electromagnetism

Topic : **B** on the axis of a circular coil & it's center. Ampere's circuital law and it's application to find **B** for infinite current carrying wire.

Multiple Choice Question : **1 x 15 = 15**

1. Which one of the followings is not true for Ampere's law?
   (a) this law is differential form of **B**
   (b) this law is based on the principal of electromagnetism
   (c) this law is related to closed current carrying curve
   (d) this law is valid for symmetrical current distribution
   Ans. (a) this law is differential form of **B**

2. A circular coil of radius R carries an electric current i. The magnetic field at a point on the axis at a distance x from the centre of the coil($x >> R$) varies as
   (a) $\frac{1}{x}$ (b) $\frac{1}{x^{3/2}}$ (c) $\frac{1}{x^2}$ (d) $\frac{1}{x^3}$
   Ans. (d) $\frac{1}{x^3}$

3. For a wire of infinite length $\vec{B}$ is
   (a) $B=\frac{\mu_o i}{2\pi r}$ (b) $B=\frac{2\pi r}{\mu_o i}$ (c) $B= o$ (d) $B=\frac{2\mu_o i}{r}$
   Ans. (a) $B=\frac{\mu_o i}{2\pi r}$

4. Magnetic field on the axis of a current carrying circular coil is
   (a) $B=\frac{\mu_o i}{2}.\frac{r^2}{(r^2+x^2)^{3/2}}$ (b) $B=\mu_o ni$ (c) $B=\frac{\mu_o i}{2}.\frac{(r^2+x^2)^{3/2}}{r^2}$ (d) none of the above
   Ans. (a) $B=\frac{\mu_o i}{2}.\frac{r^2}{(r^2+x^2)^{3/2}}$

5. $\vec{B}$ at the centre of the current carrying circular coil having N turns
   (a) $B=\frac{\mu_o NI}{2r}$ (b) $B=\frac{\mu_o I}{2r}$ (c) $B=\mu_o NI$ (d) $B=\frac{\mu_o NI}{r}$
   Ans. (a) $B=\frac{\mu_o NI}{2r}$

6. Magnetic intensity (in CGS) at the centre of a current causing circular conductor is

(a) $H = \frac{2\pi i}{r}$ (b) $H = \frac{2i}{r}$ (c) $H = \frac{\pi i}{r}$ (d) $H = \frac{2\pi r}{i}$

Ans. (a) $H = \frac{2\pi i}{r}$

7. Expression for closed line integnel —

(a) $\oint \vec{A}.\vec{dl}$ (b) $\int \vec{A}.\vec{dl}$ (c) $\int_P^Q \vec{A}.\vec{dl}$ (d) $\oint_P^Q \vec{A}.\vec{dl}$

Ans. (a) $\oint \vec{A}.\vec{dl}$

8. The magnetic induction at a point *P* which is distant 4 cm from a long current carrying wire is 10^{-8} *Tesla*. The field of induction at a distance 12 cm from the same current would be

(a) 3.33 x 10^{-9} *Tesla* (b) 1.11 x 10^{-4}*Tesla* (c) 3 x 10^{-3} *Tesla* (d) 9 x 10^{-2} *Tesla*

Ans. (a) 3.33 x 10^{-9} *Tesla*

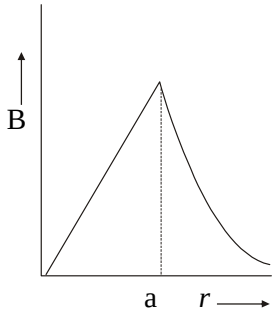
9. For the magnetic field to be maximum due to a small element of current carrying conductor at a point, the angle between the element and the line joining the element to the given point must be

(1) 0^0 (2) 90^0 (3) 180^0 (4) 45^0

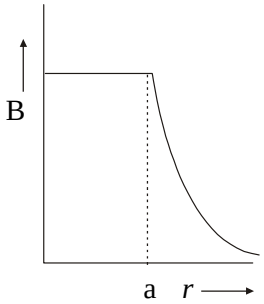
Ans. (2) 90^0

10. The magnetic field due to a straight conductor of uniform cross-section of radius a and carrying a steady current is represented by

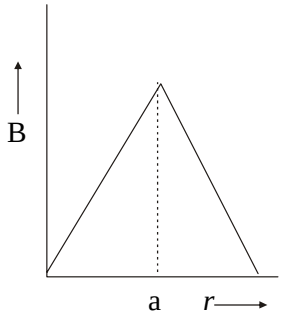
(a)



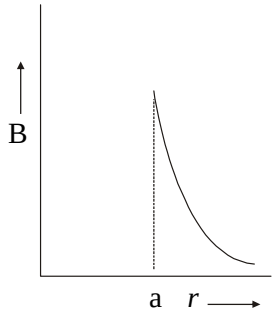
(b)



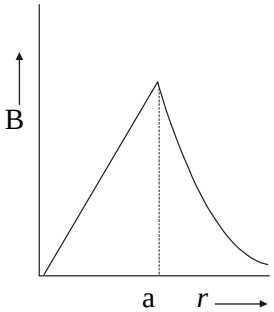
(c)



(d)



Ans. (a)

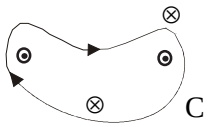


11. The distance at which the magnetic field on axis as compared to the magnetic field at the centre of the coil carrying current I and radius R is 1/8, would be

(a) R (b) $\sqrt{2}R$ (c) 2R (d) $\sqrt{3}R$

Ans. : (d) $\sqrt{3}R$

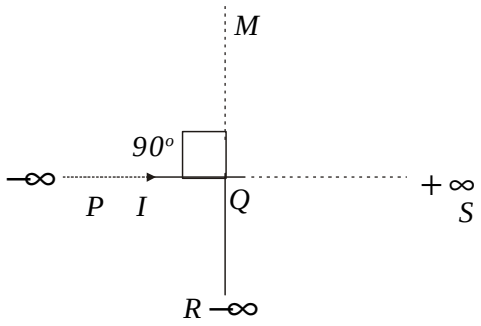
12. Four conductors carrying 2.0 A of current into or out of the page are shown in the diagram. A path C is indicated for the line integral $\int B.ds$. Find the value of the integral for the path C



(a) $2\mu_o$ (b) Zero (c) $-2\mu_o$ (d) $-8\mu_o$

Ans. : (c) $-2\mu_o$

13. 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 H_1.Now, another infinitely long straight conductor *QS* is connected at *Q*, so that the current is 1/2 in *QR* as well as *QS*. The current in *PQ* remaining unchanged. The magnetic field at *M* is now H_2. The ratio H_1 / H_2 is given by



(a) $\frac{1}{2}$ (b) 1 (c) $\frac{2}{3}$ (d) 2

Ans. (c) $\frac{2}{3}$

14. A polygon shaped wire is inscribed in a circle of radius *R*. The magnetic induction at the centre of polygon, when current flows through the wire is

(a) $\frac{\mu_0 nI}{2\pi R}\tan\left(\frac{2\pi}{n}\right)$ (b) $\frac{\mu_0 nI}{2\pi R}\tan\left(\frac{4\pi}{n}\right)$ (c) $\frac{\mu_0 nI}{2\pi R}\tan\left(\frac{\pi}{n}\right)$ (d) $\frac{\mu_0 nI}{2\pi R}\tan\left(\frac{\pi}{n^2}\right)$

Ans. (c) $\frac{\mu_0 nI}{2\pi R}\tan\left(\frac{\pi}{n}\right)$

15. Magnitude of magnetic field is maximum for a current carrying conductor

(a) at the centre (b) either side of the axis

(c) at infinity (d) none of the above

Ans. (a) at the centre

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