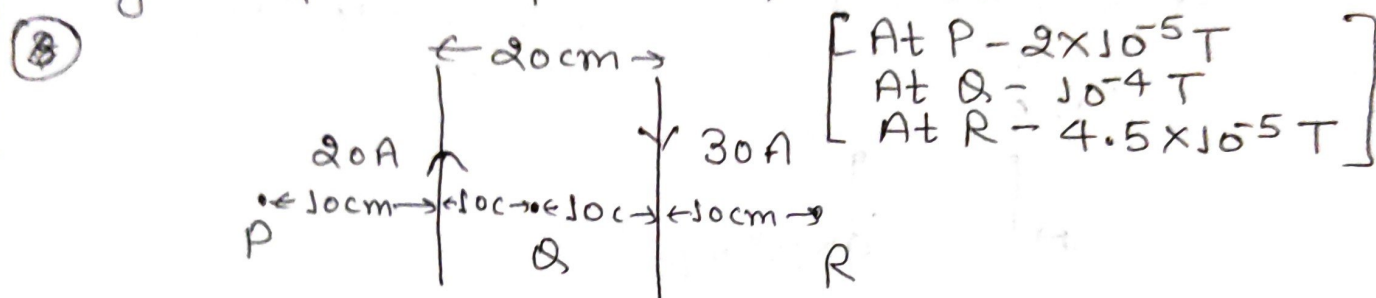# [Magnetic Effect of Current]

[PHYSICS BY RAJAT SACHDEV] [9580951094]

① Write a relation between μ_0, ε_0 and c.

② Figure shows two current - carrying wires 1 and 2. Find the magnitudes and directions of the magnetic field at points P, Q and R.

⑧

$$\begin{bmatrix} At \ P - 2\times10^{-5}T \\ At \ Q - 10^{-4}T \\ At \ R - 4.5\times10^{-5}T \end{bmatrix}$$

③ Apply Biot - Savart law to derive an expression for the magnetic field at the centre of a current - carrying circular loop.

④ A long wire is bent as shown in figure. What will be the magnitude and direction of the field at the centre O of the circular portion, If a current I is passed through the wire? Assume that the various portions of the wire do not touch at point P.

$$\begin{bmatrix} Ans - \dfrac{\mu_0 I}{2r}\left(1+\dfrac{1}{\pi}\right) \end{bmatrix}$$
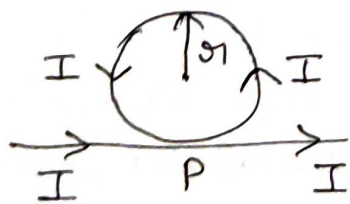

⑤ State Ampere's circuital law.

⑥ Show variation of magnetic field along the axis of solenoid.   [9580951094]

⑦ Show that the work done by a magnetic field on a moving charged particle is always zero.

⑧ A long straight wire AB carries a current of 4A. A proton P travels at 4×10^6 m/s, parallel to the wire, 0.2 m from it and in a direction opposite to the current as shown in figure. Calculate the force which the magnetic field of current exerts on the proton. Also specify the direction of the force.

$[2.56 \times 10^{-18} N]$

4A ↑
 --- • P
A |
4×10^6 m/s
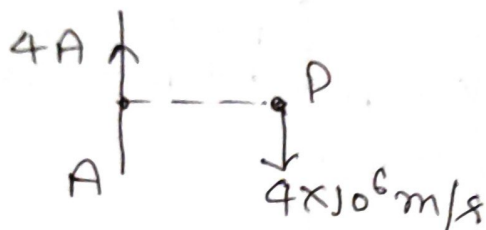
⑨ An electron moving horizontally with a velocity of 4×10^4 m/s enters a region of uniform magnetic field of 10^{-5} T acting vertically downward as shown in figure. Draw its trajectory and find out the time it takes to come out of the region of magnetic field.

$[Ans - 1.8 \times 10^{-6} s]$

$\xrightarrow{-\vec{e}}$ | × × ×
| × × ×
| × × ×
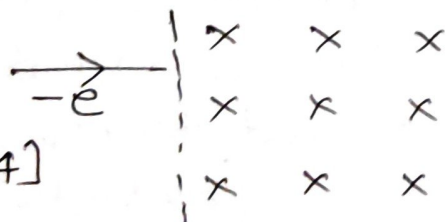
[9580951094]

⑩ A rectangular loop of wire of size 2cm × 5cm. Carries a steady current of 1A. A straight long wire carrying 4 Amp current is kept near the loop as shown in figure. If the loop and a the wire are coplanar, find (i) the torque acting on the loop and (ii) the magnitude and direction of the force on the loop due to the current-carrying wire.

4A ↑
1A ← 2cm → ↑ 5cm
← 1cm → ↓
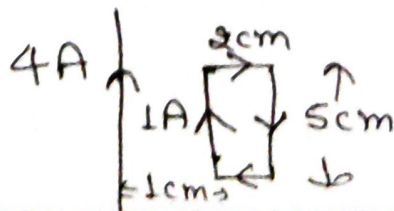
$\Big[$ Ans - (i) $\tau = 0$
(ii) $F = 2.67 \mu N$
towards straight wire $\Big]$

11. Explain the principle, construction and working of moving coil galvanometer. Also explain How you convert galvanometer into ammeter and voltmeter.

12. A current of $200\,\mu A$ deflects the coil of a moving coil galvanometer through $30°$. What should be the current to cause the rotation through $\pi/10$ radian? What is the sensitivity of the galvanometer? [Ans - $120\,\mu A$, $0.15\,deg/\mu A$

13. A galvanometer of resistance G can be converted into a voltmeter of range $(0-V)$ volts by connecting a resistance 'R' in series with it. How much resistance will be required to change its range from 0 to $V/2$? [Ans - $\dfrac{R-G}{2}$]

14. A galvanometer of resistance $20\,\Omega$ gives a deflection of one division when a potential difference of $4\,mV$ is applied across its terminals. Calculate the resistance of the shunt if the current of $10A$ is to be measured by it. The galvanometer has 25 divisions. [Ans - $0.01\,\Omega$]

15. State Biot-savart law and express this law in vector form. [9580 9510 94]

16. A proton and an alpha particle of the same velocity enter in turn a region of uniform magnetic field, acting perpendicular to their direction of motion. Deduce the ratio of the circular path describe by the particles. [Ans - $2:1$]

(17) An electron and a proton are moving along the same direction with the same kinetic energy when they pass through a uniform magnetic field perpendicular to the direction of their motion, they describe paths of the same radius. Is this statement the true or false?

(18) Why should an ammeter have a low resistance? [9580951094]

(19) A charge q, moving in a straight line is accelerated by a potential difference V. It enters a uniform magnetic field B perpendicular to its path. Deduce in terms of V an expression for the radius of the circular path in which it travels. $\left[Ans - \sqrt{\dfrac{2mV}{qB^2}} \right]$

(20) A Galvanometer coil has a resistance of 12Ω and meter shows full scale deflection for a current of 3mA. How will you convert the meter into a voltmeter of range 0 to 18V?