QB365 Question Bank Software Study Materials

Magnetism and Magnetic Effects of Electric Current Important 2 Marks Questions With Answers (Book Back and Creative)

12th Standard

Physics

Total Marks : 40

2 Marks

20 x 2 = 40

1) The repulsive force between two magnetic poles in air is 9 x 10^{-3} N. If the two poles are equal in strength and are separated by a distance of 10 cm, calculate the pole strength of each pole.

Answer : The magnitude of the force between two poles is given by

$F=k\frac{q_{m_A}q_{m_B}}{r^2}$

(Given : F = 9 × 10^{-3} N, r = 10 cm = 10 × 10^{-2} m

Since q_{mA} = q_{mB} = q_m, we have

9 x 10^{-3} = 10^{-7} x $\frac{q_m^2}{(10\times10^{-2})^2}\Rightarrow q_m$ = 30NT^{-1}

2) Using the relation $\vec{B}=\mu_\circ(\overrightarrow{H}+\vec{M})$ show that $x_m=\mu_r-1$

Answer : $\vec{B}=\mu_\circ(\overrightarrow{H}+\vec{M})$

But from equation (3.33), in vector form,

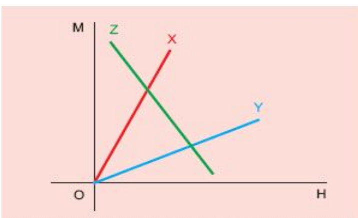
$\vec{M}=x_m\vec{H}$

Hence, $\vec{B}=\mu_\circ(x_m+1)\vec{H}\Rightarrow\vec{B}=\mu\vec{H}$

where, $\mu=\mu_\circ(x_m+1)\Rightarrow x_m+1=\frac{\mu}{\mu_\circ}=\mu_r$

$\Rightarrow x_m=\mu_r-1$

3) The following figure shows the variation of intensity of magnetisation with the applied magnetic field intensity for three magnetic materials X, Y and Z. Identify the materials X, Y and Z.



Answer : The slope of M-H graph measures the magnetic susceptibility, which is given by

$x_m=\frac{M}{H}$

Material X : Slope is positive and larger value. So, it is a ferromagnetic material.

Material Y : Slope is positive and lesser value than X. So, it could be a paramagnetic material.

Material Z : Slope is negative and hence, it is a diamagnetic material.

4) Let E be the electric field of magnitude 6.0 x 10^6 N C^{-1} and B be the magnetic field magnitude 0.83 T. Suppose an electron is accelerated with a potential of 200 V, will it show zero deflection?. If not, at what potential will it show zero deflection.

Answer : Electric field, E = 6.0 x 10^6 N C^{-1} and magnetic field, B = 0.83 T.

Then.

$v=\frac{E}{B}=\frac{6.0\times10^6}{0.83}=7.23\times10^6ms^{-1}$

When an electron goes with this velocity, it shows null deflection. Since the accelerating potential is 200 V, the electron acquires kinetic energy because of this accelerating potential. Hence,

$\frac{1}{2}mv^2=eV$

$v=\sqrt{\frac{2eV}{m}}$

Since the mass of the electron, m = 9.1 x 10^{-31}kg and charge of an electron, $|q|=e=1.6\times10^{-19}C$. The velocity acquired by the electron due to accelerating potential 200 V is

$v_{200}=\sqrt{\frac{2(1.6\times10^{-19})(200)}{(9.1\times10^{-31})}}=8.39\times10^6ms^{-1}$

Since the speed v_{200} > v, the electron is deflected towards direction of Lorentz force. So, in order to have null deflection, the potential, we have to supply is

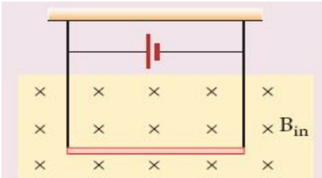
$v = \frac{1mv^2}{2\quad e} = \frac{(9.1\times10^{-31})\times(7.23\times10^{6})}{2\times(1.6\times10^{-19})}$

V = 148.65 V

5) What is meant by hysteresis?

Answer : Hysteresis is the phenomenon of lagging of magnetic induction behind the magnetising field.

6) A conductor of linear mass density 0.2 g m^{-1} suspended by two flexible wire as shown in figure. Suppose the tension in the supporting wires is zero when it is kept inside the magnetic field of 1 T whose direction is into the page. Compute the current inside the conductor and also the direction of the current. Assume g = 10 m s^{-2}



Answer : Linear mass density of the conductor is = 0.2 g/m

Mass per unit length $\frac{M}{l} = 0.2 \times 10^{-3}$ kg/m

Magnetic field B = 1T.

Acceleration due to gravity, g = 10 ms^{-2}

Force $= \frac{m}{l} \times g$

= 0.2 x 10^{-3} x 10 = 0.2 x 10^{-2}

F = 2 x 10^{-3} N ....(1)

If the coil is placed in the magnetic field then the force acting on the coil is

F= BIl ....(2)

From the equation (1) and (2) we get

BIl = 2 x 10^{-3}

∴ 1 x L x I = 2 x 10^{-3}

∴ I = 2 x 10^{-3} A [∴ l = 1m]

∴ I = 2mA

7) What is magnetic field?

Answer : Magnetic field is the region or space around every magnet within which its influence will be felt by keeping another magnet in that region.

$\vec{B} = \frac{1}{q_m}\vec{E}$

Its unit is N $A^{-1}m^{-1}$

8) What is resonance condition in cyclotron?

Answer : Resonance condition happens, when the frequency f at which the positive ion circulates in the magtetic field must be equal to the constant frequency of the electrical oscillator $f_{osc.}$

$f_{osc} = \frac{qB}{2\pi m}$

9) Explain the concept of velocity selector.

Answer : It is an arrangement of eletric field (E) and magnetic field (B) perpendicular to each other. When charged particles enter that region, particles with a certain velocity can pass through that region.

v = E/B

The speed is independent of charge and mass.

10) How is a galvanometer converted into (i) an ammeter and (ii) a voltmeter?

Answer : (i) A galvanometer is converted into an ammeter by connecting a low resistance in parallel with the galvanometer.

(ii) A galvanometer is converted into a volmeter by connecting high resistance R_s in series with the galvanometer.

11) What is magnetic axis, magnetic meridian & magnetic equator?

Answer : The straight line which connects magnetic poles of Earth is known as magnetic axis. A vertical plane passing through magnetic axis is called magnetic meridian and a great circle perpendicular to Earth's magnetic axis is called magnetic equator.

12) What is Declination?

Answer : The angle between magnetic meridian at a point and geographical meridian is called the declination or magnetic declination (D).

13) Distinguish between Uniform magnetic field and Non-uniform magnetic field?

Answer : (i) Uniform magnetic field: Magnetic field is said to be uniform if it has the same magnitude and direction at all the points in a given region.
Example, locally Earth's magnetic field is uniform.
(ii) Non-uniform magnetic field: Magnetic field is said to be non-uniform if the magnitude or direction or both varies at all its points.
Example: magnetic field of a bar magnet.

14) State Right hand thumb rule.

Answer : If we hold the current carrying conductor in our right hand such that the thumb points in the direction of current flow, then the fingers encircling the wire points in the direction of the magnetic field lines produced.

15) What are the properties of materials used as an electromagnet?

Answer : The material with high initial permeability, low retentivity, low coercivity and thin hysterisis loop with smaller area are preferred to make electromagnets.

16) When is a galvanometer said to be sensitive?

Answer : The galvanometer is said to be sensitive if it shows large scale deflection even though a small current is passed through it or a small voltage is applied across it.

17) Where on the earth's surface is the value of
(i) angle of dip maximum
(ii) vertical component of earth's magnetic field zero

Answer : (i) Angle of dip (90°) is maximum at the magnetic piles.
(ii) Vertical component of earth's magnetic field is zero at magnetic equator.

18) In what way is the behaviour of a diamagnetic material different from that of a paramagnetic when kept in an external magnetic field?

Answer : A diamagnetic substance would move towards the weaker region of the field while a paramagnetic substance would move towards the stronger region.

19) Why a freely suspended bar magnet experiences only torque?

Answer : It is because the Earth's magnetic field is uniform.

20) What kind of magnetic properties should (i) permanent magnets and (ii) electromagnets have?

Answer : **i) Permanent magnets:**
The materials with high retentivity, high coercivity and high permeability are suitable for making permanent magnets.
Examples: Steel and Alnico
ii) Electromagnets:
The materials with high initial permeability low retentivity, low coercivity and thin hysteresis loop with smaller area are preferred to make electromagnets.