

ASSIGNMENT 2 - ANSWERS

1. (d) Perpendicular to the magnetic field
2. (b) B
3. (a) 2B
4. (b) potential
5. (a) Convective currents in earth's core
6. (d) Both b and c
7. (c). Magnetic field intensity is the magnetic induction force acting on a unit magnetic pole.
8. (b) Paramagnetic
9. (c) Domains are partially aligned.
10. (b) High Permeability & Low Hysteresis Loss
11. (a) Decreased
12. (b) Large Susceptibility & Small Retentivity.

1-MARK

13. When a bar magnet of magnetic moment ($M = m2L$) is cut into two equal pieces transverse to its length, its (i) the pole strength remains unchanged ii) the magnetic moment is reduced to half.
14. A moving charge experiences a force in an external magnetic field due to the interaction of two magnetic fields, one which is produced due to motion of the charge and other due to the external magnetic field, while a stationary charge does not experience any such force.
15. Susceptibility of material is negative, so given material is diamagnetic.
16. The material having positive and small susceptibility is paramagnetic material.
The material having negative and small susceptibility is diamagnetic material.

2-MARKS

17. Torque acting on a dipole is a) Maximum when θ is 90° and b) Minimum when θ is 0° or 180°
18. Force on N pole = $qm B$ along B

Force on S pole = $qm B$ opposite to B

This give rise to a torque given by

$$\begin{aligned} r &= \text{Force} \times \text{perpendicular distance} \\ &= qmB \times 2l\sin\theta = MB\sin\theta \end{aligned}$$

19. Ferromagnetic material has a high permeability. So on passing current through windings, it gains sufficient magnetism immediately.

20. A diamagnetic specimen would move towards the weaker region of the field while a paramagnetic specimen would move towards the stronger region.

21. Curie law states that magnetization of paramagnetic substance is directly proportional to the external magnetic field applied. But as the substance is heated, its magnetization is inversely proportional to the temperature of substance.

Thus, magnetization of paramagnetic substance $M = \frac{CB}{T}$

where C is Curie constant, B is external magnetic field and T is the temperature of substance.

3 MARKS

22. (i) $B = \frac{r}{M \sin \theta} = \frac{0.063}{0.9 \sin 30} = 0.14 \text{ T}$

(ii) When $\theta = 0^\circ$ $U = -MB \cos 0 = -MB$

P.E of the bar magnet will be minimum and it will be in stable equilibrium when it is parallel to the magnetic field.

23. (a) Magnetic Susceptibility: It is defined as the ratio of the magnetisation M to the magnetising field intensity H. It is denoted by χ .

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

Magnetic susceptibility in terms of magnetic permeability.

$$\chi = \mu_r - 1$$

(b) A is a diamagnetic material, B is a ferromagnetic material.

5 MARKS

24. (a) Torque) $\tau = MB \sin \theta$

$$M = \tau / B \sin \theta$$

$$= \frac{0.032}{0.16} \sin 30$$

$$= 0.4 \text{ JT}^{-1}$$

(b) For stable equilibrium $\theta = 0^\circ$

(c) PE is given by $U = -MB \cos 0 = -0.4 \times 0.16 = -0.064 \text{ J}$

Assertion and Reason

25.(b) The magnetic dipole moment will be reduced to half when broken into two equal pieces and every atom behaves like a dipole so the dipole of a magnet cannot be separated.

26.(a) When a bar magnet is placed in a uniform magnetic field. Then the bar magnet will experience only torque and no force, and this torque on the bar magnet will be acting on both ends, and will be equal but opposite in direction.

27.(d) Parallel currents attract and antiparallel currents repel.

28.(a) Gauss's law of magnetism is different from that for electrostatics because electric charges do not necessarily exist in pairs but magnetic monopoles do not exist.

29.(b) $B = \mu_0 n I$, from this formula we see the dependence of B in current and inside a solenoid it is uniform.

30.(c) Force $= q(\mathbf{v} \times \mathbf{B})$ it is independent of mass and if v and B are perpendicular to each other, the particle describes a circle.

31.(a) A charged particle moves in a circle when its velocity is perpendicular to the magnetic field. When it forms an acute angle with the magnetic field, it can be resolved in two components, parallel and perpendicular. The perpendicular components tend to move it in a circle, the parallel components tend to move along the magnetic field to form a helical motion of uniform radius and pitch.

32.(c) Torque, $\tau = mB \sin \theta$

Here $\theta = 90^\circ$, $\sin 90^\circ = 1$ so torque will be maximum.

33.(b) A galvanometer is a device that is used to detect small electric current or measure its magnitude. The current sensitivity of a galvanometer is the deflection of current per unit

current passing through the coil $I = \frac{NAB}{s k}$

34.(b) Assertion is the property of a magnet while reason is one of the sources of magnetic field.