Magnetism And Matter

Que 1: What are the magnetic elements of earth   *Marks :(2)*

Ans: 1. Declination

2. Inclination

3. Horizontal components of Earth's magnetic field

Que 2: Distinguish between dia magnetic and paramagnetic substance *Marks :(2)*

Ans: Paramagnetic substance-Individual magnetic moment exist, In non-uniform magnetic field it move from weaker region to stronger region

Diamagnetic substance-Individual magnetic moment do not exist, in non-uniform magnetic field it move from stronger region to weaker region

Que 3: Define coercively   **Marks :(2)**

Ans: The reverse field required to demagnetise a specimen completely is called coercivity.
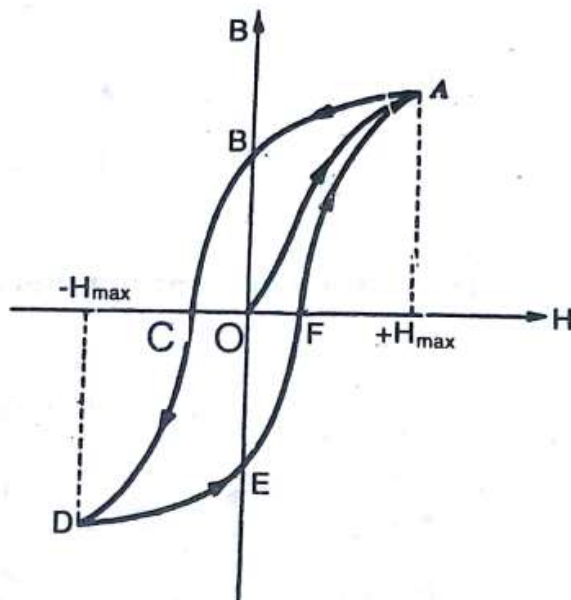
Que 4: Define retentively   **Marks :(2)**

Ans: The residual magnetism in a specimen after the removal of applied magnetic field is called retentively.

Que 5: Draw a B-H curve and locate retentively and coercively   *Marks :(4)*

Ans: OB – retentively OC – coercively

Que 6: What is magnetic hysteresis?   *Marks :(2)*

Ans: The phenomenon of lagging of magnetic induction behind the magnetising field is called magnetic hysteresis.

Que 7: For an electro magnet the value of coercively is _____ (low / high)
Marks :(1)

Ans: low

Que 8: complete the table

Sl No.Properties   DiaParaFerro

    Attractive

    Alignment

    In non-uniform magnetic field

    Temperature

    Permeability(μ)

    Susceptibility(χ_m)   *Marks(5)*

Ans:

S. No.	Properties	Dia	Para	Ferro
	Attractive	Very weak repulsion	Weak attraction	Very strong attraction
	Alignment	Right angles to field	In the field direction	In the field direction
	In non-uniform magnetic field	Moves from stronger to weaker region	Weaker to stronger	Weaker to stronger
	Temperature	Independent	Depended	Depended
	Permeability(μ)	Less than one	Slightly greater than one	Very high of the order of 100-1000 or above
	Susceptibility(χ_m)	Small negative	Small positive	Positive and very high

Que 9: Write examples for diamagnetic substances, paramagnetic substances and ferromagnetic substances.   *Marks :(2)*

Ans: diamagnetic substance : Antimony, Bismuth, Copper, Gold, Water, Alcohol, Air

Paramagnetic substance : aluminium, Platinum, Chromium, Sodium, Liquid Oxygen

Ferromagnetic substance :Iron, Nickel, Cobalt

2 score for each set

**Que 10: Define   *Marks :(2)*

1. Diamagnetism,
2. Paramagnetism,
3. Ferromagnetism

Ans: Defenition

Que 11: state curie's law   *Marks :(2)*

Ans: Magnetisation of a paramagnetic substance is directly proportional to the applied field and inversely proportional to absolute temperature.

ie $M \alpha \dfrac{B_0}{T}$

$M = \dfrac{CB_0}{T}$

Que 12: Susceptibility is slightly positive for

a. diamagnetic substances

b. paramagnetic substances

c. ferromagnetic substances   *Marks :(1)*

Ans: b. paramagnetic substances

Que 13: which of the following directions at earth's magnetic pole will a compass needle show?   *Marks :(1)*

a. Vertical

b. no direction

c. horizontal

d. inclined 45° to vertical

Ans: a. Vertical

Que 14: The vertical component of earth's magnetic field is zero at a place where the angle of dip is _____   *Marks :(1)*

a.0^0

b.45^0

c.60^0

d.90^0

Ans: a.0^0

Que 15: The dipole moment of a short bar magnet is 1.25 Am². Find the magnetic field on the axis at a distance 0.5 metre from the centre of the magnet.
        Marks :(3)

Ans: Magnetic field on the axis of a bar magnet is

$$B = \frac{\mu_0}{4\pi} \frac{2M}{d^3}$$

$$\frac{10^{-7} \times 2 \times 1.25}{0.5^3}$$

= 2X10^{-6} N/Am

Que 16: A steel wire of length 2*l* has a magnetic moment M. It is bend into a semicircular arc. What is the new magnetic moment? *Marks :(6)*

Ans:

Pole strength, $m = \frac{M}{2l}$

$\pi r = 2l$

$r = \frac{2l}{\pi}$

new magnetic moment, M' = m X 2r = $\frac{M}{2l} \times 2 \times \frac{2l}{\pi}$

$\frac{2M}{\pi}$

Que 17: If the distance between two similar magnetic poles held 1 centimetre apart be doubled, then the force of interaction between them will be: *Marks :(1)*

1. doubled
2. halved
3. unchanged
4. one quarter of the original value.

Ans: One quarter of the original value.

Que 18: A bar magnet of length 2*l*, magnetic moment M and pole strength m units is cut into two pieces at the middle. The magnetic moment and pole strength of each piece will be respectively: *Marks :(1)*

1. M/2 and m/2

2. M and m/2

3. M/2 and m

4. M and m

Ans: M/2 and m

Que 19: When the distance between two magnetic poles is doubled the force between them is *Marks :(1)*

1. doubled
2. halved
3. increased 4 times
4. decreased 4 times

Ans: decreased 4 times

Que 20: The magnetic moment of a short magnet is 16 Am². What is the field strength at appoint 20 cm from its mid-point on

(a). Axial line (b). Equatorial line. *Marks :(5)*

Ans: axial line

$$B = \frac{\mu_0}{4\pi} \frac{2M}{d^3}$$

$$\frac{10^{-7} \times 2 \times 16}{(20 \times 10^{-2})^3} = 4 \times 10^{-4} \, Tesla$$

equatorial line

$$B = \frac{\mu_0}{4\pi} \frac{M}{d^3}$$

$$\frac{10^{-7} \times 16}{(20 \times 10^{-2})^3} = 2 \times 10^{-4} \, Tesla$$

Que 21: Of the following the most suitable material for making permanent magnet? *Marks :(1)*

1. Steel
2. soft iron
3. copper
4. Nickel

Ans: Steel

Que 22: What are the quantities we need to describe the magnetic field of the earth at a point on its surface? *Marks :(3)*

Ans:

1. The declination D,
2. The angle of dip or the inclination I
3. The horizontal component of the earth's field H_E.

Que 23: What is dip or inclination?   *Marks :(1)*

Ans: dip is the angle that the total magnetic field B_E of the earth makes with the surface of the earth

Que 24: What is the range of declination on earth.   *Marks :(1)*

Ans: The declination is greater at higher latitudes and smaller in near the equator

Que 25: What is magnetic declination?   *Marks :(2)*

Ans: The angle between the true geographic north and the north shown by a compass needle is called the magnetic declination.

Que 26: What is dynamo effect?   *Marks :(2)*

Ans: The magnetic field is arises due to electrical currents produced by convective motion of metallic fluids (consisting mostly of molten iron and nickel) in the outer core of the earth is known as the dynamo effect.

Que 27: How can you determine which material is suitable for making permanent magnet?   *Marks :(3)*

Ans: By knowing the B-H curve; for permanent magnets coercively should be high and retentively should be low.

Que 28: Why the magnetic field lines can't represent the lines of force on a moving charged particle at every point?   *Marks :(2)*

Ans: The magnetic force is always normal to magnetic field. So it can't to call magnetic field lines as lines of force.

Que 29: Do the magnetic field lines also represent the lines of force on a moving charged particle at every point?   *Marks :(1)*

Ans: No

Que 30: State Gauss's law in magnetism   *Marks :(1)*

Ans: The net magnetic flux through any closed surface is zero.

Que 31: The magnetic needle has magnetic moment 6.7×10^{-2} Am^2 and moment of inertia I = 7.5×10^{-6} kg m^2. It performs 10 complete oscillations in 6.70 s. What is the magnitude of the magnetic field?   *Marks :(3)*

Ans:

The time period of oscillation is, $T = \dfrac{6.70}{10} = 0.67\,sec$

$$B = \dfrac{4\pi^2 I}{M T^2}$$

$$B = \dfrac{4 \times (3.14)^2 \times 7.5 \times 10^{-6}}{6.7 \times 10^{-2} \times (0.67)^2}$$

= 0.01 T

Que 32: The tangent to the magnetic field line at a given point represents _____   *Marks :(1)*

Ans: The direction of the net magnetic field B at that point.

Que 33: How can you determine which material is suitable for making temporary magnet?   *Marks :(3)*

Ans: By knowing the B-H curve; for permanent magnets coercively should be low and retentivity should be high.

Que 34: A bar magnet held perpendicular to a uniform magnetic field as in the figure. If the torque acting on it is to be reduced to 1/4th by rotating the magnet towards the direction of the field, find the angle through which the magnet is to be rotated.   *Marks :(3)*
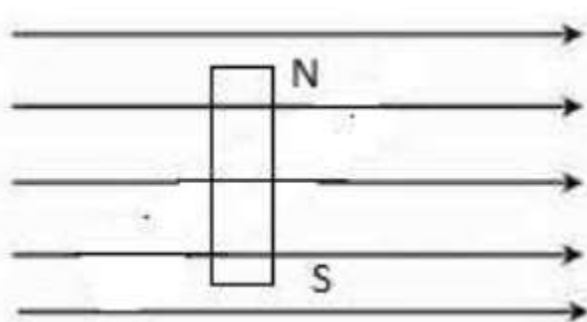
Ans: When the bar magnet is perpendicular to the field, Torque is maximum

τ = MB sin θ = MB sin(90) = MB

When rotated through an angle θ, Torque is

$$\frac{\tau}{4} = MB\sin\theta$$

$$\frac{\tau}{\left(\frac{\tau}{4}\right)} = \frac{MB}{MB\sin\theta}$$

$$4 = \frac{1}{\sin\theta}$$

$$\theta = \sin^{-1}\left(\frac{1}{4}\right) = 14.47°$$

Angle through which the magnet is to be rotated is 90- θ =75.53°

Que 35: When a magnetic needle is placed in a non-uniform magnetic field it experiences

i) a force but no torque ii) a torque but no force iii) Force and torque iv) neither a force nor a torque. *Marks :(1)*

Ans: iii) Force and torque

Que 36: a. Identify the labels, A, B, C.

b. The lines drawn on a map through places that have the same declination are called.........

c. The horizontal component of earth's magnetic field at a place is 0.25×10⁻⁴ T and the resultant magnetic field is 0.5×10⁻⁴ T. Find the dip and the vertical component of the earth's magnetic field at the place. *Marks :(5)*
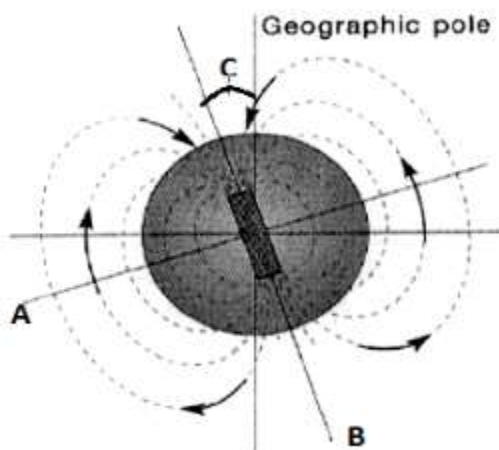
Ans: a. A- Magnetic equator

B- Magnetic axis

C- Declination

b) Isogonic lines

c) Horizontal component of earth's magnetic field is B H = B cos δ

$0.25 \times 10^{-4} = 0.5 \times 10^{-4} \cos δ$

δ = 60 °

Vertical component of earth's magnetic field is

B V = B sin δ = $0.5 \times 10^{-4} \sin 60 = 0.43 \times 10^{-4}$ T

Que 37: The temperature at which a ferromagnetic material became paramagnetic is .... *Marks :(1)*

Ans: Curie temperature

Que 38: Materials are classified into ferromagnetic, paramagnetic and diamagnetic according to their magnetic properties. *Marks :(4)*

a. which one of the following is not a ferromagnetic material?

i. Cobalt

ii. iron

iii. Nickel

iv. Bismuth

b. define the term magnetic susceptibility.

c. What is its value for a perfect diamagnetic substance.

d. State the reason why soft iron is used in making electromagnets.

Ans: a. Bismuth

b. magnetic susceptibility is the ratio of intensity of magnetisation to magnetising field.

X= M/H

c. for a perfect diamagnetic it should be less than zero or negative

d. soft iron is used in making electromagnets because it has low coercively with high permeability and low hysteresis loss.

Que 39: Earth behaves as a magnet with magnetic poles approximately near the geographic poles. *Marks :(3)*

a. The order of magnitude of Earth's magnetic field in Tesla is ....

b. what do you understand by 'dynamo' effect?

Ans: a. 10^{-5} T

b. The magnetic field is arises due to electrical currents produced by convective motion of metallic fluids (consisting mostly of molten iron and nickel) in the outer core of the earth is known as the dynamo effect.

Que 40: a. State Gauss's Law in magnetism

b. how this differ from Gauss's Law in electrostatics

c. what is the difference in two cases   Marks :(4)

Ans: a. the net magnetic flux ϕB through any closed surface is equal to zero.
$$\oint \vec{B}.\vec{ds}=0$$

b. the electric flux out of any closed surface is proportional to the total charge enclosed within the surface $\oint \vec{B}.\vec{ds}=\frac{q}{\epsilon_0}$

The net flow is zero in magnetism and net flow is $\frac{q}{\epsilon_0}$ in electrostatics for closed surfaces.

c. because magnetic monopole does not exist or the magnetic field lines form closed path.

Que 41: A magnetic needle made of iron is suspended in a uniform external magnetic field it experiences a torque and the needle starts oscillating.
        Marks :(2)

a. Write down the frequency of oscillation of the magnetic needle

b. if the needle is heated beyond Curie temperature while it is oscillating then its period

i. increases ii. decreases iii. remains the same iv. becomes infinity

Ans:

a. $f=\dfrac{i}{2\pi}\sqrt{\dfrac{mB}{I}}$

b. i. increases

Que 42: Why a freely suspended or pivoted magnetic needle always comes to rest along the geographical N – S direction.   Marks :(3)

Ans:

toeque $\tau = m\,B\sin\theta$

when $\theta = 0^0$

ie. when dipole is parallel to the magnetic field, the torque acting on it is zero. This is why a freely suspended or pivoted magnetic needle always comes to rest along the geographical N – S direction.

Que 43: Why diamagnetism is almost independent of temperature?   *Marks :(2)*

Ans: When a diamagnetic material is placed in the magnetic field, the magnetization is opposite to the direction of magnetising field. Hens it is not affected by temperature

Que 44: Write the formula for torque on a magnetic dipole in an external magnetic field. Also write conditions for maximum and minimum torque.   *Marks :(3)*

Ans:

$\tau = m \, X \, B$

$\tau = m \, B \sin \theta$

for maximum torque $\theta = 90^0$

ie when dipole is perpendicular to the magnetic field, the torque acting on it is maximum.

for minimum torque $\theta = 0^0$

ie when dipole is parallel to the magnetic field, the torque acting on it is zero.

Que 45: A magnet can be cut in two ways, perpendicular to its axis and parallel to its axis. In these two ways what are the changes occur in pole strength?
Marks :(2)

Ans: If a magnet is cut into two equal pieces perpendicular to its axis, the pole strength of either part is found exactly the same as that of the magnet.

If the magnet is cut exactly into two halves by cutting it parallel to its axis, the pole strength of each part is exactly half of the pole strength of original magnet.

Que 46: State directive property of a magnet.   *Marks :(2)*

Ans: A freely suspended magnet will always come to rest approximately in the geographic north – south direction. This is called directive property of a magnet.

Que 47: Why does a paramagnetic sample display greater magnetisation when cooled?   *Marks :(2)*

Ans: The paramagnetic material show greater amount of magnetism on cooling because the tendency of thermal agitations to disrupt the alignment of magnetic dipoles decreases on cooling.

Que 48: The earth's magnetic field varies from point to point in space, does its also changes with time? Explain *Marks :(3)*

Ans: Yes: Earth's magnetic field changes with time ie animal changes, daily changes, and secular changes with period of about 960 years. Magnetic Storms are considered as regular changes. The time for an appreciable change is roughly few hundred years

Que 49: what happens to the moment of a magnet when it is cut along

i. Transverse its length ii. Along its length. *Marks :(4)*

Ans: In both cares

if 'P' is the pole strength and '2l' is the length of the magnet, then magnetic moment is m= P X 2*l*

When the magnet is cut into two pieces in transverse or along its length, its length became half, but pole strength remains the same

new magnetic moment m' = P X *l*

m' = m/2

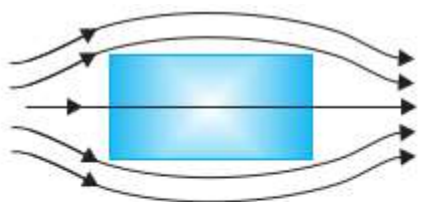Thus magnetic moment of each piece became half of the previous value.

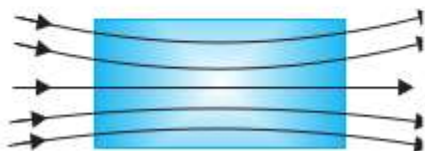**Que 50: SI unit of magnetic moment is.............** *Marks :(1)*

Ans: Am^2

Que 51: magnetic moment is a .... (vector/ scalar) quantity. *Marks :(1)*

Ans: vector

Que 52: Identify the magnetic substances 'a' and 'b'. *Marks :(2)*

(a)

(b)

Ans: (a) Dia magnetic substance (b) para magnetic substance

Que 53: Super conductor belongs to which type of magnetic material (Para magnetic / dia magnetic / ferro magnetic)   *Marks :(1)*

Ans: diamagnetic materials

Que 54: What happens if an iron bar magnet is heated to very high temperature *Marks :(2)*

Ans: When an iron bar magnet is heated to very high temperature it loses its magnetic properties. In that state the iron bar magnets is not ferro magnet

Que 55: The earth core is known to contain iron. Yet geologist do not regarded this as the source of Earth's magnetism why?   *Marks :(2)*

Ans: In the core of earth iron is in molten state Molten iron is not ferromagnetic so this is not regarded as a source of Earth's magnetism. (at high temperature ferromagnetic material loses its magnetic properties)

Que 56: An iron nail near a bar magnet experiences a force of attraction in addition to a torque. Why?   *Marks :(2)*

Ans: No force if the field is uniform. The iron nail experiences a non- uniform field due to the bar magnet. There is induced magnetic moment in the nail, therefore, it experiences both force and torque. The net force is attractive because the induced South Pole (say) in the nail is closer to the north pole of magnet than induced North Pole.

Que 57: Why the magnetic field lines can't represent the lines of force on a moving charged particle at every point?   *Marks :(2)*

Ans: The magnetic force is always normal to magnetic field. So it can't to call magnetic field lines as lines of force.

Que 58: Do the magnetic field lines also represent the lines of force on a moving charged particle at every point?   *Marks :(1)*

Ans: No

Que 59: Is a magnetised needle in a uniform magnetic field experiences a force? *Marks :(1)*

Ans: No

Que 60: A magnetised needle in a uniform magnetic field experiences .... *Marks :(1)*

Ans: a torque

Que 61: Name the physical quantity whose SI unit is weber   *Marks :(1)*

Ans: Magnetic flux

Que 62: Simplest example of magnetic dipole is ....   *Marks :(1)*

Ans: Bar magnet