

How to use this worksheet. Thirty questions, about 35 minutes. Torque uses **sine** of the angle and potential energy uses **cosine** — mixing those two accounts for most lost marks here. Dip is measured from the horizontal, so $B_H = B \cos \delta$.

Formula sheet

$m = NIA$ | $\tau = mB \sin \theta$ | $U = -mB \cos \theta$ | Axial field: $\mu_0 2m/4\pi r^3$ | Equatorial: $\mu_0 m/4\pi r^3$

Earth: $B_H = B \cos \delta$ | $B_V = B \sin \delta$ | $\tan \delta = B_V/B_H$

$B = \mu_0(H + M)$ | $\chi = M/H$ | $\mu_r = 1 + \chi$ | Curie law: $\chi \propto 1/T$

Section A · Level 1 — Dipoles, Earth's field and classification

Ten questions. None should take more than twenty seconds.

1. The magnetic moment of a current loop of N turns, area A , carrying current I is:

- (1) NIA (2) NI/A (3) IA/N (4) N/IA

2. The net magnetic flux through any closed surface is always:

- (1) Positive (2) Negative (3) Zero (4) Equal to μ_0

3. An isolated magnetic monopole:

- (1) Exists in ferromagnets (2) Has never been observed (3) Exists only at low temperature (4) Is the same as an electron

4. The angle between the geographic and magnetic meridians at a place is called the:

- (1) Dip (2) Declination (3) Inclination (4) Azimuth

5. The angle of dip at the magnetic equator is:

- (1) 0° (2) 45° (3) 90° (4) 180°

6. Substances that are weakly repelled by a magnetic field are called:

- (1) Ferromagnetic (2) Paramagnetic (3) Diamagnetic (4) Antiferromagnetic

7. The magnetic susceptibility of a diamagnetic material is:

- (1) Large and positive (2) Small and positive (3) Small and negative (4) Zero

8. Which of the following is a ferromagnetic material?

- (1) Copper (2) Bismuth (3) Aluminium (4) Iron

9. The relative permeability of a material is related to its susceptibility by:

- (1) $\mu_r = \chi$ (2) $\mu_r = 1 + \chi$ (3) $\mu_r = 1 - \chi$ (4) $\mu_r = \chi/2$

10. The SI unit of magnetic moment is:

- (1) $A\ m$ (2) $A\ m^2$ (3) $T\ m^2$ (4) Wb

Working space — Questions 1 to 10

Write the formula before you substitute.

Section B · Level 2 — Torque, dipole fields and temperature

Ten questions. Watch whether the formula needs a sine or a cosine.

11. The torque on a magnetic dipole of moment m placed at an angle θ to a field B is:

- (1) $mB \cos \theta$ (2) $mB \sin \theta$ (3) $mB \tan \theta$ (4) mB

12. A magnetic dipole of moment $0.5\ A\ m^2$ is placed at 30° to a field of $0.2\ T$. The torque on it is:

- (1) $0.05\ N\ m$ (2) $0.10\ N\ m$ (3) $0.087\ N\ m$ (4) $0.20\ N\ m$

- 13.** The potential energy of a magnetic dipole is minimum when it is:
 (1) Perpendicular to the field (2) Aligned with the field (3) Anti-parallel to the field (4) At 45° to the field
- 14.** At the same distance from a short bar magnet, the ratio of the axial field to the equatorial field is:
 (1) 1 : 1 (2) 1 : 2 (3) 2 : 1 (4) 4 : 1
- 15.** The field of a short bar magnet falls off with distance as:
 (1) $1/r$ (2) $1/r^2$ (3) $1/r^3$ (4) $1/r^4$
- 16.** If the angle of dip at a place is 45° , then the vertical and horizontal components of the Earth's field are:
 (1) Equal (2) In the ratio 2 : 1 (3) In the ratio 1 : 2 (4) Both zero
- 17.** At a place the horizontal component of the Earth's field is 0.34 G and the dip is 60° . The total field is:
 (1) 0.17 G (2) 0.34 G (3) 0.68 G (4) 0.59 G
- 18.** When a bar magnet is cut into two equal halves perpendicular to its length, each piece has:
 (1) No magnetism (2) Only a north pole (3) Half the original magnetic moment (4) The same magnetic moment
- 19.** The susceptibility of a paramagnetic material varies with absolute temperature as:
 (1) $\chi \propto T$ (2) $\chi \propto 1/T$ (3) $\chi \propto T^2$ (4) χ is independent of T
- 20.** Above its Curie temperature, a ferromagnetic material becomes:
 (1) Diamagnetic (2) Paramagnetic (3) Non-magnetic entirely (4) More strongly ferromagnetic

Working space — Questions 11 to 20 Write the formula before you substitute.

Section C · Level 3 — Magnetic materials and hysteresis

Ten questions. Each needs a material property plus a piece of reasoning.

- 21.** The magnetic field inside a perfectly diamagnetic material such as a superconductor is:
 (1) Equal to the applied field (2) Twice the applied field (3) Zero (4) Infinite
- 22.** The property by which a ferromagnetic material retains some magnetisation after the applied field is removed is called:
 (1) Coercivity (2) Retentivity (3) Permeability (4) Susceptibility
- 23.** A material suitable for making a permanent magnet should have:
 (1) Low retentivity and low coercivity (2) High retentivity and high coercivity (3) High retentivity and low coercivity (4) Low retentivity and high coercivity
- 24.** The core of an electromagnet is made of soft iron because soft iron has:
 (1) High retentivity and high coercivity (2) High permeability and low retentivity (3) Low permeability (4) Zero susceptibility
- 25.** The area enclosed by a hysteresis loop represents:
 (1) The magnetic moment (2) The energy lost per cycle of magnetisation (3) The coercivity (4) The permeability
- 26.** Magnetisation M is defined as:
 (1) Magnetic moment per unit volume (2) Magnetic moment per unit mass (3) Field per unit volume (4) Flux per unit area
- 27.** The three quantities B , H and M are related by:
 (1) $B = \mu_0 H$ (2) $B = \mu_0 M$ (3) $B = \mu_0 (H + M)$ (4) $B = H + M$
- 28.** A bar magnet suspended freely in the Earth's field oscillates with a period T . If its magnetic moment is doubled, the period becomes:

(1) $2T$ (2) $T/2$ (3) $T\sqrt{2}$ (4) $T/\sqrt{2}$

29. Domains in a ferromagnetic material are:

(1) Regions of aligned atomic dipoles (2) Isolated magnetic monopoles (3) Regions with no magnetisation (4) Impurity atoms

30. A compass needle placed at the Earth's magnetic pole would:

(1) Point horizontally north (2) Point horizontally south (3) Try to stand vertically (4) Spin continuously

Working space — Questions 21 to 30 *Write the formula before you substitute.*

Stuck on any of these? Bring them to a live class.

Live online batches and 1-on-1 mentoring for AAI ATC Junior Executive — the full Class 11 and 12 physics and maths syllabus taught straight from the real question papers. Fees are kept deliberately low so any serious aspirant can join.

Enquiry form via aviatelearnings.com · Telegram: t.me/aaiatc2026kanishk · YouTube: youtube.com/@AAIATCEXamPrep