



## Ch—05 Magnetism and Matter

### Daily Practice Problem 02

**Q1.** Calculate the magnitude of the torque required to hold a bar magnet of magnetic moment  $200 \text{ Am}^2$  along a direction making an angle of  $30^\circ$  with the direction of a uniform magnetic field of  $0.36 \text{ G}$ .

**Q2.** A bar magnet placed in a uniform magnetic field of strength  $0.3 \text{ T}$  with its axis at  $30^\circ$  to the field, experiences a torque of  $0.06 \text{ Nm}$ . What is the magnetic moment of the bar magnet?

**Q3.** A short bar magnet placed with its axis at  $30^\circ$  with a uniform external magnetic field of  $0.16 \text{ T}$  experiences a torque of magnitude  $0.032 \text{ J}$ .

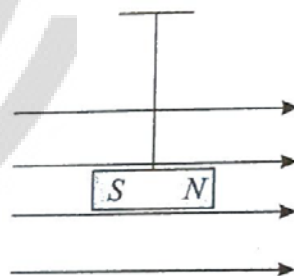
- Estimate the magnetic moment of the magnet.
- If the bar were free to rotate, which orientations would correspond to its
  - stable, and
  - unstable equilibrium?

What is its potential energy in the field for cases (i) and (ii)?

**Q4.** Calculate the work done in rotating a magnet of magnetic moment  $3.0 \text{ JT}^{-1}$  through an angle of  $60^\circ$  from its position along a magnetic field of strength  $0.34 \times 10^{-4} \text{ T}$ .

**Q5.** The magnetic dipole moment of the earth is  $6.4 \times 10^{21} \text{ Am}^2$ . If we consider it to be due to a current loop wound round the magnetic equator of the earth, then what should be the magnitude of the current? Assume the earth to be sphere of radius  $6400 \text{ km}$ .

**Q6.** A magnetic dipole of magnetic moment  $M$  is suspended by a string in a uniform horizontal magnetic field as shown in figure. If in horizontal plane this dipole is slightly tilted and released, show that it will execute simple harmonic motion and find its oscillation period. Consider the dipole as a uniform rod of mass  $m$  and length  $l$ .



## ANSWERS

1.  $3.6 \times 10^{-3} Nm$

2.  $0.4 Am^2$

3.(a)  $0.40 JT^{-1}$

(b)(i)  $-0.064 J$  (ii)  $+0.064 J$

4.  $5.1 \times 10^{-5} J$

5.  $5 \times 10^7 A$

6.  $T = 2\pi \sqrt{\frac{ml^2}{12MB}}$



Formulae Sheet Competition 4

<https://forms.gle/cX2ci45Yes3Den6n9>