Class 12 Physics · Chapter 5: Magnetism and Matter

Worksheet · 20 marks · about 40 minutes · based on NCERT

Name _____ Class and section _____ Date _____

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1. Which statement about the magnetic field lines of a bar magnet is NOT correct? [1]

(a) The tangent to a line at a point gives the direction of B there.
(b) They form continuous closed loops.
(c) They start at the north pole and end at the south pole.
(d) Two field lines never intersect.

2. The field of a short bar magnet at a point on its axis at a distance r is B. At a point on its equatorial line at a distance 2r, the field has magnitude [1]

(a) B/2
(b) B/8
(c) B/32
(d) B/16

3. The field of a short bar magnet at a point on its axis 10 cm from its centre is 4.0×10^{-4} T. At a point on its equatorial line 20 cm from its centre, the field is [1]

(a) 1.0×10^{-4} T
(b) 5.0×10^{-5} T
(c) 2.5×10^{-5} T
(d) 1.25×10^{-5} T

4. A long magnetised steel knitting needle is snapped into many short pieces. Each piece [1]

(a) is unmagnetised, except the two end pieces
(b) has only a north pole or only a south pole
(c) is a magnet with its own north and south pole
(d) is unmagnetised, since the poles stay with the end pieces

5. A bar magnet of moment 2.0 J T^{-1} lies in a uniform field of 0.30 T, its moment making 120° with the field. Taking the energy as zero when the moment is perpendicular to the field, its potential energy is [1]

(a) −0.30 J
(b) 0.30 J
(c) 0.52 J
(d) −0.60 J

6. A short bar magnet produces a field of 3.2 μT at a point on its axis 50 cm from its centre. Find its magnetic moment, and the field it produces at a point on its equatorial line 50 cm from the centre, with direction. (Take $\mu_0/4\pi = 10^{-7}$ T m A^{-1}.) [2]

7. A long solenoid carrying a fixed current is filled first with a diamagnetic liquid of $\chi = -1.0 \times 10^{-5}$, and then with a paramagnetic liquid of $\chi = +1.0 \times 10^{-5}$. Find the ratio of the field inside in the second case to that in the first, and comment on the size of the difference. [2]

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8. A bar magnet of moment 2.5 A m^2 can turn freely in a uniform field of 0.040 T. (a) What is the largest torque it can experience, and in which orientation? (b) At what angles between its moment and the field is the torque half its largest value? Find its potential energy at each, taking the energy as zero when the moment is perpendicular to the field. [2]

9. The largest torque a bar magnet can experience in a uniform field of 0.30 T is 0.060 N m. Find (a) its magnetic moment, (b) the angle between its moment and the field at which its potential energy is −0.030 J (zero when the moment is perpendicular to the field), and the torque on it there, (c) the work needed to turn it slowly from that angle to its position of unstable equilibrium. [3]

10. Using the analogy between an electric dipole and a magnetic dipole, write the magnetic counterparts of (a) $1/\varepsilon_0$ and the dipole moment p, (b) the torque $p \times E$ and the energy $-p \cdot E$, (c) the field on the axis of a short electric dipole, $2p/4\pi\varepsilon_0 r^3$. [3]

11. An iron nail is made of many magnetic domains, yet on its own it attracts nothing. (a) Explain why it shows no net magnetisation. (b) Explain how it becomes strongly magnetised when a magnet is brought near. (c) Why does it stay magnetised for only a short time after the magnet is removed, while a lodestone stays magnetised? [3]

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