

Halliday, Resnick, and Walker, *Fundamentals of Physics 10e* Question Answers

Chapter 28 Answers

1	<p>Ⓐ no because <math>\vec{v}</math> and <math>\vec{P}_B</math> must be perpendicular;          Ⓑ yes;          Ⓒ no because <math>\vec{B}</math> and <math>\vec{P}_B</math> must be perpendicular</p>
2	<p>(a) 3 and 4 tie, then 1 and 2 tie (zero);          (b) 4 (making the reasonable assumption that the rightward current is due to leftward motion of electrons in the wire)</p>
3	<p>(a) <math>+z</math> and <math>-z</math> tie, then <math>+y</math> and <math>-y</math> tie, then <math>+x</math> and <math>-x</math> tie (zero); (b) <math>+y</math></p>
4	<p>into page: <math>a, d, e</math>; out of page: <math>b, c, f</math> (the particle is negatively charged)</p>
5	<p>(a) <math>\vec{P}_E</math>;          (b) <math>\vec{P}_B</math></p>
6	<p>2, 5, 6, 9, 10</p>
7	<p>(a) <math>\vec{B}_1</math>;          (b) <math>\vec{B}_1</math> into page, <math>\vec{B}_2</math> out of page;          (c) less</p>
8	<p>(a) upper plate;          (b) lower plate;          (c) out of the page</p>
9	<p>(a) positive;          (b) <math>2 \rightarrow 1</math> and <math>2 \rightarrow 4</math> tie, then <math>2 \rightarrow 3</math> (which is zero)</p>
10	<p><math>1i, 2e, 3c, 4a, 5g, 6j, 7d, 8b, 9h, 10f, 11k</math></p>
11	<p>(a) negative;          (b) equal;          (c) equal;          (d) half-circle</p>
12	<p>(a) all tie; (b) all tie; (c) 3, 2, 1</p>

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## Halliday/Resnick/Walker Fundamentals of Physics

### Classroom Response System Questions

#### Chapter 28 Magnetic Fields

##### Reading Quiz Questions

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28.2.1. Which one of the following choices is not a possible way to produce a magnetic field?

- a) Set up a current in a long, straight wire.
- b) Uniformly distribute charges over the surface of a conductor.
- c) Make an object out of materials that have an intrinsic magnetic field.
- d) Pass a current through a coil of wire.

WILEY

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WILEY

28.3.1. Consider the following quantities: (1) mass, (2) velocity, (3) charge, and (4) magnetic field strength. Upon which of these quantities is the force on a charged particle moving in a magnetic field dependent?

- a) 1 and 4 only
- b) 2 and 3 only
- c) 1, 3, and 4 only
- d) 2, 3, and 4 only
- e) 1, 2, and 3 only

WILEY

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WILEY

28.3.2. A charged particle is moving in a magnetic field. What is the direction of the force on the particle due to the magnetic field?

- a) in the direction of the magnetic field
- b) in the direction opposite to which the particle is moving
- c) in the direction that is perpendicular to both the magnetic field and the velocity
- d) in the same plane as the magnetic field and the velocity, but not in either of those two directions
- e) in the direction of motion

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WILEY

28.3.3. Which of the following combinations of units is equivalent to the tesla?

- a)  $N/(A \cdot m)$
- b)  $N \cdot A/m$
- c)  $(J \cdot s)/(A \cdot m)$
- d)  $J/(C \cdot s)$
- e)  $C/(J \cdot s)$

WILEY

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WILEY

28.3.4. Complete the following sentence: When a positively-charged particle is released from rest in a region that has a magnetic field directed due east, the particle will

- a) remain at rest.
- b) be accelerated due east.
- c) be accelerated due north.
- d) be accelerated upward.
- e) be accelerated downward.

WILEY

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28.3.5. Which one of the following conditions is not a requirement for a particle to experience a magnetic force when placed in a magnetic field?

- a) The particle must be moving.
- b) The particle must be charged.
- c) The particle must not be under the influence of any other forces.
- d) The velocity of the particle must have a component that is perpendicular to the direction of the magnetic field.

WILEY

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38.3.6. Which one of the following is the SI unit for the magnetic field?

- a) monopole (MP)
- b) tesla (T)
- c) fermi (Fm)
- d) gross (G)
- e) Oersted (oe)

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28.3.7. What is the use of a bubble chamber?

- a) to accelerate charged particles before they move into a magnetic field
- b) to allow the trajectory of charged particles moving in a magnetic field to be observed and measured
- c) to make a magnetic field within a region of space uniform
- d) to increase the mass of charged particles so that their trajectories are more easily observed
- e) to charge a neutral particle or the increase the charge on a particle before it enters a magnetic field

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28.3.8. What is Right-Hand Rule used to determine?

- a) Given the directions of the magnetic field and the velocity of a charged particle, it is used to find the direction of the magnetic force on the particle.
- b) Given the directions of the magnetic field and magnetic force on a charged particle, it is used to determine the magnitude and sign of charge on the particle.
- c) Given the magnitude and sign of the charge on a particle and the direction of the magnetic force, it is used to determine the net force on the particle.
- d) It is used to determine the direction of the "reaction force" when applying Newton's third law of motion to the particle.

WILEY

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28.4.1. J.J. Thompson discovered which of the following with his crossed fields experiment?

- a) magnetic field
- b) electrons
- c) magnetic monopoles
- d) protons
- e) neutrons

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28.4.2. Which of the following scientists is credited with the discovery of the electron?

- a) Planck
- b) Curie
- c) Maxwell
- d) Thompson
- e) Fermi

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WILEY

28.5.1. Which one of the following quantities can be measured by performing a Hall effect measurement?

- a) magnetic monopole strength
- b) charge of the electron
- c) number density of charge carriers
- d) acceleration of an electron
- e) work function

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28.6.1. A negatively-charged particle is slowly moving as it enters a region that has a constant magnetic field. If the velocity of the particle is initially perpendicular to the magnetic field, what will be the subsequent motion of the particle?

- a) It will follow a helical path around the magnetic field lines.
- b) It will follow a circular path in the plane perpendicular to the magnetic field lines.
- c) It will follow a straight line path in the same direction as it was initially traveling.
- d) It will follow a circular path in a plane parallel to the magnetic field lines.
- e) It is impossible to predict the path the particle will follow.

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WILEY

28.6.2. A negatively-charged particle is slowly moving as it enters a region that has a constant magnetic field. If the velocity of the particle is initially parallel to the magnetic field, what will be the subsequent motion of the particle?

- a) It will follow a helical path around the magnetic field lines.
- b) It will follow a circular path in the plane perpendicular to the magnetic field lines.
- c) It will follow a straight line path in the same direction as it was initially traveling.
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28.6.3. What must the initial state of motion of a charged particle be if it will follow a helical path in a magnetic field?

- a) It must be moving at an angle that is neither parallel to nor perpendicular to the magnetic field.
- b) It must be moving parallel to the magnetic field.
- c) It must be moving perpendicular to the magnetic field.
- d) It must be moving in the direction opposite to the magnetic field.
- e) It must be initially at rest when it is placed in the magnetic field.

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- d) It must be moving in the direction opposite to the magnetic field.
- e) It must be initially at rest when it is placed in the magnetic field.

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28.6.4. An electron is traveling due south when it enters a uniform magnetic field directed due west. Which of the following statements concerning this situation is false?

- a) The subsequent motion of the electron will be the same as if there were an electric field directed due west and no magnetic field present.
- b) The electron will follow a curved path.
- c) The direction of the magnetic force on the electron will vary with time.
- d) The magnitude of the magnetic force will be constant with time.
- e) The direction of the magnetic field and the direction of the magnetic force on the electron are perpendicular to one another.

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28.7.1. Which of the following instruments is used in the field of high energy physics to accelerate protons to very high energies along circular paths?

- a) magnetron
- b) synchrotron
- c) ignitron
- d) betatron
- e) quartertron

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28.8.1. A long wire carries a current toward the north in a magnetic field that is directed vertically downward. What is the direction of the magnetic force on the wire?

- a) west
- b) north
- c) east
- d) vertically upward
- e) vertically downward

WILEY

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WILEY

28.8.2. A long wire carries a current toward the east in a magnetic field that is directed due south. What is the direction of the magnetic force on the wire?

- a) west
- b) north
- c) east
- d) vertically upward
- e) vertically downward

WILEY

28.8.2. A long wire carries a current toward the east in a magnetic field that is directed due south. What is the direction of the magnetic force on the wire?

- a) west
- b) north
- c) east
- d) vertically upward
- e) vertically downward

WILEY

28.8.3. Which one of the following parameters is not used to determine the magnetic force on a current-carrying wire in a magnetic field?

- a) length of the wire
- b) radius of the wire
- c) direction of the magnetic field with respect to the direction of the current
- d) the strength of the magnetic field
- e) the magnitude of the electric current

WILEY

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28.10.1. Consider the following quantities: (1) current, (2) resistance, (3) coil area, (4) wire cross-sectional area, and (5) magnetic field. Upon which of the quantities is the magnetic dipole moment of a current carrying coil dependent?

- a) 1 and 5 only
- b) 1 and 2 only
- c) 2 and 3 only
- d) 1, 3, 4, and 5
- e) 1 and 3 only

WILEY

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28.10.2. A magnetic dipole has two stable orientations in a magnetic field. At what two angles relative to the magnetic field direction are these orientations?

- a)  $0^\circ$  and  $90^\circ$
- b)  $0^\circ$  and  $180^\circ$
- c)  $90^\circ$  and  $270^\circ$
- d)  $45^\circ$  and  $135^\circ$
- e)  $45^\circ$  and  $90^\circ$

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WILEY

28.10.3. At what orientation angle relative to the magnetic field direction does the magnetic potential energy of a magnetic dipole have its largest value?

- a)  $0^\circ$
- b)  $45^\circ$
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 WILEY

28.10.4. At what orientation angle relative to the magnetic field direction does the torque of a magnetic dipole have its largest value?

- a)  $0^\circ$
- b)  $45^\circ$
- c)  $90^\circ$
- d)  $135^\circ$
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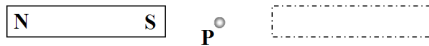
## Halliday/Resnick/Walker Fundamentals of Physics

### Classroom Response System Questions

#### Chapter 28 Magnetic Fields

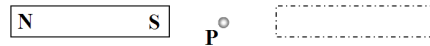
#### Interactive Lecture Questions

28.2.1. Consider the two rectangular areas shown with a point P located at the midpoint between the two areas. The rectangular area on the left contains a bar magnet with the south pole near point P. The rectangle on the right is initially empty. How will the magnetic field at P change, if at all, when a second bar magnet is placed on the right rectangle with its south pole near point P?



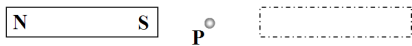
- The direction of the magnetic field will not change, but its magnitude will decrease.
- The direction of the magnetic field will not change, but its magnitude will increase.
- The magnetic field at P will be zero tesla.
- The direction of the magnetic field will change and its magnitude will increase.
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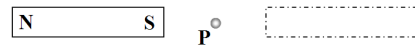
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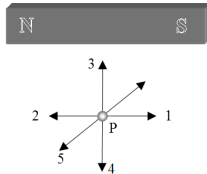


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28.2.3. What is the direction of the magnetic field at the point P, directly below a point at the center of the magnet? The numbered arrows represent various directions. Direction "1" is to the right, "2" to the left, "3" is upward, "4" is downward, and "5" is toward you.

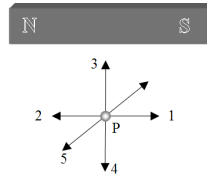
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- c) 3
- d) 4
- e) 5



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- a) 1
- b) 2
- c) 3
- d) 4
- e) 5



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28.2.4. Two rods are resting on a table. Although they appear to be identical, one is a permanent magnet and the other is made from soft iron and is not permanently magnetized. Which one of the following methods is most likely to reveal which rod is the magnet and which is the soft iron?

- a) Take one of the rods and touch it to each end of the other rod.
- b) Use a magnetic monopole to find the end of one of the rods that repels it.
- c) Move a compass along each rod to see if the compass needle behaves as it should in a magnetic field.
- d) There is no way to tell the difference between the two rods.

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- d) There is no way to tell the difference between the two rods.

WILEY

28.3.1. A negatively-charged particle travels parallel to magnetic field lines within a region of space. Which one of the following statements concerning the force exerted on the particle is true?

- a) The force is directed perpendicular to the magnetic field.
- b) The force is perpendicular to the direction in which the particle is moving.
- c) The force slows the particle.
- d) The force accelerates the particle.
- e) The force has a magnitude of zero newtons.

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28.3.2. A positively-charged particle is stationary in a constant magnetic field within a region of space. Which one of the following statements concerning the particle is true?

- a) The particle will not move.
- b) The particle will accelerate in the direction perpendicular to the field.
- c) The particle will accelerate in the direction parallel to the field.
- d) The particle will accelerate in the direction opposite to the field.
- e) The particle will move with constant velocity in the direction of the field.

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- e) The particle will move with constant velocity in the direction of the field.

WILEY

28.3.3. Which one of the following statements concerning the magnetic force on a charged particle in a magnetic field is true?

- a) The magnitude of the force is largest when the particle is not moving.
- b) The force is zero if the particle moves perpendicular to the field.
- c) The magnitude of the force is largest when the particle moves parallel to the direction of the magnetic field.
- d) The force depends on the component of the particle's velocity that is perpendicular to the field.
- e) The force acts in the direction of motion for a positively charged particle.

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- b) The force is zero if the particle moves perpendicular to the field.
- c) The magnitude of the force is largest when the particle moves parallel to the direction of the magnetic field.
- d) The force depends on the component of the particle's velocity that is perpendicular to the field.
- e) The force acts in the direction of motion for a positively charged particle.

WILEY

28.3.4. An electron traveling due east in a region that contains only a magnetic field experiences a vertically *downward force*, toward the surface of the earth. What is the direction of the magnetic field?

- a) upward, away from the earth
- b) downward, toward the earth
- c) due north
- d) due west
- e) due south

WILEY

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- b) downward, toward the earth
- c) due north
- d) due west
- e) due south

WILEY

28.3.5. A charged particle is moving through a constant magnetic field. Does the magnetic field do work on the charged particle?

- a) yes, because the force is acting as the particle is moving through some distance
- b) no, because the magnetic force is always perpendicular to the velocity of the particle
- c) no, because the magnetic field is a vector and work is a scalar quantity
- d) no, because the magnetic field is conservative
- e) no, because the magnetic force is a velocity-dependent force

WILEY

28.4.1. An electron is traveling due south in a region of space at a constant speed. What can you conclude from this situation regarding the presence any electric and/or magnetic fields?

- a) The electric field must be zero, but the magnetic field might be non-zero in the region.
- b) The magnetic field must be zero, but the electric field might be non-zero in the region.
- c) Both the electric and magnetic field might be non-zero, but they are perpendicular to each other in the region.
- d) Both the electric and magnetic field might be non-zero, but they point in opposite directions in the region.
- e) Both the electric and magnetic field must be zero in the region.

WILEY

28.5.1. Two metal bars, A and B, are identical in all ways, except that bar B has twice the width of A. The bars are parallel to each other, but far apart from each other, in a uniform magnetic field and carry the same amount of current in a direction perpendicular to the field. How does the Hall voltage of bar B compare to that of bar A?

- a) The Hall voltage for bar B will be four times greater than that of bar A.
- b) The Hall voltage for bar B will be two times greater than that of bar A.
- c) The Hall voltage for bar B will be the same as that of bar A.
- d) The Hall voltage for bar B will be one-half that of bar A.
- e) The Hall voltage for bar B will be one-fourth that of bar A.

WILEY

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WILEY

28.6.1. An alpha particle (a helium nucleus which has a net positive charge) is moving due east when it enters a magnetic field that is directed due north. Which one of the following statements best describes the motion of the alpha particle after entering the magnetic field?

- a) The particle decelerates while traveling along a straight line until it stops.
- b) The particle continues at a constant speed, but its direction changes as it follows a circular path.
- c) The particle continues at a constant speed, but its direction changes as it follows a parabolic path.
- d) The particle slows and changes direction to accelerate to move due north.
- e) The particle slows and changes direction to accelerate to move directly upward.

WILEY

28.7.1. Ernest O. Lawrence, of the University of California, Berkeley, invented the cyclotron in 1929. A more modern version was completed in 1961 at the Lawrence-Livermore Laboratory that has a radius of 88 inches. What is the frequency of circular motion at the "88-incher" if protons are circulating in a magnetic field of 0.48 T?

- a)  $1.4 \times 10^6$  Hz
- b)  $4.5 \times 10^6$  Hz
- c)  $7.3 \times 10^6$  Hz
- d)  $3.6 \times 10^5$  Hz
- e)  $9.7 \times 10^4$  Hz

WILEY

28.7.2. Two positively-charged particles are moving in circles within a uniform magnetic field. Particle A has a radius that is one-half that of particle B. Which one of the following statements concerning these particles is true?

- a) Both the velocity of particle A and its frequency are larger than those of particle B.
- b) Both the velocity of particle A and its frequency are smaller than those of particle B.
- c) The velocity of particle A is larger than that of particle B, but its frequency is smaller than that of particle B.
- d) The velocity of particle A is smaller than that of particle B, but its frequency is larger than that of particle B.
- e) The velocity of particle A is smaller than that of particle B, but they both have the same frequency.

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- d) The velocity of particle A is smaller than that of particle B, but its frequency is larger than that of particle B.
- e) The velocity of particle A is smaller than that of particle B, but they both have the same frequency.

WILEY

28.8.1. Three long, straight, identical wires are inserted one at a time into a magnetic field directed due east. Wire A carries a current of 2 A in the direction of  $45^\circ$  south of east. Wire B carries a current of 8 A, due north. Wire C carries a current of 10 A, due west. Rank the wires in terms of the magnitude of the magnetic force on each wire, with the largest force listed first and the smallest force listed last.

- a)  $A > B > C$
- b)  $B > A > C$
- c)  $C > B > A$
- d)  $A > C > B$
- e)  $B > C > A$

WILEY

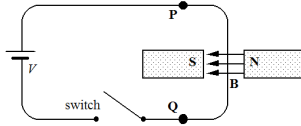
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- d)  $A > C > B$
- e)  $B > C > A$

WILEY

28.8.2. A portion of a loop of wire passes between the poles of a magnet as shown. We are viewing the circuit from above. When the switch is closed and a current passes through the circuit, what is the movement, if any, of the wire between the poles of the magnet?

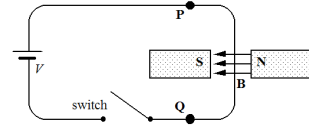
- a) The wire moves toward the north pole of the magnet.
- b) The wire moves toward the south pole of the magnet.
- c) The wire moves upward (toward us).
- d) The wire moves downward (away from us).
- e) The wire doesn't move.



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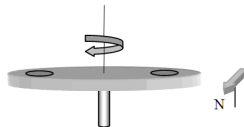
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WILEY

28.8.3. Small charged disks are inserted into a larger, insulating disk. A compass is placed near the larger disk and points due north as shown. The larger disk is then rotated uniformly counterclockwise (as viewed from above). What, if anything, will happen?

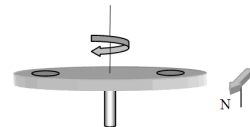
- a) The north end of the compass will move toward the large disk as it rotates.
- b) The north end of the compass will move away from the large disk as it rotates.
- c) The compass will not be affected by the motion of the large disk.
- d) The north end of the compass will oscillate toward and away from the large disk as it rotates.



WILEY

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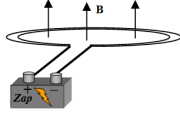
- a) The north end of the compass will move toward the large disk as it rotates.
- b) The north end of the compass will move away from the large disk as it rotates.
- c) The compass will not be affected by the motion of the large disk.
- d) The north end of the compass will oscillate toward and away from the large disk as it rotates.



WILEY

28.9.1. A circular loop of wire is placed in a magnetic field such that the plane of the loop is perpendicular to the magnetic field. The loop is then connected to a battery and a current then flows through the loop. Which one of the following statements concerning this situation is true?

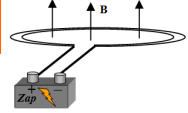
- a) The magnetic force exerts a net torque on the loop.
- b) The magnetic force exerts a net force on the loop.
- c) The magnetic force exerts both a net force and a net torque on the loop.
- d) The magnetic field has no effect on the loop.



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- c) The magnetic force exerts both a net force and a net torque on the loop.
- d) The magnetic field has no effect on the loop.



WILEY

28.10.1. Consider the relationships between the directions of the torque acting on a magnetic dipole in a magnetic field, the magnetic field, and the magnetic dipole moment. Which one of the following statements regarding these directions is true?

- a) The torque is parallel to both the magnetic field and the dipole moment.
- b) The torque is perpendicular to the magnetic field, but parallel to the dipole moment.
- c) The torque is parallel to the magnetic field, but perpendicular to the dipole moment.
- d) The torque is perpendicular to both the magnetic field and the dipole moment.

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