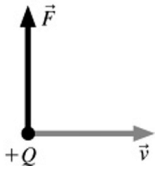
1) A straight bar magnet is initially 4 cm long, with the north pole on the right and the south pole on the left. If you cut the magnet in half, the right half will
   A) contain only a north pole.
   B) no longer contain any poles.
   C) contain a north pole on the right and a south pole on the left.
   D) contain only a south pole.

2) Which one of the following statements is correct?
   A) Earth's geographic north pole is the north pole of Earth's magnetic field.
   B) The north pole of a magnet points towards Earth's geographic south pole.
   C) The north pole of a magnet points towards Earth's geographic north pole.
   D) Earth's geographic south pole is the south pole of Earth's magnetic field.
   E) None of the above statements is correct.

3) A positive charge is moving to the right and experiences an upward magnetic force, as shown in the figure. In which direction must the magnetic field have a component?



   A) out of the page
   B) to the left
   C) upward
   D) to the right
   E) into the page

4) A proton, moving north, enters a magnetic field. Because of this field, the proton curves downward. We may conclude that the magnetic field must have a component
   A) upward.
   B) towards the north.
   C) towards the west.
   D) downward.
   E) towards the east.

5) If a calculated quantity has units of $\frac{\mathrm{N \cdot s}}{\mathrm{C \cdot m}}$, that quantity could be
   A) an electric field.
   B) a magnetic torque.
   C) an electric potential.
   D) a magnetic field.
   E) μ_0.

6) If a calculated quantity has units of $T \cdot m/A$, that quantity could be
A) a magnetic field.
B) a magnetic torque.
C) an electric field.
D) μ_0.
E) an electric potential.

7) After landing on an unexplored Klingon planet, Spock tests for the direction of the magnetic field by firing a beam of electrons in various directions and by recording the following observations:
Electrons moving upward feel a magnetic force in the northwest direction.
Electrons moving horizontally toward the north are pushed downward.
Electrons moving horizontally toward the southeast are pushed upward.

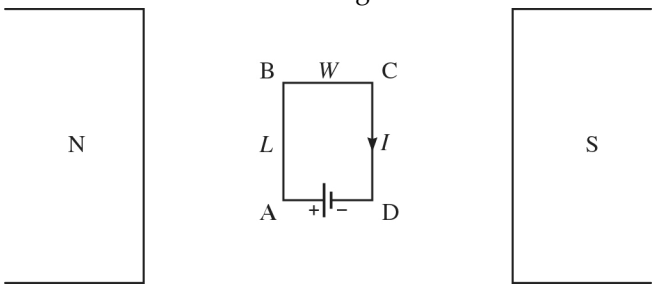
Mr. Spock therefore concludes that the magnetic field at this landing site is in which direction?
A) toward the southeast
B) toward the west
C) toward the east
D) toward the northeast
E) toward the southwest

8) A charged particle is injected into a uniform magnetic field such that its velocity vector is perpendicular to the magnetic field lines. Ignoring the particle's weight, the particle will
A) move in a straight line.
B) move along a parabolic path.
C) follow a circular path.
D) follow a spiral path.

9) A particle carrying a charge of $+e$ travels in a circular path of radius R in a uniform magnetic field. If instead the particle carried a charge of $+2e$, the radius of the circular path would have been
A) $2R$. B) $R/2$. C) $8R$. D) $R/4$. E) $4R$.

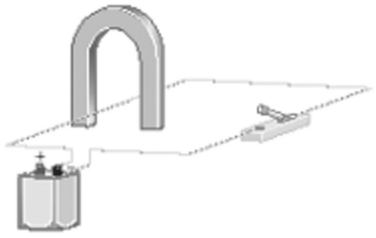
10) A proton, moving in a uniform magnetic field, moves in a circle perpendicular to the field lines and takes time T for each circle. If the proton's speed tripled, what would now be its time to go around each circle?
A) $3T$ B) $9T$ C) $T/3$ D) $T/9$ E) T

11) A rectangular coil, with corners labeled ABCD, has length L and width w. It is placed between the poles of a magnet, as shown in the figure If there is a current I flowing through this coil in the direction shown, what is the direction of the force acting on section BC of this coil?



A) in the direction of the magnetic field
B) perpendicular to and into the page
C) perpendicular to and out of the page
D) in the opposite direction of the magnetic field
E) The force is zero.

12) For the horseshoe magnet shown in the figure, the left end is a north magnetic pole and the right end is a south magnetic pole. When the switch is closed in the circuit, which way will the wire between the poles of the horseshoe magnet initially deflect?



A) upward B) to the right C) to the left D) downward

13) When two long parallel wires carry unequal currents, the magnitude of the magnetic force that one wire exerts on the other is F. If the current in both wires is now doubled, what is the magnitude of the new magnetic force on each wire?

A) $F\sqrt{2}$ B) $16F$ C) $8F$ D) $2F$ E) $4F$

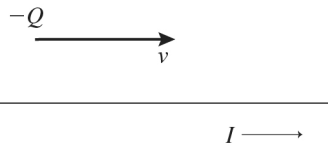
14) The maximum torque on a flat current–carrying loop occurs when the angle between the plane of the loop's area and the magnetic field vector is

A) 90° B) 135° C) 0° D) 45°

15) Two long parallel wires placed side–by–side on a horizontal table carry identical current straight toward you. From your point of view, the magnetic field at a point exactly between the two wires

A) points downward.
B) points toward you.
C) is zero.
D) points upward.
E) points away from you.

16) A negatively charged particle $-Q$ is moving to the right, directly above a wire having a current I flowing to the right, as shown in the figure. In what direction is the magnetic force exerted on the particle due to the current?

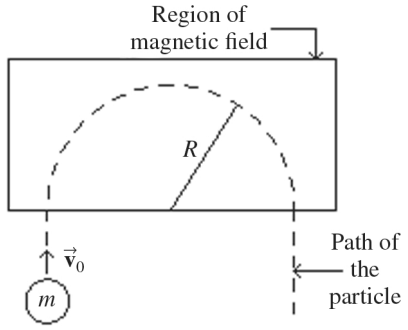


A) down B) into page C) out of page D) up E) zero .

17) A proton moving with a velocity of 4.0×10^4 m/s enters a magnetic field of 0.20 T. If the angle between the velocity of the proton and the direction of the magnetic field is 60°, what is the magnitude of the magnetic force on the proton? ($e = 1.60 \times 10^{-19}$ C)

18) A proton is accelerated from rest through 0.50 kV. It then enters a uniform magnetic field of 0.30 T that is oriented perpendicular to its direction of motion.
(a) What is the radius of the path the proton follows in the magnetic field?
(b) How long does it take the proton to make one complete circle in the magnetic field?.

19) In the figure, a small particle of charge –1.9 x 10^{-6} C and mass $m = 3.1 \times 10^{-12}$ kg has speed $v_0 = 8.1 \times 10^3$ m/s as it enters a region of uniform magnetic field. The particle is initially traveling perpendicular to the magnetic field and is observed to travel in the semicircular path shown with radius R = 5.0 cm. Find the magnitude and direction of the magnetic field in the region.

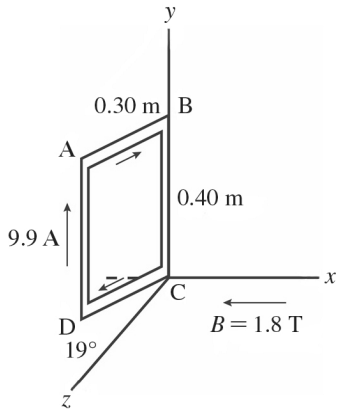


20) An electron is accelerated from rest through a potential difference of 3.75 kV. It enters a region where a uniform 4.0–mT magnetic field is perpendicular to the velocity of the electron. Calculate the radius of the path this electron will follow in the magnetic field. ($e = 1.60 \times 10^{-19}$ C, $m_{\text{electron}} = 9.11 \times 10^{-31}$ kg)

21) A straight wire carries a current of 10 A at an angle of 30° with respect to the direction of a uniform 0.30–T magnetic field. Find the magnitude of the magnetic force on a 0.50–m length of the wire.

22) A thin copper rod 1.0 m long has a mass of 0.050 kg and is in a magnetic field of 0.10 T. What minimum current in the rod is needed in order for the magnetic force to balance the weight of the rod?

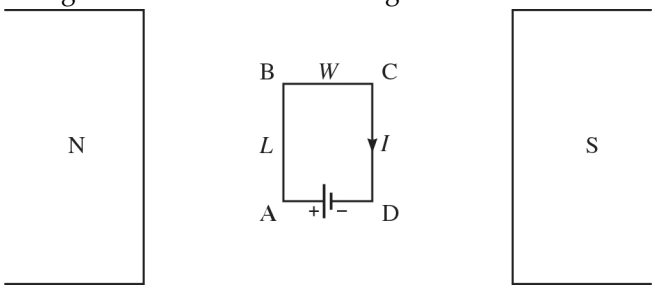
23) A rigid rectangular loop, measuring 0.30 m by 0.40 m, carries a current of 9.9 A, as shown in the figure. A uniform external magnetic field of magnitude 1.8 T in the –x direction is present. Segment CD is in the xz–plane and forms a 19° angle with the z–axis, as shown. What is the y component of the magnetic force on segment AB of the loop?



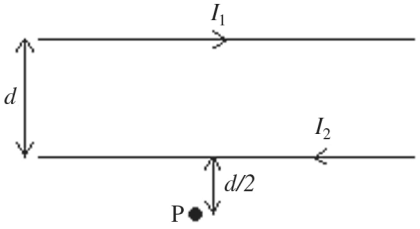
24) Two parallel straight wires are 7.0 cm apart and 50 m long. Each one carries a 18–A current in the same direction. One wire is securely anchored, and the other is attached in the center to a movable cart. If the force needed to move the wire when it is not attached to the cart is negligible, with what magnitude force does the wire pull on the cart? ($\mu_0 = 4\pi \times 10^{-7}$ T • m/A)

25) A flat coil containing 25 identical loops carries 6.4 A of current. When it is placed in a uniform magnetic field of 0.22 T that is oriented parallel to the plane of the coil, the magnetic torque on it is 3.7 N • m.
(a) What is the magnetic moment of the coil?
(b) What is the area of each loop?

26) A flat rectangular loop of wire is placed between the poles of a magnet, as shown in the figure. It has dimensions $w = 0.60$ m and $L = 1.0$ m, and carries a current $I = 2.0$ A in the direction shown. The magnetic field due to the magnet is uniform and of magnitude 0.80 T. The loop rotates in the magnetic field and at one point the plane of the loop is perpendicular to the field. At that instant, what is the magnitude of the torque acting on the wire due to the magnetic field?

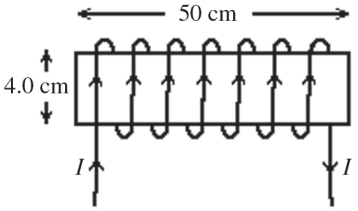


27) In the figure, the two long straight wires are separated by a distance of $d = 0.40$ m. The currents are $I_1 = 1.0$ A to the right in the upper wire and $I_2 = 8.0$ A to the left in the lower wire. What are the magnitude and direction of the magnetic field at point P, that is a distance $d/2 = 0.20$ m below the lower wire? ($\mu_0 = 4\pi \times 10^{-7}$ T • m/A)



28) In order to trap the starship Enterprise, the diabolical Klingons build a huge ideal solenoid 10 light-years long with a diameter of 2.0 million kilometers. Every kilometer of length of the solenoid contains 100 turns of wire. What magnetic field strength is produced near the center of the solenoid using a current of 2.00 kA? ($\mu_0 = 4\pi \times 10^{-7}$ T • m/A)

29) An ideal solenoid is wound with 470 turns on a wooden form that is 4.0 cm in diameter and 50 cm long. The windings carry a current in the sense shown in the figure. The current produces a magnetic field of magnitude 4.1 mT, at the center of the solenoid. What is the current I in the solenoid windings? ($\mu_0 = 4\pi \times 10^{-7}$ T • m/A)



Answer Key
Testname: CH20_MAGNETISM

1) C
2) C
3) E
4) E
5) D
6) D
7) E
8) C
9) B
10) E
11) E
12) D
13) E
14) C
15) C
16) D
17) 1.1×10^{-15} N
18) (a) 11 mm (b) 0.22 μs
19) 0.26 T, into the paper
20) 5.2 cm
21) 0.75 N
22) 4.9 A
23) +5.1 N
24) 46 mN
25) (a) 17 A $\cdot$ m^2 (b) 0.11 m^2
26) 0.00 N $\cdot$ m
27) $B = 7.7 \times 10^{-6}$ T, out of the plane of the paper.
28) 251 μT
29) 3.5 A