Name: _____Answer Key_____ Date: _____
Honors Physics Test #11 Review

Magnetism

1. Chapters 21 and 22 in text
2. Lodestone, magnetic poles, permanent magnet, temporary magnet, electromagnet, magnetic flux, right hand rules, EMF
3. How do like poles react? REPEL How do unlike poles react? ATTRACT
4. Can you separate the poles of a magnet? NO, you would only get smaller magnets
5. Magnetic Field lines
   - Around a bar magnet, around two like poles, around two unlike poles
   - What direction do magnetic field lines point? From North to South
   - Symbols for into the page X and out of the page ●
6. Direction a compass would point when near a bar magnet Out of N and into S
7. Hand rules
   - Conventional current follows which charges? (positive or negative) Which hand should you use? (right or left)
   - If a negative charge, i.e. electron, enters a magnetic field, which hand should you use? (right or left)
   - Three meanings: I and B, **or** B and F and v **or** B and I and F
8. Three equations from this unit and their meanings.
9. For a charge to experience a force it must be moving (perpendicular/parallel/at an angle) with the magnetic field?

Constructed Response Practice

10. A muon (a particle with the same charge as an electron) is traveling at 5.95 x 10^6 m/s at right angles to a magnetic field. The muon experiences a force of 6.84 x 10^{-15} N. Calculate the magnitude of the magnetic field.

Honors Equation F=Bqv

$$B = \frac{F}{qv} = \frac{6.84\times10^{-15}N}{(1.60\times10^{-19}C)(5.95\times10^{6}\ \frac{m}{s})} = 0.00718T$$

11. A beta particle (high speed electron) is traveling at right angles to a 0.60 T magnetic field. It has a speed of 2.5 x 10^7 m/s. Calculate the magnitude of the force acting on the particle.

$$F = Bqv = (0.60T)(1.6\times10^{-19}C)(2.5\times10^{6}\ \frac{m}{s}) = 2.4\times10^{-12}N$$

Honors Equation

12. A space vehicle is sent to Jupiter to explore the planet's properties from orbit. The vehicle travels 1.0 x 10^3 km/min. When in orbit, the probe deploys a horizontal antenna that is 120 m long. Data received on Earth indicate that the probe is flying over a location where the magnetic field is 0.18 T. Calculate the voltage induced between the antenna's tips.

Convert km/min into m/s

$$\frac{1.0\times10^3\,km}{\text{min}}\left(\frac{10^3\,m}{1km}\right)\left(\frac{1\,\text{min}}{60\text{s}}\right)=1.7\times10^4\ {}^{m}\!/_{s}$$

EMF is also called potential difference or voltage

Honors Equation

$$EMF = BIv = (0.18T)(120m)(1.7\times10^4\ {}^{m}\!/_{s}) = 3.7\times10^5 V$$

13. A wire 0.50 m long carrying a current of 8.0 A is at right angles to a uniform magnetic field. The force on the wire is 0.40 N. Calculate the magnitude of the magnetic field.

Honors Equation
F=BIl

$$B=\frac{F}{Il}=\frac{0.40N}{8.0A(0.50m)}=0.10T$$

14. A wire 625 cm long is in a 0.40 T magnetic field. A 1.8 N force acts on the wire.
    a. Calculate the current in the wire.

Honors Equation
F=BIl

$$I=\frac{F}{Bl}=\frac{1.8N}{(0.40T)(6.25m)}=0.72A$$

    b. If the wire is part of a circuit that has a potential difference of 12 V, calculate the total resistance of the circuit.

$$R=\frac{V}{I}=\frac{12V}{0.72A}=16.67\Omega=17\Omega$$

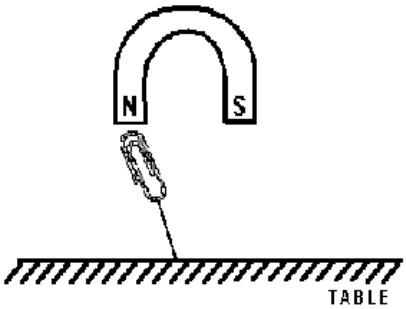
15. A magnetic field of 16 T acts in a direction due west. An electron is traveling due south at 8.1 x 10^5 m/s. Calculate the magnitude of the force acting on the electron.

Honors Equation

$$F = Bqv = (16T)(1.60\times10^{-19}C)(8.1\times10^5\ \tfrac{m}{s})$$
$$=2.1\times10^{-12}N$$

16. In the diagram below, a steel paper clip is attached to a string, which is attached to a table. The clip remains suspended beneath a magnet.

The field decreases the further away from the magnet you get



As the magnet is lifted, the paper clip begins to fall as a result of

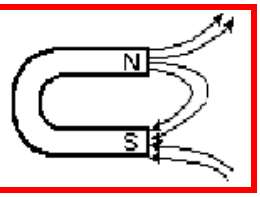
(A) an increase in the potential energy of the clip
(B) an increase in the gravitational field strength near the magnet
(C) a decrease in the magnetic properties of the clip
(D) a decrease in the magnetic field strength near the clip

17. An accelerating particle that does *not* generate electromagnetic waves could be

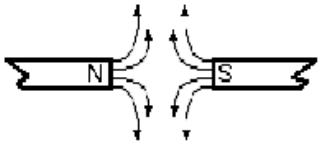
(A) an electron (B) a proton (C) a neutron (D) an alpha particle

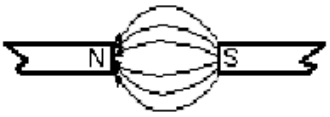
Moving charges create EM waves, neutrons are neutral

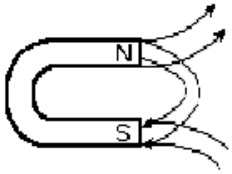
18. Which diagram correctly shows a magnetic field configuration?

A)


Out of the N, into the S

C)


B)


D)


Field lines can't cross

19. As a charged particle moves through a magnetic field, the particle is deflected. The magnitude of the magnetic force acting on the particle is directly proportional to the

(A) work done on the charge by the magnetic field
(B) polarity of the magnetic field
(C) electric charge on the particle
(D) mass of the particle

F=qvB

20. A potential difference of 12 volts is induced across a 0.20 meter long straight wire as it is moved at a constant speed of 3.0 meters per second perpendicular to a uniform magnetic field. What is the strength of the magnetic field?

(A) 7.2 T (B) 20. T (C) 13 T (D) 180 T

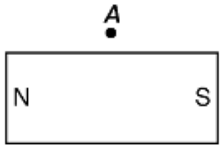
$$B = \frac{EMF}{lv} = \frac{12V}{(0.20m)(3.0\frac{m}{s})}$$

21. A wire conductor is moved at constant speed perpendicularly to a uniform magnetic field. If the strength of the magnetic field is increased, the induced potential across the ends of the conductor

(A) decreases (B) increases (C) remains the same

EMF = Blv

22. The diagram below shows a bar magnet

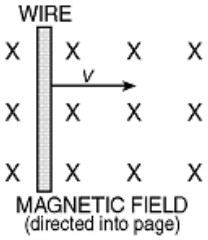


Compass points along magnetic field lines
Out of the north, into the south

Which arrow *best* represents the direction of the needle of a compass placed at point A?

A) ← B) ↑ C) ↓ D) →

23. The diagram below shows a wire moving to the right at speed v through a uniform magnetic field that is directed into the page.



EMF = Blv

As the speed of the wire is increased, the induced potential difference will

(A) decreases (B) increases (C) remains the same

24. In order to produce a magnetic field, an electric charge must be

(A) positive (B) negative (C) moving (D) stationary

25. Which type of field is present near a moving electric charge?

(A) a magnetic field, only
(B) an electric field, only
(C) neither an electric field nor a magnetic field
(D) both an electric and a magnetic field

Charges always have electric fields, moving charges also have magnetic field

26. A charged particle is moving with a constant velocity. On entering a uniform magnetic field, the particle

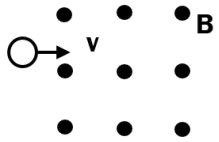
(A) may increase in kinetic energy
(B) must decrease in speed
(C) may change its direction of motion
(D) must change the magnitude of its momentum

The force is perpendicular to the motion creating a circular path

27. A cluster of magnetically aligned atoms in a magnetic material is called a

(A) domain (B) molecule (C) pole (D) charge (E) electron cloud

Questions 28 through 29 relate to a small particle entering a magnetic field B, which is directed out of the page as shown.



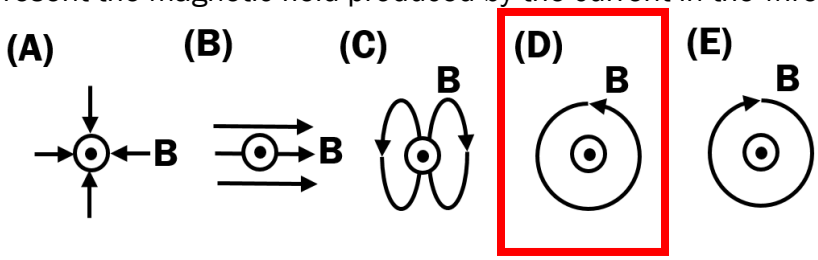
28. Which of the above particles would follow the path shown below while moving through the magnetic field?

(A) proton (B) electron (C) neutron (D) x-ray (E) photon

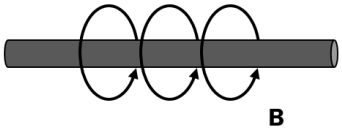
29. Which of the above particles would follow the path shown below while moving through the magnetic field?

(A) proton (B) electron (C) neutron (D) x-ray (E) photon

30. The current in a wire is directed out of the page and perpendicular to the page. Which of the following best represent the magnetic field produced by the current in the wire?



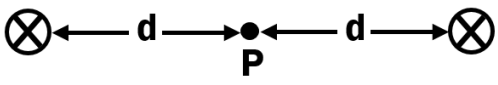
31. A wire carries a current, creating a magnetic field around itself as shown.



The current in the wire is

(A) directed to the right
(B) directed to the left
(C) equal to the magnetic field
(D) in the same direction as the magnetic field
(E) zero

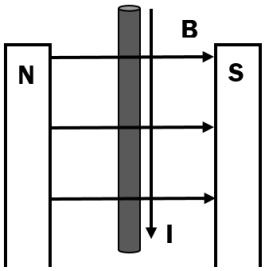
32. Two parallel wires are located a distance 2d apart. Each wire has a current of 1 A flowing into the page as shown above. The direction of the net magnetic field at point P halfway between the wires is



(A) upward (B) downwards (C) to the left (D) to the right (E) zero

Questions 33 through 34 refer to the following.

A wire carrying a current of 2 A is placed in a magnetic field of 0.1 T as shown. The length of the wire in the magnetic field is 0.3 m.



33. The force on the wire is directed

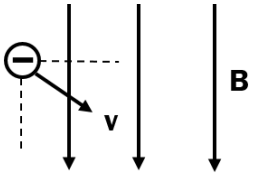
(A) into the page
(B) out of the page
(C) toward the top of the page
(D) toward the bottom of the page
(E) to the left

34. The magnitude of the force on the wire is

(A) 0.06 N (B) 2.0 N (C) 6.7 N (D) 0.15 N (E) 0.015 N

Questions 35 through 36 refer to the following.

An electron enters a magnetic field as shown.



35. The electron will experience a force that is initially

(A) into the page
(B) out of the page
(C) toward the top of the page
(D) toward the bottom of the page
(E) to the left

36. The subsequent path of the electron is a

(A) parabola (B) straight line (C) spiral or helix (D) hyperbola (E) circle

37. For electromagnetic induction to occur,

(A) a magnet must be at rest within a coil of wire
(B) a coil of wire must be at rest relative to the magnet
(C) a magnet must move through a coil of wire
(D) a magnet and a coil must have the same velocity
(E) a magnet must be pointing north

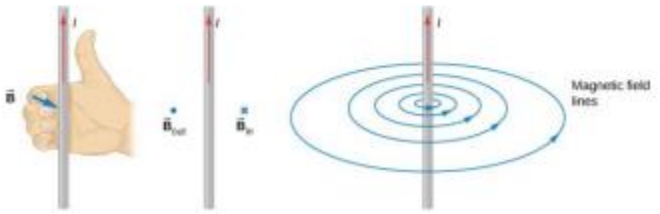
38. A magnet moves into a coil of wire, inducing a current in the wire. If the magnet is pulled back out of the coil in the opposite direction as it went into the coil, which of the following will occur?

(A) There will be a current produced in the coil in the same direction as before
(B) There will be a current produced in the coil in the opposite direction as before
(C) There will be no current produced in the coil
(D) The current produced must be stronger than before
(E) The current produced must be weaker than before

Answers:
10. 0.00718 T
11. 2.4 x 10^{-12} N
12. 3.7 x 10^{5} V
13. 0.10 T
14. a. 0.72 A
b. 17 Ω
15. 2.1 x 10^{-12} N
16. D
17. C
18. A
19. C
20. B
21. B
22. D
23. B
24. C
25. D
26. C
27. A
28. B
29. A
30. D
31. A
32. E
33. B
34. A
35. B
36. C
37. C
38. B

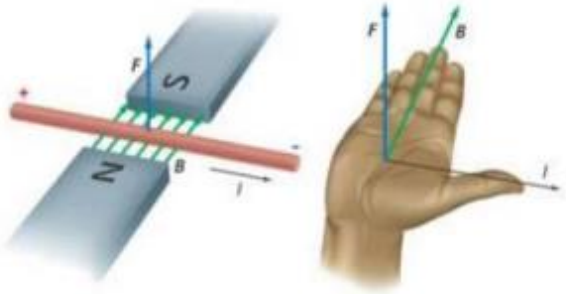
Straight Wire

- Thumb: Current (I)
- Fingers: Magnetic Field (B)



Current-Bearing Wire

- Thumb: Current (I)
- Fingers: Magnetic Field (B)
- Palm: Force (F)



Moving Charged Particle

- Thumb: Velocity (v)
- Fingers: Magnetic Field (B)
- Palm: Force (F)