Name _____

1. _____ _____ is the source of all magnetic fields.
2. _____ _____ are microscopic groups of atoms that have their magnetic fields aligned.
3. Unlike charged objects that have a positive and a negative charge, magnets have _____ and _____ poles.
4. _____ poles of a magnet attract and _____ poles repel.
5. Un-magnetized materials have their magnetic domains _____ aligned, while the magnetic domains of magnetic materials are _____. (see below)

Un-magnetized Iron Bar

Slightly magnetized Iron Bar

Strongly magnetized Iron Bar

6. Magnetic fields flow from _____ to _____ outside a magnet and from _____ to _____ inside a magnet.

7. Why does an iron nail become magnetized in the presence of a magnetic field?

8. What happens to a magnet if it is broken in half?

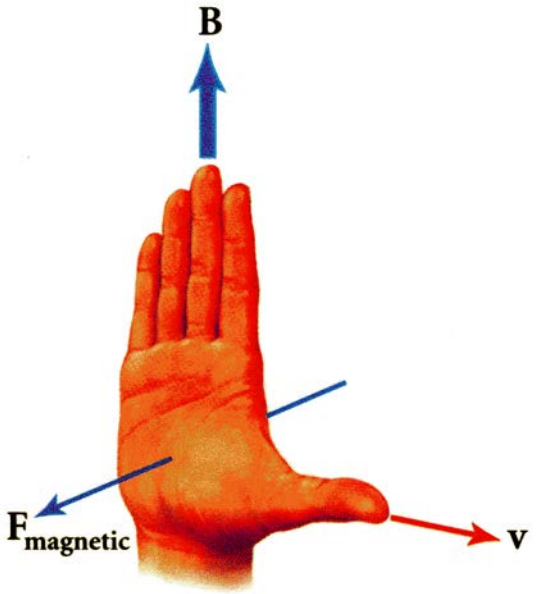
9. Strong magnets are called _____ magnets, and some of their properties are?

10. Weak magnets are called _____ magnets, and some of their properties are?

11. Ways that you can magnetize an object are?

12. Ways that you can de-magnetize an object are?

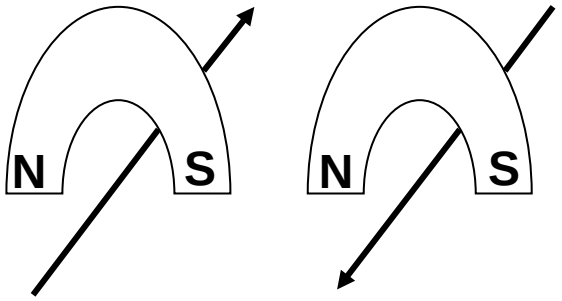
Right Hand Rule – Current or velocity, Magnetic field and direction of force.

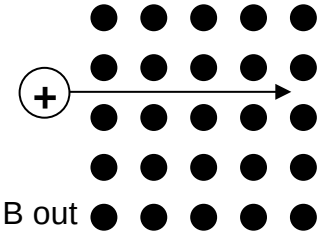


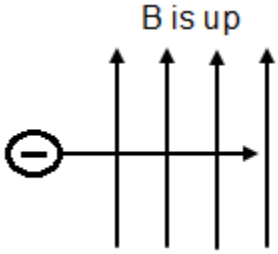
The direction of the magnetic force (F) on a moving charge is always perpendicular to both the magnetic field (going N to S) and the velocity of the charge V (direction of the current)

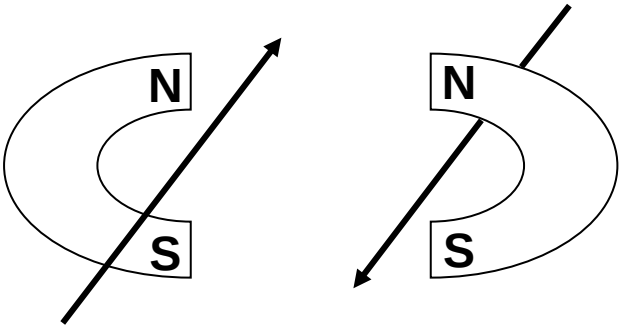
Into the page:

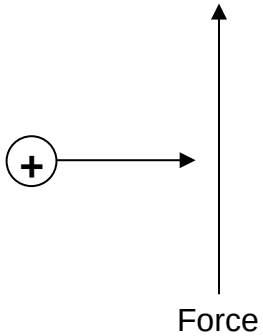
Out of the page:

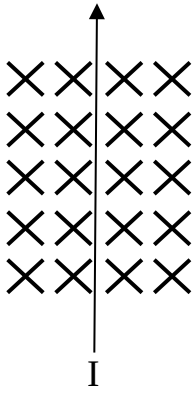










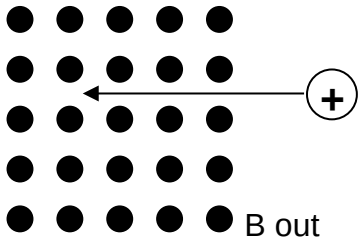


Name _____

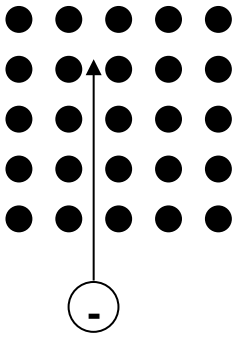
Magnetic Force Direction on a Moving Charge:

1. Determine the direction of the force on a moving charge.

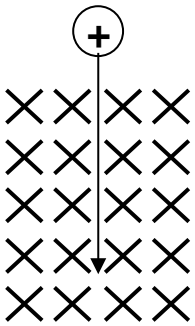
(a)



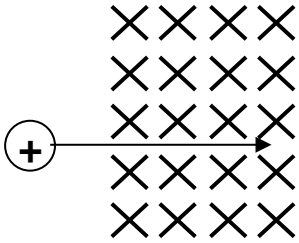
(b)



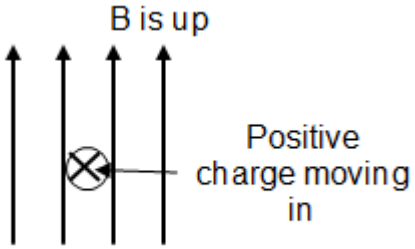
(c)



(d)



(e)



Magnetic Force on a Moving Charge:

$F = Bqv$

$B =$ Magnetic field strength in Teslas (T)

$q =$ Charge of the object in Coulombs (C)

$v =$ Velocity of the object (m/s)

1. A positive charge of 0.65 C moves to the right at 60 m/s and enters a magnetic field of 0.25 T directed downward (into the page). What is the magnitude and direction of the force on the charge?

Draw a diagram of the force, field, and velocity

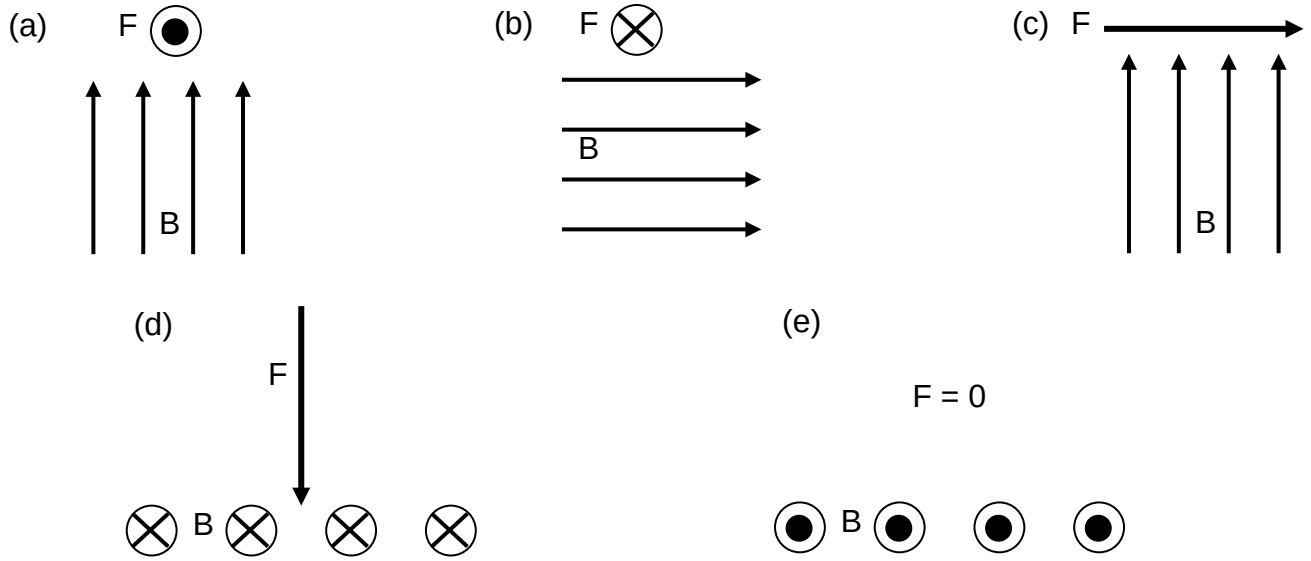
2. A positive charge of 0.9 C moves to the North at 250 m/s and enters a magnetic field of 0.15 T to the East. What is the magnitude and direction of the force on the charge?

Draw a diagram of the force, field, and velocity

Magnetic Force on a Current Carrying Wire:

Force Direction on a Wire – Use RHR, positive charge moving + to - :

1. Use the right hand rule to find the direction of the current in a wire based on the force and field.



Magnetic Force on a wire:

From our experience in the lab, we also know that a wire with a current in it also contains moving charges and will experience a force on it if it is placed in a magnetic field. Starting with the equation for a moving charge, derive an equation for the force on a current carrying wire.

$$F = BIL$$

$B =$ Magnetic field strength in Teslas (T)

$I =$ Current in the wire in amperes (A)

$L =$ Length of the wire in meters (m)

3. A 1.0 meter long wire with a 6.0 amp current to the left enters a magnetic field of 0.35 T directed toward the top of the page. What is the magnitude and direction of the force on the wire?

Draw a diagram of the force, field, and velocity

Magnetic Force Problems:

For each problem calculate the missing value and draw a diagram of the force, field, and direction of the velocity or current.

1. A positive charge of 0.25 C moves to the left at 200 m/s and enters a magnetic field of 0.40 T directed downward (into the page). What is the magnitude and initial direction of the force on the charge?

2. An electron traveling at 100 m/s to the left enters a uniform magnetic field and experiences a force of 5.0×10^{-15} N directed up (out of the page). What is the magnitude and direction of the magnetic field? (charge on an electron $q_e = 1.6 \times 10^{-19}$ C)

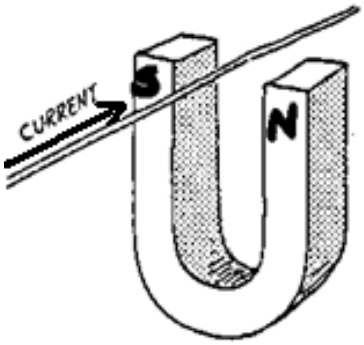
3. A straight wire of 50.0 cm long conducts a current of 4.00 A toward the top of the page, if the wire experiences a force of 0.02 N to the right. What is the magnitude and direction of the magnetic field?

4. A magnetic field of 0.01 T is directed out of the page. Find the force on a straight 0.75 m long wire with a 15 amp current. If the force on the wire is directed toward the bottom of the page, what is the direction of the current?

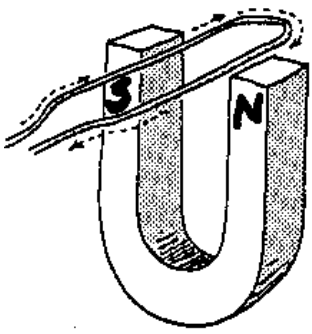
5. A horizontal copper wire 40 cm long with a weight of 0.35 N carries a current of 8.0A to the right. Determine the strength and direction of the magnetic field required to balance the force of gravity on the wire.

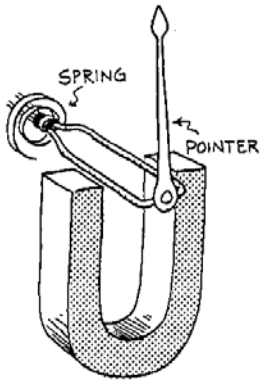
(1) 20 N (2) 312.5 T (3) 0.01 T (4) 0.1125 N (5) 0.109 T

ELECTRIC METERS AND MOTORS



When current flows through the wire placed in the magnetic field, as shown to the left, the wire is forced _____.If the wire is fomed into a loop, as shown to the right, the right side of the loop will be forced _____ and the left side of the loop will be forced _____ . This will cause the loop will tend to _____.



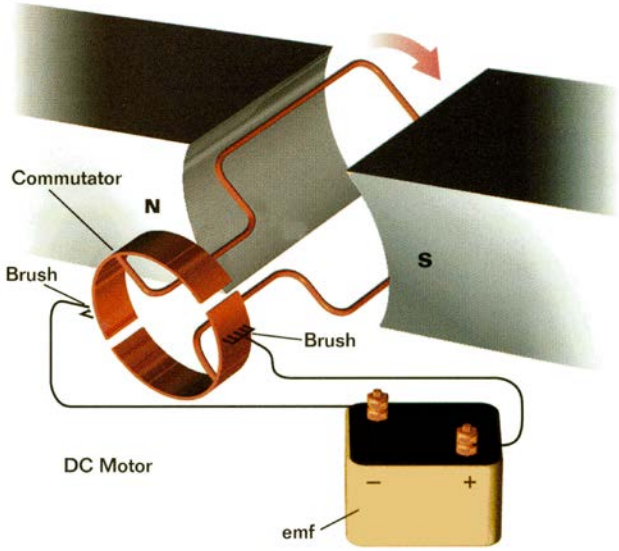


If you make the loop rotate against a spring and attach a pointer to it, you have made a simple electric meter. What type of meter is this?

If you make the current change direction (alternate) at every half turn, it will rotate continuously. You then have a motor.

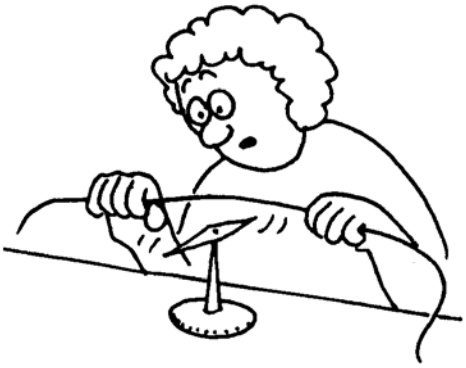
ELECTRIC MOTORS

If you remove the spring and the needle from the galvanometer and allow the coil to spin, you have made an _____ _____. Once your motor has moved ½ of a full revolution, the direction of the force will _____, making the motor spin _____. If you make the current change direction (alternate) at every half turn, it will rotate continuously. You then have a more efficient motor.



Faraday's Law

Circle the correct answers.

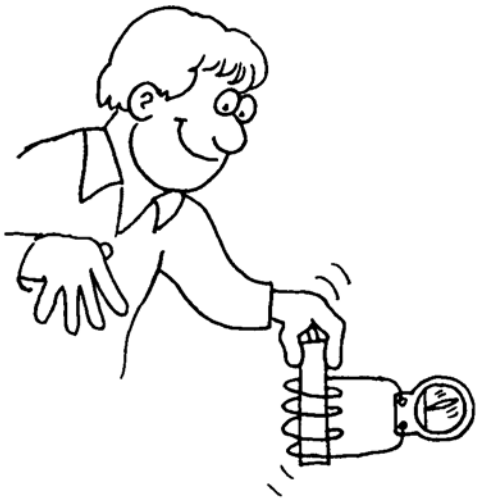


1. Hans-Christian Oersted discovered that magnetism and electricity are

   (related) (independent of each other).

   Magnetism is produced by

   (batteries) (the motion of electric charges).



Faraday and Henry discovered that electric current can be produced by

(batteries) (motion of a magnet).

More specifically, voltage is induced in a loop of wire if there is a change in the

(batteries) (magnetic field in a loop).

This phenomenon is called

(electromagnetism) (electromagnetic induction)

2. When a magnet is plunged in and out of a coil of wire, voltage is induced in the coil. If the rate of the <u>in-and-out</u> motion of the magnet is doubled, the induced voltage

   (doubles) (halves) (remains the same).

   If instead the number of loops in the coil is doubled, the induced voltage

   (doubles) (halves) (remains the same).

3. A rapidly changing magnetic field in any region of space induces a rapidly changing

   (electric field) (magnetic field) (gravitational field)

   which in turn induces a rapidly changing

   (electric field) (magnetic field) (gravitational field)

   This generation and regeneration of electric and magnetic fields makes up
   (electromagnetic waves) (sound waves) (both of these).

Electromagnetism Review

1. What two major components do an electric motor, a speaker, a microphone and an electric generator have in common?

2) Describe how the parts work together to make the different things work.

a) electric motor

b) speaker

c) microphone

d) generator

e)Which of these four items are pairs?

f) Which of these four items are opposites?

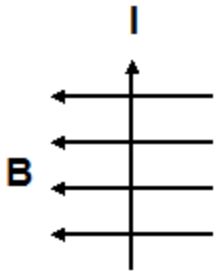
REVIEW RHR

For questions 1-7 use the following answers.

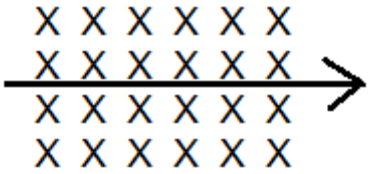
A = DOWN (Toward the Bottom of the page)
B = UP (Toward the Top of the page)
C = INTO THE PAGE
D = OUT OF THE PAGE
E = RIGHT
F = LEFT

For 1-3, find the direction of the force on the wire show as an arrow in its associated magnetic field. The current is in the direction of the tip of the arrow.

1. _____



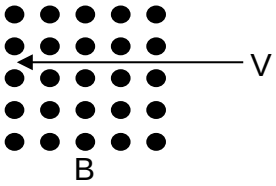
2. _____



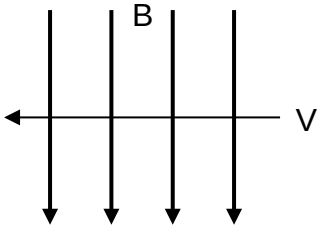
3. _____

This problem is intentionally left blank.

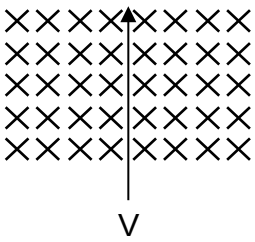
4. The force on an electron moving in the magnetic field as shown below would be _____.



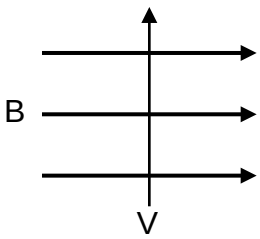
5. The force on a proton moving in the magnetic field as shown below would be_____.



6. The force on a proton moving in the magnetic field as shown below would be _____.



7. The force on an electron moving in the magnetic field as shown below would be _____



Force Calculations Review:

1. An object is thrown to the east with a velocity of 25 m/s at the equator where the magnetic field strength is 1.5×10^{-2} T straight north. It is noticed that the object is deflected upwards when it has a charge of 2.25 coulombs.

   What is the magnetic force on the object?

   Is the object charged positive or negative? Support your answer with a diagram.

2. A 1.5 meter long wire with a weight of 0.22 N is suspended in a magnetic field with strength of 0.665 T, What is the minimum current required to cause the wire to levitate?