Name _____ Regents Physics
Mr. Mellon Based on Chapters 24, 25, & 26

Unit 12: Magnetism and Electricity

Essential Questions

- What causes magnetism?
- What are magnetic domains and how must they align themselves in order for an object to be magnetized?
- What are the laws of magnetism?
- What is the direction of magnetic field lines? How can the strength of the magnetic field be indicated by the field lines?
- What is the direction of the magnetic field around a current-carrying wire?
- **EXTRA**: How can the direction of the force on a current-carrying wire within a magnetic field be predicted?
- **EXTRA**: List several ways how a current can be induced in a wire within a magnetic field. List several ways to gain maximum current.
- **EXTRA**: How can the direction of the force on a moving charged particle moving within a magnetic field be predicted?

I. Applications of Magnetism

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II. Review of Electric Field

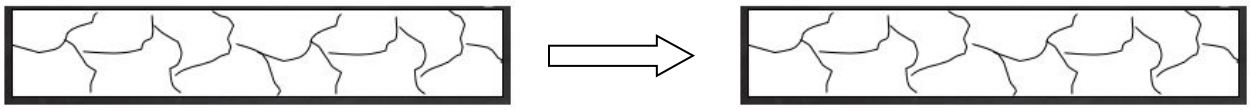
- Electric Field – created by objects that have a _____
- Electric Force – experienced by charges within an _____
- What happens if the charges are moving…?

III. Cause of Magnetism:

The _____ of _____ particles creates a _____

A. Magnetic Domains:

- Clusters of _____
- Each domain is perfectly magnetized and is made of billions of aligned atoms



Becomes a magnet when domains point in the same direction

B. Ferro magnets: Naturally occurring magnets

- **Examples:** _____
- **Created by:**

1. Leaving an ferromagnetic material in a strong _____
2. Running an _____ through a conductor

IV. Laws of Magnetism:

1. Every magnet has _____ poles: called _____ and _____

2. Like poles _____ (___ near a _____ or _____ near a _____)

And opposite poles _____ (_____ near a _____)

3. Magnetic poles on a magnet cannot be _____

V. Magnetic Field Lines:

Characteristics

1. Magnetic field lines form _____
2. Lines go from _____
3. Closer the field lines are, the _____ the magnetic field is
4. Lines _____

Like Poles **Unlike Poles**

VI. Magnetic Field Strength (Magnetic Flux):

- Field is strongest where lines are _____ ( )

VII. Magnetic Fields Created by Current-Carrying Wires

- A current carrying wire carries _____, therefore it creates a _____

A. Direction:

Current going into the page

Current going out of the page

Current going to the left

Current going to the right

_____ _____

_____ _____

Note: Farther you move away from the wire, _____ the magnetic field

VIII. Force on a Current in a Magnetic Field

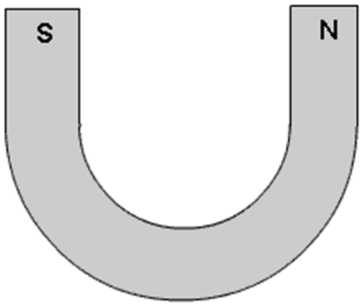
A. Current carrying wires are essentially _____

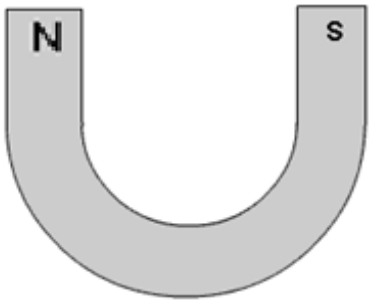
B. Moving electrical charges experience a _____ if placed in a _____

C. Direction of Force: (Left Hand Rule)

1. **Thumb points in the direction of _____**
2. **Fingers point in the direction of _____**
3. **Palm points in the direction of _____**

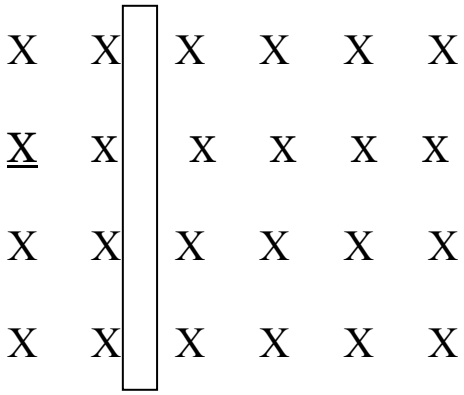
Example:





IX. Inducing a Current

- A current in a wire produces a magnetic field surrounding the wire.
- **Question**: Can a magnetic field cause a current to be induced in a wire?
- **Conceptual Development:**



- Electrons in the wire experience a magnetic force and are pushed _____
- Movement of the electrons _____ a _____

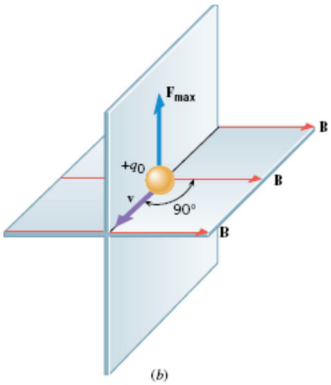
X. How do we create this Current (Faraday's Law)?

1. Move a coil _____ and _____ of a _____
2. _____ a coil in a _____
3. _____ the intensity of the _____

XI. How do we gain Maximum Current:

1. Wire must be _____ to magnetic field
2. Increase the _____ of coils of wire
3. Increase the _____ of wire or magnet
4. Increase the _____ of the magnetic field

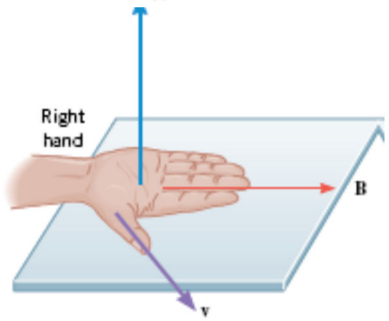
XII. Magnetic Forces on Charged Particles



- Moving charges _____
- If a charged particle moves through a magnetic field, it will experience a _____

A. Direction of Magnetic Force (Right Hand Rule):

1. Point fingers in the direction of _____
2. Point thumb in direction of _____
3. Palm points in the direction of _____



NOTE For _____ charges, use _____ hand (force is in the _____ direction)

Rules:

1. Charge must be _____
2. Velocity of moving charge must have a component _____ to the direction of the _____

XIII. Magnetic Field in 3-D

Positive Charge: B into the page

Positive Charge: B out of the page

Negative Charge: B into the page

Negative Charge: B out of the page

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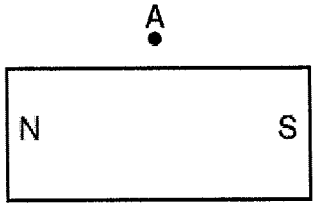
Magnetism

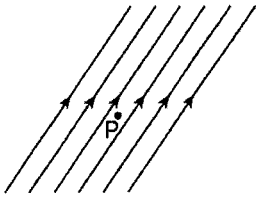
1. In order to produce a magnetic field, an electric charge must be
   1. stationary
   2. moving
   3. positive
   4. negative

2. The diagram below shows a bar magnet.

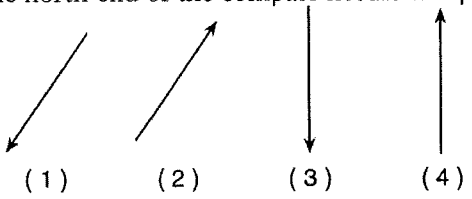


What is the direction of a compass needle placed at point A?
   1. up
   2. down
   3. right
   4. left

3. The diagram below represents the magnetic field near point P.



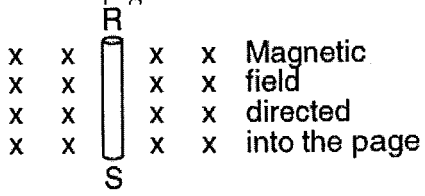
If a compass is placed at point P in the same plane as the magnetic field, which arrow represents the direction the north end of the compass needle will point?



4. Which type of field is present near a moving electric charge?
   1. an electric field, only
   2. a magnetic field, only
   3. both an electric field and a magnetic field
   4. neither an electric field nor a magnetic field

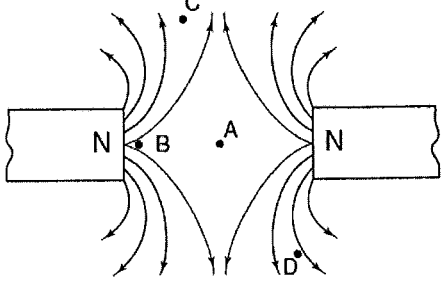
5. A student is given two pieces of iron and told to determine if one or both of the pieces are magnets. First, the student touches an end of one piece to one end of the other. The two pieces of iron attract. Next, the student reverses one of the pieces and again touches the ends together. The two pieces attract again. What does the student definitely know about the initial magnetic properties of the two pieces of iron?

6. The diagram below represents a wire conductor, RS, positioned perpendicular to a uniform magnetic field directed into the page.



Describe the direction in which the wire could be moved to produce the maximum potential difference across its ends, R and S. (CURRENT)

7. The diagram below shows the lines of magnetic force between two north magnetic poles.



At which point is the magnetic field strength greatest?
   1. A
   2. B
   3. C
   4. D

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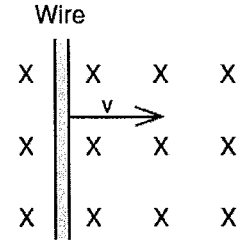
Magnetism

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

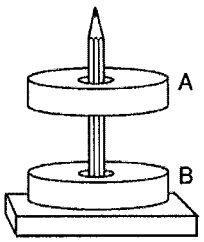


Magnetic field directed into page

As the speed of the wire is increased, the induced potential difference will (CURRENT)
1. decrease
2. increase
3. remain the same

9. Which is *not* a vector quantity?
1. electric charge
2. magnetic field strength
3. velocity
4. displacement

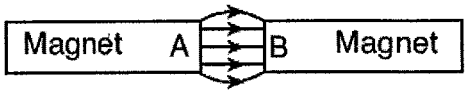
10. When two ring magnets are placed on a pencil, magnet A remains suspended above magnet B, as shown below.



Which statement describes the gravitational force and the magnetic force acting on magnet A due to magnet B?
1. The gravitational force is attractive and the magnetic force is repulsive.
2. The gravitational force is repulsive and the magnetic force is attractive.
3. Both the gravitational force and the magnetic force are attractive.
4. Both the gravitational force and the magnetic force are repulsive.

11. Moving a length of copper wire through a magnetic field may cause the wire to have a
1. potential difference across it
2. lower temperature
3. lower resistivity
4. higher resistance

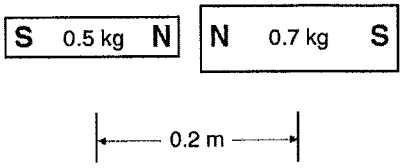
12. The diagram below shows the magnetic field lines between two magnetic poles, A and B.



Which statement describes the polarity of magnetic poles A and B?
1. A is a north pole and B is a south pole.
2. A is a south pole and B is a north pole.
3. Both A and B are north poles.
4. Both A and B are south poles.

13. Magnetic fields are produced by particles that are
1. moving and charged
2. moving and neutral
3. stationary and charged
4. stationary and neutral

14. The diagram below represents a 0.5-kilogram bar magnet and a 0.7-kilogram bar magnet with a distance of 0.2 meter between their centers.



Which statement best describes the forces between the bar magnets?
1. Gravitational force and magnetic force are both repulsive
2. Gravitational force is repulsive and magnetic force is attractive.
3. Gravitational force is attractive and magnetic force is repulsive.
4. Gravitational force and magnetic force are both attractive.

15. Draw a diagram of a bar magnet, with a minimum of four field lines to show the magnitude and direction of the magnetic field in the region surrounding the bar magnet.

Name:_____

Score: 10

Regents Physics

Worksheet 4.3.1 – Magnetism (10 points)

Show all work – multiple choice answers MUST be proven for full credit!

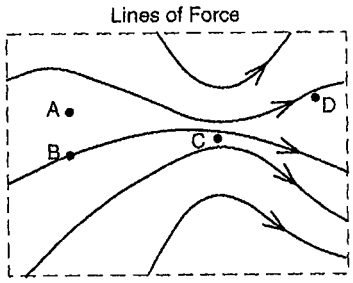
1. Sketch the magnetic field in each system.

a. N N

b. N S

c. S S

2. The diagram below represents magnetic lines of force within a region of space.



The magnetic field is strongest at point

(1) A (3) C

(2) B (4) D

Proof: Explain your reasoning.

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

(1) electric field only

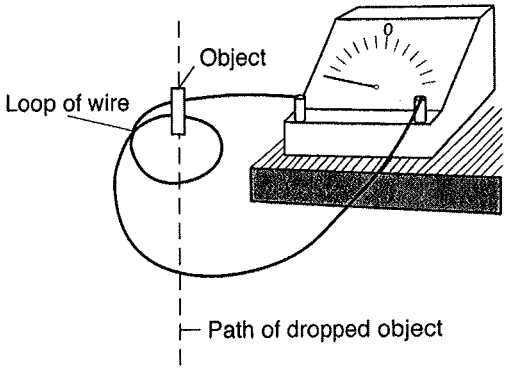
(2) magnetic field only

(3) both electric and magnetic fields

(4) neither electric nor magnetic fields

Proof: Explain your reasoning.

4. A small object is dropped through a loop of wire connected to a sensitive ammeter on the edge of a table as shown in the diagram below.



A reading on the ammeter is most likely produced when the object falling through the loop of the wire is a

(1) flashlight battery

(2) bar magnet

(3) brass mass

(4) plastic ruler

Proof: Explain your reasoning.