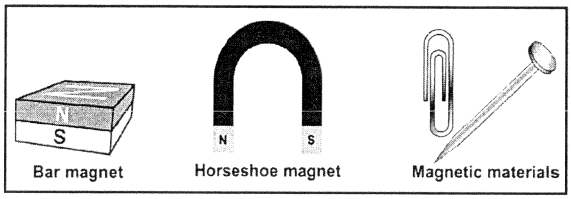
Name: _____

Period: _____

Magnetism

What is a Magnet?

A magnet is something that can attract metal or another magnet. A magnet can also repel another magnet.



Properties of magnets:

- Magnets have two opposite poles: north and south.
- If divided, each part of a magnet will also have a north and south pole (you can never make an un-paired pole)
- Magnets exert forces on other magnets, called "Magnetic forces"
- Opposite poles attract (North attracts South) Like poles repel (North repels North, etc)

Permanent and Temporary Magnets

Iron makes the best temporary magnets. Only lodestone and magnetite are permanent magnets.

Permanent magnet – a magnet that retains its magnetism and does not need to be "recharged." *Lodestone* and *magnetite* are the only two permanent magnetic substances.

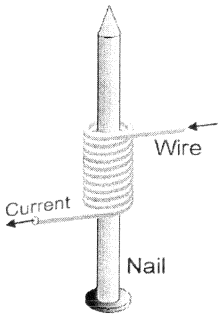
Temporary magnet – a magnet that occurs when near a permanent magnet, but loses its magnetism away from the permanent magnet; many metals can be temporary magnets.

Electromagnets

Electromagnet—a magnet made from electricity. When electricity moves it causes magnetism.

Best use of an electromagnet— we can turn it on and off. Toasters, doorbells: any job needing a force on command needs an electromagnet.

A simple electromagnet



Strengthening an electromagnet –

Increase electricity
– more batteries or stronger battery;

Increase number of coils
– actually adds electricity, too.

Add iron to the core (center of electromagnet)
- the iron amplifies the electromagnetic field.

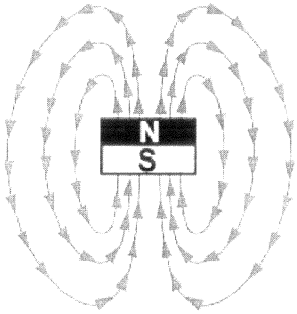
Second best use of an electromagnet
—we can control how much force we need by increasing or decreasing the electricity.

How do Magnets Work?

Spinning electrons cause magnetism.

Permanent magnets—all of the electrons in an atom are spinning the same way and the little electromagnets add up.

Temporary magnets— the electrons can switch to spin in the same way when near a magnet, but will fall back after the magnet leaves.



Any magnet will reach inside the magnetic field (the arrows)

The arrows show the direction a North pole would move in the magnetic field.

Magnetic Fields

Magnetic Field—the area in which a magnet or piece of metal feels the force of another magnet.

Rules for magnetic fields—
- drawn from North pole to South pole;
- closer or more arrows = stronger field.
- any magnet will react in a magnetic field.
- every magnet creates a magnetic field.

The magnet of a compass reacts to the Earth's magnetic field to point to ***magnetic north*** (in Canada), not ***true north*** (the North Pole).

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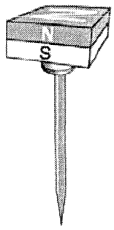
1. Magnet	A. Where a compass points to (in Hudson Bay, Canada).
2. Permanent magnet	B. Becomes a magnet near a magnet, then loses its magnetism when moved away.
3. Temporary magnet	C. Anything that attracts or repels another magnet or magnetic material.
4. True north	D. The North Pole; where maps point to as north.
5. Magnetic north	E. Does not lose its magnetism: lodestone and magnetite are only types.

1. Compass	A. The center of an electromagnet.
2. Electromagnet	B. A magnetic navigational device that point toward magnetic north.
3. Magnetic field	C. The area in which magnets will feel magnetic force. More arrows show a stronger one.
4. Core	D. Best magnetic substance; more of this in an electromagnetic core makes it stronger.
5. Iron	E. A magnet made from electricity.

Two magnetic north poles: attract or repel?

A magnetic north and south pole: attract or repel?

1) Label the north and south poles of the nail magnet.
2) Draw the magnetic field lines.
(don't forget arrows).



You move a 25 N object 4 meters. Find the work you did.

You move a 3N object 15 meters. Find work.

You push on a 35 N object for 3 seconds. Find work.

You move a 4 N object 10 meters. Find work.

Then find power if it is done in 5 seconds.

Draw a simple electromagnet:

Name three ways you could increase the strength of an electromagnet:

An 5 kg object is 6 meters up a hill. Find potential energy.

A 10 kg boat is moving 3 m/s. Find kinetic energy.

A rock is thrown 0.8 meters into the air. Find how fast it was thrown.

You do 25 J of work to move a 4 N object 5 meters. Find your efficiency.

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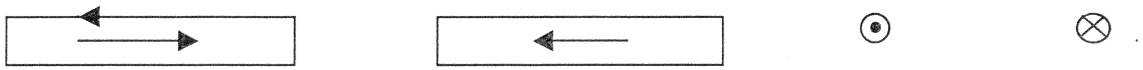
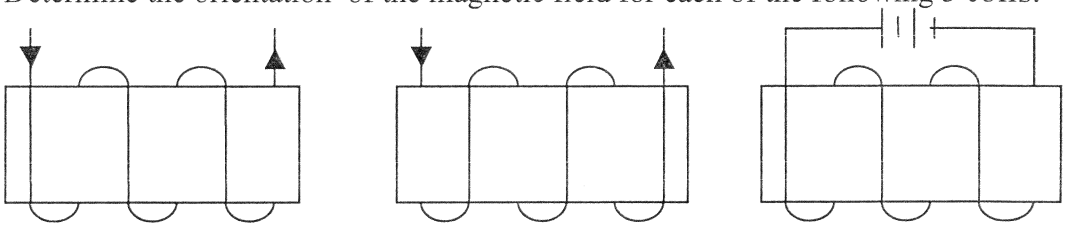
Physics Worksheet – Right Hand Rule

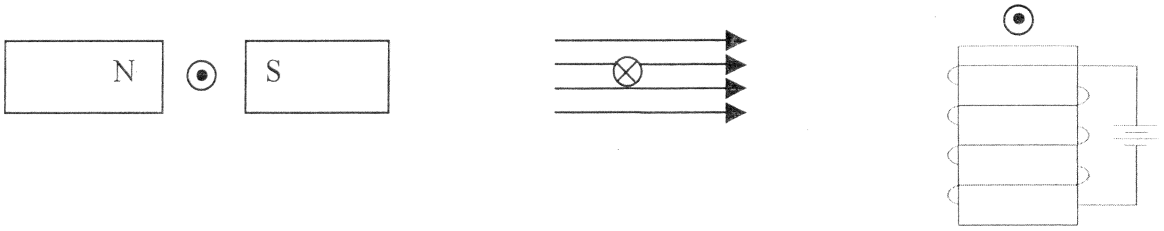
1. Determine the direction of the magnetic field for each of the following 4 wires.



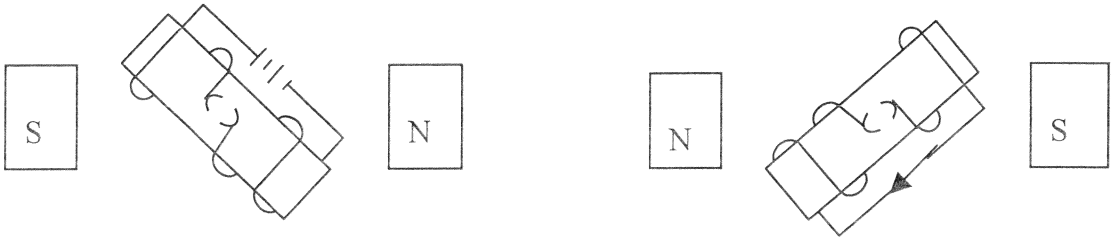
2. Determine the orientation of the magnetic field for each of the following 3 coils.



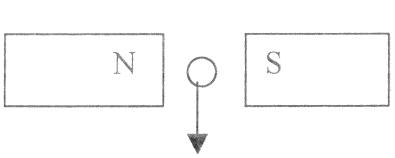
3. Determine the direction of the force on the wire for the following 3 cases.



4. Determine the direction of rotation for each of the following DC motors.

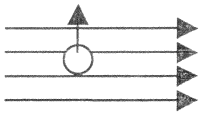


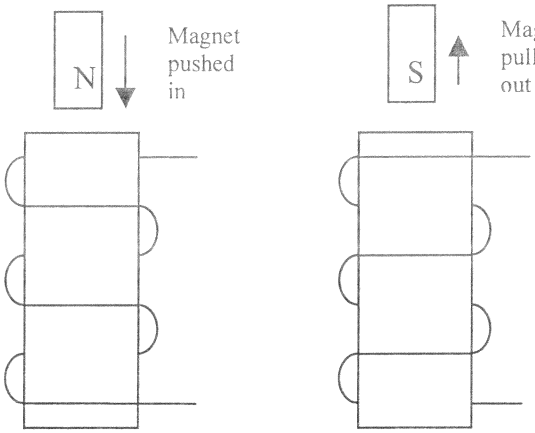
5. Determine the direction of the induced current – using Lenz's law - for the following 4 cases



Wired pulled down

Wired pulled up





Name_____

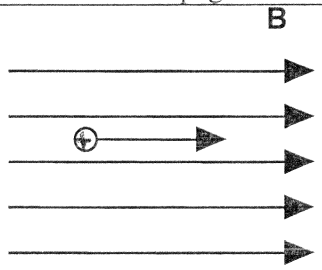
Date_____ Pd____

E&M Unit 4 - Magnetism: Worksheet 2

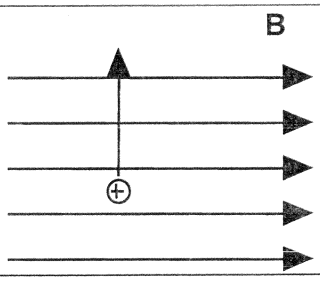
Part 1 - Magnetic Force Direction

The following diagrams show a charged particle or a current carrying wire in a magnetic field. For each diagram use the right-hand rule to draw an arrow on the object that shows the direction of the magnetic force. Remember that a ⊗ means the direction is into the page and a • means the direction is out of the page towards you.

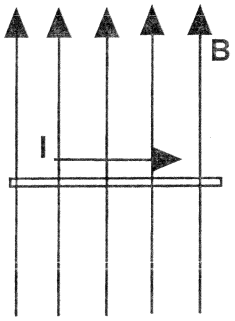
1.



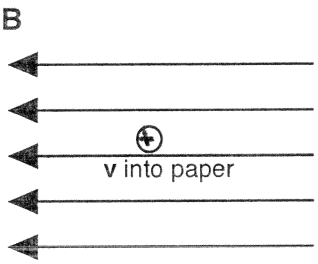
2.



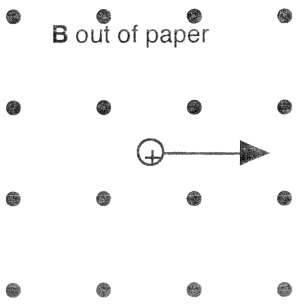
3.



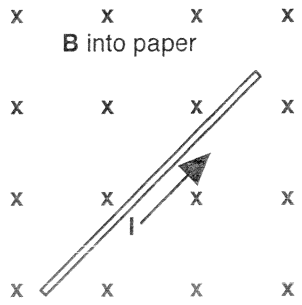
4.



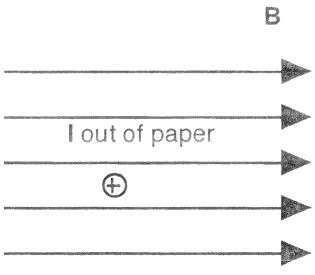
5.



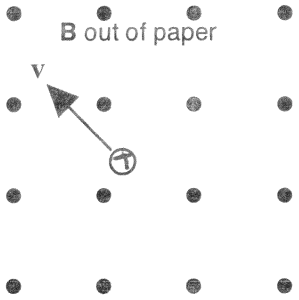
6.



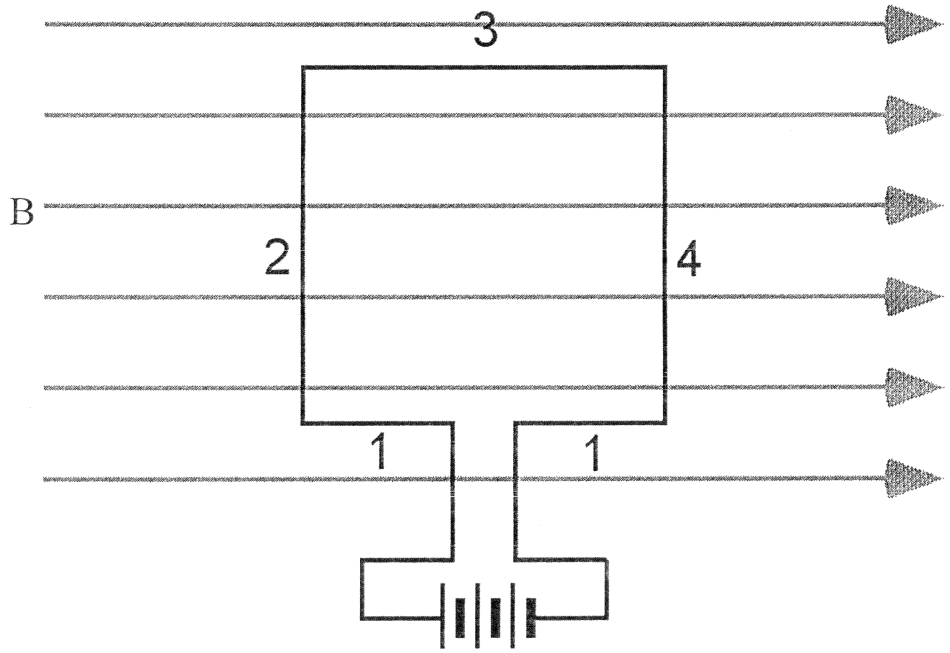
7.



8.



13. A rigid wire loop is placed in a uniform magnetic field as shown below. Determine the direction of the current in each segment of the loop, then the direction of the force on each segment.



A) Direction of magnetic force on segment 1
a) to the left b) to the right c) out of plane of page d) into plane of page e) none

B) Direction of magnetic force on segment 2
a) to the left b) to the right c) out of plane of page d) into plane of page e) none

C) Direction of magnetic force on segment 3
a) to the left b) to the right c) out of plane of page d) into plane of page e) none

D) Direction of magnetic force on segment 4
a) to the left b) to the right c) out of plane of page d) into plane of page e) none

E) Will the loop tend to rotate? If so, in which direction? Explain.

EM REVIEW

Name: _____ **Date:** _____

1. Which statement *best* explains how iron can become a magnet?

   A. Electrons are easily removed.

   B. Electrons spin in a unique direction.

   C. Atoms are strongly bonded together.

   D. Atoms have smaller nuclei.

2. Two parallel copper wires are each carrying the same electrical current in the same direction. Which statement explains how they respond to each other?

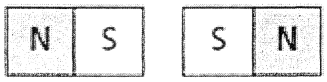
   A. They repel each other, because they have similar magnetic fields.

   B. They repel each other, because they have opposite magnetic fields.

   C. They strengthen each other, because they have similar magnetic fields.

   D. They strengthen each other, because they have opposite magnetic fields.

3. Look at the diagram of the bar magnets below.



   What will happen to the force between the two magnets if they are pulled farther apart?

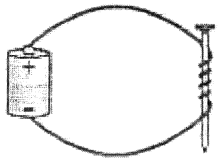
   A. The force would be weaker.

   B. The force would be stronger.

   C. The force would stay unchanged.

   D. The force would reverse the poles.

4. The diagram below shows an object made from a battery, a nail, and some wire.



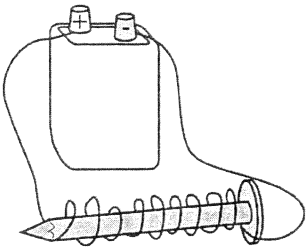
   What will happen if you touch a metal paperclip to the nail?

   A. The wires will melt.

   B. The battery will spark.

   C. The nail will give you a shock.

   D. The paperclip will stick to the nail.

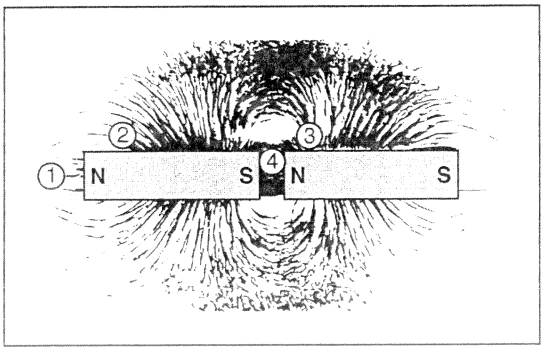
5. 

Which of the following is shown above?

A. electromagnet B. electric motor

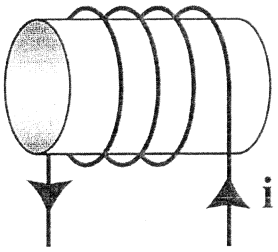
C. electric generator D. transformer

6. Iron filings and bar magnets were placed on a sheet of paper. The following diagram shows the pattern made on the paper.



At which location is the magnetic field the strongest?

A. 1 B. 2 C. 3 D. 4

7. 

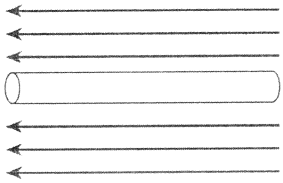
A coil with a current is shown above. In the center of the coil, a magnetic field points

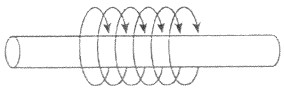
A. to the right. B. to the left.

C. upward. D. downward.

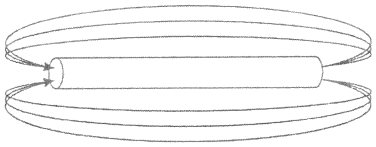
8. The diagram below shows current flow through a wire.

Which of the following represents the magnetic field resulting from the current?

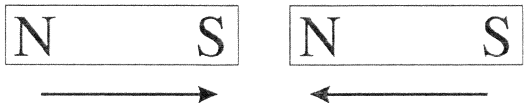
A. 

B. 

C. 

D. 

9. *Use the illustration below to answer the following question.*



Look at the two magnets above. If you push the two magnets toward each other as shown, the magnets will

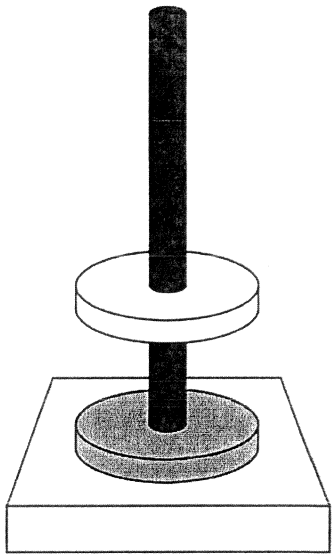
A. break into many pieces.

B. turn in opposite directions.

C. be pushed away from each other.

D. be pulled toward each other.

10. A student places one magnet above another magnet as shown below.



Why does the top magnet appear to float above the bottom magnet?

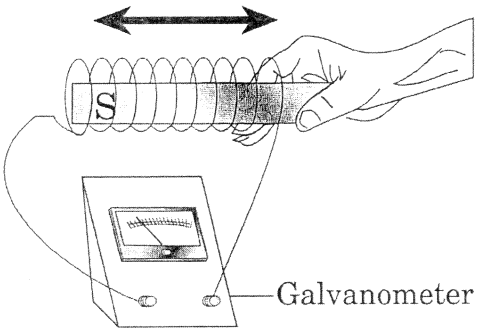
A. The magnets are made of different material.

B. The like poles of the magnets repel each other.

C. The opposite poles of the magnets repel each other.

D. The magnets have a different gravitational attraction.

11. A magnet is moved back and forth through a loop of wire as shown below.



What will happen as the magnet is moved back and forth as shown?

A. The wire will attract the magnet.

B. The magnet will attract the wire.

C. The galvanometer needle will stay at 0 on the scale.

D. The galvanometer needle will move back and forth.

12. A student coiled wire around a nail, attached both ends to a 1.5-V battery, and attempted to lift paper clips with the nail.

Results

Number of Turns of Wire	Paper Clips Picked Up
10	2
20	4
30	10
40	20

What is a valid conclusion for this investigation?

A. Increasing voltage increases electromagnetic strength.

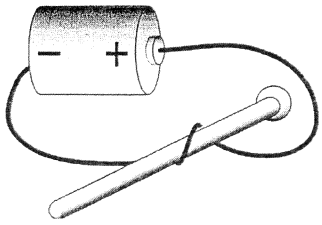
B. Increasing the number of turns of wire decreases electromagnetic strength.

C. Increasing the number of turns of wire increases electromagnetic strength.

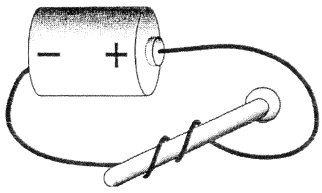
D. Increasing the number of turns of wire has no effect on electromagnetic strength.

13. Which of the following electromagnets would have the greatest magnetic field?

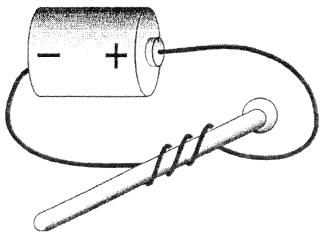
A.



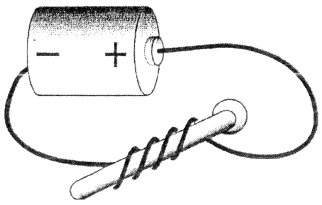
B.



C.



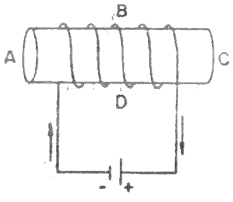
D.



14. The north pole of the coil of wire shown in the diagram is directed toward

A. *A* B. *B*

C. *C* D. *D*

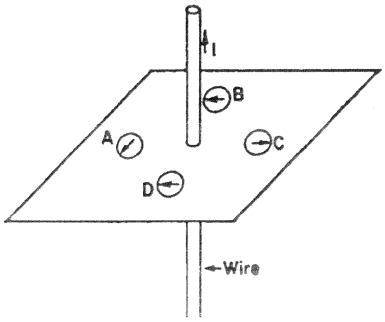


15. The diagram shown represents a current-carrying wire in a magnetic field. If the electron flow is into the paper, which arrow points in the direction of motion of the wire?

A. → B. ↑

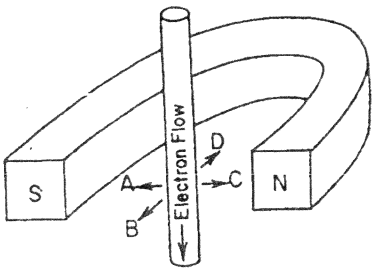
C. ← D. ↓

16. In the diagram the electrons flow through the wire as shown. Which compass reacts correctly in the magnetic field of the current?



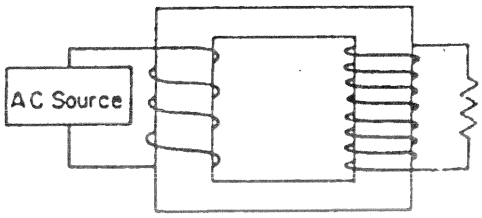
A. *A* B. *B* C. *C* D. *D*

17. In the diagram shown, a wire is suspended in the presence of a magnetic field. As electrons begin to flow through the wire as indicated, in which direction will the wire tend to move?



A. *A* B. *B* C. *C* D. *D*

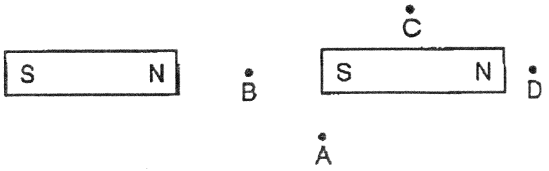
18. The diagram represents a 100% efficient transformer connected to an AC source. This transformer has two turns in the secondary coil for each turn in the primary coil.



Compared to the power in the primary coil, the power in the secondary coil is

A. less B. greater C. the same

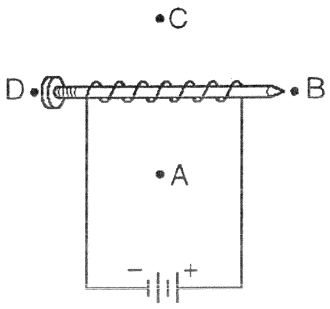
19. Two bar magnets of equal strength are positioned as shown.



At which point is the magnetic flux density due to the two magnets greatest?

A. *A* B. *B* C. *C* D. *D*

20. The accomapnying diagram shows an electromagnet made from a nail, a coil of insulated wire, and a battery.



The south pole of the electromagnet is located closest to point

A. *A* B. *B* C. *C* D. *D*