Name: _____

Period: _____

Magnetic Fields

4.1

Directions

Since paper is only two dimensional, we need symbols to show our three dimensional world. Also, we use different words depending on our situation (on paper or in relation to your body).

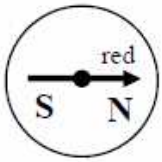
Left Right Up Down Into page Out of page

Or "Forward" *Or "Backwards"*

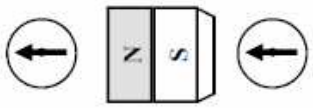
Forwards and backwards come from the tip and tail of an arrow, showing it coming towards you (a point) or away from you (a cross).

Compasses

Compasses are small temporary magnets and very useful as indicators for magnetic fields.
A compass always points in the direction of the magnetic field.



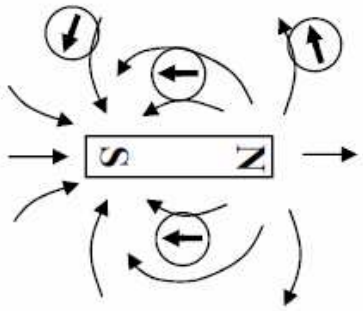
The red side of a compass is the north pole of its magnet. We will use an arrow to show the red side.



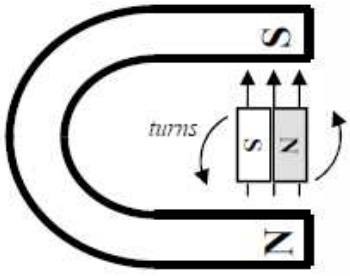
A compass always points towards a south pole or away from a north pole.

Magnetic Fields

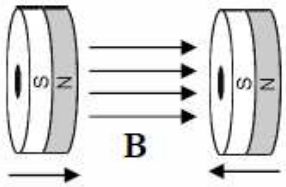
Magnetic fields are very similar to electric fields: they are a region in which a magnet feels a force. We use the letter B as the variable for magnetic field.



Field lines always point from North to South and are stronger closer to the poles.



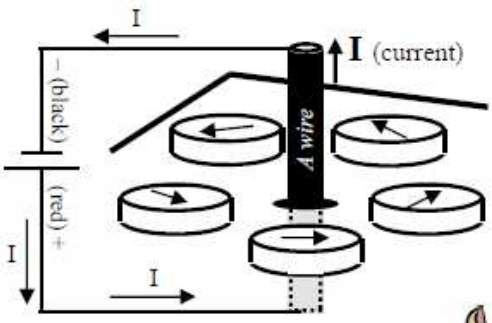
A magnet (or compass) will turn to align with the magnetic field.



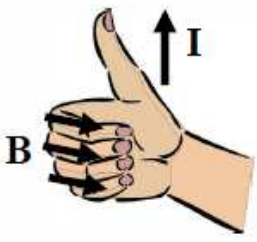
B shows the direction a north pole of a magnet will move.

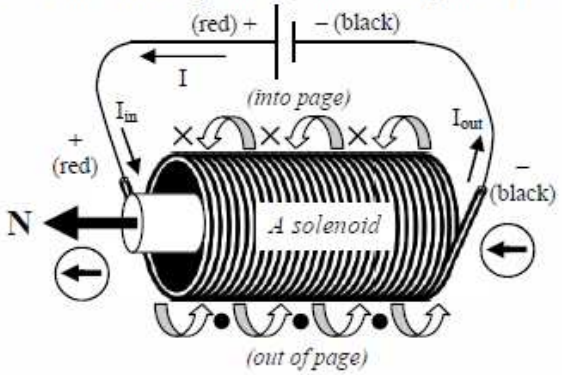
Current Carrying Wires

Electricity causes magnetism. Using the right-hand rule you can find the direction of B. Remember that the direction of the current is for positive (conventional) current flow.

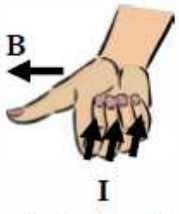


A straight current carrying wire creates a circular magnetic field. With your thumb in the direction of the positive current flow, your fingers coil in the direction of the magnetic field.

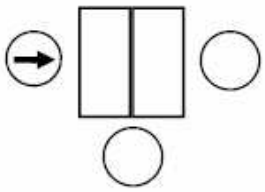




Circular currents (as in a solenoid) produce straight magnetic fields. With your fingers curled in the direction of the positive current flow, your thumb points in the direction of B.

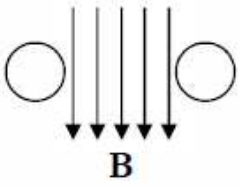


1. Using the first compass as an indicator, label the poles of the magnet and fill in the other compasses.



2. A. Label the N and S sides of the magnetic field (B).

   B. Fill in the compasses.

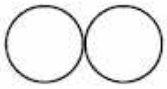


3. What is the direction of B (magnetic field) in these situations?

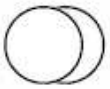
A) × × / × × B) ↑ ↑ ↑ C) • • / • •

4. What happens to two compasses that are put together?

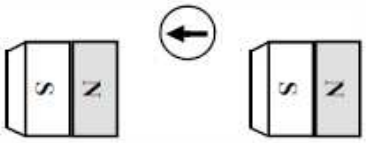
Side-by-side



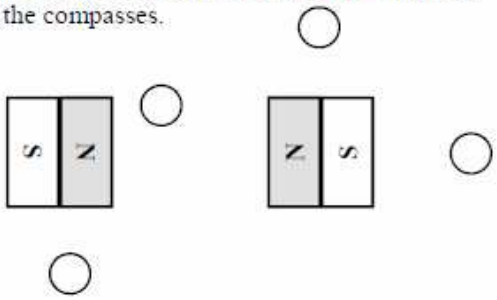
On top of each other



5. A) Draw the direction of B between the magnets.
   B) Which way will the compass turn?

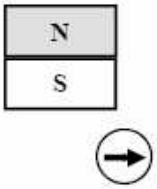


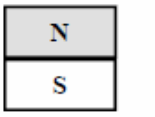
6. A) Draw the magnetic field lines around the magnets.
   B) Fill in the compasses.



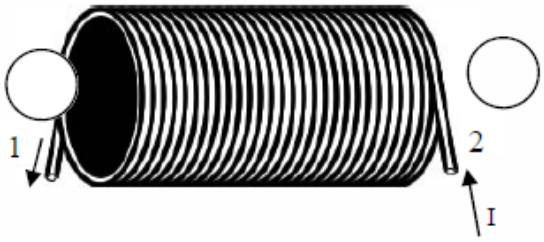
7. A) Draw the direction of B between the magnets.

   B) Which way will the compass turn?

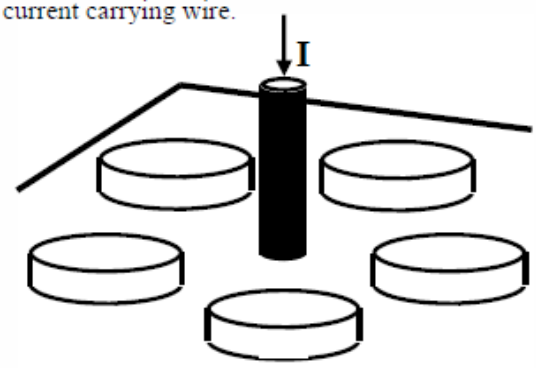




8. Positive current is hooked up to side 2 (goes in 2).
   A) Which side is north?
   B) Fill in the compasses

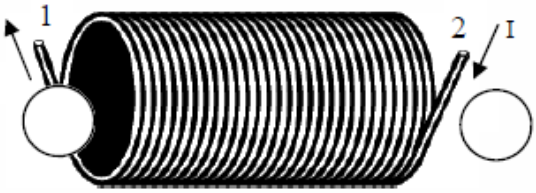


9. A) Draw the direction the compasses would point due to the current carrying wire.



   B) Which direction is B on the right side of the wire? (And draw it with the symbols given on the front).

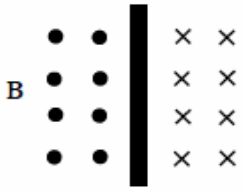
10. Positive current is hooked up to side 2 (goes in 2).
    A) Which side of the solenoid is north?
    B) Fill in the compasses.



11. A) Which direction is B on the right side of the wire?

    B) Which direction is B on the left side?

    C) Using the right-hand-rule, determine the direction the current must be flowing in the wire.



A wire

12. A) If the diagram shows a wire with current coming out of the page, draw B around the wire.

    B) Is B clockwise or counterclockwise?

13. A) Is the current in the wire moving clockwise or counterclockwise?

    B) Which direction is the magnetic field pointing inside the loop?