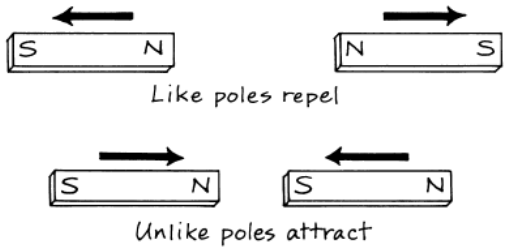
Name: _____

## Magnetic Potential Energy

A little review before we introduce a new term in magnetism. We've been discussing all the wonderful things about magnets.

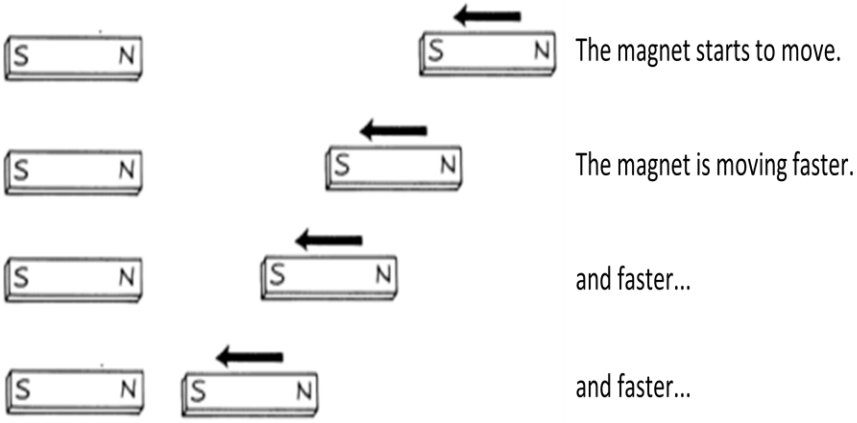
1. We've talked about magnets and magnetic materials being ***made of metal***.
2. We've discussed and accomplished how to make a magnet using both electricity (electromagnet) and by rubbing a piece of metal (a needle) against something that already is magnetized.
3. All magnets, no matter the shape or size, have ***two regions where their magnetic force is strongest***. These regions are called ***magnetic poles***. We drew the fields using a compass and bar magnet and saw how the fields all end near the poles.
4. And finally, the *law of magnetic poles* states that ***like poles of a magnet (north and north or south and south) repel*** each other while ***unlike poles of a magnet (north and south) attract*** each other.




Magnetism describes all the above effects of a magnetic field, including something new called ***magnetic potential energy***. Recall, potential energy is the ability of an object to do work because of its position. The energy of an object that has the ability to do work because of its position in a magnetic field is called magnetic potential energy.

Magnetized objects move in the direction that reduces their magnetic potential energy. This is no different than the skate park. It basically says that ***as potential energy decreases, kinetic energy increases*** and vice versa (as one goes up the other goes down).

In the picture to the right, as the magnet starts to move, the speed increases. Think about the skate park. As the skater falls down the half pipe, the speed increases. As the speed increases, the KE increases. As the KE increases, the PE decreases. It's a vicious circle going the opposite way as PE increases only to start over when the skater starts to fall.



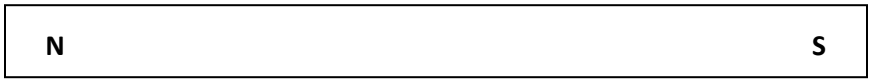

- As we already mentioned, the magnetic PE gets larger the further away the magnetic material moves from the magnet. Remember, we are not measuring the strength of the attraction just how far away it can still pull an object.
- The mass of the magnet can play a role. The bigger the magnetic field is the larger its magnetic potential energy can be.
- The location on the magnet plays a role on how much magnetic potential energy an object will have.

**Assignment:** take two magnets and observe what happens as you slowly move them closer together.

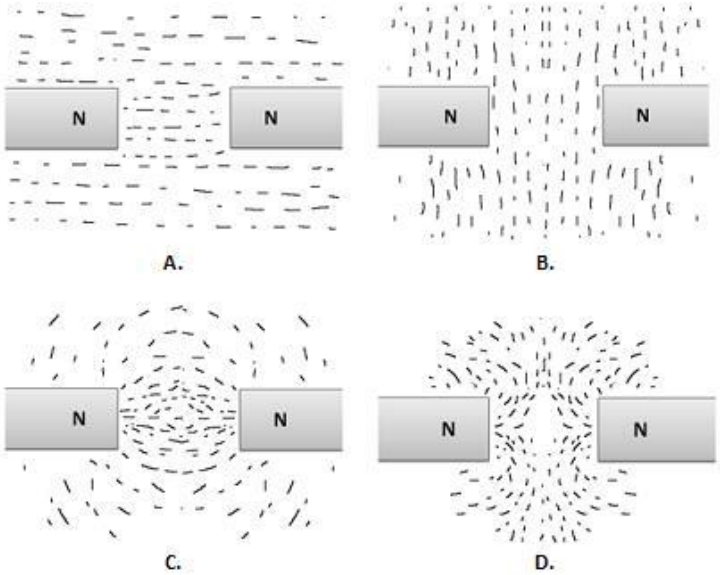
### Questions

1. Magnetic potential energy is dependent on...
   a. the mass of a magnet and how fast the magnet is moving.
   b. the shape and size of a magnet.
   c. the position of magnetic objects relative to one another.
   d. the distance a magnet has moved from its resting position.

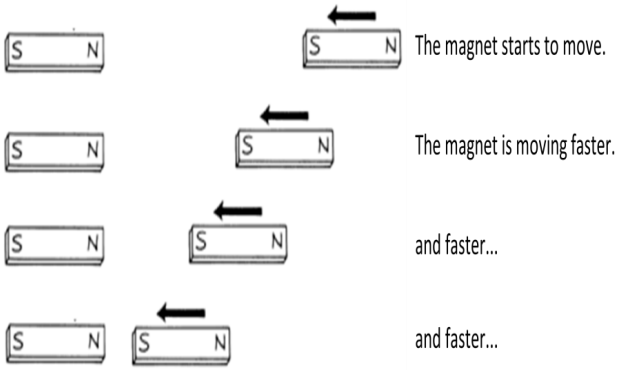
2. One of the components on the front mentioned location on the magnet playing a role in magnetic PE. Draw what a magnetic field would look like on a typical bar magnet:




3. Jane places two bar magnets on her desk next to each other with like poles facing. She then sprinkles a few iron filings on and around the magnets. Which of the following best shows how the iron filings will arrange themselves?




4. Using what you learned from the skate park lab, draw how a plot of KE and PE would look in the following scenario:




Energy

5. Compare Magnetic PE to Gravitational PE. How are they similar?

6. For GPE, the ball wants to fall to the lowest energy state possible. Where would the lowest energy state be for two magnets? Why?