Magnetism

Otter: Do 4 requirements including the 2 starred

_____1.* Find out what happens when you bring 2 magnets close together. How can you make them attract (come together) or repel (push away from each other)? The ends of a magnet are called the poles. If both north poles or both south poles are facing together the magnets will repel each other, but if you place a north pole against a south pole, the magnets will attract and stick to one and other.

_____ 2.* Make a simple magnet by magnetizing something metal (such as a needle or paper clip). Stroke it with a strong magnet, in the same direction, about 30-40 times. Test your magnet to see how strong it is. Can it pick up a paper clip? A heavy bolt?

_____ 3. The earliest use for magnets was to create a compass. Learn how a compass works and the difference between magnetic north and true north.

_____ 4. Compare the strength of two different magnets. Take a paper clip and bend one side out slightly to make a small hook. Then one by one, hang more paperclips off the first one. How many paperclips can it hold before they fall? Which magnet was the strongest? Were they the same?

_____ 5. Using two magnets, find out whether they are stronger if they attract one and other or repel one and other. Take a clothes pin and use it to hold two magnets together. First hold the magnets so that they line up (attract) each other. Then take a paper clip and bend one side out slightly to make a small hook. One by one, hang more paperclips off the first one. How many paperclips can it hold before they fall? Repeat the experiment holding the magnets together so that they repel each other. Which way produced the stronger magnetic field?

_____ 6. Find out what things a magnet will attract. Place a rubber band, a penny, a paper clip, some aluminum foil, a nail and a piece of string on the counter. Which ones will the magnet pick up? Why?

Dolphin: Do 5 requirements including the 2 starred

_____1.* Do Otter requirements 1 and 2.

_____ 2.* Make your own compass. Magnetize a pin or needle using the method in Otter requirement 2. Carefully place the needle on a piece of foam or cork and float it in a small glass of water. One end of the needle should point north and one should point south. Find out how to use the sun to figure out which is north and which is south.

_____ 3. Write a story about the discovery of lodestone. Tell how you think this discovery led to the invention of the compass. Be creative.

_____ 4. Using a compass and a ruler, solve the following three puzzles (each puzzle will draw a letter of the alphabet)

1. Mark a starting dot on a piece of paper. Draw a line 3” long due North. From where you ended, draw a 2” line due East. Go back to your starting dot and draw a line 1 ½” long due North. From this point draw a 1 ½” line due East. What letter did you draw? (F)

2. Make a starting dot on a piece of paper. Draw a 4” line due North. From the end of your line draw another line that is 2” South East. From this point draw another line 2” South West. Finally draw line 2 ¾” South East. What letter did you draw?

(R)

3. Make a starting dot on a piece of paper. Draw a 3" line due North. From here draw a 2" line South East. Then draw a 2" line North East. Finally draw a 3" line due South. What letter did you draw?
(M)

_____ 5. Learn about how iron atoms are arranged in a weak magnet, a strong magnet and demagnetized material. Draw a diagram to demonstrate what you have learned.

_____ 6. Draw a diagram of a magnetic field around a bar magnet.

_____ 7. Scientists believe that many animals navigate using magnetic fields, such as birds, whales, and butterflies. Make a list of as many animals as you can that are believe to use magnetic fields to navigate.

Butterfly: Do 6 requirements inducing the 2 starred

_____1.* Do Dolphin requirements 1 and 2.

_____ 2.* Read about electromagnets and make your own. You can follow the directions below or find your own online.

You will need roughly 5 feet of copper wire, a 2 ½" nail and a D cell battery. Take the wire, and leaving about a 3" tail, start coiling the wire tightly around the nail from the end up to the head and back. When you are done, you should have two wire ends about 3" inches each protruding from the end of the nail. If you are using insulated wire, you will need to strip the insulation off each end. Tape one wire to the positive end of the battery and one to the negative end. Now try to pick up something using the nail as a magnet. What happens if you take one wire off the battery? Understand and be able to explain why your electromagnet works. (Make sure you do not leave your wires taped to the battery when not in use as it will drain the battery.)

_____ 3. What role do magnets play in producing electricity? Read about generators and write a short report or diagram on how they work.

_____ 4. Junk yard cranes use giant electromagnets to pick up old car bodies. If you pulled this electromagnet apart, what would you expect to find inside? As a crane operator, how would you pick up a car body and let it down again? Would this crane work if you used a giant permanent magnet in place of the electromagnet? Why?

_____ 5. Find out who William Gilbert was (1600). What was his revolutionary idea regarding magnetism?

_____ 6. Conduct a "Rice Round Up". To do this, open a manila folder and cut it in half along the fold. Using one half of the folder, place an index card lengthwise in the center of the folder and draw circles at each end using a D battery as a template. Tape a flat ruler along the two short ends of the folder with at least 4" sticking out past one end. Place your folder off the edge of a table and use books piled on the rulers to keep it in place and create a platform. Put 10 grains of rice in one circle and an open staple in the other. Pass a magnet underneath your platform to herd your rice from one circle to the other using the staple.

_____ 7. Learn about the history of Morse Code. Write a short sentence using the dot dash method and decode at least one sentence that someone else has written for you.

_____ 8. Find a magnet experiment either online or in a book that you would like to try and test it out.

Explain to someone younger than you what you have done and what the results mean.

Eagle: Do 7 requirements including the 2 starred

_____1.* Do Butterfly requirements 1 and 2.

_____ 2.* Using the electromagnet you made in requirement #1, you are now going to make a simple electromagnetic pin motor. You can follow the directions below or find your own online.

First, you need to make a hat pin compass. Fold an index card in half and then fold the ends back again so that you have an "M" shape. Pinch the folded part together and extend the two ends until you have a "T" shape and place a piece of tape on the seam to keep it in place. Flip the card over to create a stand. From the center of the fold (which should now be sticking upright) cut a half circle from the center of the fold to the bottom edge on each side. You should end up with sort of a pointy tower sticking up from the table. Tape a pin to the side of the tower so that it sticks up like a flag pole.

Next, draw a 4 cm circle on paper and cut it out. Make a 2 cm cut to the center of the circle. Bring one end of the cut slightly over the other to create a "hat" and tape in place. (It should look sort of like a Chinese style hat.) Tape a pin to one side of the hat so that it sticks out at least ¼". Tape another pin on the opposite side of the hat, also sticking out ¼". Stroke one pin with the North pole of a magnet and the other with the South pole. Balance the "hat" on the tip of the pin sticking up from your index card tower. One pin should point North and the other South.

Now, stick the nail of the electromagnet from requirement #1 in a small lump of clay near your compass. Stand the D battery on one end of the wires. Turn on the electromagnet by touching the other wire to the top (positive) end of the battery. Turn it off by removing the wire. You should be able to get your hat pin compass to spin around by turning your electromagnet on and off at the right times. For example, turn it on to attract the North Pole, but turn it off just as it reaches the magnet so that it will keep going past. Once the South pole passes, turn it on again to push the South pole away and reattract the North pole.

_____ 3. Find the magnetic variation (declination) for your area. Using an isogonic map of the world, find other areas with the same variation.

_____ 4. Research a career that uses magnetism such as physicist, geophysicist, surveyor, electrical engineer, or ceramic engineer. What education and experience will you need? What is the typical salary and hours worked per week?

_____ 5. Research the history of the telegraph. What role did magnetism play in its invention? What modern day inventions came from the ideas presented in the telegraph?

_____ 6. Research and explain how magnets are used are used in modern day roller coasters.

_____ 7. What is an MRI machine and how does it diagnose illnesses?

_____ 8. Research "Magnetic Therapy." The possible health benefits of magnetism have been under debate for years. Read articles from both sides and present you case either for or against this type of therapy.

_____ 9. Find out what ferromagnetism, paramagnetism, and diamagnetism are.

Helpful Links:

http://www.kidscanmakeit.com/SN0002.htm

http://www.creativekidsathome.com/science/magnetexp.html

http://writerbynature.com/2006/03/07/nature-activity-how-to-make-a-compass/

http://edtech.kennesaw.edu/web/electric.html

http://www.cln.org/themes/magnetism.html

Butterfly or Eagle Level Links:

http://www.sciencenetlinks.com/lessons.cfm?BenchmarkID=4&DocID=428

http://www.exploratorium.edu/snacks/stripped_down_motor.html

http://www.exploratorium.edu/snacks/iconmagnetism.html