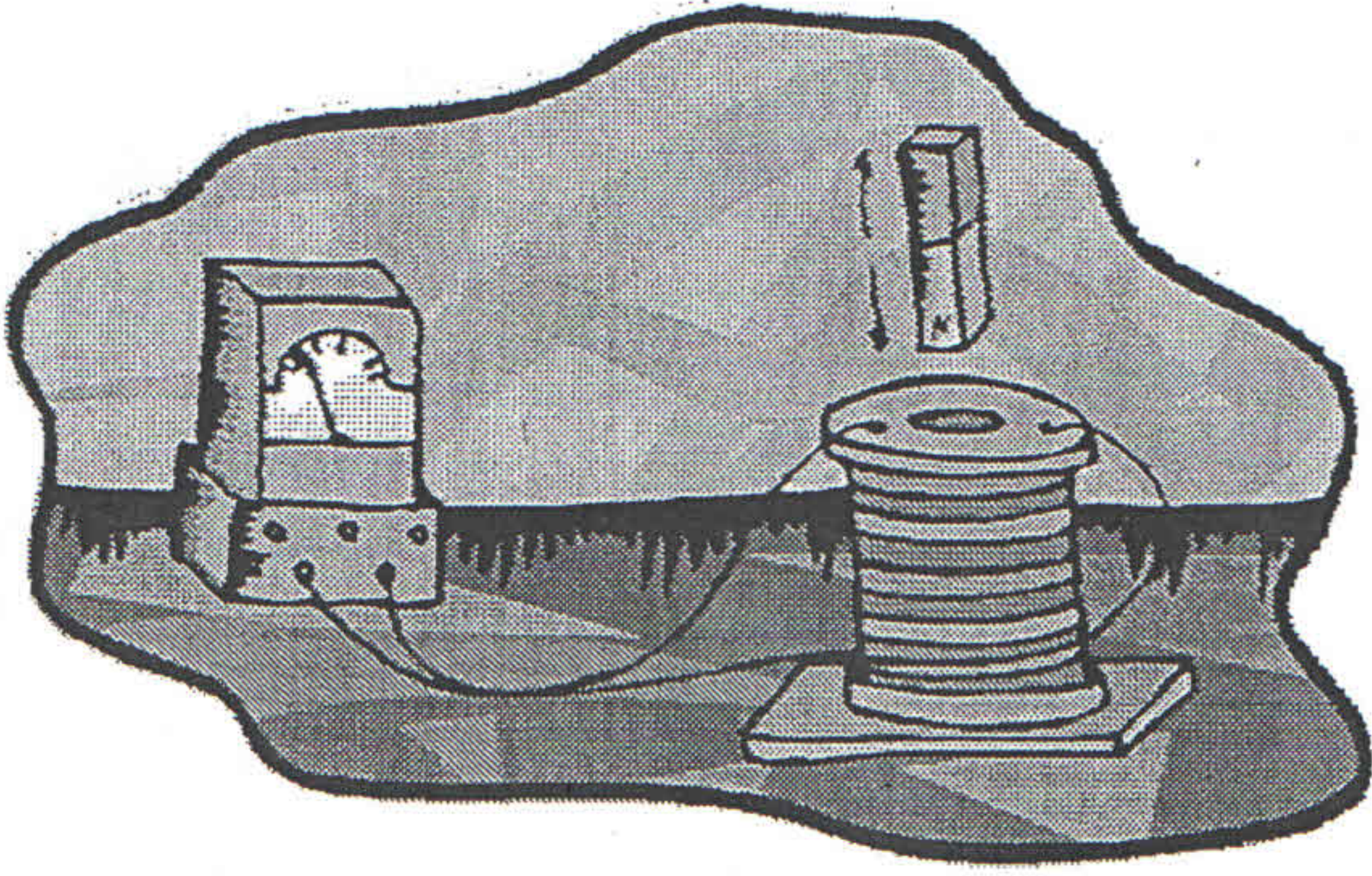


Build an Electromagnet

Lesson Title: *Build an Electromagnet*

Page 1 of 2

Name: _____



If you have ever played with a really powerful magnet, you have probably noticed one problem. You have to be pretty strong to separate the magnets again! Today, we have many uses for powerful magnets, but they wouldn't be any good to us if we were not able to make them release the objects that they attract. In 1820, a Danish physicist, Hans Christian Oersted, discovered that there was a relationship between electricity and magnetism. Thanks to Oersted and a few others, by using electricity, we can now make huge magnets. We can also cause them to release their

objects.

Electricity and magnetism are closely related. The movement of electrons causes both, and every electric current has its own magnetic field. This magnetic force in electricity can be used to make powerful electromagnets that can be turned on and off with the flick of a switch. But how do you make an electromagnet?

By simply wrapping wire that has an electrical current running through it around a nail, you can make an electromagnet. When the electric current moves through a wire, it makes a magnetic field. If you coil the wire around and around, it will make the magnetic force stronger, but it will still be pretty weak. Putting a piece of iron or steel inside the coil makes the magnet strong enough to attract objects. The strength of an electromagnet can be increased by increasing the number of loops of wire around the iron core and by increasing the current or voltage.

You can make a temporary magnet by stroking a piece of iron or steel (such as a needle) along a permanent magnet. There is another way that uses electricity to make a temporary magnet, called an electromagnet. Let's build one!

You'll need:

- An iron or steel bolt
- 24 inches of insulated wire
- 2 D-cell batteries with holders
- Alligator clips or tape to hold the wire connections together
- Some paper clips or other magnetic items
- A journal or paper to take notes and respond to questions

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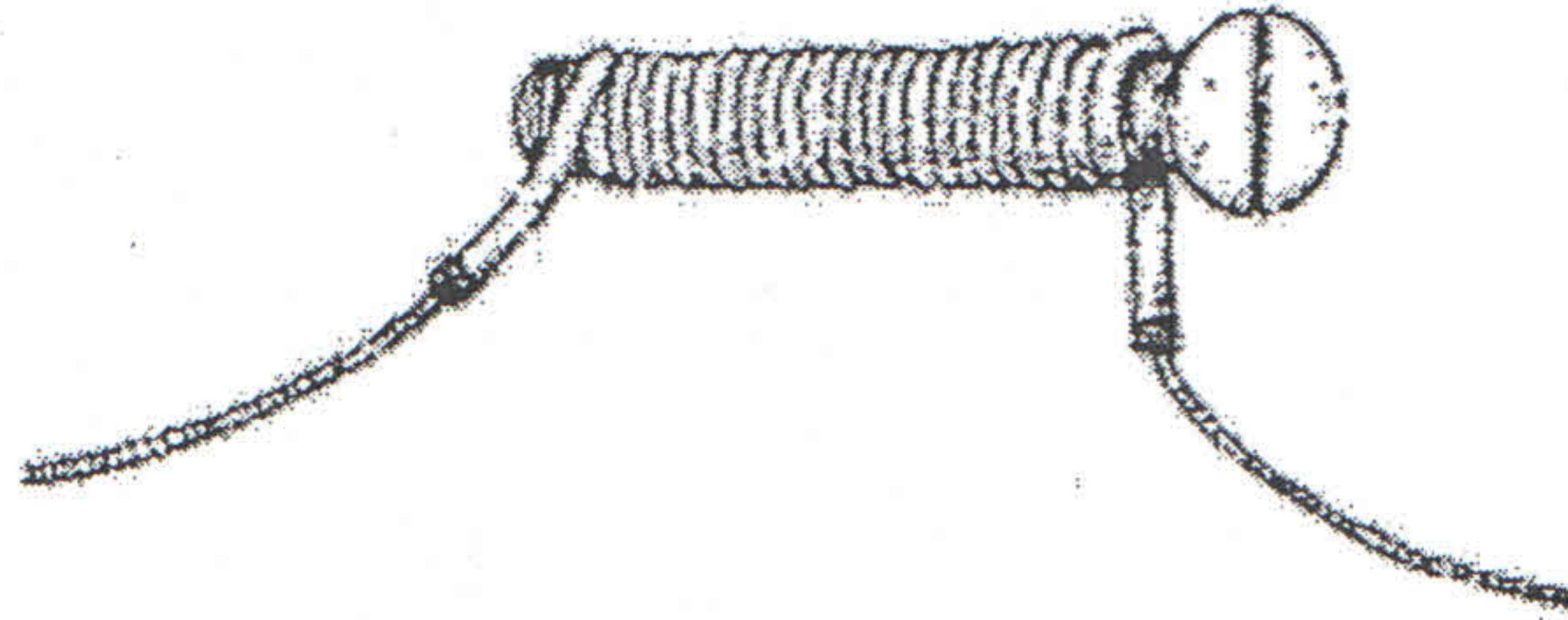
Lesson Title: *Build an Electromagnet*

Page 2 of 2

Name: _____

Directions:

1. Wrap the wire in a **tight, even coil** around the bolt. Leave 3 or 4 inches of wire loose at each end. Keep wrapping the wire until you get to the end of the bolt. There may be as many as 3 or 4 layers of wire all the way up and down the bolt. Your electromagnet should look something like this:



2. Attach one end of the wire to the positive (+) end of one of your batteries. Attach the other end of the wire to the negative end (-) of your battery pack.
3. Try to pick up one of the paper clips with your electromagnet. What happens? Now, unhook one of the wires from the battery. Will your electromagnet pick up a paper clip now? What do you need flowing through the wire to make the iron bolt act like a magnet?
4. How many paper clips will your electromagnet hold? Can you hang clips on both ends of the bolt? Why?
5. How can you make your electromagnet stronger? Try adding more batteries to your battery pack. Make sure all the batteries "face" the same direction in the circuit. Now, how many paper clips will your electromagnet hold?
6. How is the strength of the electromagnet affected by the increase in electricity traveling through the wire?
7. After using the electromagnet, remove the iron nail or bolt. Can the nail still pick things up? How many paper clips or staples can it pick up? Try dropping the nail or bolt a couple of times on the floor. How does this affect whether or not you can pick up any paper clips or staples? How many paper clips or staples can the nail or bolt pick up after being dropped?

Be sure to disconnect your electromagnet when it is not in use. Leaving the wires connected will drain your battery.