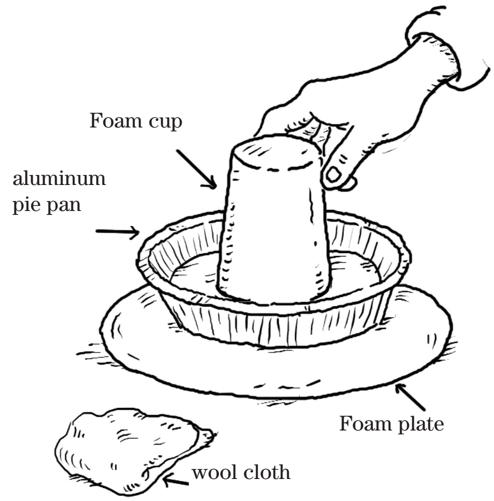
You’re the Scientist: The Charge Carrier

Name ____

Directions: Early studies of lightning are at the base of our current knowledge of electricity. You are a scientist who will investigate electric charges by making an electrophorus (elec-TRÄ-for-us; Greek for “charge carrier”).



Materials:
- Foam dinner plate
- Wool cloth
- Disposable aluminum pie pan
- Foam cup
- Masking tape

Procedure:
1. Tape the cup, upside down, to the inside center of the aluminum pie pan.
2. Turn the foam plate upside down and rub it with a wool cloth for about a minute.
   Then, charge the pie pan in the following manner:
3. Place the pie pan directly on top of the charged foam plate, with the cup sticking up like a handle.
4. Quickly touch the pie pan with your finger.
   What do you hear?

   What do you feel?

5. Using the insulating foam cup as a handle, lift the pie pan.
   What do you see?

6. Darken the room. Then, discharge the pie pan by touching it with your finger.
   What do you hear?

   What do you feel?

   What do you see?

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7. Repeat the experiment. How can you make the largest spark?

Analysis:

What is the charge of the foam plate once it attracts electrons from the wool?

What is the insulator in this experiment? Why is it important to use an insulator?

What happens to the charged pie pan when you touch it?

What charge does the pie pan carry?

What causes the spark of light and sound?

What are you actually feeling when the "shock" flows through your finger?

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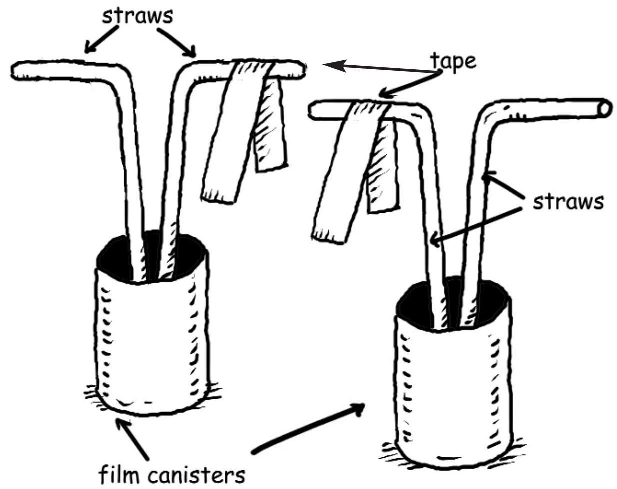
You're the Scientist: The Sticky Static Charge

Name ____



Directions: Static electricity demonstrates the flow of electrons between atoms. You are a scientist who will investigate electric charges by making an electroscope.

Materials:

- Roll of plastic tape
- 2 small containers, such as 35-mm film canisters
- 4 flexible plastic straws
- Putty or modeling clay
- Wool cloth or plastic comb

Procedure:

1. Fill each film canister half full of putty or clay.
2. Press the long end of 2 straws into each canister and bend the flexible lengths to form horizontal "arms" facing in opposite directions. Be sure that the straws are all the same height.
3. Pull 2 pieces of 4-inch (10-centimeter) lengths of tape from the roll and stick them to the table, folding one edge to act as a "handle." Quickly pull each piece of tape from the table and lay one over the arm of a straw in one canister and the other over the arm of a straw in the other canister. Allow the length of the tape to hang down about 2 inches (5 centimeters) on either side of the straw. Move the canisters so that the taped straws are facing each other, about 6 inches (15 centimeters) apart. **As you move them closer together**, **what happens? Why do they repel each other?**

4. Pull 2 more 4-inch (10-centimeter) lengths of tape from the roll and stick the length of one tape against the nonadhesive side of the other. Quickly pull them apart and hang them on the other 2 straw arms.

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You're the Scientist: The Sticky Static Charge

5. Move the canisters so that these tapes are facing each other. **As you move them closer together, what happens? Why do they attract each other?**

6. Run the comb through your hair several times and then hold it near the dangling tapes. **What happens? Why does the comb repel the tape whose smooth side was attached to the sticky side of the other tape? Why does it attract the other piece of tape? How does it react to the tapes that were pulled from the table? (*Note:* Depending on the surface of the table, the comb will attract or repel these tapes.)**

7. Experiment with other types of tape and other surfaces to discover more about positive and negative charges.

Analysis:
Can you explain why the tapes pulled from the table repel each other based on electrons? Why would the material of the table not matter as far as whether or not the tapes repel each other? Why does the material of the table matter as far as whether or not the comb repels or attracts these tapes?

Can you explain why the two tapes pulled from each other attract each other based on electrons? Since a plastic comb pulled through your hair becomes negatively charged, can you explain the static you feel in your comb? Draw your demonstration and label each piece of tape as positive or negative.

Use your electroscope to test the charge of other objects. *Note:* The charge will "leak" off into the air, so you may need to recharge the tape every few minutes.

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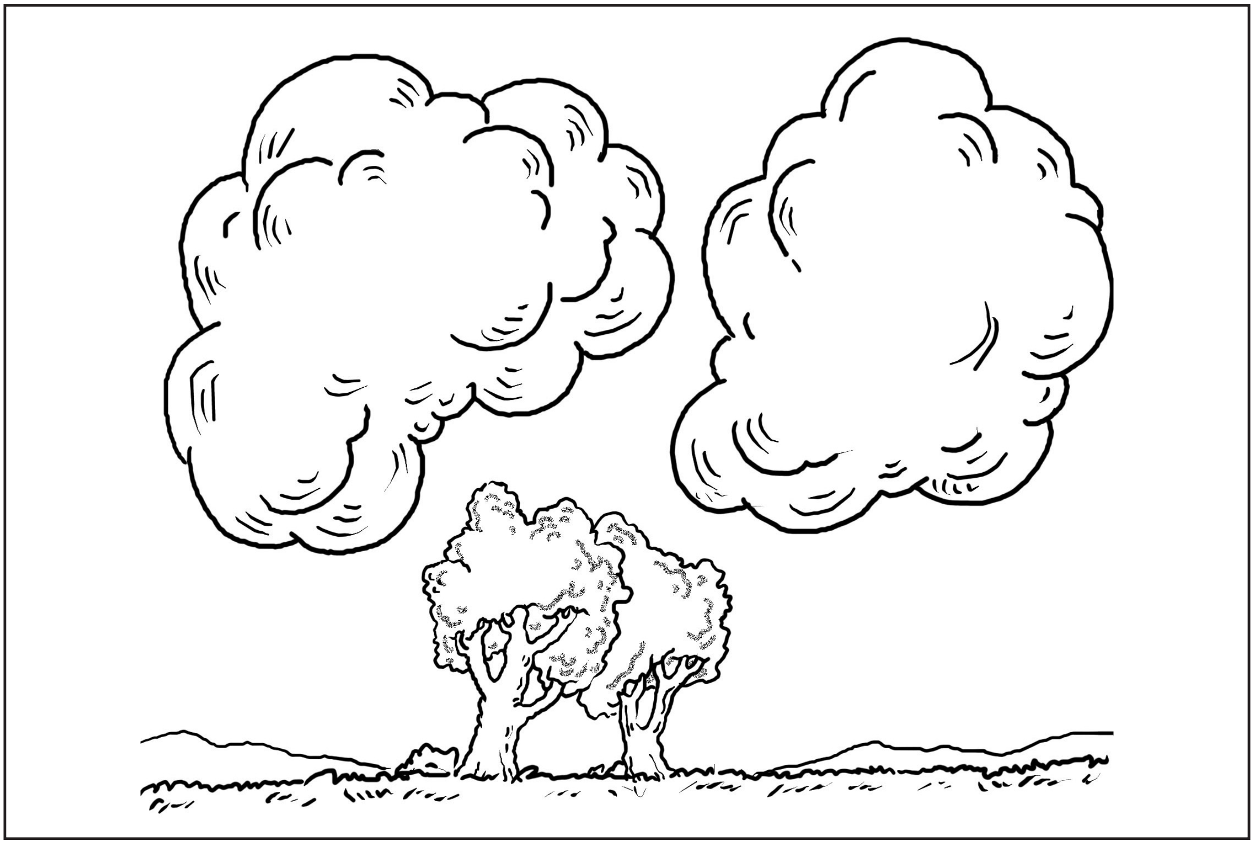
How Lightning Forms

Name ____

Directions: Lightning involves the exchange of electrons between clouds and the earth. Use the symbols and terms below to complete the diagram and create your own "lightning flashes."



Terms to use:

positive charge (+)

negative charge (–)

step leader

return stroke

cloud-to-ground lightning

lightning within clouds

base of the cloud

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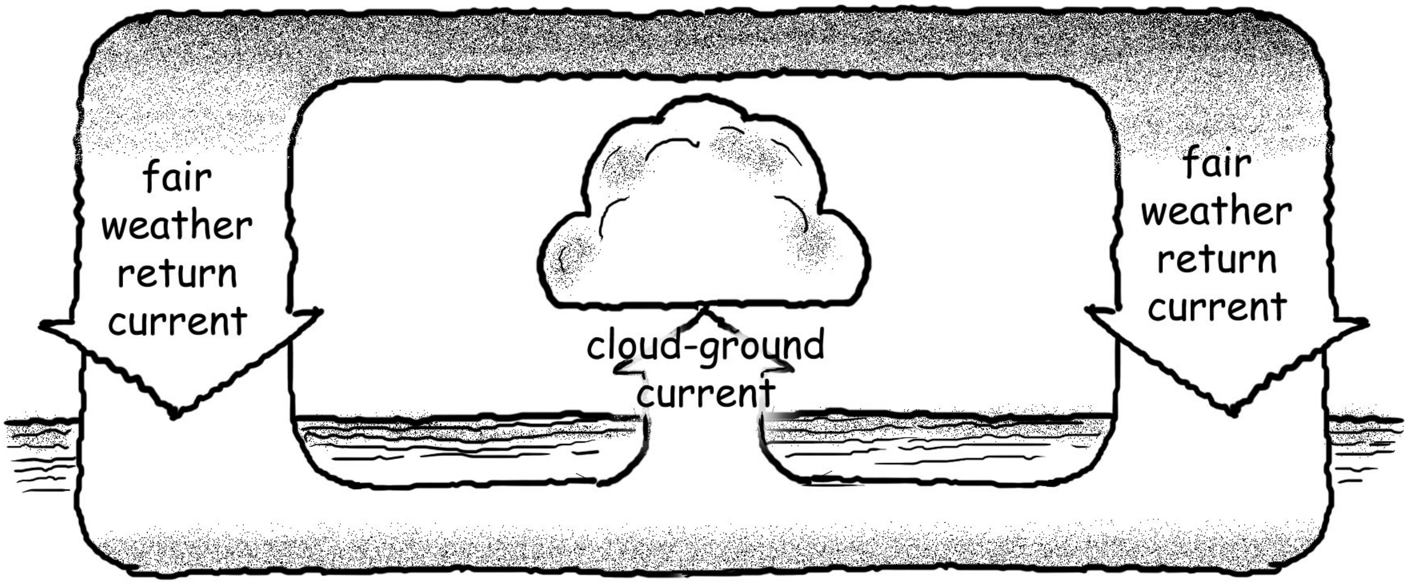
Lightning Study

Name ____

Directions: Read the information below. Then write, or discuss with your family, a summary of the importance of lightning strikes and a description of the fair weather field.



Benjamin Franklin proved that lightning is caused by electricity in the atmosphere around us. Charge generation happens inside thunderstorm clouds. Current flows from the top of clouds into the upper atmosphere and the ionosphere. The current returns to earth through the clear atmosphere. We cannot feel the current because it is diffused around the globe and is, therefore, very weak.

During a thunderstorm, a current is completed by electrons from the base of a storm cloud passing through and ionizing the atmosphere below. We see the return path of current as a flash of lightning.

Use the information above to explain:

- If there were no lightning, we'd all walk around electrically charged and getting real shocks from our surroundings. **Is this statement true or false? Why?**

- Work within assigned research groups to find out more about lightning research and to illustrate the information you find for the rest of the class.

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Lightning Study

Research Topics:

- Global lightning maps: Why are they important and what do they show?

- Lightning flash: What is the impact of lightning in different parts of the world?

- Lightning technology: How and why are we learning more about lightning?

Research Tasks:
- Resource coordinator—gathers appropriate resources from the media center.
- Online researcher—works online to gather further information.
- Project coordinator—works with the group to outline the model/illustration of the group's research.
- Presentation coordinator—leads the group's presentation of its findings to the rest of the class.

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Lightning Myths

Name ____

Directions: Sometimes, what you don't know can hurt you. The following lightning myths have grown over the years—often increasing fear and promoting unsafe actions. Research to show why the following statements are incorrect. Provide scientific explanations and examples.

1. Lightning never strikes the same place twice.

2. When I'm in a car, I'm safe. Rubber tires protect me from lightning.

3. Wearing rubberized rain gear or rubber-soled shoes will protect me from lightning.

4. Everyone struck by lightning dies.

5. Most lightning strikes happen on the golf course. I don't play golf, so I don't have to worry.

6. Lightning victims hold an "electric charge," so it is dangerous for me to try to help them.

7. As long as I'm in a covered space, I'm safe from lightning during a thunderstorm.

8. Lightning strikes only during heavy rain.

9. In a thunderstorm, it is safe for me to talk on the phone or take a bath.

10. Carrying an umbrella does not increase my risk of being struck by lightning.