

**Goal** • Apply your knowledge of electric charge from the chemistry unit by designing an experiment.

#### Question

How can you make an empty pop can roll the greatest distance without touching it?  
(Brainstorm)

You can use a type of 'blow' as in air to move the pop can, like a fan or a hair dryer

You can use static, by rubbing a balloon and creating static and having a different amount of charges and making the pop can move

#### Group Members

1. Kalen
2. Nash
3. David

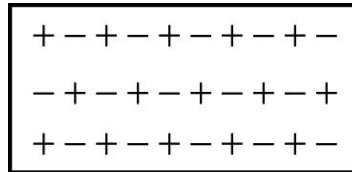
#### Group Name

The Grapes

Goal • Review your understanding of charge transfer.

### What to Do

Use the following diagram to answer question 1–3. Use (–) to represent negative charges and (+) to represent positive charges.

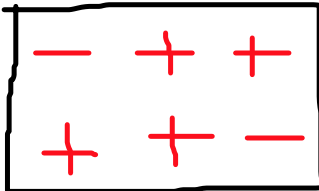


1. The diagram shows represents a neutral solid object. What is the relationship between the number of positive and negative charges in a neutral object?

There is always a balanced amount of positive and negative charges

2. When the above neutral object is rubbed with a material, it becomes positively charged.

(a) Draw a new diagram that represents the object with a positive charge.



(b) How do the number of positive charges compare to the original diagram?

There are more protons

(c) How do the number of negative charges compare to the original diagram?

There are less electrons

3. When the neutral object is rubbed with a different material, it becomes negatively charged.

(a) Draw a new diagram that represents the object with a negative charge.



(b) How do the number of positive charges compare to the original diagram?

There are less positive charges

(c) How do the number of negative charges compare to the original diagram?

There are more electrons (negative charges)

Goal • Review your understanding of the laws of static charge.

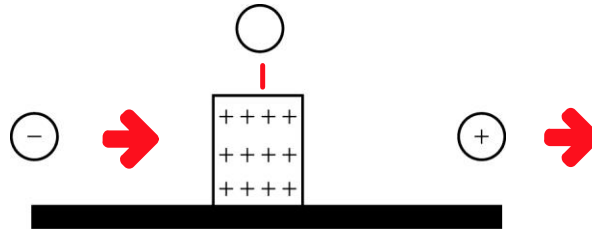
### What to Do

Complete the following sentences using the following terms. Each term may be used more than once.

attracts, repels, positive, neutral, negative

1. A negative charge is repelled by a negative charge.
2. A positive charge attracts a negative charge.
3. A charged object attracts a neutral object.
4. A negative object attracts an unknown object. The unknown object could be positive or neutral.
5. A positive object repels a positive object.

Use the diagram below to answer question 6.

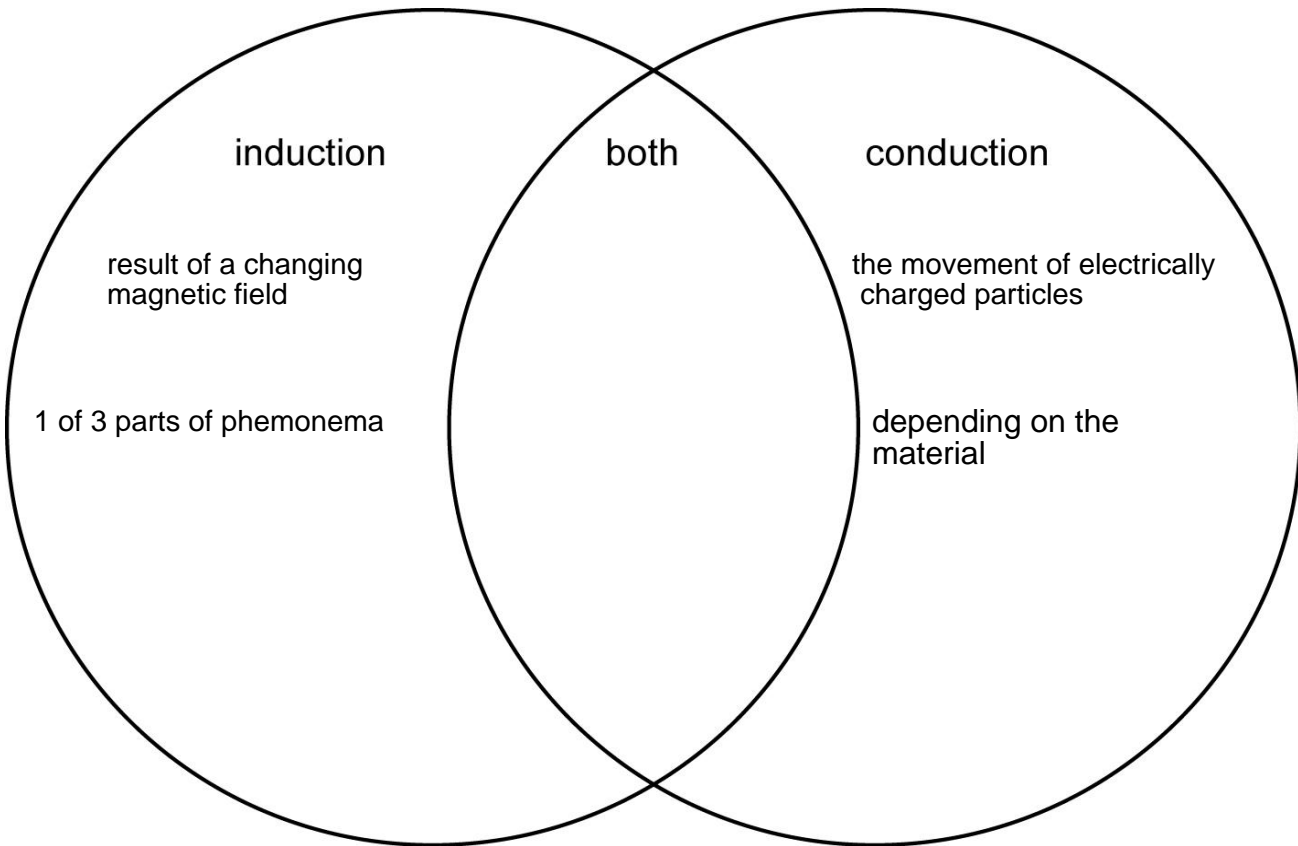


6. A positively charged object is attached to a table as shown. Use an arrow to indicate the direction of the force on the negative (-), positive (+), and neutral (no sign) charges placed near the object on the table.
7. Use the words "increased" or "decreased" to complete each of the following statements.
  - (a) To increase the electric force between two charged objects, the distance separating the two charges should be decreased.
  - (b) To increase the electric force between two charged objects, the amount of charge on one or both objects should be increased.
  - (c) To decrease the electric force between two charged objects, the distance separating the two charges should be increased.
  - (d) To decrease the electric force between two charged objects, the amount of charge on one or both objects should be decreased.

Goal • Compare and contrast conduction and induction.

What to Do

Complete the following Venn diagram. List points that are true of induction on the left side. List points that are true of conduction on the right side. List points that are true of both induction and conduction in the middle.



**Goal** • Review your knowledge of electric charge and its interaction with conductors, insulators, and electroscopes.

**What to Do**

Answer the questions that follow.

1. Classify the following items using an X.

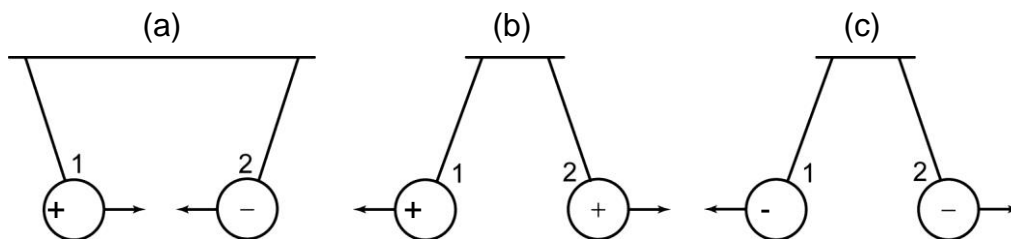
	Conductor	Insulator
Human body	X	
Air		X
Wood		X
Rubber		X
Plastic		X
Aluminum	X	
Silver	X	
Wool		X
Copper		X
Iron		X
Fur		X

2. Using the list of words below, complete the following sentences. Each word may be used more than once.

negative, negatively, positive, positively, opposite

- Opposite charges are unlike charges.
- Two like charges are either both positive or both negative.
- If two opposite charges are brought together, they will be attracted.
- If a positively charged object is brought near a positively charged electroscope, the leaves will separate.
- If a negatively charged balloon is brought near a positively charged rod, the balloon is attracted to the rod.

3. The diagram below shows two charged pith balls hanging on thin threads. One ball in each diagram is shown with either a positive (+) or a negative (-) charge. The arrows indicate whether the two balls are attracted or repelled. On the diagram, indicate the charge on the blank balls.



## Question

How can you make an empty pop can roll the greatest distance without touching it?

## Hypothesize

Write a hypothesis for your experiment.

I think that the pop can will roll some distance, but I am not sure if the power of the static will be enough to roll it in a greater distance.

## Materials

- fur or wool
- rubber rod
- plastic or glass rod
- plastic golf tube
- balloon
- empty pop can
- plastic wrap and/or plastic bags

## Procedure

1. With your group of 3. Include any or all of the above materials in the design of your experiment. Write your procedure below.

Balloon, Nash's hair, and a can

We will create friction and static by rubbing the balloon onto Nash's hair, then direct it towards the direction we want the can to go.

2. Test the procedure and revise it as necessary. If you touch the can during the race, the can will be disqualified.
3. Write the revised procedure below. Have your procedure approved by the teacher. You will use this procedure in a race against your classmates.

We will take either the fur, or Nash's hair and rub it against the balloon, right before the race starts.

Then when the race starts, we will create the static. Keeping the balloon as close to the can as possible, without it actually touching. Hopefully, there is enough static to 'push' the can the furthest

distance.

## Observations

As your group tests each part of its procedure, write down your observations below. You will need to refer to these observations when you decide which method of racing your can will give you the best chance of winning.

We used every item that was available in the classroom, we tried fur, hair, metal, plastic, and they all

worked in some sort of way. But, the whole entire class was using either fur, or hair. We tried the two

and realized that hair created more static than fur did. So, we used Nash's hair to create the static in the

## Results

balloon and 'push' the can to the furthest distance.

Record the results of the race. Describe briefly how each group (including your own group) moved its race can and how well each method worked.

Since each group used practically the same method (fur/hair), they all went the distance. Some cans moved sideways or around, since controlling the can with static isn't that easy. But, our can had dents

all around the outside, so it wouldn't move a great distance because of how 'bumpy' the outer 'shell' was.

## Conclusion

Draw specific conclusions about your group's method of moving the pop can. If your group's method worked, explain why. If your group's method did not work or did not work well, explain why.

Our method was rubbing the balloon against one of our team mates' hair (Nash), to create static so that

the pop can could move. It worked originally, but did not during the race, since our pop can had a dent

which made it harder to be 'pushed' by the balloon.

1. Was your original hypothesis correct? Explain.

Our hypothesis was correct. Since we all knew that balloons created static, once rubbed onto hair

or fur, the material of the pop can would react by moving.  
2. Evaluate your group's approach to this activity. What aspects of your group's procedure and interaction would you change in future investigations?

We approached this activity very well. We all had different ideas, and interpreted everyone's ideas.

We think that being more prepared and checking everything before attempting it would help.

## Group Reflection – Collaboration Fluency

“Establish”

1. Did your group stick to the original agreed upon non-negotiables? Explain

Yes we all stuck to the original plans, and we worked together and imputed everyone's  
ideas like

we said we would.

“Envision”

2. Did your group stick to the original plan? Explain

We did not have an original plan, since we didn't know exactly what we were working with. But,  
when

we found what we were comfortable with, we stuck 100% to that plan.

“Execute”

3. Did your group execute the plan? Explain

Yes we did. We did exactly what we were planning to do, although there might have been  
some

'bumps' in our procedure, we did everything that we were supposed & planned to do.

“Examine”

4. How did the collaboration go? Explain

It went very well. Once we felt comfortable with each other, all of us shared ideas that were  
imputed,

and we all came to a decision and worked together to find a solution.



## Self-Reflection – Collaboration Fluency

“Establish”

5. Did you stick to the original agreed upon non-negotiables? Explain

Yes, we all thought of ideas together, and when we found an idea that we thought was good, we

stuck to it and followed through.

“Envision”

6. Did you stick to the original plan? Explain

Yes we stuck to the original plan, using either the fur or Nash's hair, to create static, then hold it near the can so that the static would 'push' it forward.

“Execute”

7. Did you execute the plan? Explain

Yes we executed the plan, but although we did not go a long distance because of a little bump in

our can, we still did what we were planning to do.

“Examine”

8. How did the collaboration go? Explain

I think the collaboration went very well. We all had different ideas, and at the end, we put them all

together. With all of our brains put together, we accomplished things that we could have never done

by ourselves.