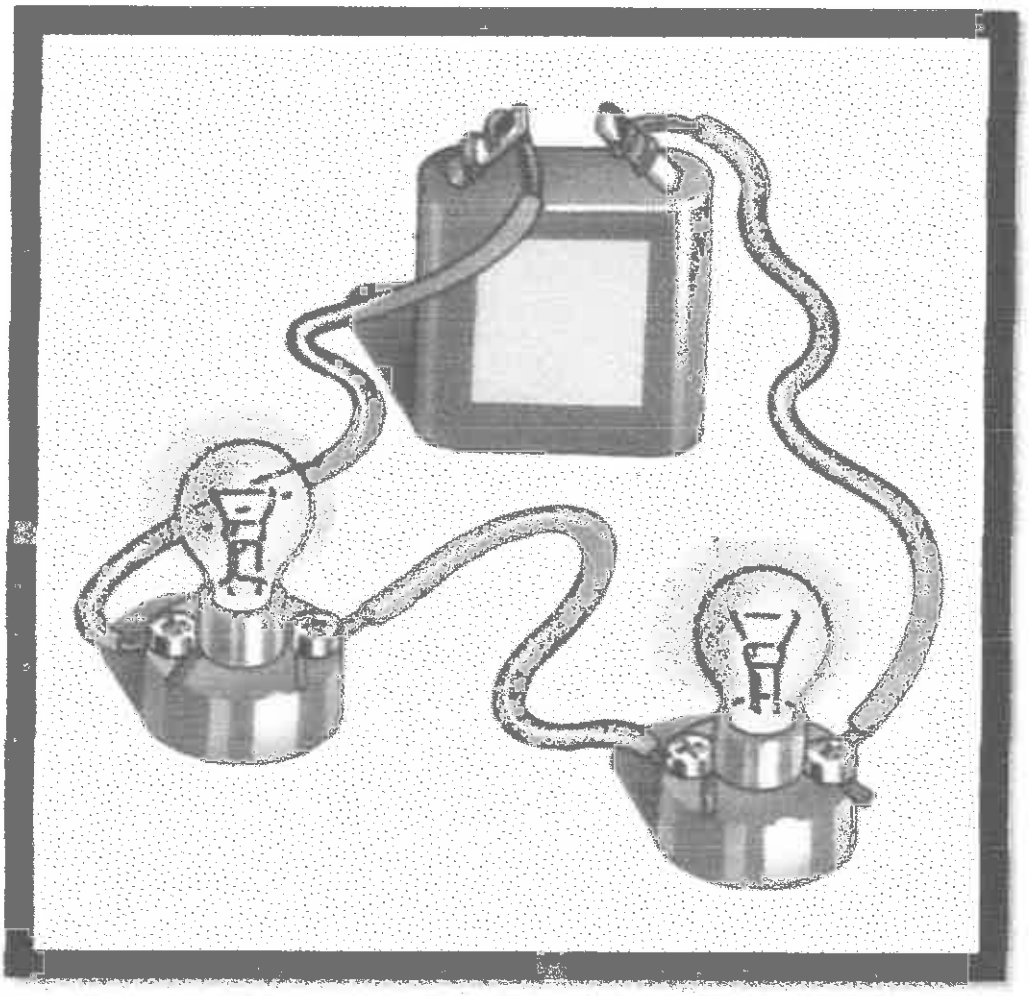
# ELECTRICITY!



**Name:** _____

# Links to Educational Videos
# *ELECTRICITY*

**Please use these links to help guide in the learning process. Before starting each worksheet, check this list below to look for a corresponding video. The websites can be copied by the links or searched up by their titles give below!**

**Brainpop – Electricity**

*Through this website, students can learn about different topics about Electricity through a variety of videos. At the end of each video students are encouraged to take the quizzes!*

Log in: ps101
Password: brainpop

**Science Kids (Electricity)**
Link:
https://www.sciencekids.co.nz/electricity.html

**Conductors and Insulators:**
Link: https://www.youtube.com/watch?v=PafSqL1riS4

**Electric Circuits**
Link: https://www.youtube.com/watch?v=HOFp8bHTN30 (Power of Circuits)
Link: https://www.youtube.com/watch?v=VnnpLaKsqGU&t=52s (What is an Electrical Circuit)

**Types of Circuits (Series and Parallel Circuits)**
Link: https://www.youtube.com/watch?v=XSukRnxGy5c
Link: https://www.youtube.com/watch?v=RQ3djos_LY8

**Bill Nye the Science Guy (Electricity)**
Link: https://www.youtube.com/watch?v=SYacUaukaxg

**Dexter Duck - Electrical Safety Video**
Link: https://www.youtube.com/watch?v=igK-DRB5faU&t=17s

**Bill Nye the Science Guy – Static Electricity**
Link: https://www.youtube.com/watch?v=iHGpJChYQ5o

Name _____ Class period _____

# Bill Nye - S1E18 Electricity

Circle the word (or words) then write it in the blank(s) that best completes the sentence or answers the question, using the video.

1. Electricity is the flow of tiny particles called _____.

Protons Neutrons Electrons Quarks

2. *Circuit is an old word meaning* _____

Run around Go around Go through Go under

3. Did you know that? Your brain uses the same power as a _____ watt light bulb.

10 40 60 100

4. Things that let electricity flow through them are called _____. Things that don't are called _____.

Insulators Insulation Conductors Conduction

5. Electrical and water circuits both have _____ and _____.

Flow Rhythm Pressure Timing

6. Measuring the number of electrons that flow through a wire is called _____.

Watts Amps Volts AC

7. The combination of volts and amps is called _____.

Watts Amps Volts AC

8. Electrical power is measured in _____

Amps Watts DC Volts

9. Inside of a battery there some goopy chemicals called _____ that makes electricity flow.

Water Electrolyte Slime Jelly

10. Bill visits the _____ Coulee dam in Washington state that produces electricity from falling water.

Grand Hoover Massive Concrete

11. AC stands for _____ current.

Awesome Atomic Asymmetrical Alternating

12. When using batteries they produce DC current that stands for _____ current.

Dilated Direct Dull Duracell

13. Different _____ use different style plugs for their electricity (in the wall).

Appliances Countries Toasters TV's

14. How is it possible for birds to sit on power lines?

_____

_____

15. How are hotdogs like batteries?

_____

_____

16. Where does electricity come from?

_____

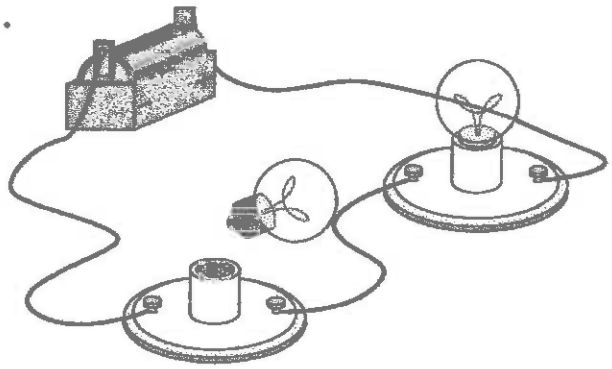
_____

Name: _____

# Electrical Circuits

Tell whether the light bulb or bulbs **will light** or **will not light** based on the circuit.

1.



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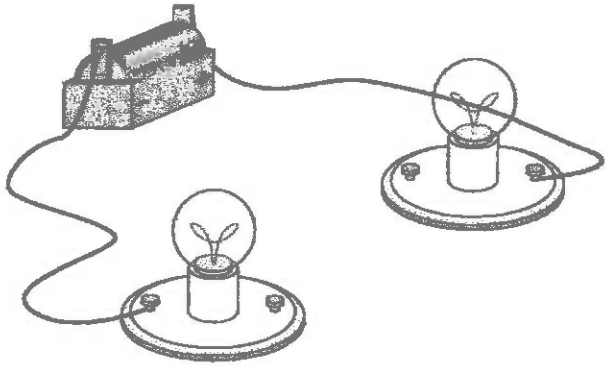
2.



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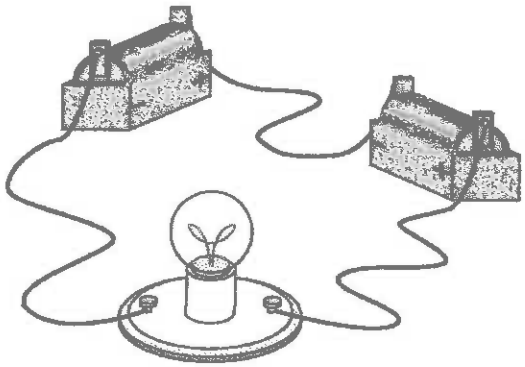
3.



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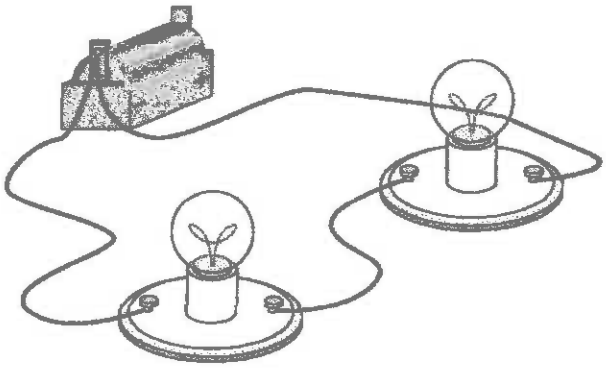
4.



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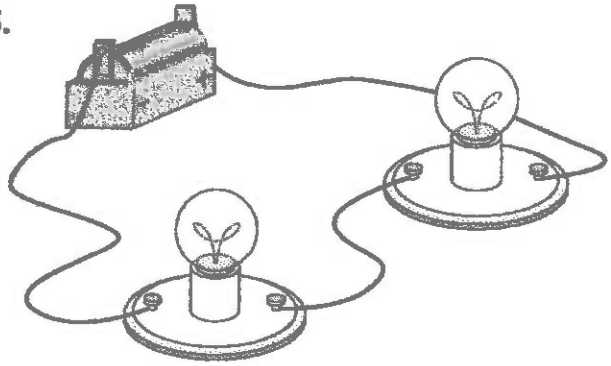
5.



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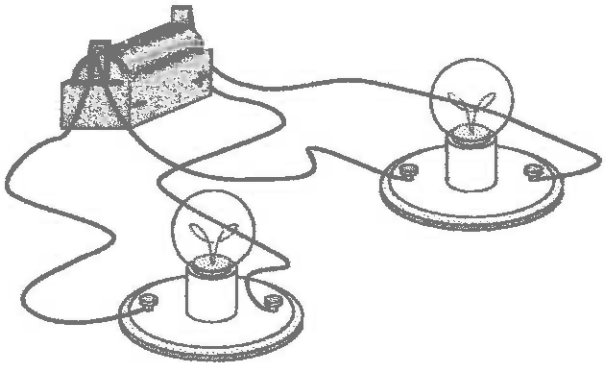
6.

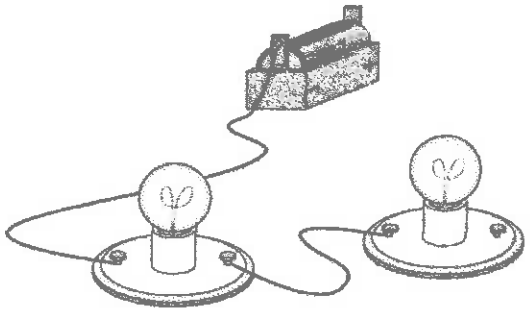


_____

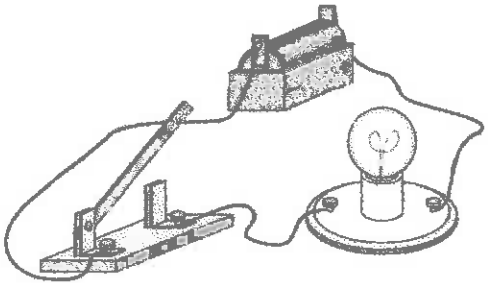
Name: _____

# What's Wrong With These Circuits?

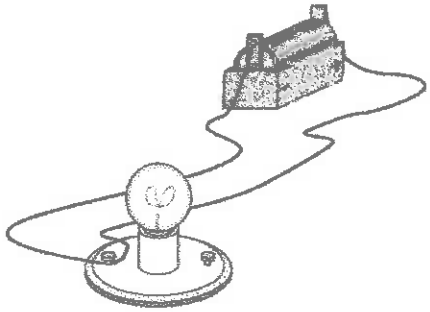
1. Explain why the light bulbs won't light in the circuit pictured on the right.



2. Explain why the light bulb isn't lighting up in the circuit pictured on the right.



3. Explain why the light bulb isn't lighting up in the circuit pictured on the right.

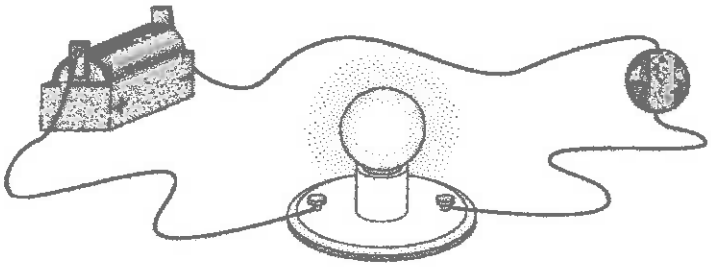


Name: _____

# Conductors and Insulators

A **conductor** is a material that allows electricity to flow through it.
An **insulator** is a material that electricity cannot flow through.

To determine whether an object is a conductor or insulator, you can build a simple circuit with a battery, light bulb, and three pieces of wire.



*Touch the free ends of the wire to the object you are testing. If the light bulb lights up, the object is made from a conductor. if it does not, the object is made from an insulator.*

Complete the table. Predict whether each item is made from a material that is a conductor or insulator. Then test each item to determine if it is made from a conductor or insulator.

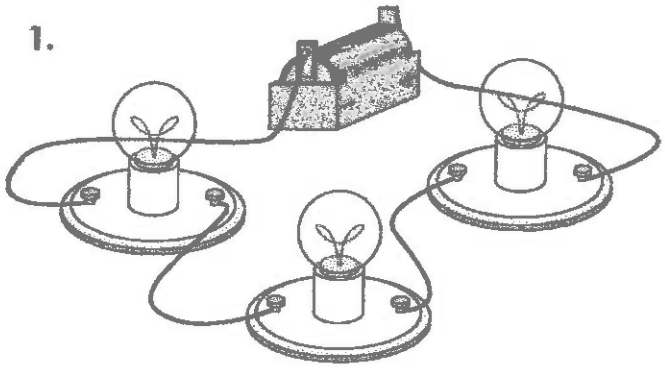
| Object | Prediction: Conductor or Insulator? | Explain WHY |
|---|---|---|
| **rubber band** | | |
| **penny** | | |
| **nickel** | | |
| **toothpick** | | |
| **key** | | |
| **paper clip** | | |
| **brass paper fastener** | | |
| **glass microscope slide** | | |
| **(your choice)** | | |
| **(your choice)** | | |

Name: _____

# Series & Parallel Circuits

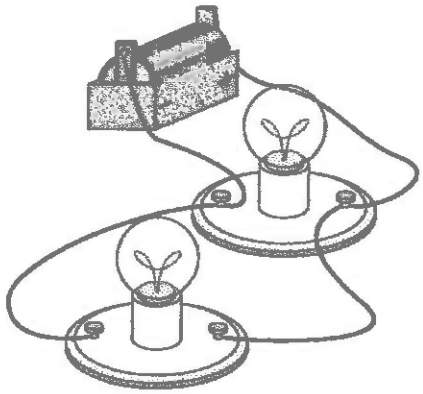
Tell whether each picture shows a **series circuit** or **parallel circuit**.

1.



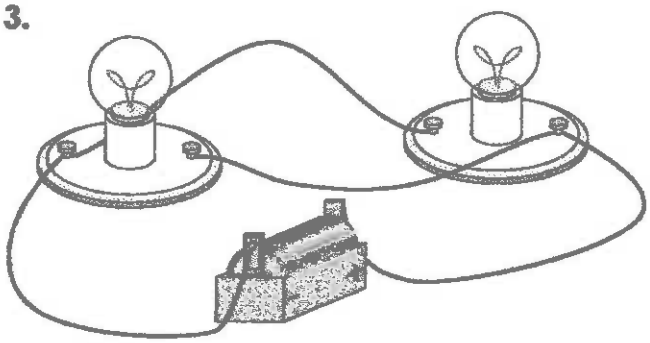
**type:** _____

2.



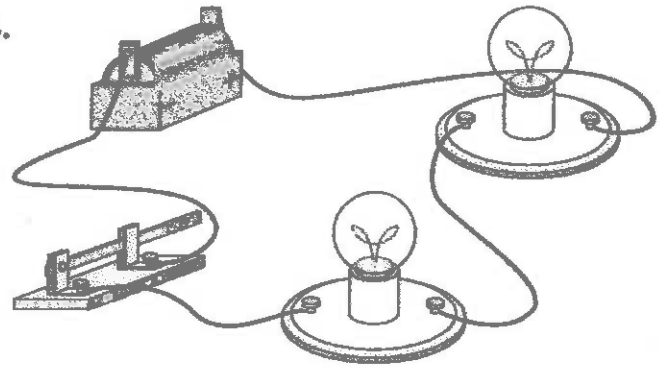
**type:** _____

3.



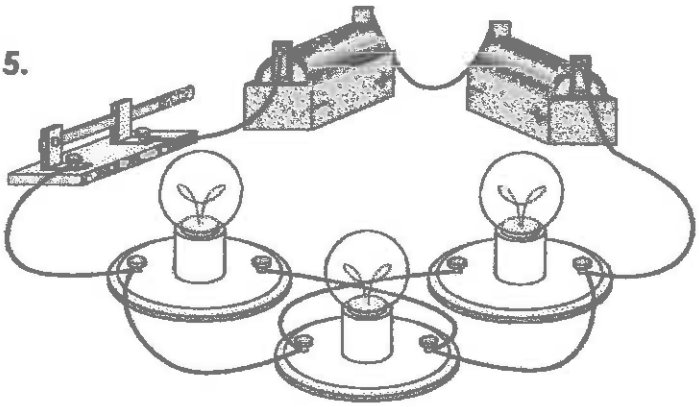
**type:** _____

4.



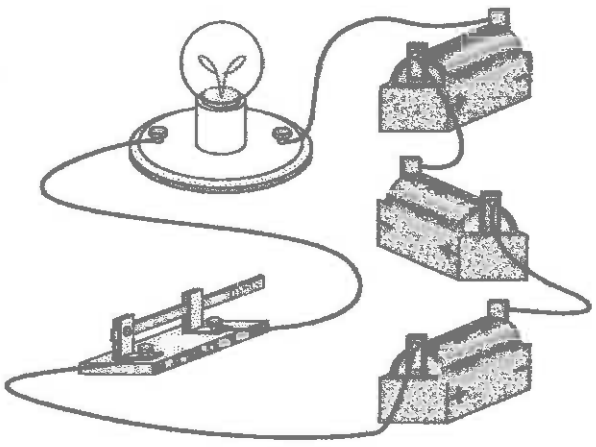
**type:** _____

5.



**type:** _____

6.



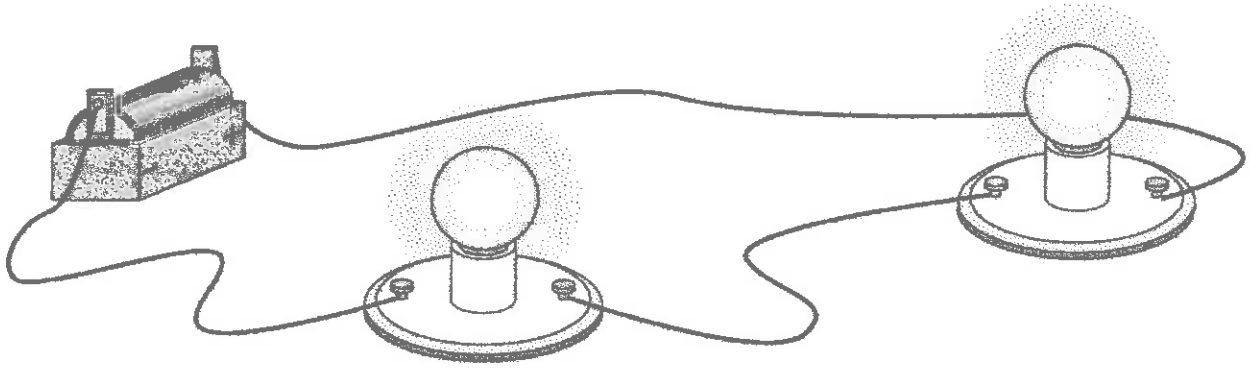
**type:** _____

Name: _____

# Series and Parallel Circuits

In a **series circuit** electricity has only one path to follow. All parts are connected one after another. Electrons flow from the negative side of the battery around in a loop to the positive side.

Draw arrows to show the path the electrons move in this series circuit.



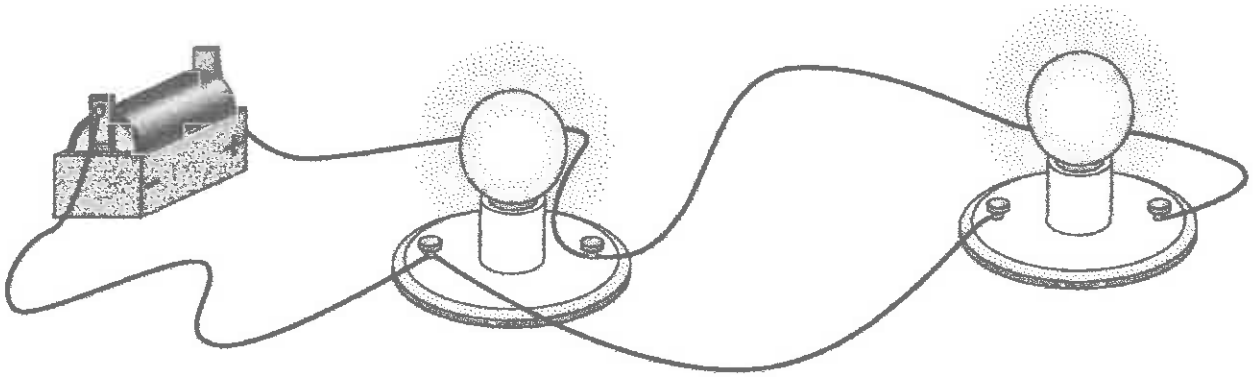
If a light bulb is missing or broken in a series circuit, will the other bulb light? Explain.

_____

_____

In a **parallel circuit**, electricity has more than one path to follow. Electrons can follow different paths as they flow from the negative side of the battery to the positive side.

Draw arrows to show the different paths electrons can travel in this parallel circuit.



If a light bulb is missing or broken in a parallel circuit, will the other bulb light? Explain.

_____

_____

Name: _____

# Electrical Charges

If an object has more positive charges (⊕) than negative charges (⊖), its electrical charge is positive (⊕).

If an object has more negative charges (⊖) than positive charges (⊕), its electrical charge is negative (⊖).

If an object has the same number of positive (⊕) and negative (⊖) charges, it has no electrical charge or is neutral.

Example:

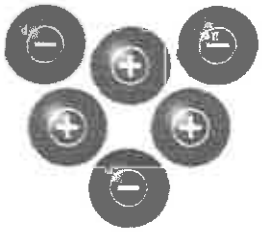
Electrical charge: positive charge

Count the positive and negative charges in each picture. Write *positive charge*, *negative charge*, or *no charge* on each line.

**1.**

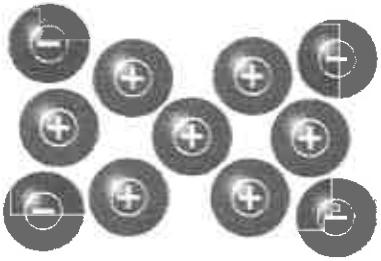
electrical charge: _____

**2.**



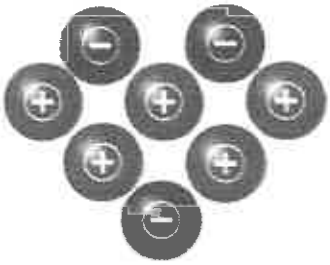
electrical charge: _____

**3.**



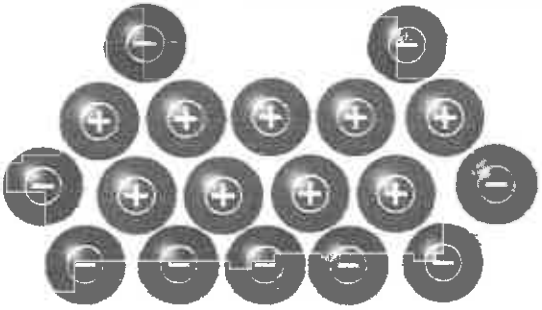
electrical charge: _____

**4.**



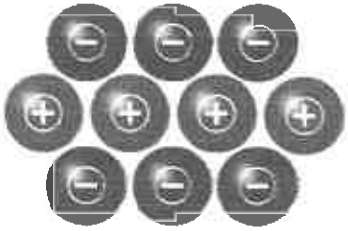
electrical charge: _____

**5.**



electrical charge: _____

**6.**



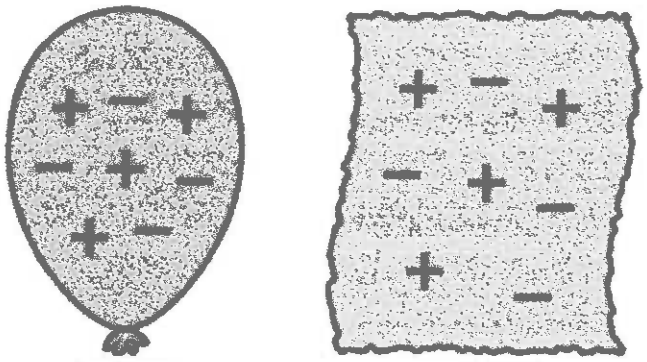
electrical charge: _____

Name: _____

# Static Electricity

Rubbing a balloon with wool cloth will create static electricity charges.

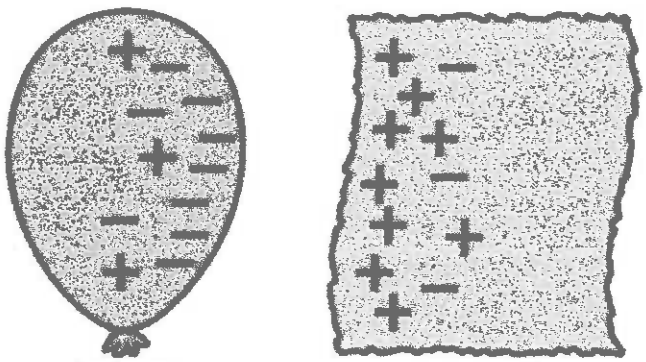
This balloon has **not** been rubbed with the wool cloth.



balloon wool cloth

**Picture 1**

This balloon **has** been rubbed with the wool cloth.



balloon wool cloth

**Picture 2**

In Picture 1, does the balloon have a positive charge, negative charge, or no charge? _____

In Picture 1, does the cloth have a positive charge, negative charge, or no charge? _____

In Picture 2, does the balloon have a positive charge, negative charge, or no charge? _____

In Picture 2, does the cloth have a positive charge, negative charge, or no charge? _____

If you place small pieces of tissue paper near the balloon in Picture 2, they would probably stick to the balloon. Explain why.

_____

_____

_____

_____

Name: _____

# Electricity

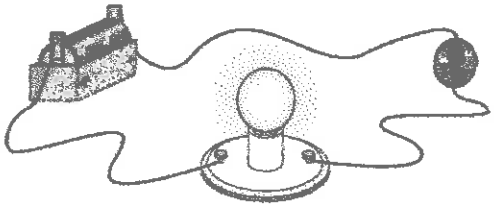
**Choose the best answer for each question. Write the letter on the line.**

_____ **1.** What supplies energy in an electric circuit?

**a.** a conductor **b.** light bulb
**c.** a wire **d.** a battery

_____ **2.** Which material is a conductor?

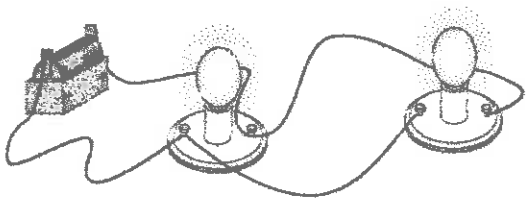
**a.** plastic **b.** silver
**c.** glass **d.** wood



**Circuit A**

_____ **3.** Which type of circuit is Circuit A?

**a.** series **b.** parallel
**c.** perpendicular **d.** current



**Circuit B**

_____ **4.** Which item is a resistor in Circuit B?

**a.** light bulb **b.** wire
**c.** battery **d.** screws

_____ **5.** Why did the person who made Circuit A probably connect the wires to a penny?

**a.** They needed to use a penny to make the bulb light.
**b.** They were testing to see if the penny conducts electricity.
**c.** They used the penny to supply extra power.
**d.** The penny will prevent sparks.

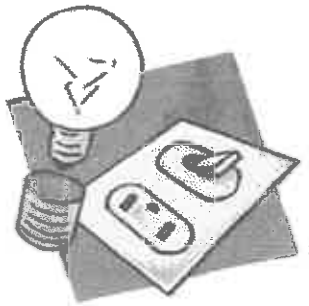
_____ **6.** Which of these could be used as a resistor in a circuit?

**a.** a pencil
**b.** a gas engine
**c.** a rubber eraser
**d.** an electric motor

Name: _____

# Electricity

| | | | |
|---|---|---|---|
| **circuit** | **glass** | **insulators** | **conductors** |
| **electric current** | **rubber** | **series** | **parallel** |
| **resistor** | **copper** | **battery** | **silver** |



***Chose the best word(s) from the word box to complete each sentence.***

**1.** The flow of electricity is an _____.

**2.** A path that an electric current follows is a _____.

**3.** A _____ supplies energy to move electricity through a circuit.

**4.** _____ are materials that electrical current cannot pass through.

**5.** _____ are materials that electrical current can easily pass through.

**6.** _____ and _____ are examples of materials that are conductors.

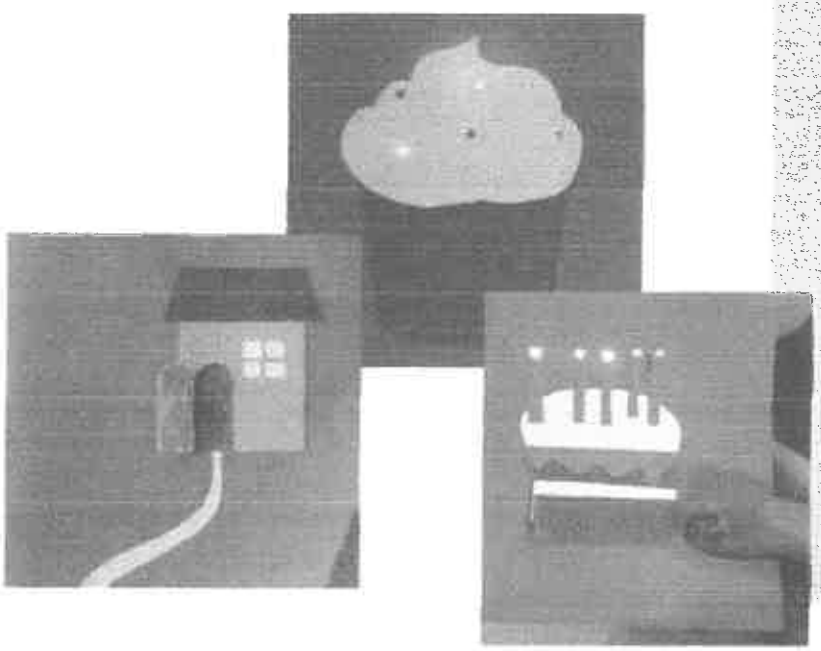
**7.** _____ and _____ are examples of materials that are insulators.

**8.** A _____ is a material that cuts down the flow of current, but does not stop it.

**9.** A _____ circuit is a circuit in which electrical current can follow only one path.

**10.** A _____ circuit is a circuit in which electrical current has more than one path to follow.

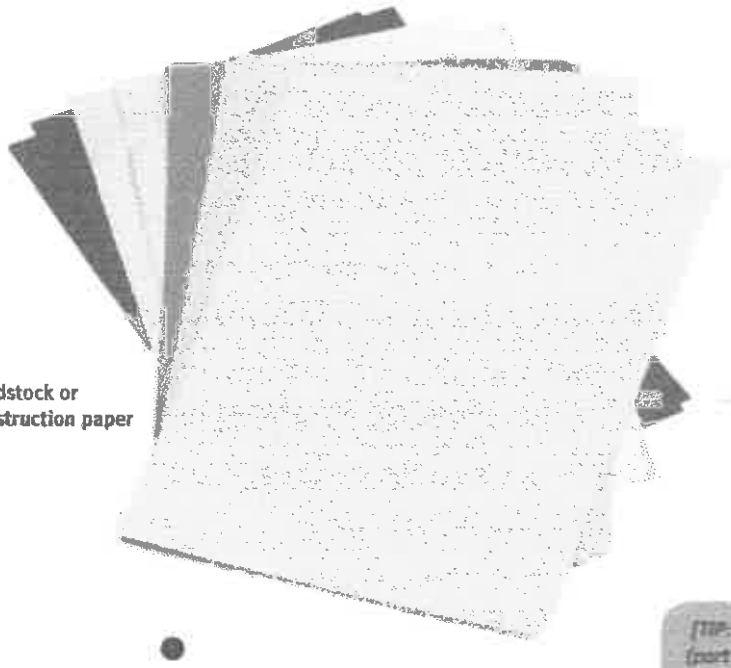
# PAPER CIRCUITS



Make simple or complex electrical circuits on a piece of paper! Copper tape and surface-mount LEDs allow you to turn a fully functional circuit into a light-up greeting card, origami animals, or three-dimensional pop-up paper sculptures that have working lights in them.

## BUILD IT!

Collect These Things



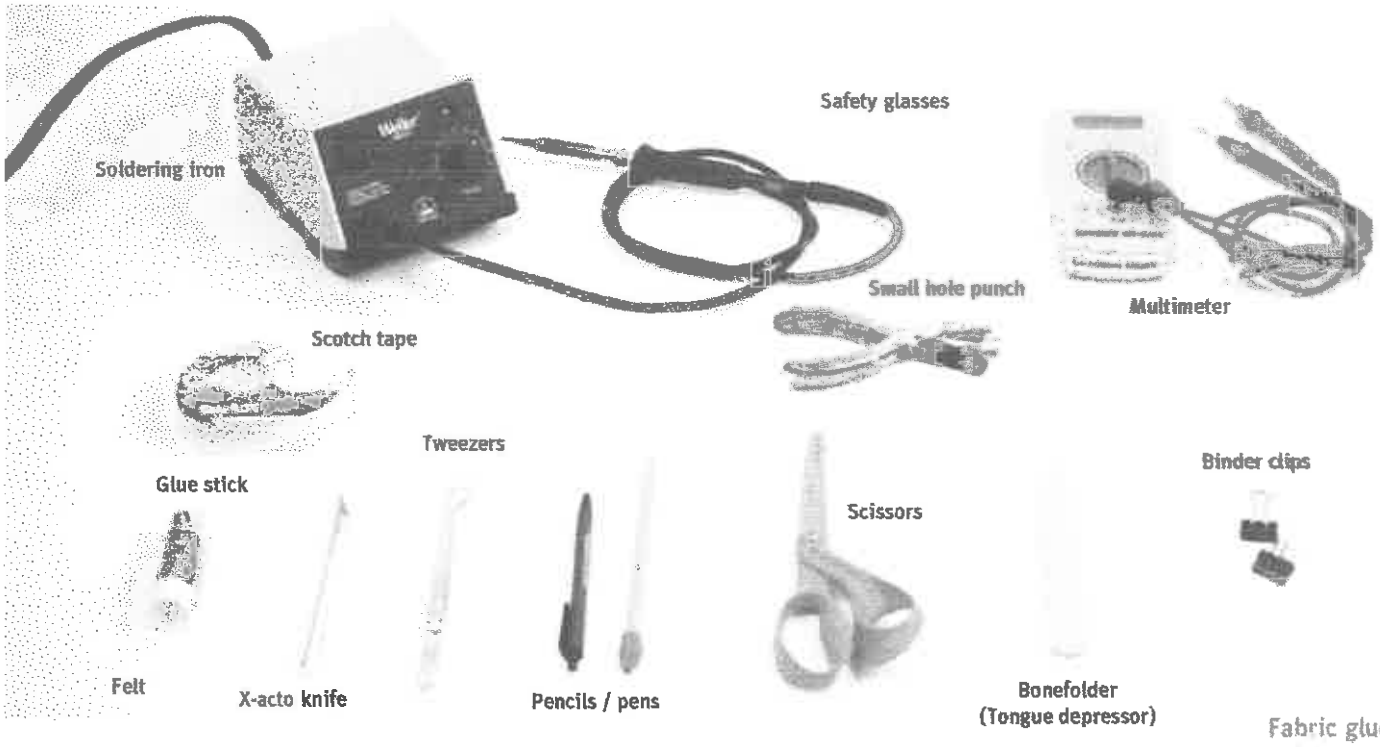
Cardstock or construction paper

Surface mount LEDs

3V coin cell batteries

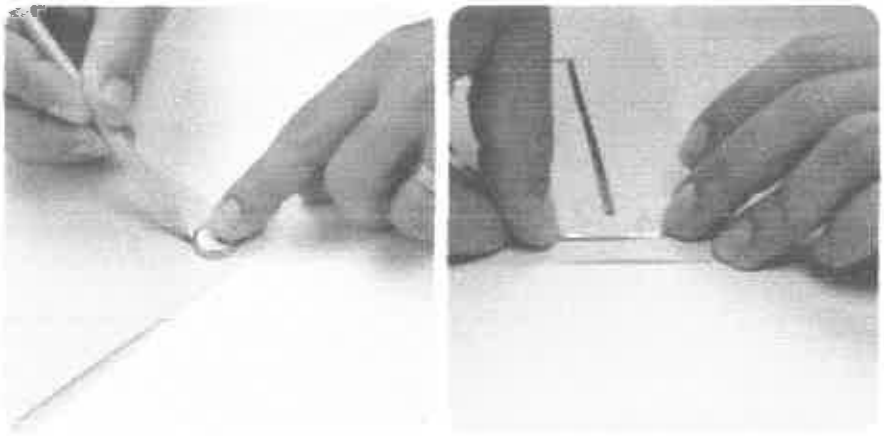

*[TIP: You can get 5 mm copper tape, ready for use, from sparkfun.com (part #PRT-1-561). It is also often sold in hardware stores under the name of Slug Tape—it is taped to the lip of planters to prevent slugs and snails from climbing in. If you use slug tape, you might want to cut it into thinner strips before using it on your paper circuit.]*

**the tinkering studio**



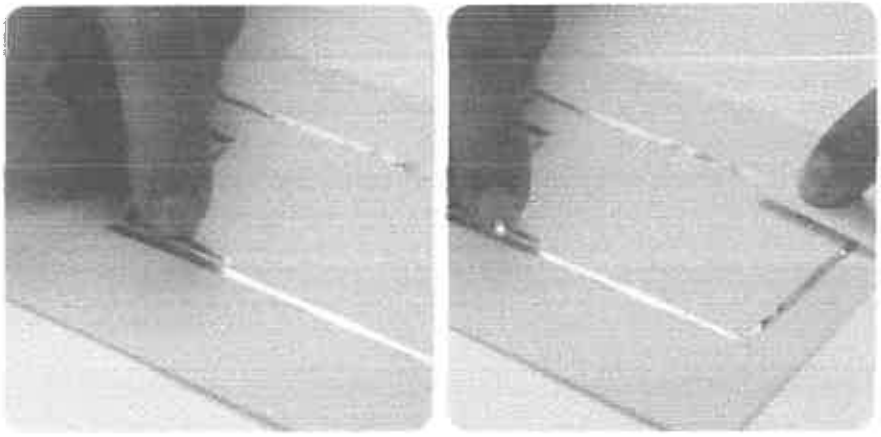

# TRY IT!

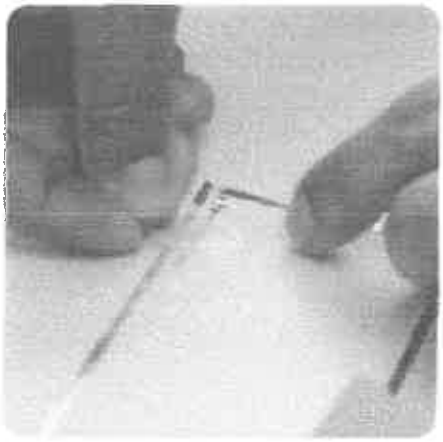
## Getting started:



**Start simple** – fold over one corner of the paper and trace the battery on either side of the fold. Try taping down two strips of copper tape with each piece starting from one of the circles and ending about 1 mm apart (don't worry about how it looks for now).

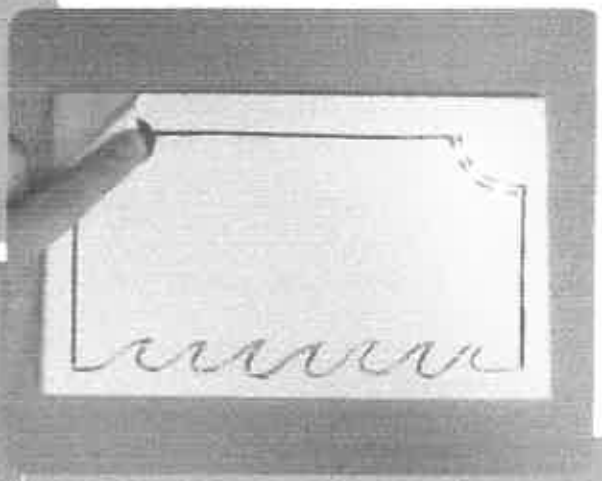
**Place a surface mount LED in the gap.** Fold the battery in the tab you created earlier and see what happens. Does the light turn on? If not, try flipping the battery or gently pushing down on the light.





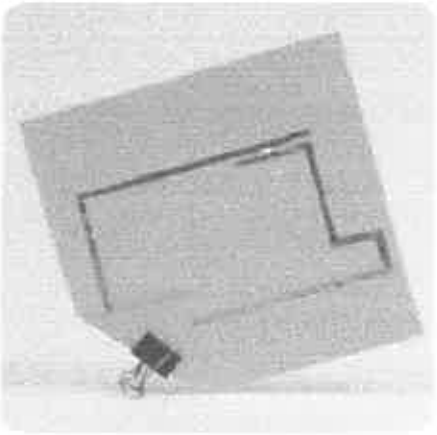
**You can lay a piece of Scotch tape over your LED** to secure it to the copper tape or solder the LED to the copper tape using a soldering iron. (See helpful techniques below for tips on soldering the lights.)

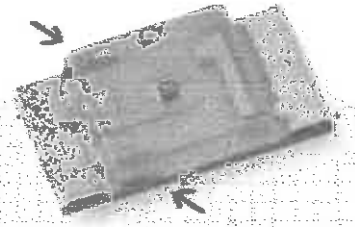
With these starting steps, the possibilities for creating your paper circuits are endless. You can **fold the copper tape into different designs** or make a collage that is lit by a hidden circuit on another piece of paper underneath.



**Could you make a battery holder somewhere else on the paper besides the corner?** Or a switch that turns your lights on and off when pushed?

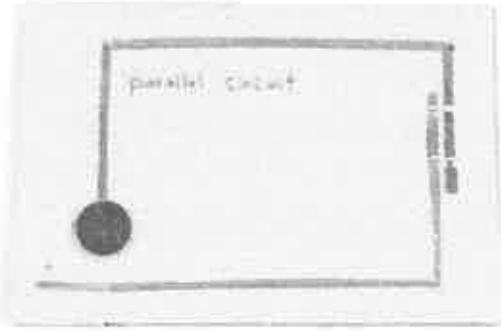
Binder clips are a great tool for holding the battery in place to keep the light turned on when displaying your circuit.

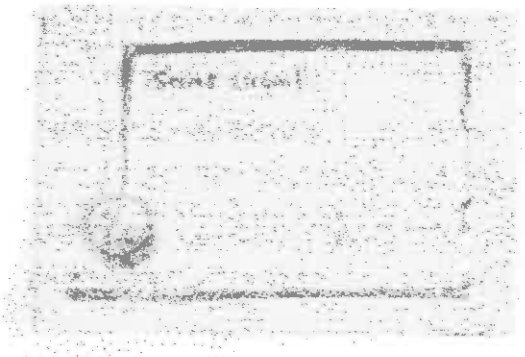




**Look closely at your LED (a magnifying lens might help here). You'll notice one or two green markings on one side. These dots indicate the negative side of the LED. Being able to tell the positive from negative sides will come in handy later on, especially if you're using more than one light.**

**You can make cards with one light or many lights.** When using multiple lights it's helpful to make a parallel circuit. It's possible to make series circuits, but you'll need an additional battery for each light.



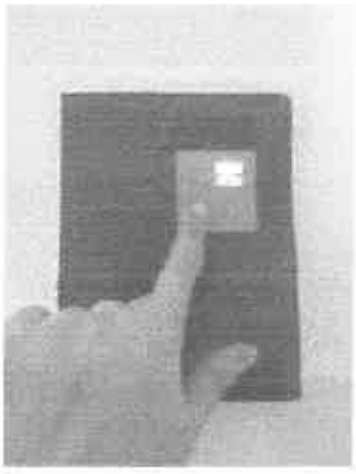



When making a parallel circuit, we like to **think of it as creating two copper tape pathways** that come very, very close together but don't touch. Your surface mount LEDs will have to bridge the gap between them, so we've found that placing them about 1 mm or less apart is ideal.

**Make sure your LEDs are all oriented in the same direction**, with all the positive leads touching the positive path, and vice versa. *(TIP: Many times if a light isn't working, it's oriented backwards.)*

**...acts like an insulator, blocking th... electricity from flowing.** ...ake a tiny solder "bridge" ... the connection or fold ... back on itself (st... ...ky side) then Scot... ...that over the seam as a diffe... ...

Depending on the LEDs you buy, you might find that some colors work together and other colors don't (for us, red, yellow, and green work together, as do blue and white). This could become a feature of your circuit where by pushing a switch the lights change colors. You could also experiment with resistors to make incompatible colors (like blue and green) work at the same time.



**The LEDs make diffuse circles when shined through thin, light-colored paper.** Cardstock can block the light, so poking holes in it with an X-acto knife or small hole punch will let the light shine through.

**Helpful tape folding techniques:**

**Making a sharp corner:** Fold the copper tape back on itself and make a sharp crease. While holding down the crease, turn the tape the direction you would like it to go. Flatten the tape with a bone folder or Popsicle stick.

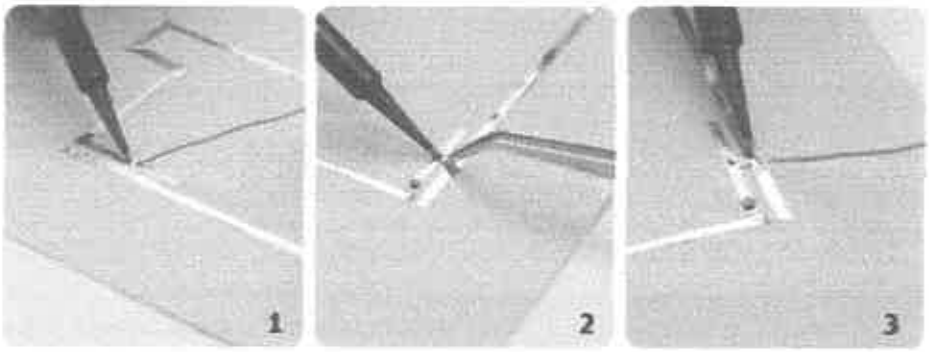
**Making a curve:** This works better with thinner tape. With one hand guide the tape along with curve you'd like to make. With the other hand, push down the tape to secure it to the paper. You might notice tiny puckers in the tape; you can smooth those out with a bone folder or Popsicle stick.

**Soldering an LED:**

1) Place a dot of solder on one side of your copper tape where you would like the LED to be.

2) Pick up one of the LEDs with the tweezers and hold it right next to the blob of solder. With your other hand, melt the solder and stick the LED into the liquid metal. Hold the LED in place while the solder cools.

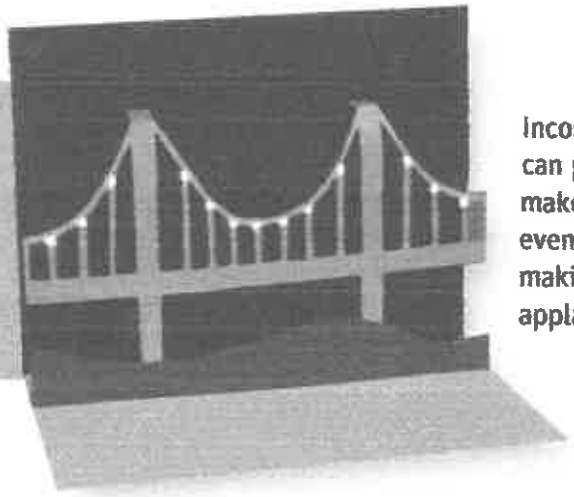
3) Now you should be able to solder the other side onto the other piece of copper tape. Make sure both the leg of the LED and the copper tape get hot enough for the solder to flow and connect to them.




Test your design! And remember, working with a soldering iron takes time and practice, so don't be too frustrated if you don't get it perfect on the first try.

# TAKING IT FURTHER

Origami and pop-ups: make your paper circuits three-dimensional by incorporating them into origami animals or pop up scenes.



Incorporate microcontrollers: You can program an ATTiny chip to make your lights blink, flicker, or even respond to sensors. Try making a circuit that responds to applause or changes in light.