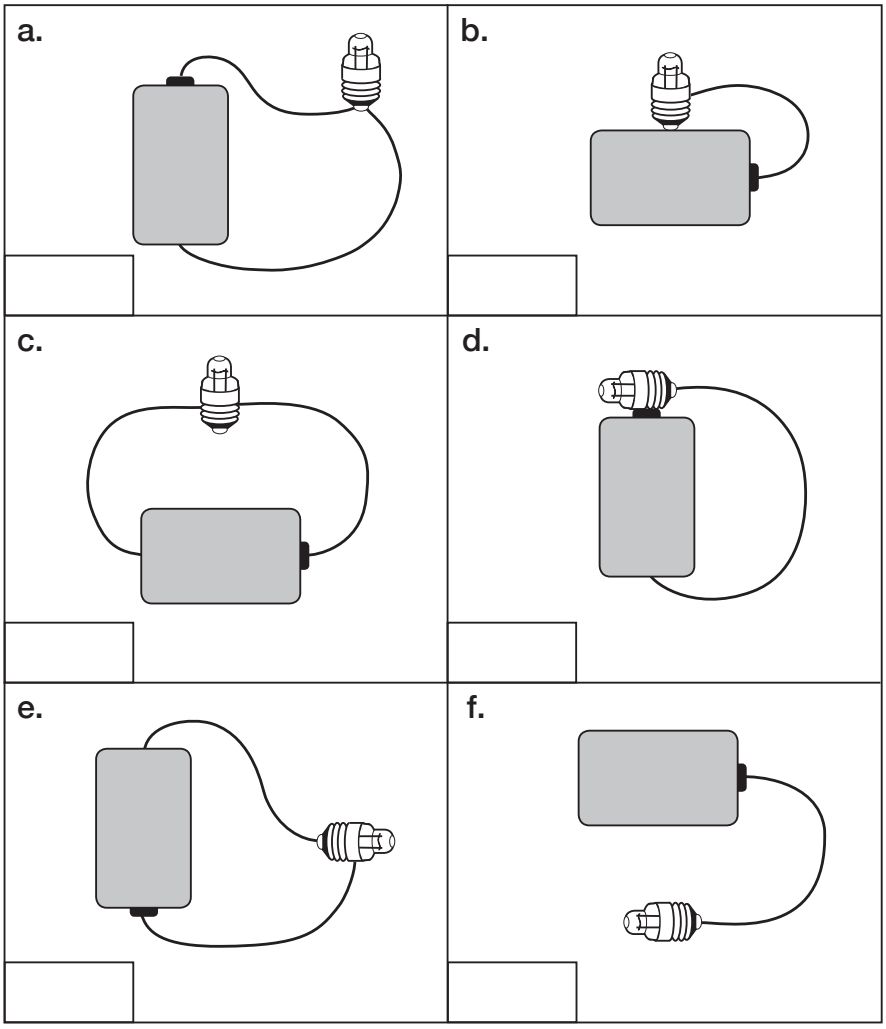
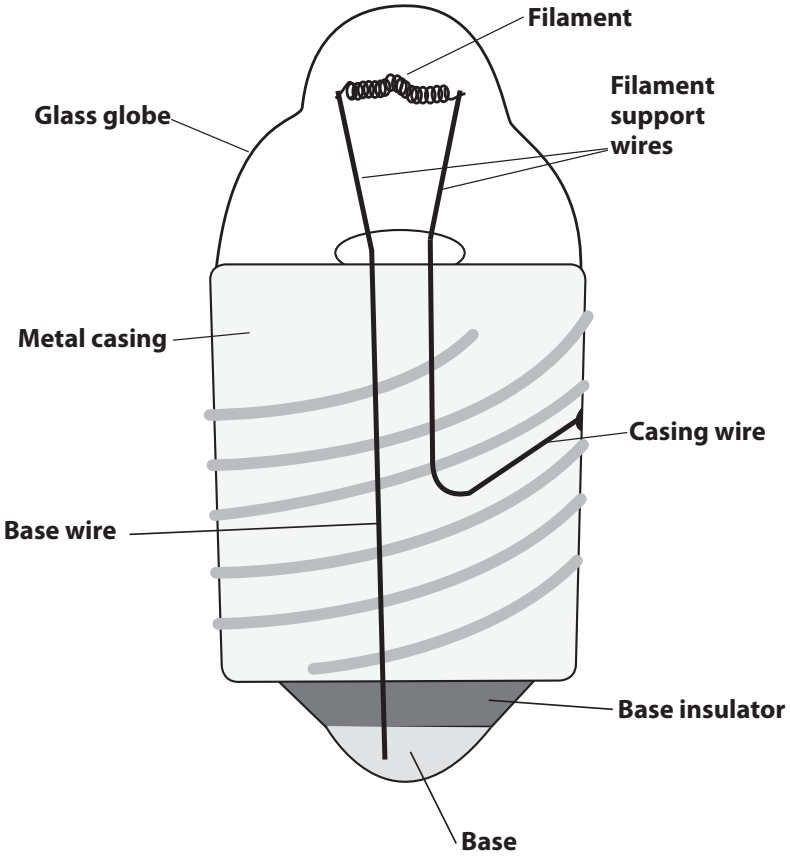
Lighting Bulbs

Write a prediction for each circuit in the small box. If you think it will light, write "yes."
If you think it won't light, write "no."



Inside an Incandescent Bulb



"Edison Sees the Light" Review Questions

1. How do you know when energy is moving in a lightbulb circuit?

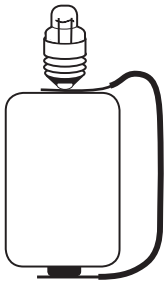
2. Describe the path taken by electricity through an incandescent lightbulb.

3. What are some of the reasons why lamp technology has changed?

4. Research a science career that deals with energy and electricity. Write two new facts you learned about that career.

5. Write a paragraph about Thomas Edison and some of his contributions to science.

Response Sheet—Investigation 1



Look at the bulb-and-battery circuit pictured. Will the bulb light? Why or why not?

"Electrical Energy" Review Questions

1. What is energy?

2. What can electrical energy, or electricity, do?

3. What is a battery? What kind of energy does it have?

Conductors and Insulators

1. Make a prediction. Which kinds of materials can complete the pathway of an electric circuit?

Object	Will it conduct? (predictions)	Did it conduct? (test results)
aluminum foil		
aluminum nail		
black rock		
brass ring		
cardboard		
copper foil		
paper fastener		
plastic chip		
plastic straw		
river rock		
rubber band		
sponge		
steel nail		
steel paper clip		
steel screen		
steel screw		
steel washer		
wood stick		
wool yarn		

2. What is similar about all the conductors?

"Conductors and Insulators" Review Questions

1. How are conductors and insulators different?

2. Name some materials that are conductors.

3. Name some materials that are insulators.

Energy Stations

For each energy station, answer the following questions:

1. Describe the system.

2. What was the energy source?

3. Where was the energy stored?

4. What evidence of energy is present?

Systems and Energy

System	Energy source	Evidence of energy transfer

"Changes in Energy" Review Questions

1. Forms of energy include light, thermal or heat, sound, electrical, and mechanical. Write about each form in your notebook. How are they alike? How are they different?

2. How are food, coal, wood, and batteries alike?

3. What is the source of most of the energy used by people?

"What Is Energy?" Video Review Questions

1. What are some other forms of energy?

2. What can each form of energy be converted into?

3. What is energy?

Series Circuits

1. Describe the problem when you made a series circuit using two bulbs, a D-cell, a switch, and wires.

2. What do you think caused the problem?

3. How did you solve the problem?

4. Why do you think that worked?

5. Draw the series circuit you built that solved the problem.

Parallel Circuits

Part A

1. Draw another parallel circuit that makes two lightbulbs shine brightly.

2. Why do you think the two lights are bright when they are in parallel?

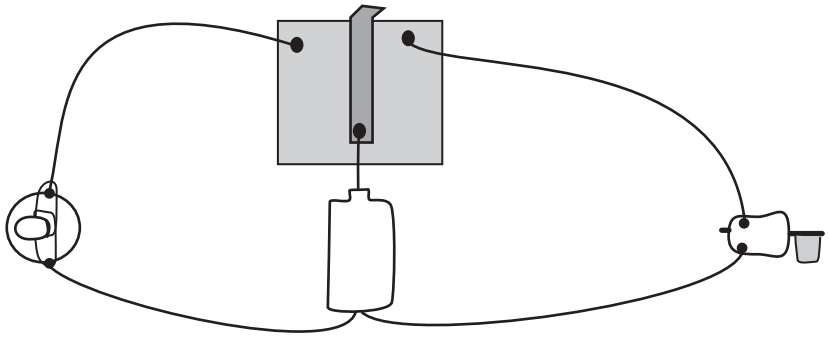
Part B

3. Compare the two circuit designs—series and parallel. How are they alike? How are they different?

4. When might a series circuit be the best design? When might a parallel circuit be the best design?

Response Sheet—Investigation 2

A student wants to build a circuit to light a bulb and run a motor at the same time. She drew the circuit she plans to build. She used a special switch (shown in the gray box). The switch can move to the right or to the left.



Look at the student's drawing. Explain why you think the circuit will or will not work the way she wants it to.

"Series and Parallel Circuits" Review Questions

1. Will electricity flow in an open circuit? Explain.

2. What is the advantage of wiring two lightbulbs in parallel?

3. Why are two lightbulbs in series with a D-cell dim?

4. Do you think the lights in your home are wired in series or in parallel? Why do you think so?

Recommendation to the Board

Research

Keep a record in your notebook of all the things you do to research the problem. Below are some of the things you might want to include in your notes.

1. What happens when you simulate a burned-out bulb in a series circuit?
2. What happens when you simulate a burned-out bulb in a parallel circuit?
3. How many bulbs did the class light in a parallel circuit using only one D-cell?

Memo

Write a letter to the board of directors with your recommendations for a new circuit design. Be sure to include the following:

- ☐ The type of circuit you recommend (series or parallel)
- ☐ The reasons why you think that type of circuit is best
- ☐ What you did to reach your conclusion
- ☐ A drawing of your recommended circuit

"Alternative Sources of Electricity" Review Questions

1. What are nonrenewable resources? Give three examples.

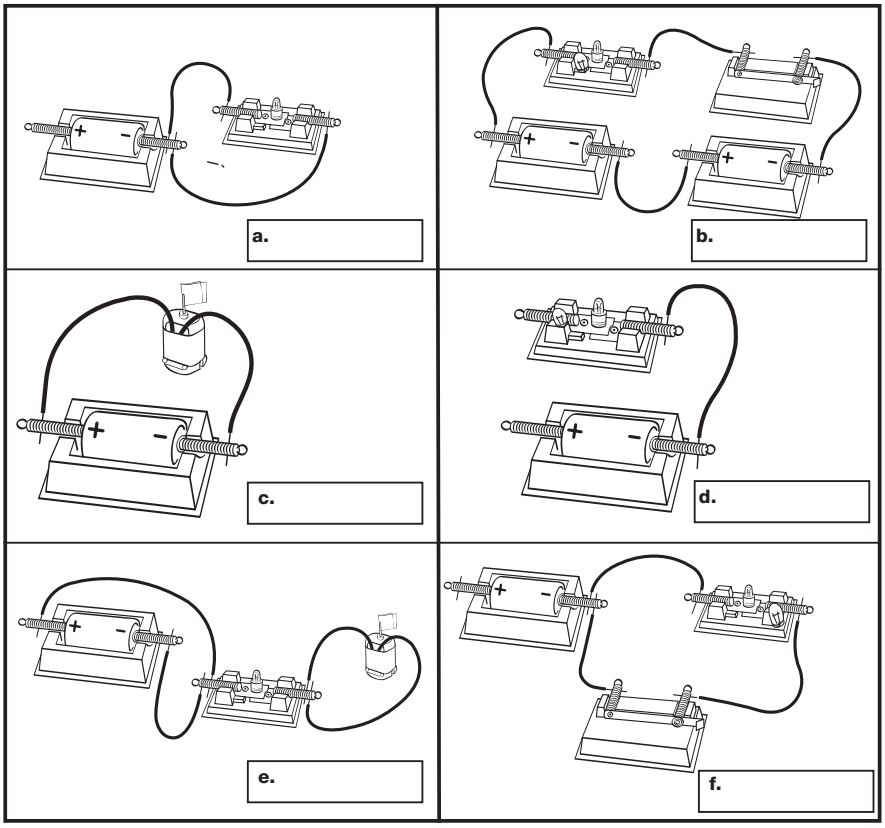
2. What are renewable resources?

3. What are some renewable resources we can use to produce electricity?

4. What are some ways you can conserve energy and resources? Why is it important?

Additional Circuits

Look at the pictures below. If the bulb will light or the motor will run, write "yes" in the small box with a letter. Write "no" if the bulb will not light or the motor will not run.



Choose one of the circuits above that will not work. Explain what you would do to fix it.

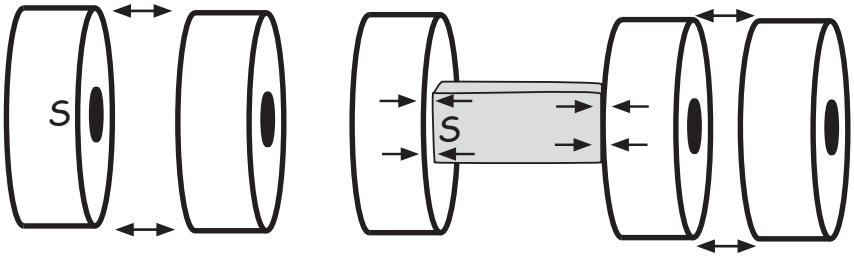
Magnetic Observations

Will it stick? (yes/no)	**Object**	**Things that stick**	**Things that don't stick**
	aluminum foil		
	aluminum nail		
	black rock		
	brass ring		
	cardboard		
	copper foil		
	paper fastener		
	plastic chip		
	plastic straw		
	river rock		
	rubber band		
	sponge		
	steel nail		
	steel paper clip		
	steel screen		
	steel screw		
	steel washer		
	wood stick		
	wool yarn		

Magnetic Poles

1. Label the poles (north and south) on these two attracting magnet systems.

2. Show where the poles (north and south) are on these two interacting magnet systems.



3. What makes magnets repel each other? Use poles in your explanation.

4. What makes magnets attract each other?

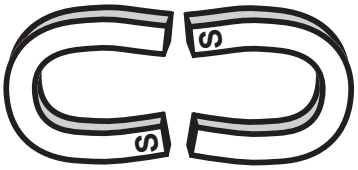
"When Magnet Meets Magnet" Review Questions

1. Why does magnetite stick to a magnet?

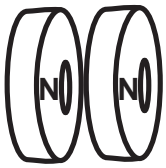
2. What causes magnets to attract each other at some times and repel each other at other times?

3. The magnets shown below have one pole labeled. Which pairs of magnets will attract, and which will repel?

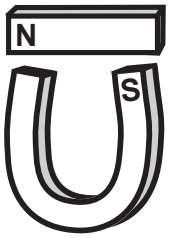
a.



b.

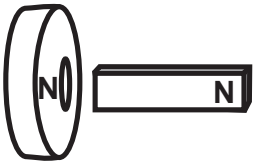


c.



d.

e.



How Magnets Work

1. Can a magnet attract a paper clip through materials? What kinds of materials?

2. How can a magnet make a paper clip float in air?

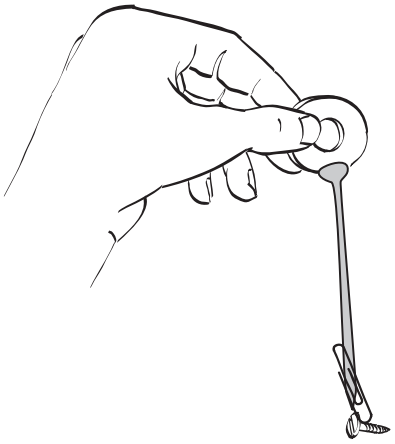
3. What happens to a steel nail when a magnet touches it?

Response Sheet—Investigation 3

1. You probably noticed that an iron object doesn't have to touch a magnet before it begins to move toward the magnet. Why do you think that happens?

2. If you put something like a piece of cardboard between a magnet and an iron nail, the magnet still holds the nail in place. How can that happen?

3. When you make a "chain" of iron objects, you start with a magnet, stick an iron object to the magnet, then stick other iron objects to more iron objects. Why do you think the iron objects stick to each other even when they are not touching the magnet?



"Magnificent Magnetic Models" Review Questions

1. Explain why the containers filled with magnets act the way they do.

2. Why doesn't the paper clip fall to the bottom of the jar?

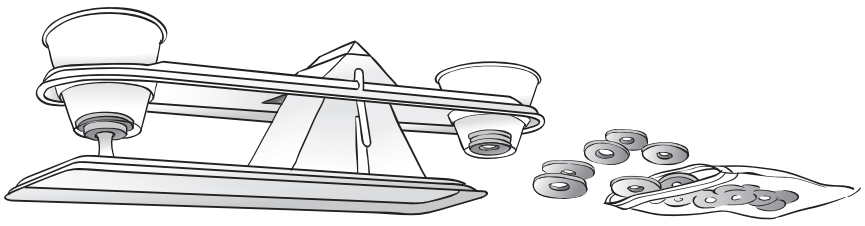
3. If you wanted to have three containers of magnets dance around one another, how would you orient the magnets?

4. Suppose you want to test the effect of magnetic force on an object. Design an experiment. What materials would you need? What would you do?

Magnetic Force—Procedure

1. Zero the balance. Use the white plastic slider.
2. Insert the magnet-on-a-post in the hole on the base.
3. Position a magnet inside the cup over the magnet-on-a-post. The two magnets should attract.
4. Put washers in the empty cup. Find out how many it takes to break the force between the two magnets. Try to reset the balance each time the force is broken.
5. Test the magnets several times. Be ready to answer the following questions.
   a. Where should you place the washers in the cup?

   b. Does it make a difference whether you place the washers in the cup gently or drop them in?



Magnetic Force—Graph

"Electromagnetic Energy" Video Review Questions

1. Is electromagnetism a form of energy?

2. What is an example of how magnetism is used to create electricity on a large scale?

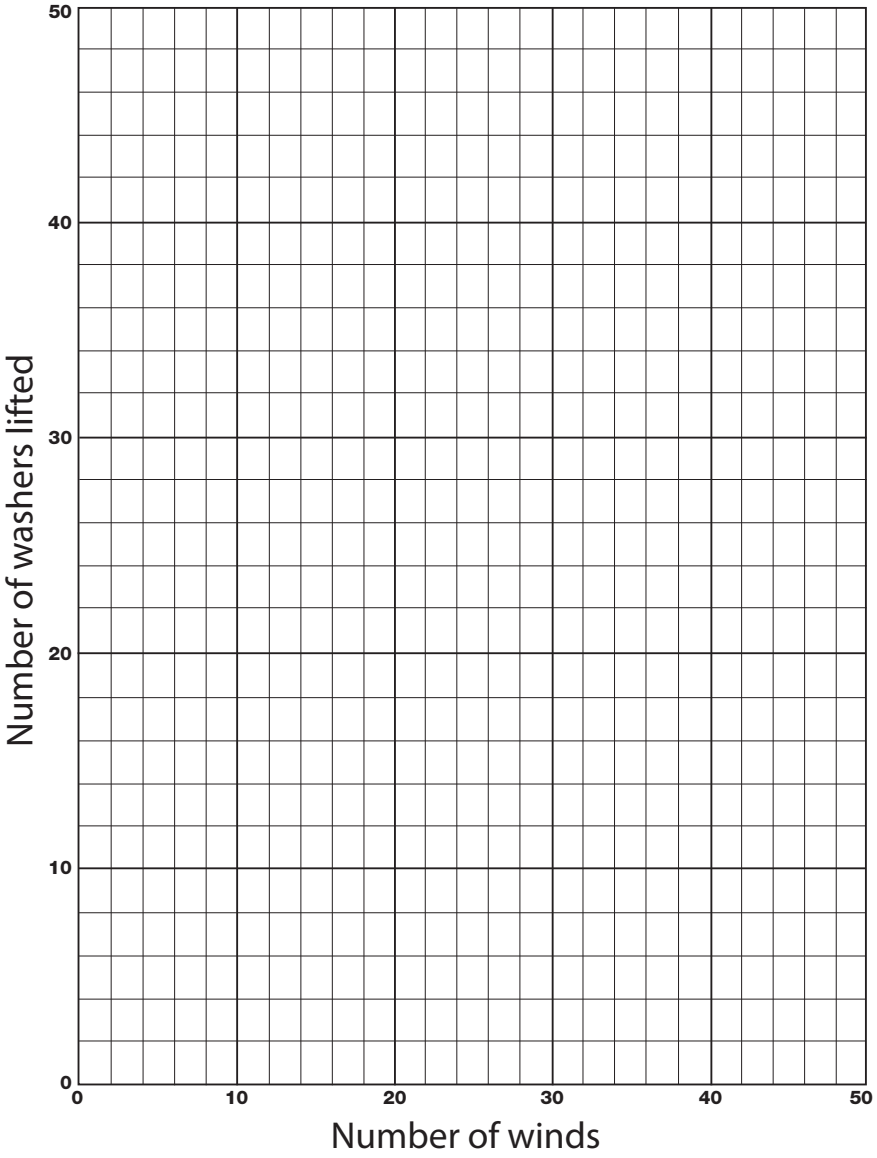
"Electricity Creates Magnetism" Review Questions

1. What was Oersted's historic discovery? Describe his contributions to science.

2. How does an electromagnet work?

3. Why did Oersted's compass needle rotate when he ran electric current through the thin wire?

Changing Number of Winds—Graph



Response Sheet—Investigation 4

A student was trying to make an electromagnet. She found a nail and wrapped wire around it. She hooked up the wire to a D-cell and switch. She closed the switch and tried to pick up some washers, but nothing happened.

This student needs your help. Make a list of questions you would ask her to help her solve the problem.

"Using Magnetic Fields" Review Questions

1. What is one way to tell if a wire has current flowing through it?

2. How do you make an electromagnet?

3. How can you make an electromagnet stronger?

"Electromagnets Everywhere" Review Questions

1. How does a motor work?

2. How does a doorbell make a continuous ring?

3. How does a speaker work?

S-T-R-E-A-M Code

Use the stream code to send and receive messages on the telegraph.

1 2 3 4 5 6
S T R E A M

Grid Code

Here's another code to try. When you use this code, you have to send two sets of clicks for each letter.

What rules do you need to set so everyone understands how the message is being sent?

Can you set up the alphabet grid in a better way? (HINT: What letters are used most often in words?)

	1	2	3	4	5
1	A	B	C	D	E
2	F	G	H	I	J
3	K	L	M	N	O
4	P	R	S	T	U
5	V	W	X	Y	Z

"Morse Gets Clicking" Review Questions

1. How did Samuel Morse build on Oersted's discovery?

2. How is an electromagnet used in a telegraph?

3. How is the telegraph you made like the one Morse made?

4. When your telegraph does not have enough power to make a click, you might have to modify your system. Can you decode these suggestions from Morse?

   .- -.. -.. / -- --- .-. . / -.-. . .-.. .-.. … .-.-.-

   ..- … . / -- --- .-. . / -.-. --- .. .-.. … .-.-.-

Design Your Own Investigation A

1. I want to learn more about

2. Focus question

My prediction

3. Equipment or technology I will use to answer my question. (Include safety equipment. Mark things you will be able to recycle or reuse.)