



Observe the situations above. Why do they happen?

SOURCES OF ELECTRICAL ENERGY

We use electrical energy every day. Electrical energy is used to produce light, heat, sound, and to move objects. What are the sources for electrical energy?



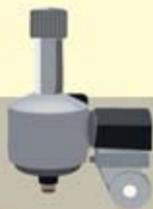
POWER PLANT

Power plants use kinetic energy produced from winds, waves, and hydroelectric to move turbines and generate electricity.



SOLAR CELL

Solar cells convert light energy from the Sun into electrical energy. Solar cells are also used in satellites and calculators.



DRY CELL

Dry cells store chemical energy. The chemical energy is converted into electrical energy to move tools such as toy cars. Dry cells are often used because of their small size and easy to bring everywhere.

DYNAMO

When wheels rotate, a small wheel of the dynamo also rotates. The dynamo converts kinetic energy into electrical energy that can light up a bicycle light.

ACCUMULATOR

Accumulators convert chemical energy into electrical energy. It is used to start up vehicles such as cars.

GENERATOR

Generators convert chemical energy from fossil fuels into electrical energy.

Explain the examples of sources for electrical energy.



TEACHER'S NOTES

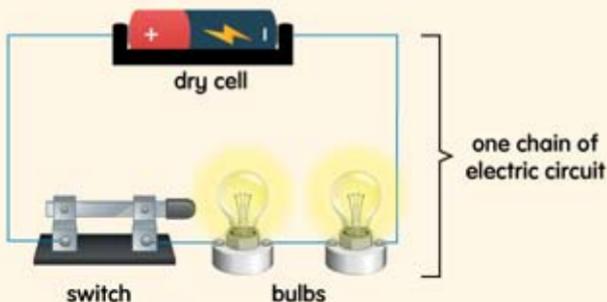
Energy from the Sun is also known as solar energy.

SERIES CIRCUIT AND PARALLEL CIRCUIT

Bulbs and other electrical components can be connected into two types of circuits. They are series circuit or parallel circuit.

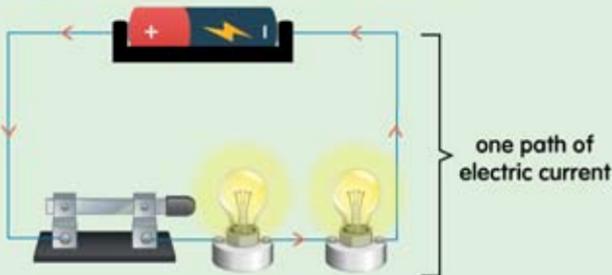
SERIES CIRCUIT

In a series circuit, each bulb is arranged in one chain.



Based on the arrangement of the circuits that you have learned, how many paths for the electric current to flow in series and parallel circuits?

Series circuit has a single path for the electric current to flow.

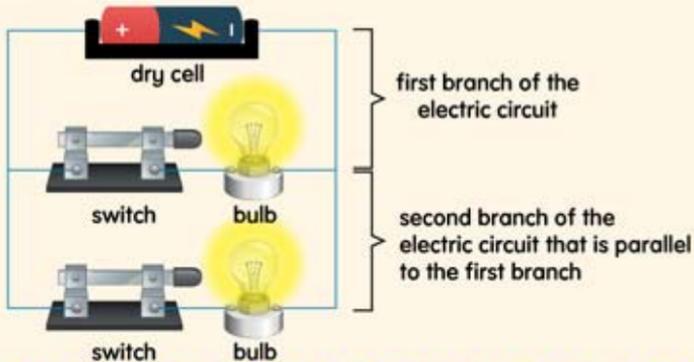


Observe the circuit below. What is the difference between the arrangement of bulbs in series and parallel circuits in a complete circuit?

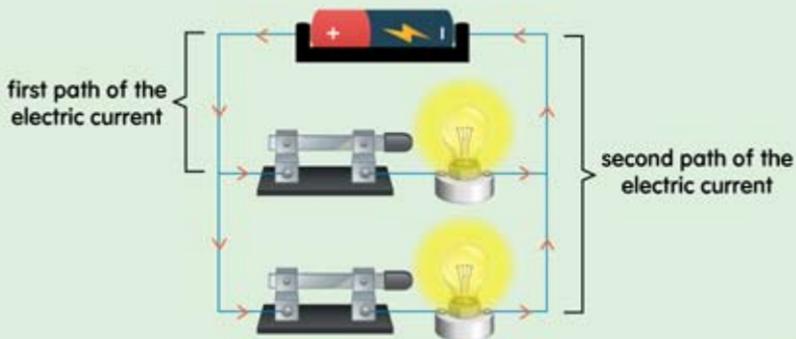


PARALLEL CIRCUIT

In a parallel circuit, each bulb is arranged in several branches that are parallel to each other.



The electric current in parallel circuit can flow in more than one path.

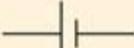
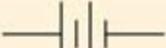
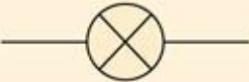


SKETCHING USING SYMBOLS

In a circuit diagram, electrical symbols are used to represent the components in an electric circuit.

Let's look at the symbols for the components in an electric circuit.

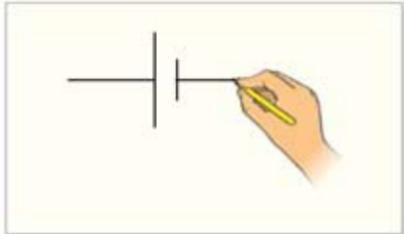


COMPONENT	SYMBOL
<p>Dry cell</p>  	 1 dry cell  2 dry cells
<p>Switch</p>  open switch  closed switch	 open switch  closed switch
<p>Bulb</p> 	

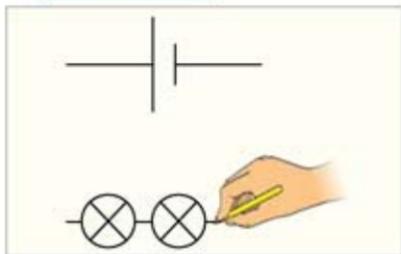
Sketching using the electrical symbols is easier to understand as compared to using the pictures of actual components. It shows the connections of the electrical components more clearly.



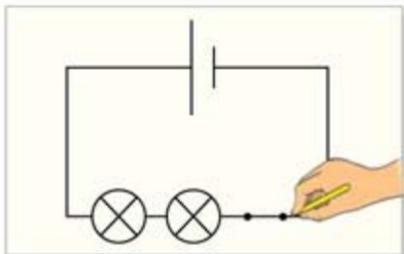
Let's sketch the diagram for this series circuit.



1. Sketch the symbol of the dry cell.

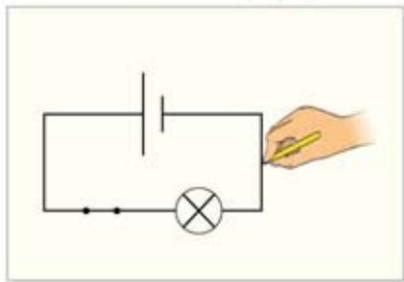
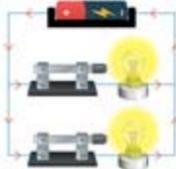


2. Then, sketch the symbol of the bulbs.

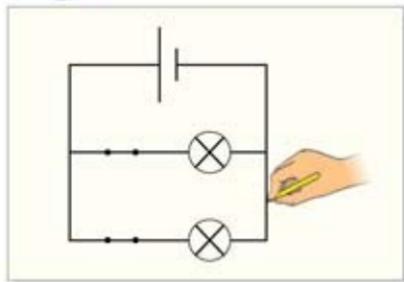


3. Sketch a linear connection between the dry cell and the bulbs. Lastly, insert the symbol for the switch.

How do I sketch the parallel circuit?



1. Sketch the first branch of the electric circuit.



2. Then, sketch the second branch of the electric circuit in parallel.



FUN ACTIVITY

SKETCHING ELECTRIC CIRCUIT DIAGRAMS USING SYMBOLS



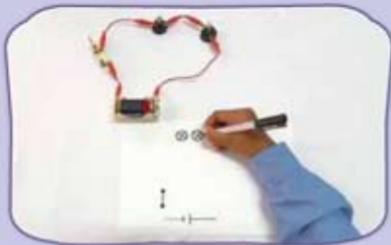
APPARATUS AND MATERIALS

Series circuit and parallel circuit arrangements, marker pen, A4 paper, and ruler.

STEPS



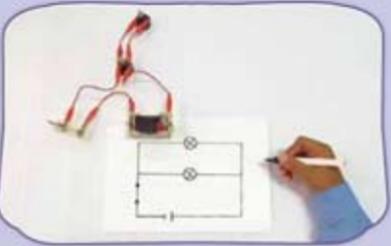
1. Observe the arrangement of the series circuit. Then, sketch the symbol for the dry cell on the A4 paper.



2. Take turns to sketch the symbol for each dry cell, switch, and the bulbs in the series circuit.



3. Connect the symbols of the components with the symbol of the connecting wire in linear lines.



4. Repeat steps 1 to 3 for parallel circuit arrangement.

5. Share the sketch of the circuit diagrams of your group in front of the class.

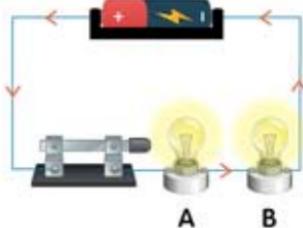


- (a) Explain all the symbols for the electrical components that you have sketched.
- (b) Compare the positions of the actual components with the sketched symbols in the circuits. Are the connections of the components shown clearly?

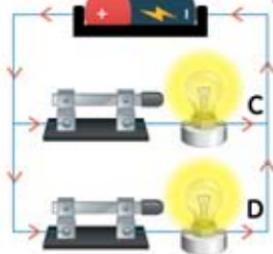
THE BRIGHTNESS OF BULBS



What is the difference in the brightness of the bulbs between the series and parallel circuits?



Series Circuit

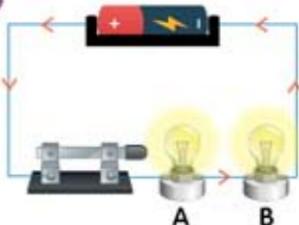


Parallel Circuit

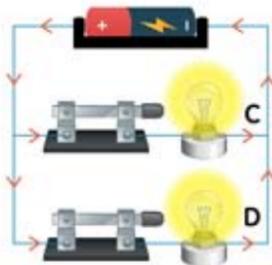
Wow! It looks like the bulbs arranged in the parallel circuit are brighter than the bulbs arranged in the series circuits.



Why do the bulbs arranged in the parallel circuit light brighter?



The series circuit has one path for the electric current to flow. All the bulbs share the electric current. This causes bulbs A and B to be dimmer than the bulbs arranged in the parallel circuit.



The parallel circuit has more than one path for the electric current to flow. The total electrical energy that flows through each path is the same. This causes bulbs C and D to be brighter than the bulbs arranged in the series circuit.



LET'S TEST

THE BRIGHTNESS OF BULBS



GROUP ACTIVITY

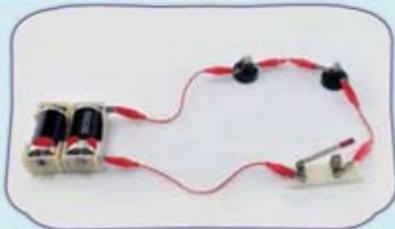
AIM

To investigate the relationship between types of circuit and the brightness of bulbs.

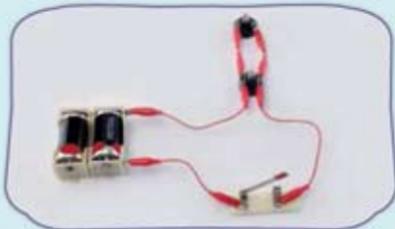
APPARATUS AND MATERIALS

Four bulbs, four bulb holders, four dry cells, four dry cell holders, two switches, and connecting wires with crocodile clips.

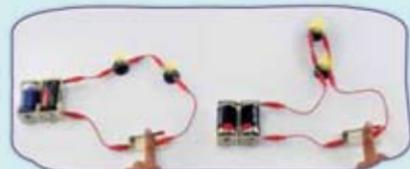
STEPS



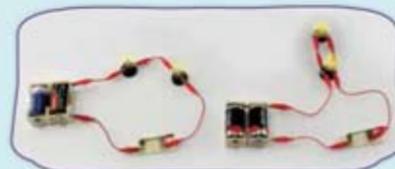
1. Build a series circuit using two bulbs.



2. Then, build a parallel circuit using the same number of bulbs.



3. Close the switches in both circuits simultaneously.



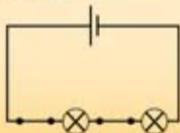
4. Observe the brightness of the bulbs in both circuits.



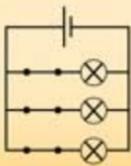
- (a) What are your observations on the brightness of the bulbs in this activity? Explain.
- (b) What can you conclude from your observations?



Ozair arranges five bulbs for two different arrangement of circuits. Which circuit lights brighter bulbs? Why?



Circuit A

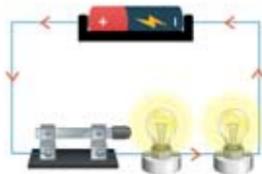


Circuit B

FACTORS AFFECTING THE BRIGHTNESS OF BULBS

IN SERIES CIRCUIT

NUMBER OF DRY CELL



Can we make the bulbs in this series circuit brighter?



If we increase the number of dry cells, the bulbs will light brighter.



Let's test this hypothesis by carrying out an experiment.

1. Aim

To determine the factors affecting the brightness of the bulbs in a series circuit.

2. Problem statement

Does the number of dry cells affect the brightness of the bulbs in a series circuit?

3. Hypothesis

As the number of dry cells increases, the brightness of the bulbs in a series circuit also increases.

4. Variables

- manipulated: number of dry cells.
- responding: brightness of the bulbs.
- constant: number of bulbs and type of circuit.

5. Apparatus and materials

Three bulbs, three bulb holders, six dry cells, six dry cell holders, three switches, and connecting wires with crocodile clips.

6. Steps

- Build three series circuits as follows:
 - A series circuit using a bulb and a dry cell.
 - A series circuit using a bulb and two dry cells.
 - A series circuit using a bulb and three dry cells.
- Then, close the switches simultaneously.
- Observe the brightness of the bulbs and record the results in the table as shown below.

7. Data

Number of dry cells	Brightness of bulbs		
	brightest	brighter	bright
1	/	/	/
2	/	/	/
3	/	/	/

8. Conclusion

- Hypothesis is (accepted/not accepted).
- As the number of dry cells , the brightness of the bulbs also .

NUMBER OF BULB

Melia, in your opinion, does the brightness of the bulbs increase by increasing the number of bulbs in this series circuit?



No, Chan. In my opinion, the brightness of the bulbs in a series circuit will decrease if the number of bulbs increases.

Let's carry out the experiment again to prove the hypothesis above.

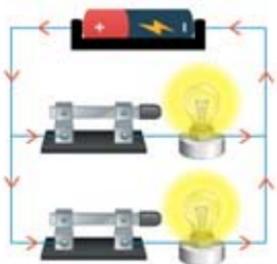


IN PARALLEL CIRCUIT

NUMBER OF DRY CELL

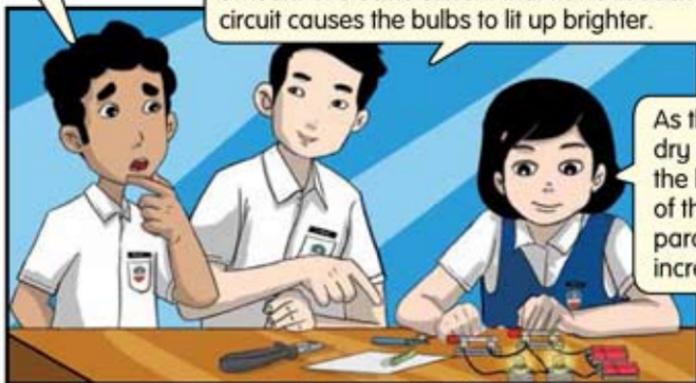


Does the number of dry cells affect the brightness of the bulbs in a parallel circuit?

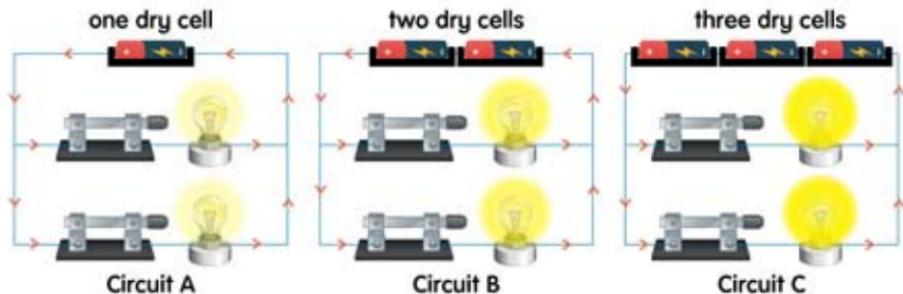


How do we change the brightness of the bulbs in a parallel circuit?

The brightness of the bulbs can be changed by adding more dry cells. The increase in the number of dry cells will provide more electrical energy to the circuit. The increased amount of electric current that flows in each branch of the circuit causes the bulbs to lit up brighter.



As the number of dry cells increases, the brightness of the bulbs in a parallel circuit also increases.



Based on Circuits A, B and C, plan an experiment to investigate whether the number of dry cells affects the brightness of the bulbs in a parallel circuit.

NUMBER OF BULB

Ana, in your opinion, does the brightness of the bulb in a parallel circuit decrease if the number of bulbs increases?

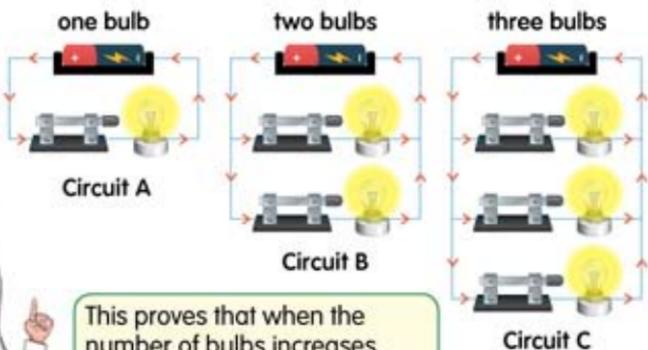


I don't think so, Ravi. A parallel circuit has more than one path for the electric current to flow. Therefore, the total amount of electricity that flows in each path is the same.

I agree with you, Ana. When the number of bulbs increases, the brightness of the bulbs in a parallel circuit does not change.



You can carry out an experiment to prove the hypothesis.



Wow, the bulbs in all three parallel circuits have the same brightness!



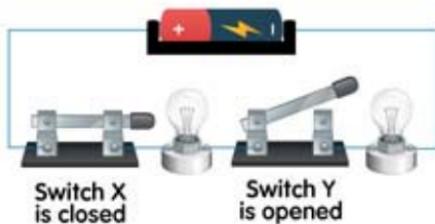
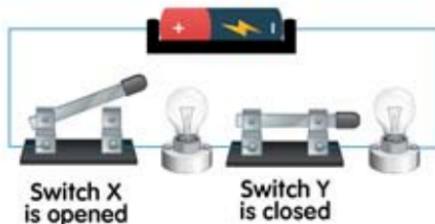
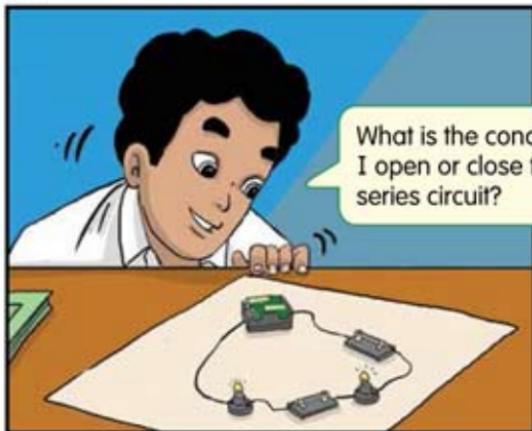
This proves that when the number of bulbs increases, the brightness of the bulbs in a parallel circuit does not change.

What is your conclusion about the factors affecting the brightness of bulbs in series and parallel circuits?



CLOSED SWITCH, OPEN SWITCH

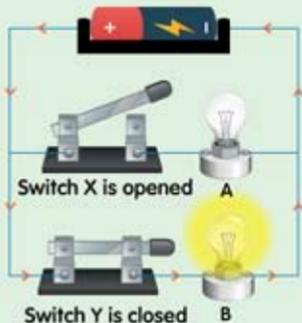
Ravi has built a series circuit. He has connected two switches in the circuit to observe the condition of the bulbs when these switches are closed or opened.



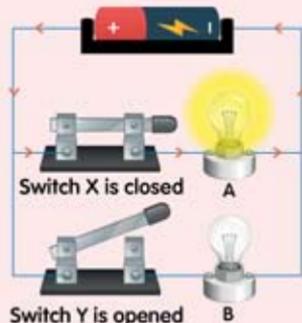
Why do both bulbs in this series circuit not light up if one of the switches is opened?

When either switch X or Y is opened, both bulbs do not light up. This is because the circuit has become an incomplete circuit and electric current cannot flow.

Chan also tested the condition of the bulbs when one of the switches is opened or closed in the parallel circuit that he has built.



When switch X in the first branch of the electric circuit is opened, bulb A in the first branch does not light up because the circuit on this branch becomes an incomplete circuit and the electric current cannot flow through it.



When switch Y in the second branch of the electric circuit is opened, bulb B in the second branch does not light up because the circuit on this branch becomes an incomplete circuit and the electric current cannot flow through it.

Bulb B in the second branch of the electric circuit still lights up because electric current can flow through this branch.

Bulb A in the first branch of the electric circuit still lights up because electric current can still flow through this branch.





LET'S TEST

CLOSE THE SWITCH, OPEN THE SWITCH



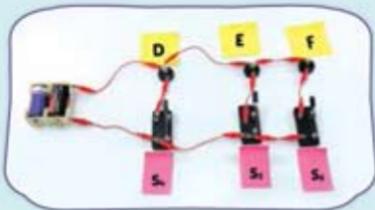
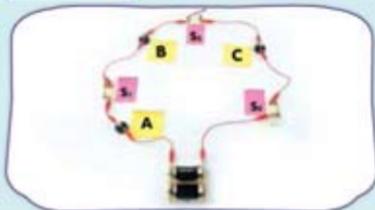
AIM

To investigate the relationship between the conditions of switches and bulbs.

APPARATUS AND MATERIALS

Six bulbs, six bulb holders, four dry cells, four dry cell holders, six switches, and connecting wires with crocodile clips.

STEPS



- Build a series circuit using three bulbs and three switches. Label the bulbs as A, B, C and the switches as S_1 , S_2 , S_3 .
- Build a parallel circuit using three bulbs and three switches. Label the bulbs as D, E, F and the switches as S_1 , S_2 , S_3 .
- Close the switches in both circuits simultaneously.
- Then, open and close the switches by following the instructions in the table as shown below. Record your observations.

Circuit	Condition of switches			Condition of bulbs		
	S_1	S_2	S_3	A	B	C
Series circuit	close	open	open	does not light up	does not light up	does not light up
	open	close	open	/	/	/
	open	open	close	/	/	/
Parallel circuit	S_1	S_2	S_3	D	E	F
	close	open	open	/	/	/
	open	close	open	/	/	/
	open	open	close	/	/	/



- State the condition of the bulbs if S_1 is closed while S_2 and S_3 are opened. Give an inference to your observation.
- Which bulb will light up if S_1 is closed while S_2 and S_3 are opened?

FACTORS AFFECTING THE USAGE OF ELECTRICAL ENERGY

Electrical energy makes our life easier and comfortable. The mishandling of electrical appliances causes higher usage of electrical energy. We have to pay the cost of the electrical energy used. Using electrical energy wisely can reduce our monthly electricity bill.



Using a fan instead of an air conditioner.

Switching off the lights when sleeping.

Switching off electrical appliances when not in use.

Avoid leaving the refrigerator door open for a long time.



What are the factors affecting the usage of electrical energy?

Legend:

 Type of electrical appliance used

 Duration of using the electrical appliance



SCIENCE INFO

Green technology is a method to make or manufacture sustainable products using recyclable and environmentally friendly sources that do not cause pollution. An example of green technology is the light-emitting diode (LED) lamp that is used to reduce the usage of electrical energy.

Reduce the usage of water heater when showering.



LED lamp



compact
fluorescent
lamp



filament lamp

Using energy-saving lamps such as LED lamp and compact fluorescent lamp instead of filament lamp.



State ways to reduce the usage of electrical energy in the situation above.





FUN ACTIVITY

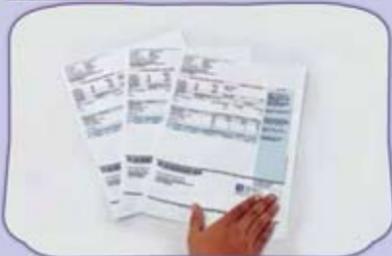
ANALYSING THE USE OF ELECTRICAL ENERGY AT HOME



APPARATUS AND MATERIALS

Copies of the monthly electricity bill.

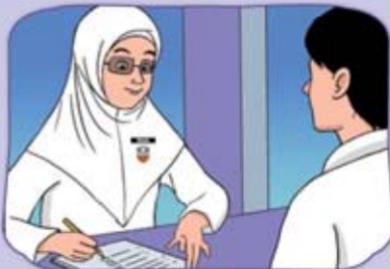
STEPS



1. Gather the electricity bills of your friend's house for the past several months.



2. Observe the total amount paid for each month. Build a bar chart based on the gathered information.



3. Gather information about how the electrical appliances were used through an interview or a house visit.

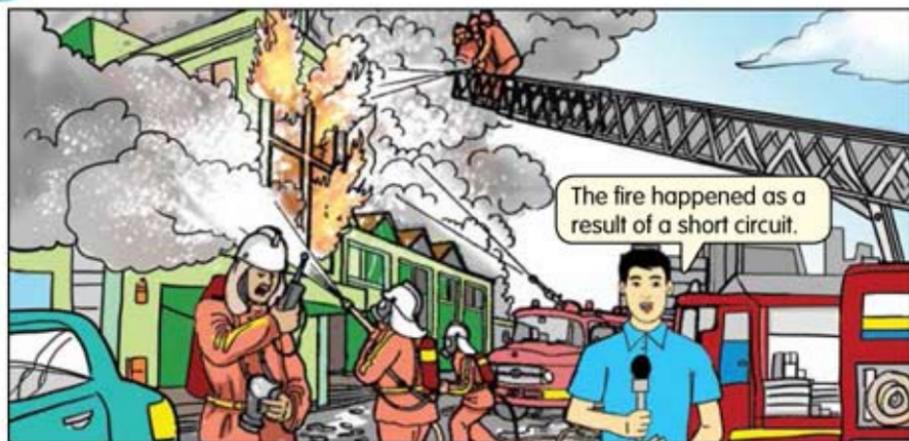


4. Suggest ways to save electrical energy in a house in the form of a mind map.



State ways to reduce the usage of electrical energy in a house.

MISHANDLING OF ELECTRICAL APPLIANCES



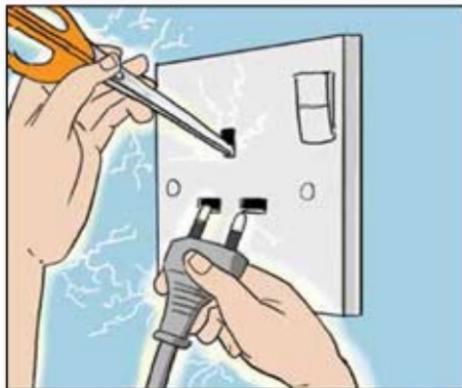
Electricity has various uses. However, mishandling electrical appliances is very dangerous.

The following are examples of mishandling of electrical appliances.

Electrocution

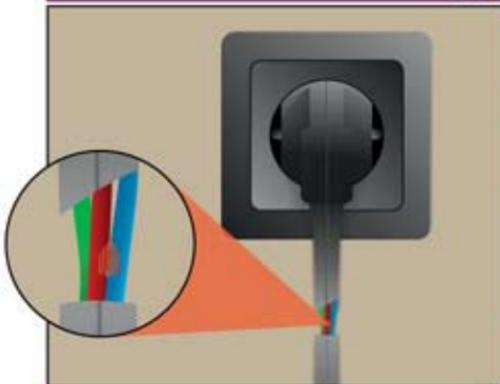


Touching a switch or an electrical appliance with a damp or wet hand.



Inserting an object that conducts electric current into the socket.

Short circuit



Using an electrical appliance with a damaged wire.



Connecting too many plugs in a socket.

Fire



Mishandling of an electrical appliance.



Charging an electrical appliance for too long.



Siti covers a light bulb using a towel to make the light dimmer in her room. Based on her action, what is the effect that could happen?

HANDLING ELECTRICAL APPLIANCES SAFELY

If we got electrocuted by a large amount of electric current, we may experience injury and it can be fatal. Therefore, we must practise safety precautions when handling electrical appliances.



How do we use electrical appliances safely?



Faulty electrical appliances should be repaired by certified personnel.



Hands must be dry when touching a switch.



Connect only one plug to one socket.



Turn off the switch before removing the plug from the socket.



Replace a damaged wire with a new one.



FUN ACTIVITY

SAFETY CARD AND SAVING ELECTRICAL ENERGY



APPARATUS AND MATERIALS

Computer, internet access, scissors, glue, manila card, and adhesive tape.

STEPS



1. Identify the places with electrical appliances in your school such as the canteen, computer laboratory, and library. Mark the locations of the electrical appliances using adhesive tape.



2. Use the computer and the internet to gather information about the safety precautions and ways to save energy when handling these electrical appliances. Print the gathered information.



3. Cut the manila card into smaller cards. Paste the gathered information onto these cards to make cards on safety precautions and saving electrical energy.



4. Paste the safety cards on the marked locations. Present your work to other groups.



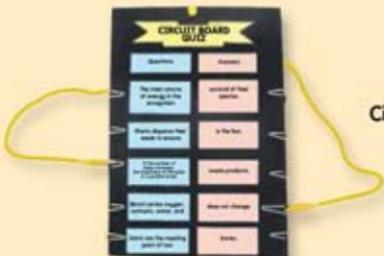
Explain the safety precautions needed when handling the electrical appliances.



Construct a circuit board quiz using a mounting board, coloured paper, paper clips, adhesive tape, connecting wires with crocodile clips, dry cells, bulbs, dry cell holders, hole puncher, and glue.



Circuit board quiz



STEPS



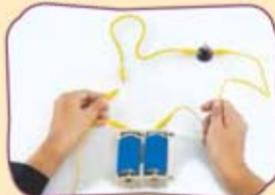
1. Prepare written or printed questions and answers for the quiz. Paste the questions and answers randomly on the mounting board.



2. Make a hole on the top part of the mounting board.



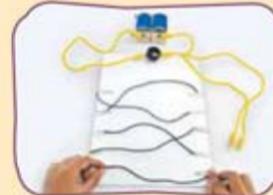
3. Using the paper clips, clip one side of each coloured paper with the questions and answers.



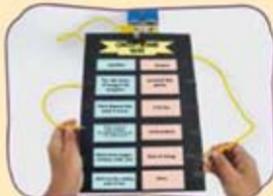
4. Build an electric circuit using the connecting wires with the crocodile clips as shown above.



5. Insert the bulb through the hole from the back of the mounting board. Fasten it using the adhesive tape.



6. Connect the paper clips for a question to the respective correct answer using the connecting wires at the back of the mounting board.

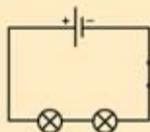


7. Touch one end of the crocodile clip to the paper clips for the questions. Touch the other end of the crocodile clip to the paper clips for the answers.

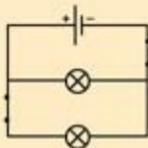


MIND REFLECTION

1. The sources of electrical energy are from solar cells, dry cells, dynamos, accumulators, generators, and power plants that use winds, waves, and hydroelectric.
2. Bulbs can be arranged in series or parallel circuits.
3. Examples of sketches of series and parallel circuits using symbols are as follows:



The sketch of a series circuit



The sketch of a parallel circuit

4. The brightness of bulbs in a circuit can be changed by:
 - changing the number of bulbs or the number of dry cells in a series circuit.
 - changing the number of dry cells in a parallel circuit.
5. The differences in the condition of the bulbs between series and parallel circuits when a switch is opened are as follows:

Series circuit	Parallel circuit
 <p>Switch X is opened</p> <p>Switch Y is closed</p>	 <p>Switch X is opened</p> <p>Switch Y is closed</p>
All the bulbs do not light up.	The bulb in branch Y still lights up.

6. Factors affecting the use of electrical energy:
 - Using a fan instead of an air conditioner.
 - Switching off the lights when sleeping.
 - Switching off electrical appliances when not in use.
 - Avoid leaving the refrigerator door open for a long time.
 - Reducing the usage of water heater when showering.
 - Using energy-saving lamps such as the LED lamp instead of filament lamp.

7. The effects of mishandling electrical appliances:
- electrocution.
 - short circuit.
 - fire.
8. The safety precautions when handling electrical appliances:
- Faulty electrical appliances should be repaired by certified personnel.
 - Hands must be dry when touching a switch.
 - Connect only one plug to one socket.
 - Turn off the switch before removing the plug from the socket.
 - Replace a damaged wire with a new one.

MIND TEST

Answer all questions in the Science exercise book.

1. State all the sources of electrical energy.
2. Observe the circuit components below.



bulbs



switches



dry cell

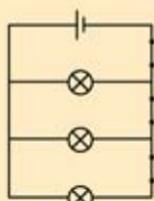


connecting wires
with crocodile clips

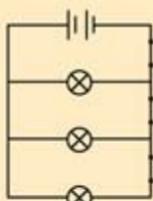
- (a) Using all the components above, sketch the circuit diagrams for two different circuits using symbols.
- (b) Which arrangement has brighter bulbs? Why?
- (c) Explain the difference in the arrangement of the bulbs in the series and parallel circuits in the table as shown below.

Circuit	Series	Parallel
Arrangement of bulbs		

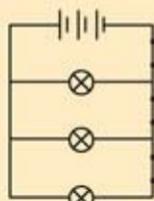
3. Ali is investigating the brightness of bulbs in parallel circuits.



Circuit A



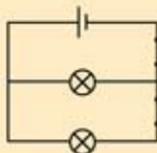
Circuit B



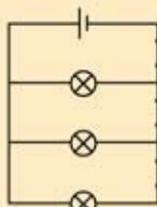
Circuit C

Based on the circuit diagrams above,

- what is the manipulated variable in this investigation?
- arrange the brightness of the bulbs in the three circuits in descending order.
- Ali then investigates another factor that affects the brightness of the bulbs in a parallel circuit. His investigation is shown in the diagrams below:



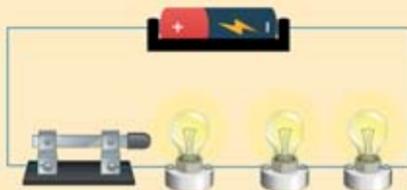
Circuit A



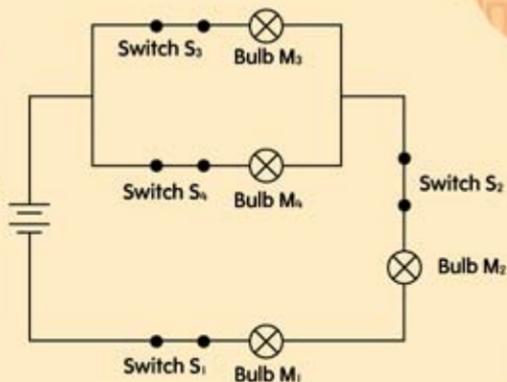
Circuit B

Based on the circuit diagrams above, is there any differences in the brightness of the bulbs in both circuits? Why?

- Based on the circuit diagram below, suggest two ways to increase the brightness of the bulbs.



5. The diagram shows four bulbs that are arranged in parallel and series circuits. Each switch is closed. Based on the arrangement of the switches and bulbs in the diagram, state the condition of the bulb if one of the switches is opened.



- Switch S_1
- Switch S_2
- Switch S_3

6. Observe the situation below on the usage of electrical energy in Ahmad's house.



List ways for Ahmad to reduce the usage of electrical energy at his house.

7. The situation below shows a mishandling of an electrical appliance.



- What is the possible effect on the pupil?
- How could the mishandling be avoided?
- Give two safety precautions when handling electrical appliances.