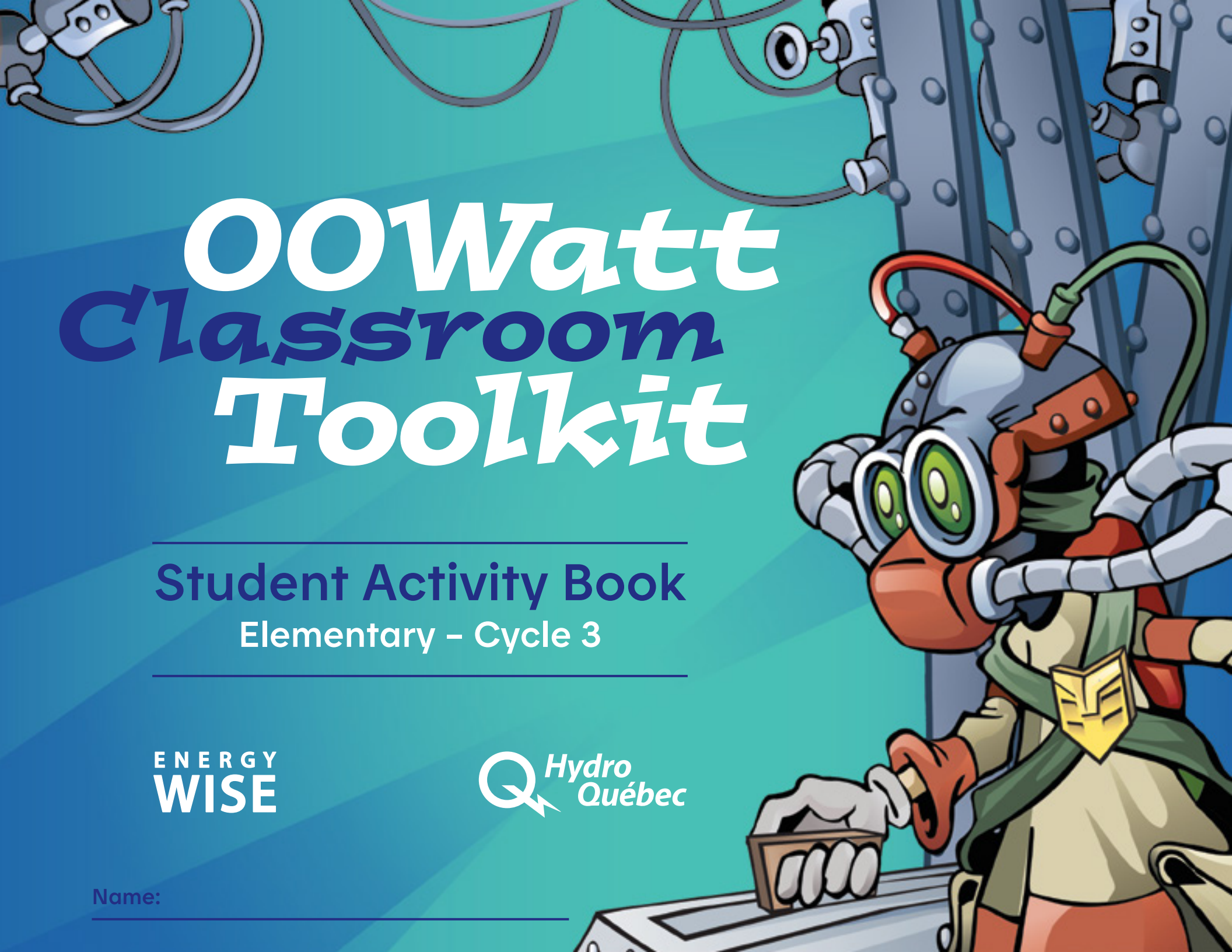
OOWatt Classroom Toolkit

Student Activity Book

Elementary – Cycle 3

ENERGY WISE

Hydro Québec



Name: _____

ID Card

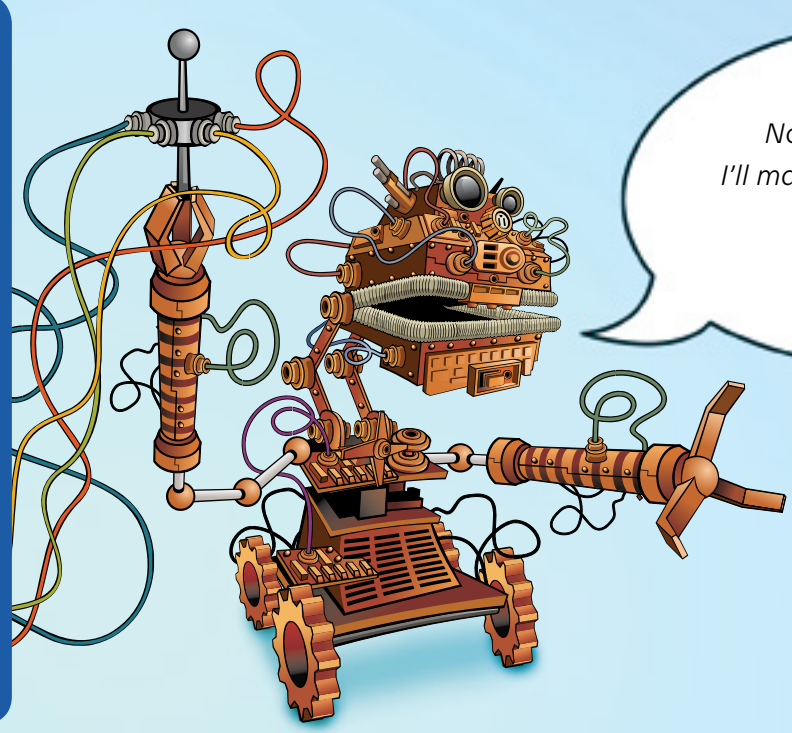
Name
Terawattus Energivorus

Sex
Depends on the time of day.

Age
About 125

Crimes
Consuming, over-consuming and wasting energy without caring about the consequences. Encouraging others to be wasteful.

Warning!
This dangerous evildoer is everywhere and very sneaky. He must be neutralized before humans start using energy-hogging appliances for absolutely everything.



No one can stop me!
I'll make you waste lots and lots of energy!
Gnahahaha!

ID Card

Name
OOWatt

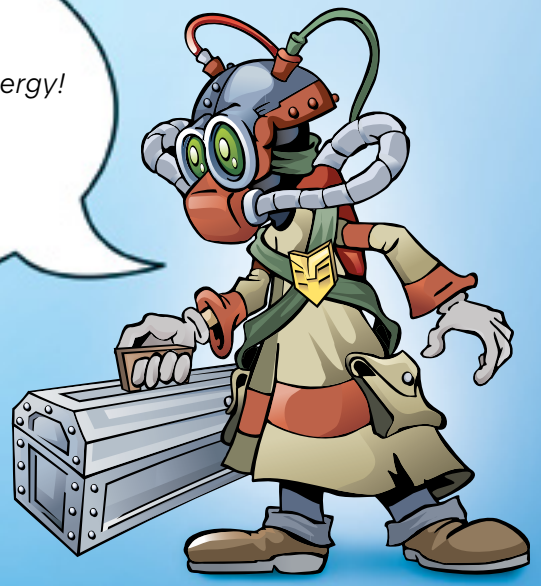
Title
Chief Inspector of the Anti-Waste Brigade

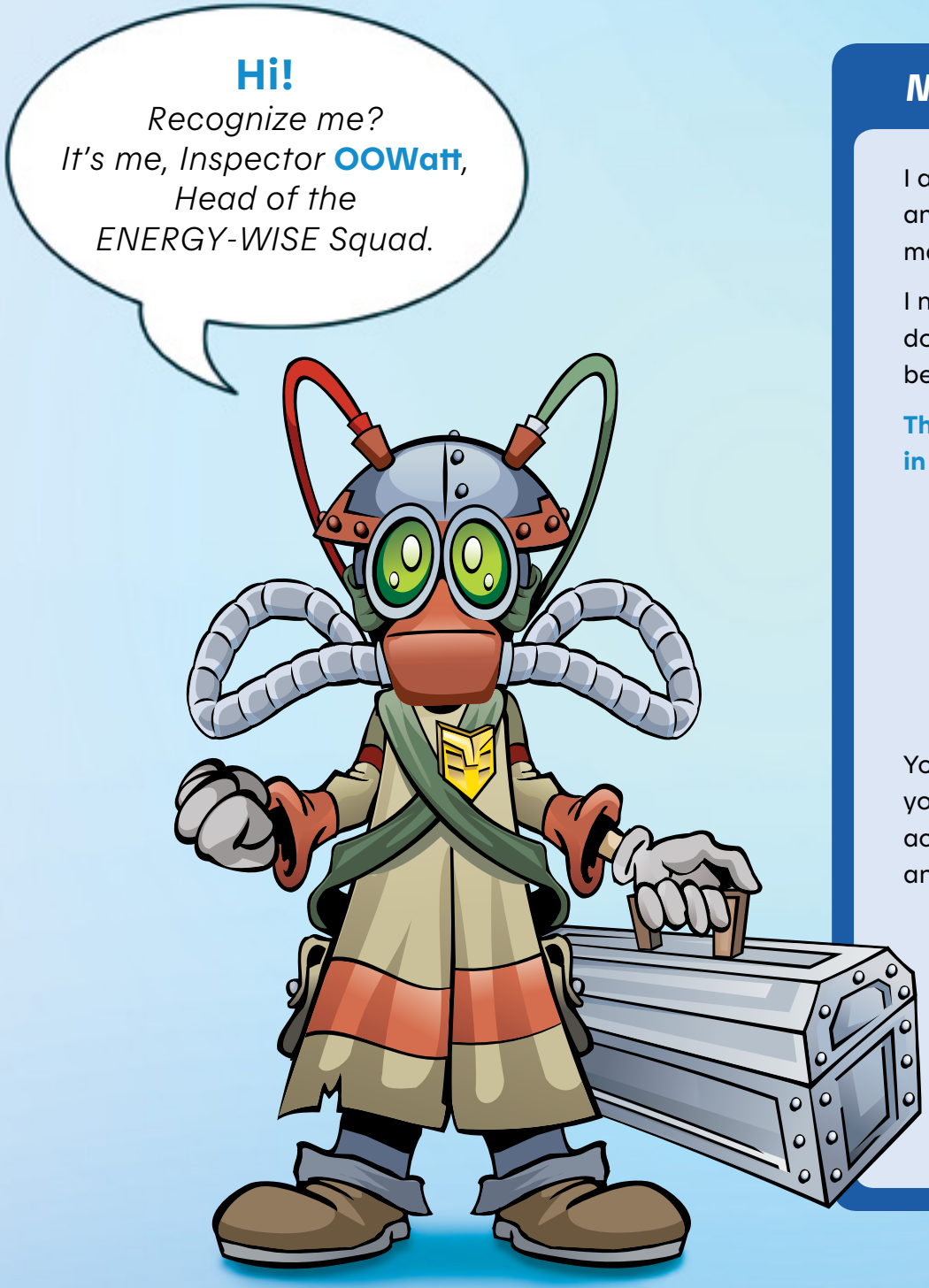
Goals in life
Track down and defeat Terawattus Energivorus. Promote the wise use of energy.

Lifelong dream
For people everywhere to start using energy wisely and protecting the environment.

Philosophy
We can be energy wise without sacrificing our comfort.

Nonsense!
The students and I will stop you, because it's easy to avoid wasting energy!
The **OOWatt** *Toolkit will help us understand why and how.*
It's all up to us!





Mission

I am constantly on the lookout for the evil, dastardly and insatiable **Terawattus Energivorus**. He has infiltrated many homes—maybe even yours.

I need you and your classmates to help me track him down and put a stop to energy waste. Your teacher will be our guide as we carry out our mission.

The challenges you will tackle are grouped together in five parts:

Part 1: OOWatt's Mission
(*Student Activity Book* not needed)

Part 2: An Adventure Right down the Line!

Part 3: Electricity at Home

Part 4: Tracking Down the Virus!

Part 5: Stop the Virus!

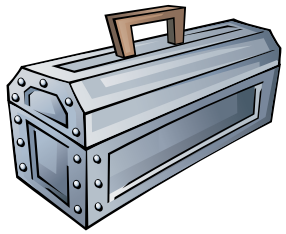
You can use this Student Activity Book to compile your observations, analyses and findings for certain activities. Don't forget to read the instructions carefully and check out the helpful hints in the left margin.

When you're done, you can keep this activity book as a wonderful souvenir of your experience. You can also use it to share what you've learned with the members of your family and introduce them to energy conservation too!

Good luck!

Part 2

Hydroelectricity



An Adventure Right down the Line!

How Hydroelectricity Is Generated

Energy is neither created nor destroyed – Hydro-Québec video

Psst!
Only questions 1 to 9 relate to the video.

Your challenge

Now that you've watched the video attentively, you should be able to answer these questions:

Q1. What do you call the movement of **electrons** in an electric wire?

- ◯ Static
- ◯ Electric current
- ◯ Electron dance

Q2. What machine generates **electrical energy**?

- ◯ A generator
- ◯ A transformer
- ◯ A turbine

Q3. The stator is the stationary part of a generator. What do you call the **moving part**?

- ◯ The rotor
- ◯ The tenor
- ◯ The penstock

Q4. What changes the **power of moving water**?

- ◯ Spring runoff
- ◯ The size of the reservoir
- ◯ The difference in elevation and the flow

Q5. Which of these statements apply to a **reservoir-type generating station**? Check **all** that apply.

- ◯ It has no turbines.
- ◯ It has a water reservoir.
- ◯ More power can be generated when needed.

Psst!
The **power** of electric devices is measured in watts (W).

Psst!
Electrical energy **consumption** is calculated in kilowatt hours (kWh).

Incandescent bulb

Q6. Which of these statements apply to a **run-of-river generating station**? Check **all** that apply.

- ◯ It is fed directly by flowing water.
- ◯ It has only a small water reservoir.
- ◯ The power it generates varies with the flow of water.

Q7. What turns a **turbine**?

- ◯ An electric motor
- ◯ Wind
- ◯ The power of the moving water

Q8. What drives a **generator**?

- ◯ A turbine
- ◯ Electricity
- ◯ A penstock

Q9. Complete the following sentence with these words: **powerful / transformed / force**

The surging _____ of our water

is _____ into a form of energy

just as _____: electricity.

Q10. About how many **incandescent light bulbs** do you use **in your home**?

_____ incandescent light bulbs

Q11. How much **energy** do ten 100-W incandescent light bulbs use in one hour?

_____ kWh

E.g.: How much energy does one 100-W incandescent light bulb use in ten hours?
1 x 100 W x 10 hrs = 1,000 Wh = 1 kWh

Q12. Can you imagine how many incandescent light bulbs are used **every day** in Québec and all of Canada?

For your information

- **Canada has about 15,000,000 households (2015).**
- **Québec has roughly 4,000,000 households (2015).**

Multiply the estimated number of light bulbs in your home by the number of households.

In Québec, over _____ million!

In Canada, over _____ million!

Psst!
Ask your teacher if you have any questions!

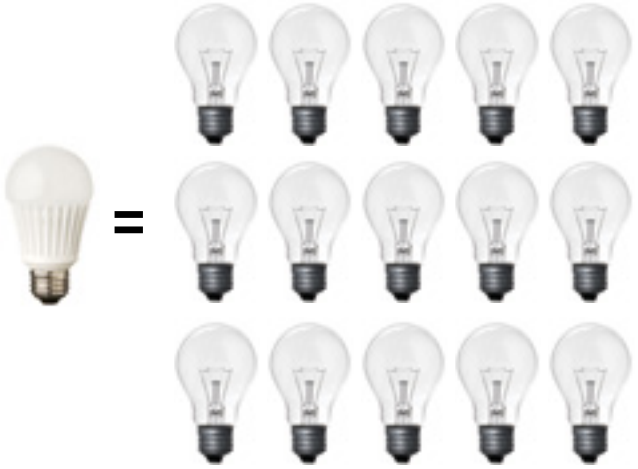
What is the difference between an incandescent and an LED light bulb?

LED bulbs use much less energy than incandescent bulbs. They also last much longer. Another advantage is that there's no risk of burning yourself!

Incandescent bulb

Light-emitting diode (LED) bulb

An **LED bulb** lasts 15 times longer than an incandescent bulb and uses 70% to 90% less energy.



Question

Are light bulbs recyclable?

Incandescent bulbs are not recyclable, so make sure you don't put any in your recycling bin! However, while over 90% of the materials that may be found in **LED bulbs** are recyclable, they don't go in the recycling bin either. Because of their electronic components, they should be dropped off at a municipal ecocentre or other designated facility.

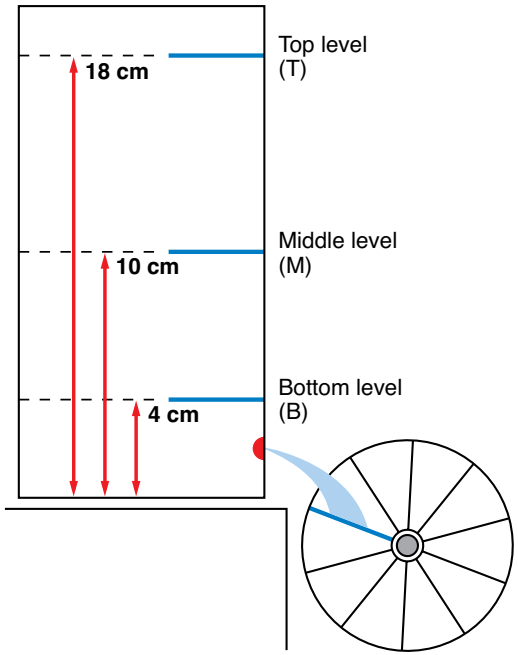
How a Hydroelectric Generating Station Works

An experiment to Demonstrate the Power of Water

Psst!
Watch the demonstration closely.

Your mission

Find which of the three water levels (heads) drives the turbine **the fastest**.



What's your guess? Level T, M or B?

To check your hypothesis:

- Watch the demonstration by your classmates closely.
- For each water level, note the number of times the turbine turns in 10 seconds. Write it in the table below.

Table

	Number of times the turbine turns in 10 seconds
Top level (T) (Head of water: 18 cm)	
Middle level (M) (Head of water: 10 cm)	
Bottom level (B) (Head of water: 4 cm)	

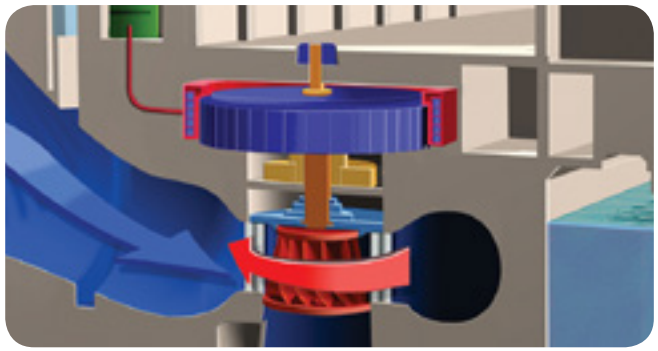
Psst!
If you want to conduct this experiment again at home, follow the instructions on page 10.

Now answer these questions!

Q1. Which of the three water levels makes the turbine turn **the most times** in 10 seconds?

- ◯ Top (T)
- ◯ Middle (M)
- ◯ Bottom (B)

Q2. The power of flowing water makes the turbine turn faster or slower. **Why** is the power greatest for the level you chose in the question above?



Study the diagram on the next page closely. It illustrates how a hydroelectric generating station works. Can you see how the experiment is very similar to the way hydroelectricity is produced?

Q3. **Why** do you think we need to build a dam to produce hydropower?

Q4. **Where** do you think **the turbines are located** in relation to a hydroelectric generating station's water intakes, which are usually located on the wall of the dam?

Psst!

The generator, which is connected to the turbine, converts the energy of the moving water into electricity.

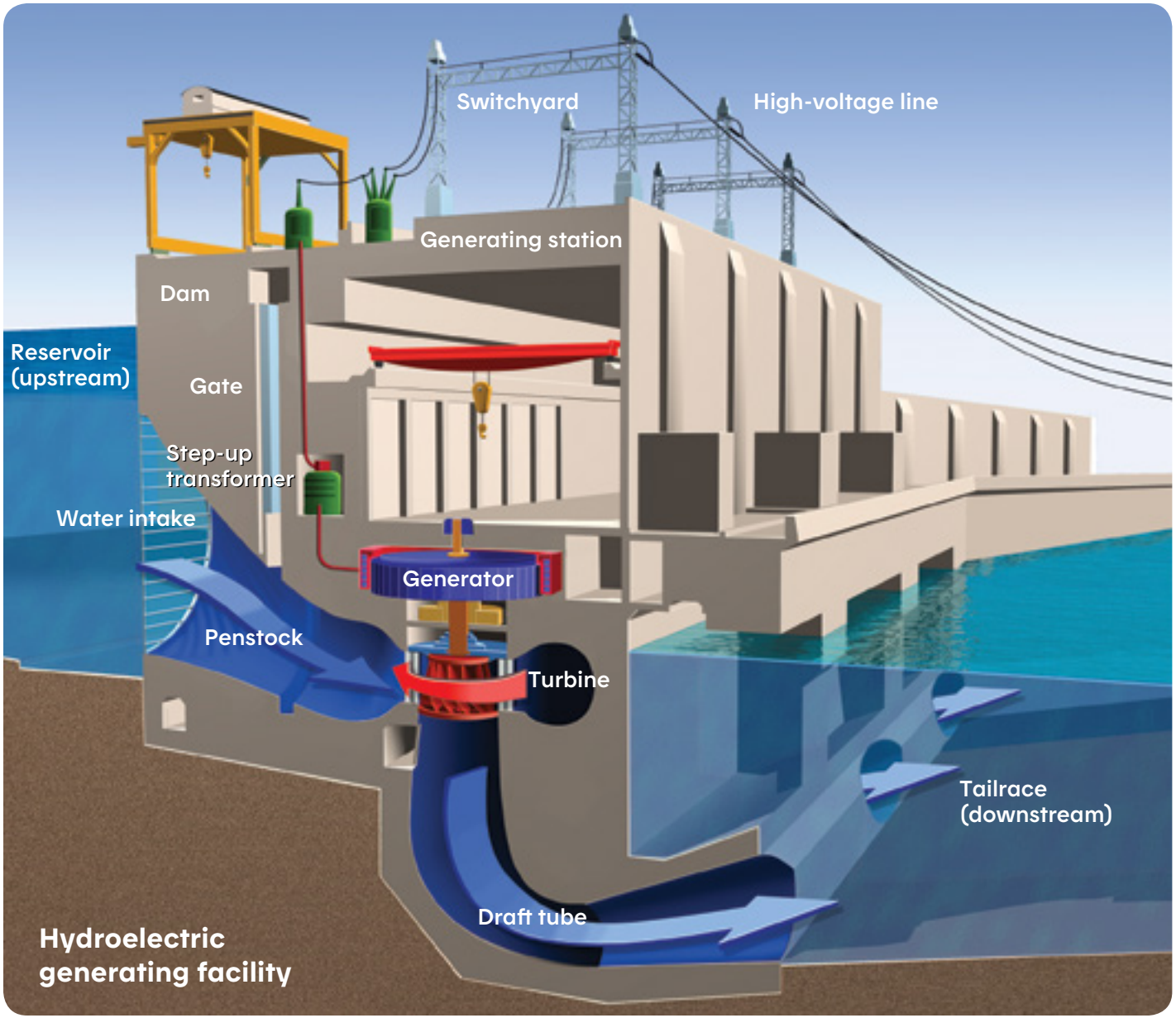


Illustration: Cité de l'énergie

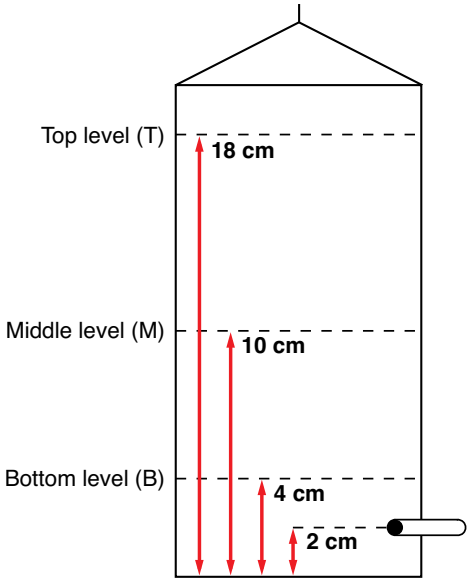
Psst!
Measure the levels from the bottom of the milk carton.

Here's how to repeat this experiment at home:

Materials Required

You'll need the following materials (experiment without turbine)

- 1 clean 2-litre milk carton
- 1 nail
- 1 straw
- 1 binder clip or clothespin
- 1 ruler, 30 cm or longer
- 1 pen
- 1 cookie sheet
- 1 dishcloth or towel
- Adhesive tape



Instructions

Make your *generating station*

1. Open the top of the 2-litre milk carton.
2. On one side of the milk carton, measure the heights of the three water levels and draw a horizontal line for each one using the pen and ruler:
   a) Top level **(T)**, 18 cm from the **bottom** of the milk carton
   b) Middle level **(M)**, 10 cm from the **bottom** of the milk carton
   c) Bottom level **(B)**, 4 cm from the **bottom** of the milk carton
3. Use the nail to poke a hole about 2 cm from the bottom of the milk carton. The hole should be about the same diameter as the straw.
4. Cut the straw to a length of 4 cm and insert it halfway into the hole.
5. Tape it in place. Make sure there are no leaks around the straw!
6. Pinch the straw closed with the binder clip.
7. Place the milk carton on the cookie sheet, next to the kitchen sink.

Psst!
Remember to refill the milk carton after each measurement.

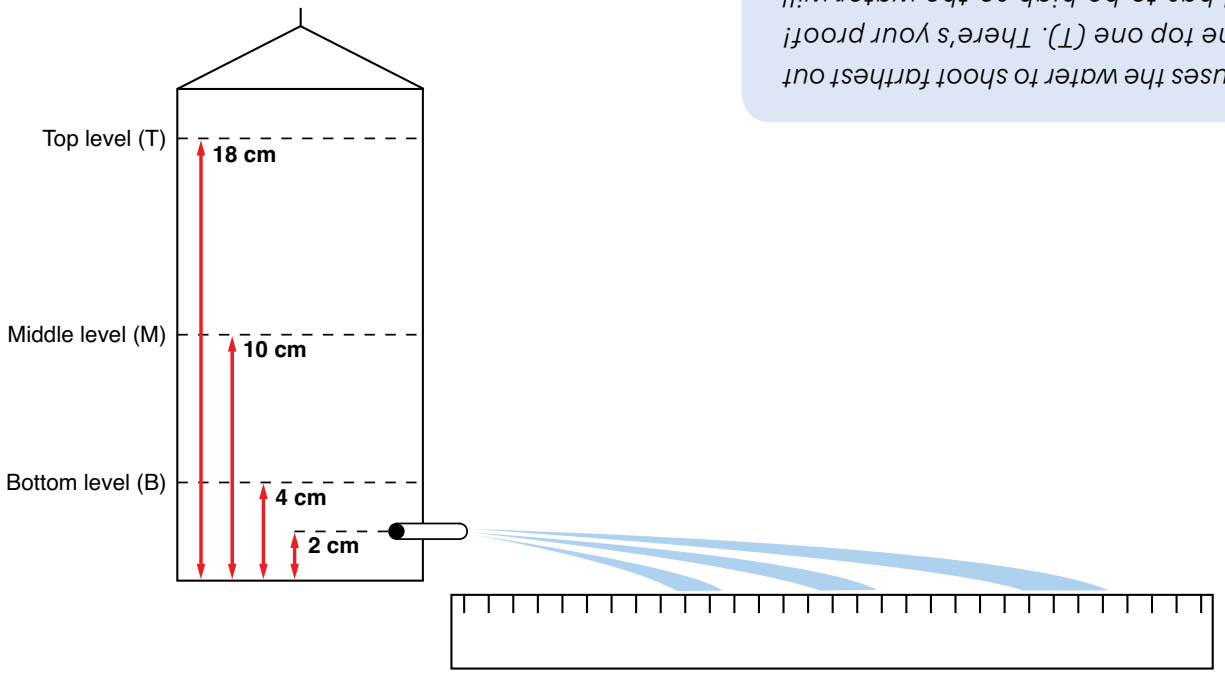
Assumptions

Explain the experiment to your parents and ask them to guess **which of the three levels will make the water flow out the most powerfully**. Then, conduct the experiment to test their assumptions.

Experiment

To help you understand, see the diagram below.

1. Place the ruler in the sink with the zero under the tip of the straw to measure how far the water shoots out.
2. Fill the milk carton with water up to the line that marks the bottom level (B).
3. Take the binder clip off the straw.
4. Measure how far the water shoots out.
5. Put the clip back on the straw.
6. Repeat steps 2 to 5 for the middle (M) and top (T) levels. ●



Answer

The level that causes the water to shoot farthest out of the straw is the top one (T). There's your proof! The water level has to be high so the water will be more powerful and the generating station can produce more electricity!

The Generating, Transmission and Distribution System

An Adventure Right down the Line! Digital Game

Psst!
Play on your own or as part of a group!

Your challenge

Are you able to name the different parts of a hydropower system? Learn what the various components of a power grid do and how they work together to deliver electricity, from the generating site to the service address.

How to play

No doubt you will have an opportunity to try this game in the classroom. But you can also play at home on a computer or tablet.

To start the game, go to **hydroquebec.com/teachers** website and click on the link to *An Adventure Right down the Line!* Why not challenge your parents, siblings or friends?

Finally, to get an idea of how big Québec's power grid is, take a look at the *Overview of Generating Facilities* map on the next page.

Overview of Generating Facilities

Making Energy Work for You

Electricity Quiz Experiment

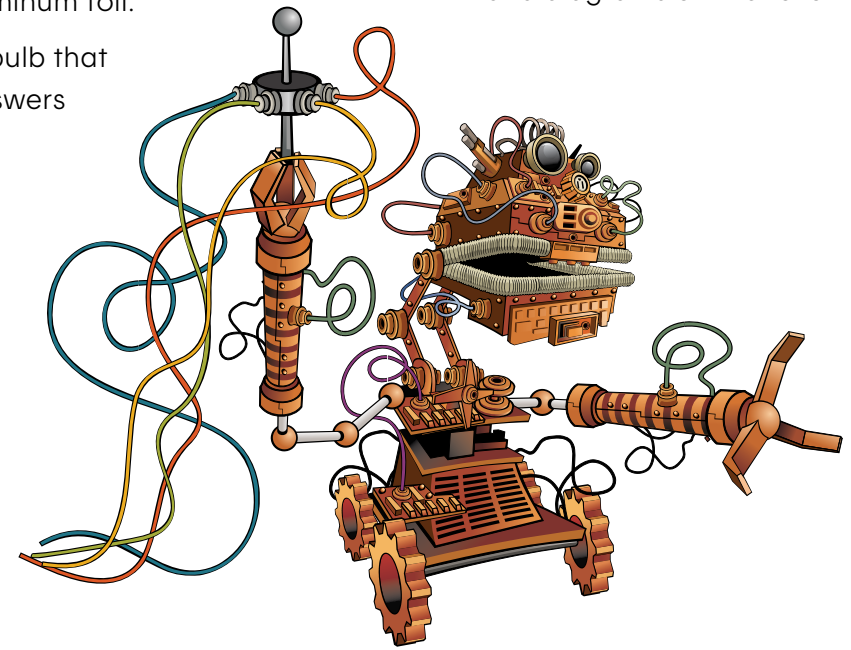
Psst!
Take a look at the materials you were given.

Your challenge

Make your own question and answer game using an **electric circuit**. Use a battery, electric wires and even aluminum foil.

Don't forget to add a light bulb that lights up only if a player answers a question correctly!

Wait! Before you start making your game, you have to understand how a circuit works. The information and diagrams on the following pages will help.



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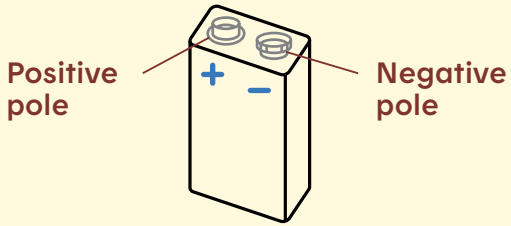
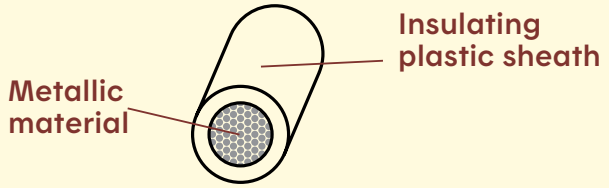


Battery

The battery will **supply the energy** in the circuit you're going to build.

A battery is an **electrochemical** device: it transforms energy from a chemical reaction into electric energy. The chemicals that react in the battery are put there when it is manufactured. Once they are used up, the battery has to be replaced. There are also rechargeable batteries, which can be reused hundreds of times.

Every battery has **two poles** (or terminals), one positive and one negative. In an electric circuit, one wire must be connected to the positive pole and another to the negative pole so the current can flow through the circuit.



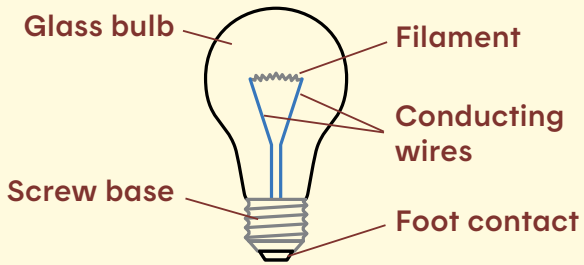
Electric wire

The electric wire in your circuit is made of a metallic material that is a **good conductor** of electric current. It is generally wrapped in a sheath of insulating plastic.

Many materials, like copper, aluminum and brass, conduct electricity. The **human body** and **water** are also good conductors. That's why you have to be careful not to get a **dangerous shock**, even with household electric circuits.

Go to **hydroquebec.com/security** for fun games and cartoons on how to avoid electric shocks.

Information

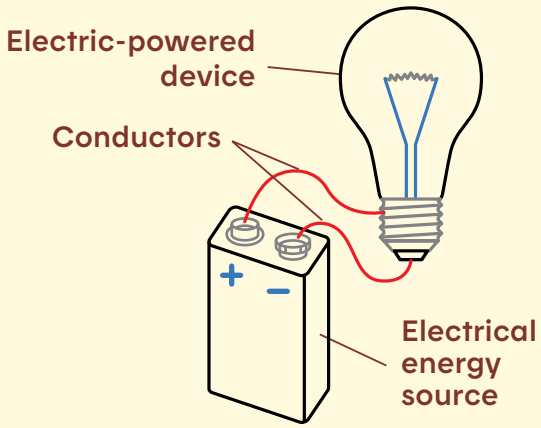


Incandescent light bulb

Just like a battery, a light bulb has two poles: one at the foot of the bulb and the entire metal screw base. For the light to work, one wire must touch the screw base, and the other, the foot of the bulb.

Incandescent bulbs consist of a very thin metal **filament** inside a glass globe. When the electric current flows through the filament, it encounters **resistance**. As a result, the filament quickly gets extremely hot–so hot that it gives off light.

Inside the bulb is a **gas** that enables the filament to heat up to higher temperatures than it would otherwise. That way, the bulb gives off more light and lasts longer.



Electric circuit

A **circuit** connects the electric components inside a **closed loop**.

It consists of an electric energy source (e.g., a battery or generator), conductors (e.g., electric wires) and an electric device (e.g., a light bulb or computer). It may also include a **switch** to open and close the circuit. What happens if the circuit is open? The electricity can't flow through it!

For instance, when you turn on a wall switch at home, it closes the circuit and turns on the light.

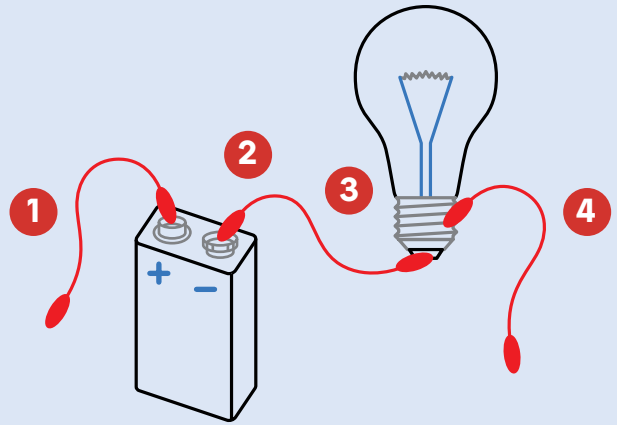
Instructions

Make your circuit

1. Connect the end of one wire to the positive pole (+) on the battery.
2. Connect the end of the other wire to the negative pole (-) on the battery.
3. With the other end of one of the two wires, touch the contact on the foot of the light bulb.
4. Touch the end of a third wire to the the screw base of the light bulb.

The ends of two wires should be free. Keep this set-up handy, because you will use it to play the game.

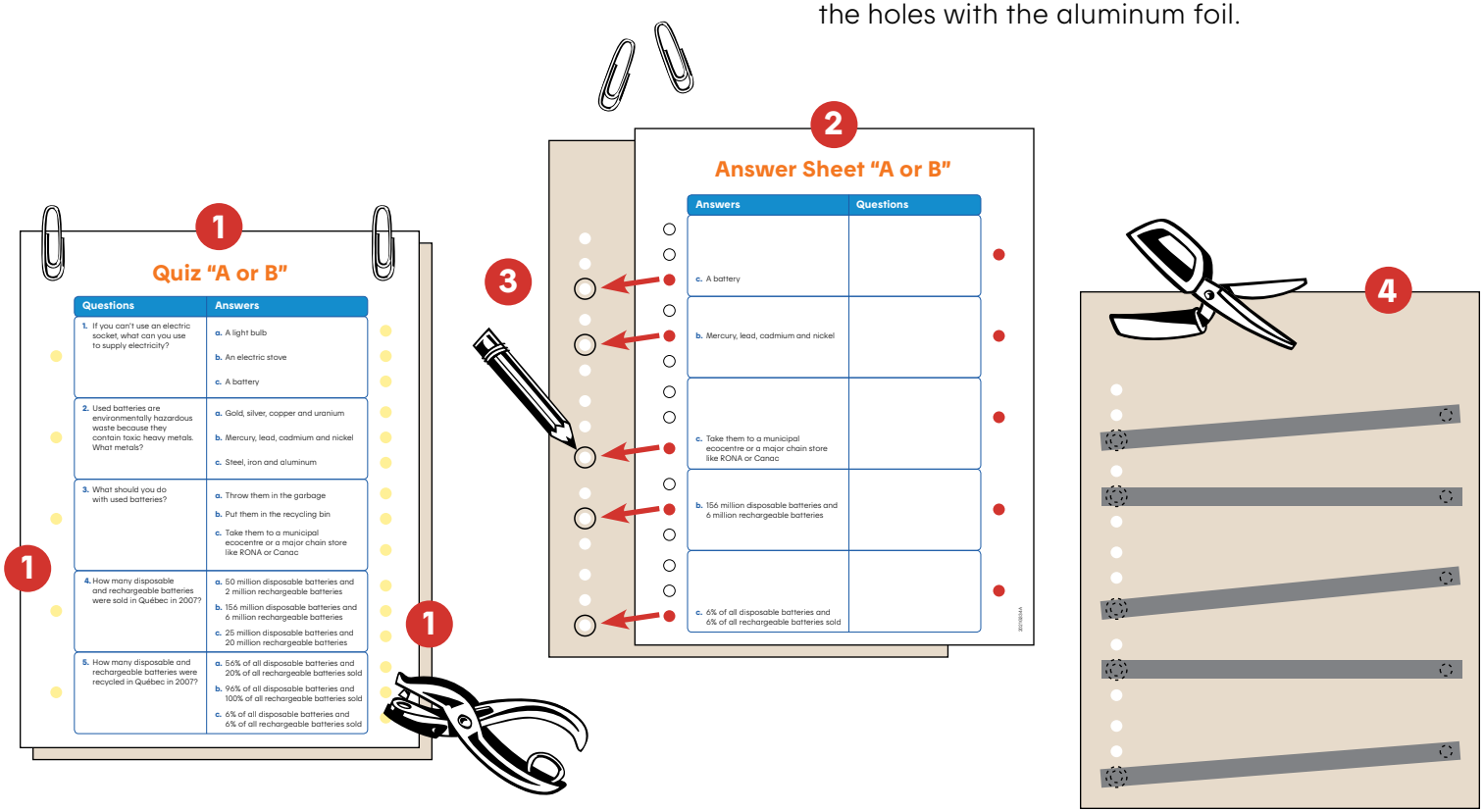
Diagram



Make your game

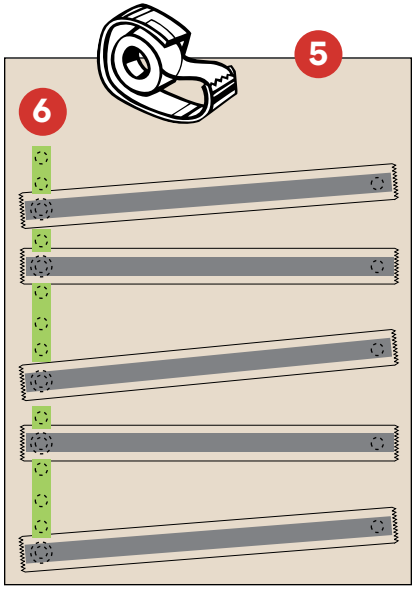
1. Paper clip the quiz to the piece of cardboard. Use a one-hole punch to make holes in the cardboard and quiz as shown.
2. Remove the paper clips and turn the cardboard over. Turn the quiz over too, and place the answer sheet on the cardboard, moving it over just enough to see the row of holes along the left edge of the cardboard.
3. For each question, refer to the answer sheet and circle the hole on the cardboard that corresponds to the correct answer.
4. Cut six strips of aluminum foil, 1 cm wide by 20 cm long. For each question, place one strip of foil on the cardboard so that it runs from the holes you circled on the left to the corresponding holes on the right. Make sure you completely cover the holes with the aluminum foil.

Psst!
To make your game, follow steps 1 to 8 and refer to the diagrams.

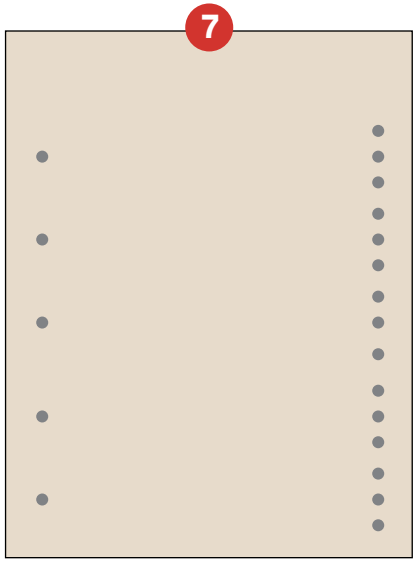


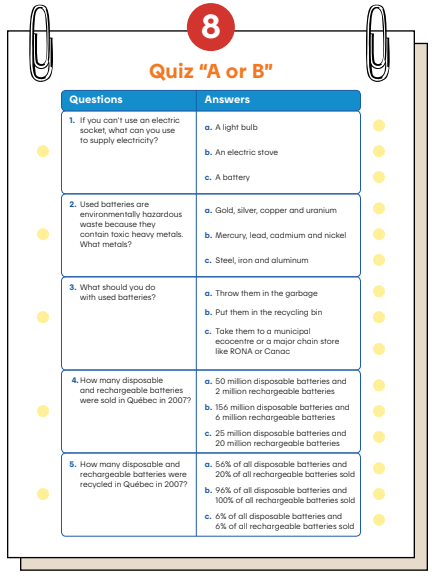
Psst!
If you have a question, ask your teacher!

5. Tape the strips in place. Make sure you cover the entire strip of foil with tape so the strips don't touch one another. **If they touch, there will be a short circuit and your game won't work.**



6. To finish making the game, cover the remaining holes with tiny squares of foil (shown in green on the diagram) and tape them in place. Make sure these squares don't touch the foil strips!
7. Turn the cardboard over. You will see aluminum foil in the holes.
8. Paper clip the quiz to the cardboard, as you did in step 1. You're ready to play!

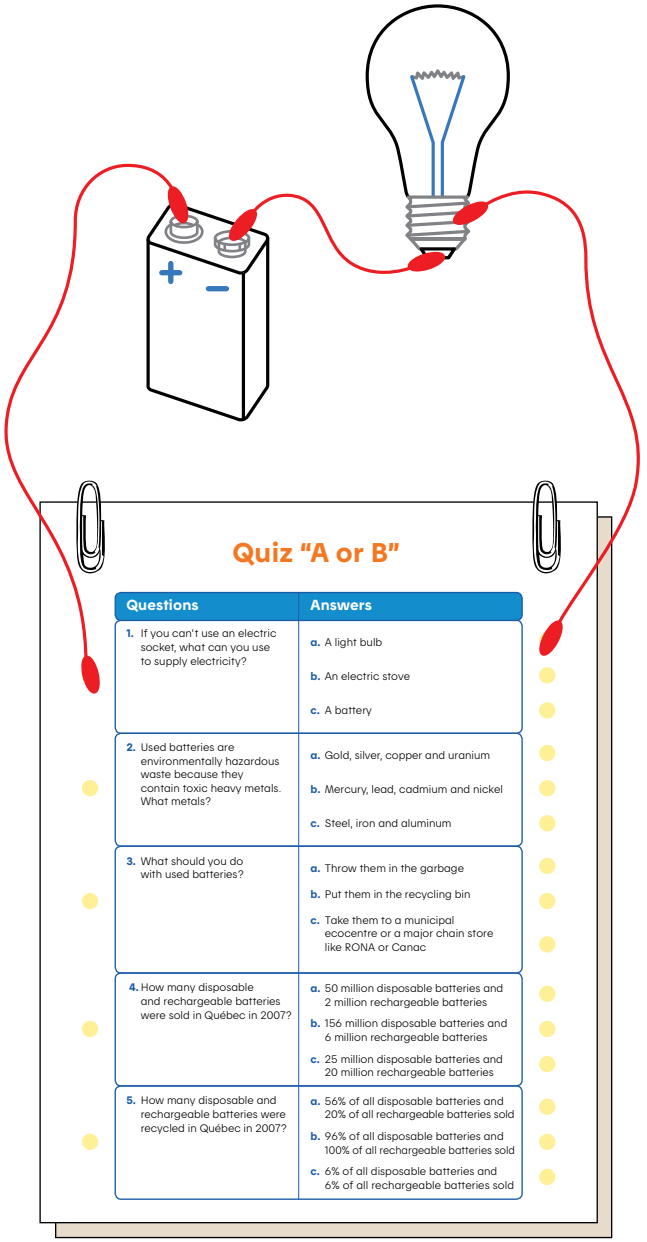




Try it out

Now you're ready to test your game!

1. Ask your teammate to hold the wires to the two contacts on the light bulb.
2. Close the circuit by touching one clip to the hole for a question and the other clip to the hole for the right answer. The light bulb should come on.
3. If the light doesn't come on, make sure you chose the right answer. Does the aluminum foil strip connect the right question to the right answer? Does your light bulb come on when you touch the two clips together?
4. Test the wrong answers, too. If the light bulb comes on when you touch the wrong answer with the clip, it means there is a contact between the foil strip (correct answer) and one of the foil squares covering the holes of the wrong answers. Fix the problem and try again.



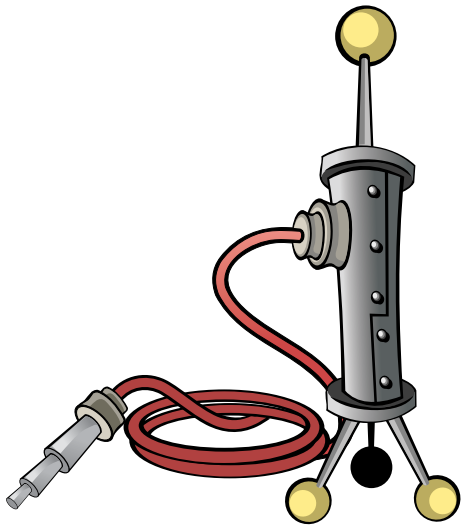
Quiz "A or B"

Questions	Answers
1. If you can't use an electric socket, what can you use to supply electricity?	a. A light bulb b. An electric stove c. A battery
2. Used batteries are environmentally hazardous waste because they contain toxic heavy metals. What metals?	a. Gold, silver, copper and uranium b. Mercury, lead, cadmium and nickel c. Steel, iron and aluminum
3. What should you do with used batteries?	a. Throw them in the garbage b. Put them in the recycling bin c. Take them to a municipal ecocentre or a major chain store like RONA or Canac
4. How many disposable and rechargeable batteries were sold in Québec in 2007?	a. 50 million disposable batteries and 2 million rechargeable batteries b. 156 million disposable batteries and 6 million rechargeable batteries c. 25 million disposable batteries and 20 million rechargeable batteries
5. How many disposable and rechargeable batteries were recycled in Québec in 2007?	a. 56% of all disposable batteries and 20% of all rechargeable batteries sold b. 96% of all disposable batteries and 100% of all rechargeable batteries sold c. 6% of all disposable batteries and 6% of all rechargeable batteries sold

Psst!
Think carefully before you answer!

Play the game

- Once you have tested the game and got it working properly, your team should exchange your quiz with a team in another group (Quiz A or B).
- Students in both groups take turns trying to answer the questions. If they get a right answer, the light bulb will come on.
- While you play, have your teammate count the number of times the bulb lights up on your first try and keep track of your score.
- If you don't get the answer right away, your teammate can help you.



Think safety

Why can't you plug the wires directly into a wall socket instead of using a battery?

- Because the materials you are using (light bulb, cardboard, aluminum foil, electric wires) aren't strong enough for the powerful electric current used in our homes.
- You could get an electric shock and even injure yourself very badly.
- If you want to use your game at home, make sure you use a battery!

Suggestion

Instead of using wires, use other strips of aluminum foil by attaching them directly to the contacts on a small light bulb. Make sure they are properly insulated.

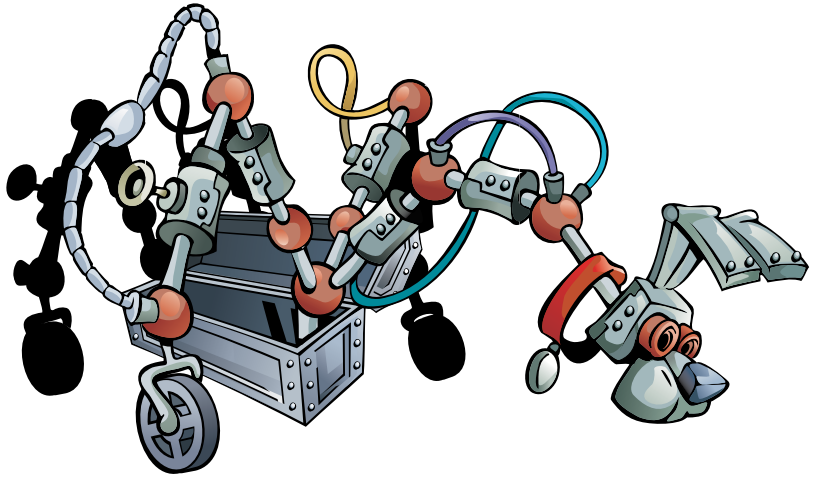
Series and Parallel Circuits
Connection Experiment

Your challenge

Working with three other students, form two teams of two students. One team will make a series circuit, and the other will make a parallel circuit.
Your goal is to light up the bulbs on each circuit.

Take a close look at the difference between the two circuits. Try to understand how the two set-ups work. The diagrams on the next page will help.

Psst!
If you have a question, ask your teacher!



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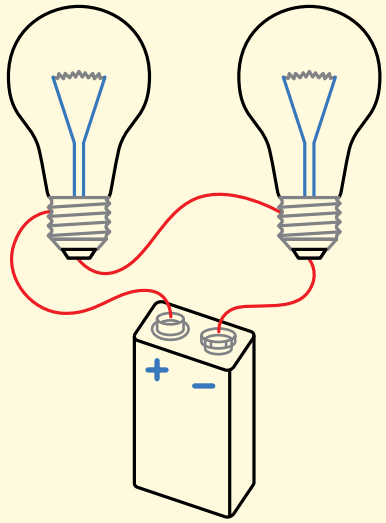
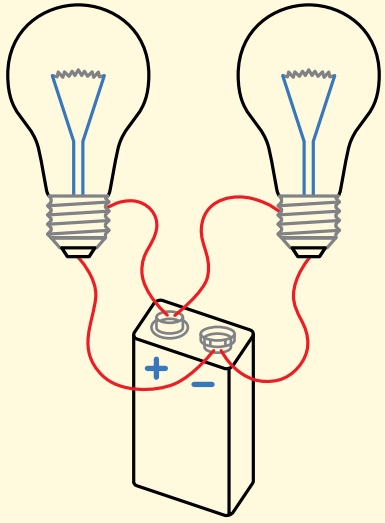


Series circuit

A series circuit is an electric circuit consisting of a **single loop**. The light bulbs are connected in a row along the wire. The same current flows through each part of the circuit.

So, if one of the bulbs burns out, the circuit is open, the current stops flowing and none of the other bulbs can light up. That's how strings of holiday lights used to be made!



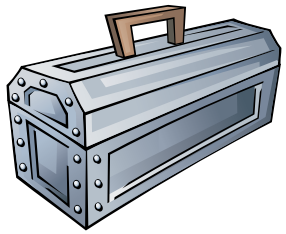
Parallel circuit

A parallel circuit is an electric circuit consisting of **several loops**. Each light bulb has its own loop.

If one of the bulbs burns out, current still flows to the other ones, so they continue to light up. That's how holiday lights are made these days, and it's much more practical!

Part 3

Electric Appliances and Devices



Electricity at Home

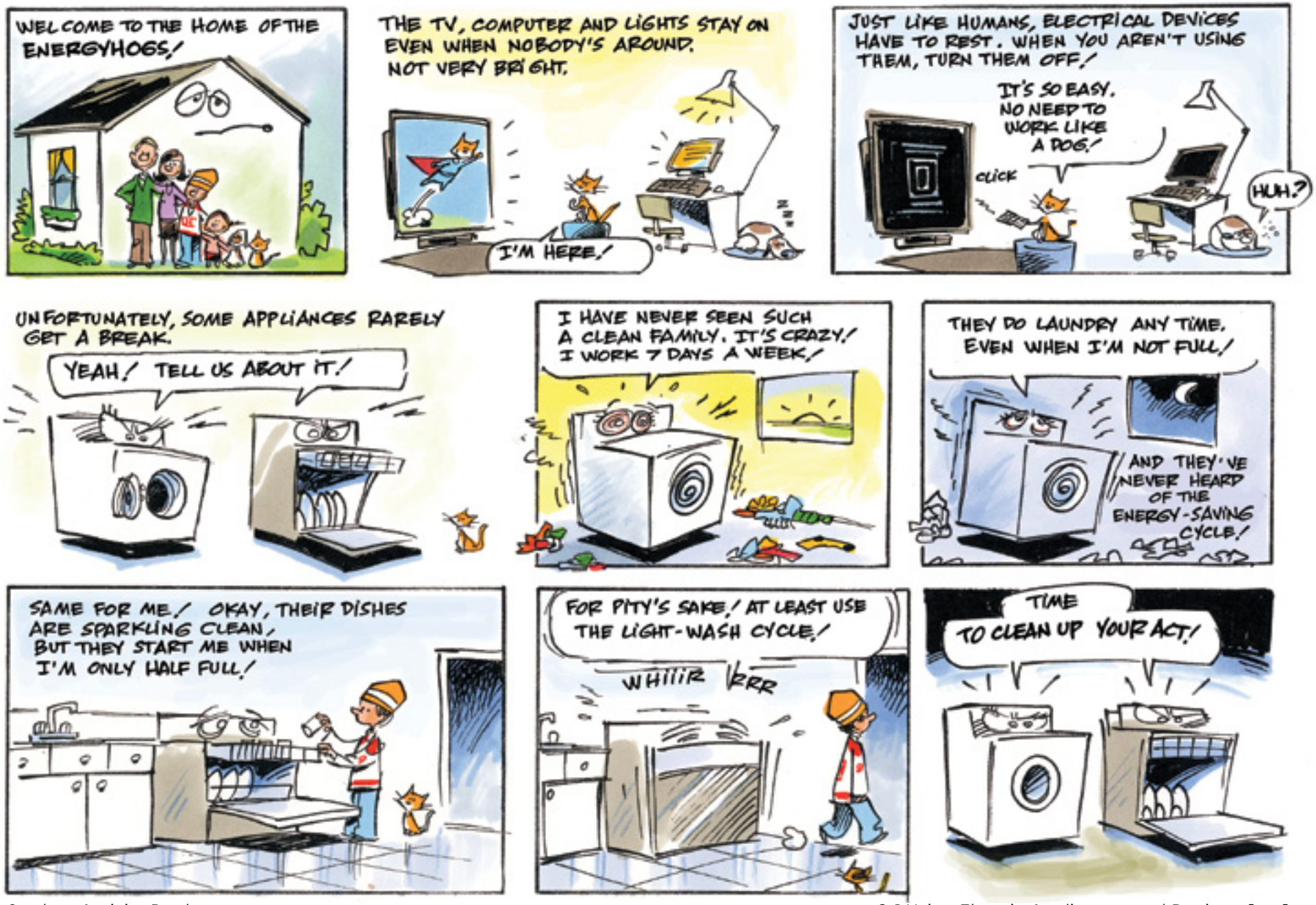
Using Electric Appliances and Devices

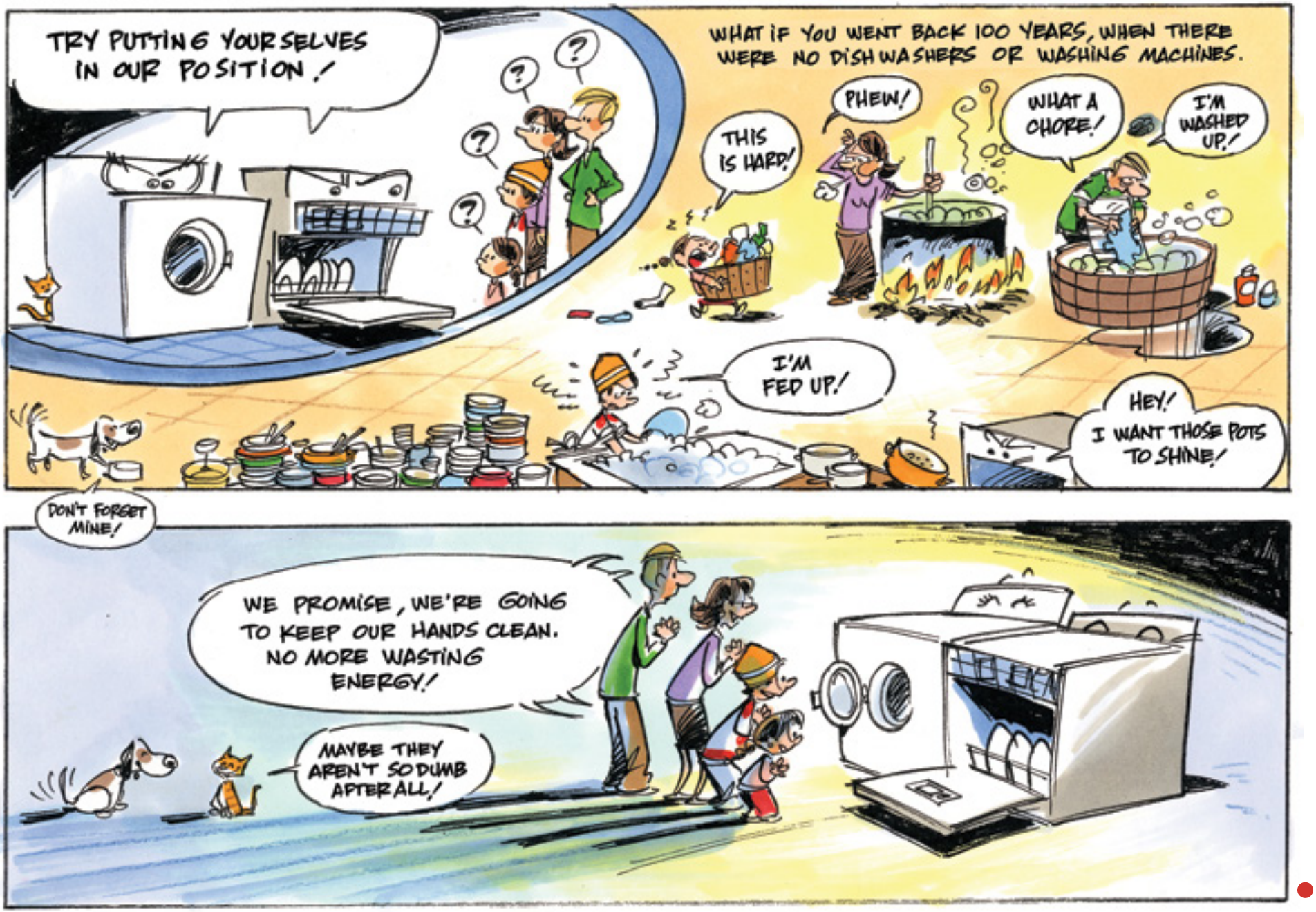
Waste Not, Want Not! Comic Strip

Food for thought

Could we be wasting energy by misusing our electric appliances and devices?

WASTE NOT, WANT NOT!




TRY PUTTING YOURSELVES IN OUR POSITION!
WHAT IF YOU WENT BACK 100 YEARS, WHEN THERE WERE NO DISHWASHERS OR WASHING MACHINES.
THIS IS HARD!
PHEW!
WHAT A CHORE!
I'M WASHED UP!
I'M FED UP!
HEY! I WANT THOSE POTS TO SHINE!
DON'T FORGET MINE!
WE PROMISE, WE'RE GOING TO KEEP OUR HANDS CLEAN. NO MORE WASTING ENERGY!
MAYBE THEY AREN'T SO DUMB AFTER ALL!

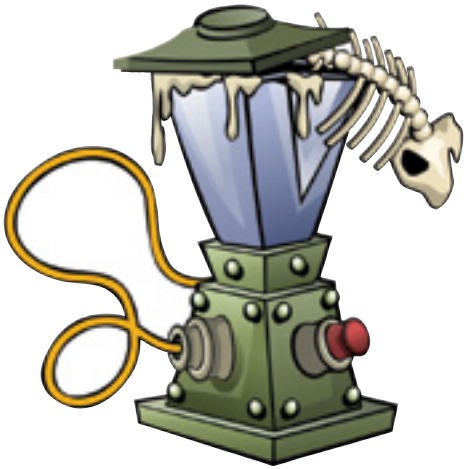
All Kinds of Household Appliances and Devices

Family Inventory

Psst!
Watch
your spelling!

Your mission

How many electric devices and household appliances do you and your family have at home? Electricity may be a bigger part of your life than you think!



Assumption

Before carrying out the inventory, estimate how many electric appliances and devices are in your home. Make a note of your estimates in the box under each room (at the top of pages 29 and 30).

How many electric appliances and devices do you think there are in all? Add up all the estimates you entered in the boxes.

Total estimate for my home =

Experiment

Now look through each room listed and make a note of all the electric appliances and devices you find on the next page. **Don't forget your home electronics and any devices that are unplugged or put away in a closet or cupboard!**

Hello!

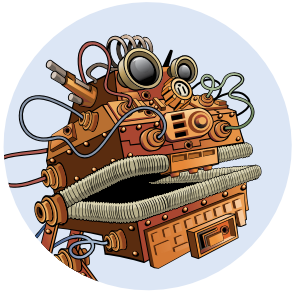
Don't forget your major and small appliances, power tools, vacuum and heating and air-conditioning systems!

Kitchen	Dining room	Living room	Bathrooms
Total:	**Total:**	**Total:**	**Total:**

Psst!

Did you remember your family's alarm clocks, cell phone chargers, audiovisual equipment and game consoles?

Bedrooms	Bedrooms	Office or family room	Garage or workshop
Total:	**Total:**	**Total:**	**Total:**



Gnahahaha!

More! More!
Sure you haven't
forgotten anything?
Did you look
everywhere?

1. Now add up the total number of electric appliances and devices in your home (add the totals from the preceding pages).

   There are _____ appliances and devices that run on electricity in my home!

2. Are you surprised?

   ◯ Yes ◯ No

   Why?

   _____

   _____

   _____

   _____

   _____

3. Does it seem like a lot?

   ◯ Yes ◯ No

   Why?

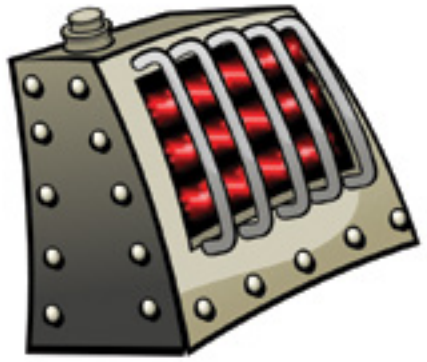
   _____

   _____

   _____

   _____

   _____



The Power of Electric Appliances and Devices

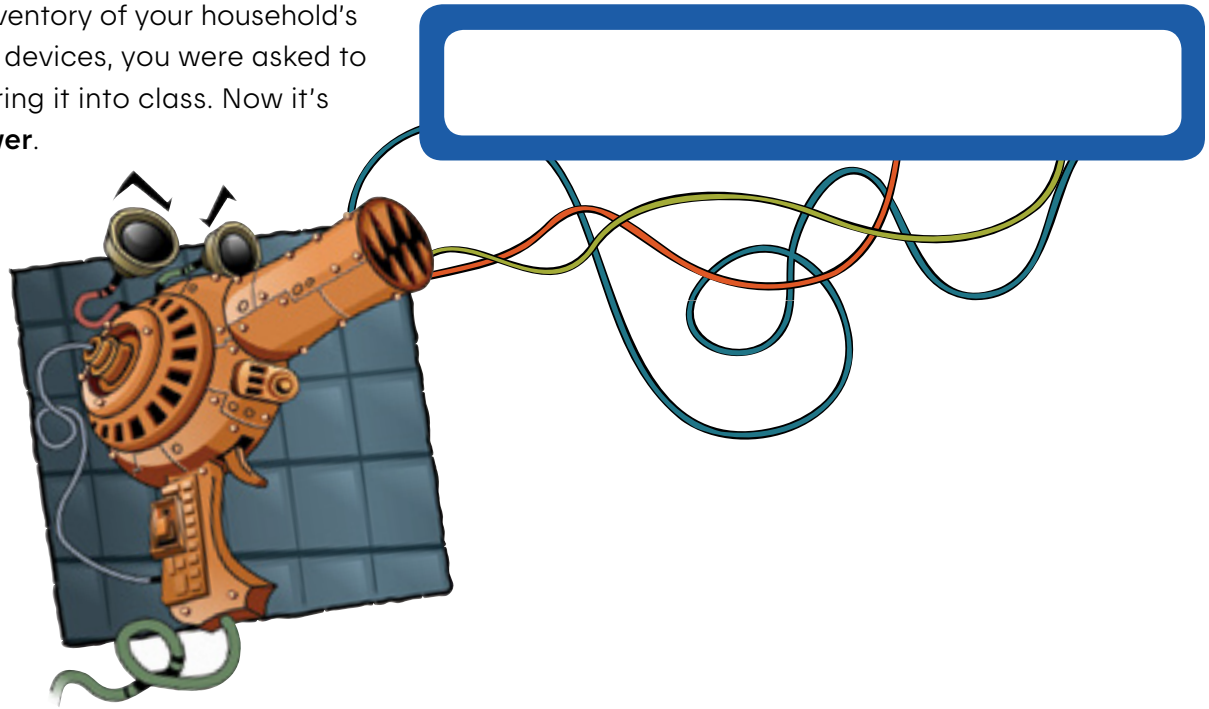
Wattmeter Experiment

Psst!
Write down or check off your answers, as appropriate!

Your mission

While conducting the inventory of your household's electric appliances and devices, you were asked to choose one item and bring it into class. Now it's time to measure its **power**.

What item did you choose?



Using the legend below, make a **starting assumption**. Do you think the item's power is:

- ◯ low **(green)**
- ◯ medium **(yellow)**
- ◯ high **(red)**

Don't forget to place a sticker corresponding to your assumption on the item.

Legend

Low power: 0 to 399 watts
Items that use little power (fairly to very energy wise)

Medium power: 400 to 1,099 watts
Items that consume a moderate amount of power (somewhat energy wise)

High power: 1,100 watts and over
Items that consume a lot of power (energy hogs)

Now, **measure your item's power** with the wattmeter. Follow your teacher's instructions.

1. According to the wattmeter, what is your item's power in watts?

   _____ watts

2. Your item's power is:
   - ◯ low
   - ◯ medium
   - ◯ high

3. In your opinion, this item is:
   - ◯ energy wise
   - ◯ somewhat energy wise
   - ◯ an energy hog

4. Referring to your classmates' readings, rank the electric appliances and devices by their power, from the most **energy wise** to the biggest **energy hogs**. Write your answers on the next page.

5. Indicate the power of each appliance in watts (W) and colour the circle the corresponding colour.

Psst!

Green = low
Yellow = medium
Red = high

1. _____ _____ W Zone ◯
2. _____ _____ W Zone ◯
3. _____ _____ W Zone ◯
4. _____ _____ W Zone ◯
5. _____ _____ W Zone ◯
6. _____ _____ W Zone ◯
7. _____ _____ W Zone ◯
8. _____ _____ W Zone ◯
9. _____ _____ W Zone ◯
10. _____ _____ W Zone ◯
11. _____ _____ W Zone ◯
12. _____ _____ W Zone ◯
13. _____ _____ W Zone ◯
14. _____ _____ W Zone ◯
15. _____ _____ W Zone ◯
16. _____ _____ W Zone ◯
17. _____ _____ W Zone ◯
18. _____ _____ W Zone ◯

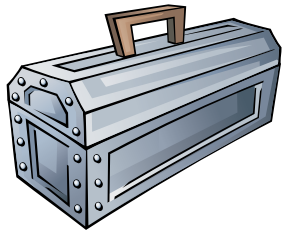
Psst!

Green = low
Yellow = medium
Red = high

19. _____ _____ W Zone ◯
20. _____ _____ W Zone ◯
21. _____ _____ W Zone ◯
22. _____ _____ W Zone ◯
23. _____ _____ W Zone ◯
24. _____ _____ W Zone ◯
25. _____ _____ W Zone ◯
26. _____ _____ W Zone ◯
27. _____ _____ W Zone ◯
28. _____ _____ W Zone ◯
29. _____ _____ W Zone ◯
30. _____ _____ W Zone ◯
31. _____ _____ W Zone ◯
32. _____ _____ W Zone ◯

Note

An electric appliance or device that is fairly energy wise but used for a long time will consume as much electricity as an energy-hungry item used for just a few minutes!



Hello!
Choose items used by **several** members of your family!

Psst!
Use the tables on the next page.

Energy Use by Electric Appliances and Devices

Calculating Energy Costs

Your challenge

How much does it cost **per year** to run three different electric appliances or devices with different power ratings? Calculate the cost here based on the approximate amount of time they are used by family members.

Table 1

1. Start by selecting **three appliances or devices** from the ones you used in the previous activity. Be sure to choose one for each sticker color. Write your item choices in Table 1 on the next page.
2. Next, enter the power for each item in watts (W) (step A), as measured in the previous activity. Then calculate the power in kilowatts (kW) by dividing the power by 1,000 (step B).

Table 2

For each electric appliance or device, use Table 2 on the next page to estimate the number of hours your family uses the item in **one week**.

1. Enter the name of each appliance or device in the column headings. Then write the name of each family member in the first column.
2. In the column under each item, estimate the approximate number of minutes of use for each family member in one week (seven days).
3. Add up the minutes of use for each item over one week (step C).
4. Convert the three totals into hours by dividing them by 60 (step D).

Table 1

	APPLIANCE OR DEVICE POWER	Item 1	Item 2	Item 3
	Steps and equations			
	Power in watts			
A	Power measured in Activity 3.3, Question 1	W	W	W
	Power in kilowatts			
B	Power (W) ÷ 1,000	kW	kW	kW

Table 2

	AMOUNT OF TIME USED	Item 1	Item 2	Item 3
	Steps and family member's first name			
	Me:	min/week	min/week	min/week
		min/week	min/week	min/week
		min/week	min/week	min/week
		min/week	min/week	min/week
		min/week	min/week	min/week
C	**Total for the family, in minutes**	min/week	min/week	min/week
	Total for the family, in hours			
D	Total in minutes C ÷ 60	hrs/week	hrs/week	hrs/week

Table 3

Next, calculate the **annual electricity cost** of each appliance or device (Table 3).

1. First, calculate the number of hours of use for each of the three appliances or devices in one year (step E). Follow the instructions in the table.
2. Next, determine their annual electricity consumption (step F). Electricity consumption is calculated by multiplying each item's **power** by the **number of hours of use**. Follow the instructions in the table.
3. Finally, multiply the consumption by the **rate** in effect (in 2021) for each kilowatthour (kWh), as shown in the table (step G). That's all there is to it! Now you know roughly how much each appliance or device costs in one year.

Table 3

ANNUAL ELECTRICITY COST		Item 1	Item 2	Item 3
Steps and equations				
	Number of hours of use per year			
E	Total number of hours per week D x 52 weeks	hrs/yr	hrs/yr	hrs/yr
	Annual electricity consumption			
F	Power (in kW) B x number of hours of use per year (hrs/yr) E	kWh/yr	kWh/yr	kWh/yr
	Annual electricity cost			
G	Consumption (in kWh) F x $0.09/kWh[1]	$/yr	$/yr	$/yr

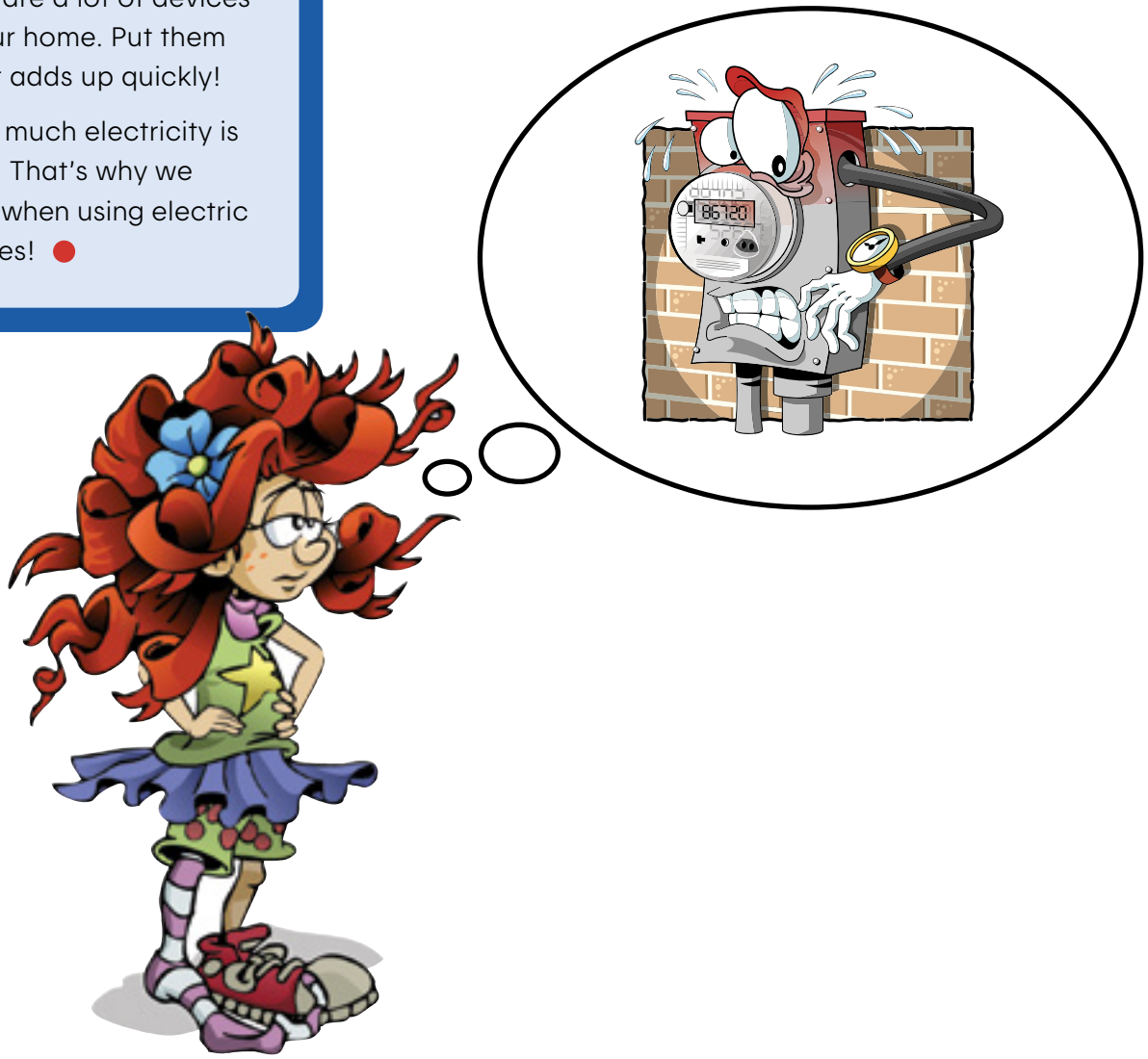
1 According to the rates in effect in April 2021, including taxes.

Note

Does it seem like not very much?

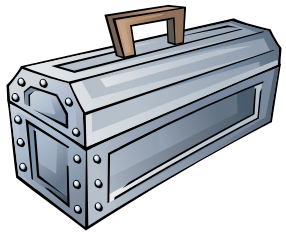
Remember that there are a lot of devices and appliances in your home. Put them together and the cost adds up quickly!

Now think about how much electricity is used all over Québec. That's why we shouldn't be wasteful when using electric devices and appliances!



Part 4

Energy Consumption Habits



Tracking down the Virus!

Wasting Energy

The Class under Investigation!

Psst!
Do this first observation exercise only if it's cold outside!

Your mission

Does your class waste energy in ways that could be prevented? Can you identify them?

Make your observations in the morning, and then answer the questions in the afternoon while discussing them with your teacher.

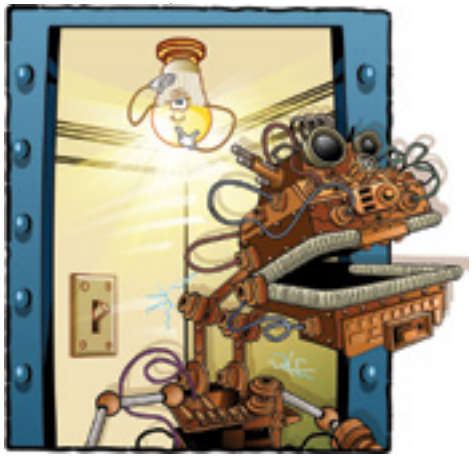
Can air leak in or out?

Cold air that leaks in through poorly insulated windows makes the room colder, so we turn up the heat. And what's more, warm air leaks out through the same openings!

Electric sockets on the outside walls of the building can also let cold air in.

1. If there are windows in your classroom, have you ever noticed whether cold air seeps in around them? How can you check?

Are lights left on for no reason?



2. Is there lots of natural light in the classroom during the day?

   ◯ Yes ◯ No

3. Are the lights turned off when you leave for recess, lunch and at the end of the day?

   ◯ Yes ◯ No

Do you make good use of curtains?

4. If there are windows in the class, do they have curtains or blinds?

   ◯ Yes ◯ No

In cold weather

5. Are the curtains or blinds open during the day to allow the sun in to heat the room?

   ◯ Yes ◯ No

6. Are the curtains or blinds closed at the end of the day to keep the heat in the room?

   ◯ Yes ◯ No

Do computers get forgotten?

7. Are classroom computers turned off or switched to standby or sleep mode when they are not in use?

   ◯ Never
   ◯ Sometimes
   ◯ Often
   ◯ Always

Other situations

8. Are there other possible energy-wasting situations in the classroom that you or your teacher could fix? (E.g., a window that doesn't close properly, a hot water tap that leaks or is left running for too long, calculators that use non-rechargeable batteries, etc.)

_____

_____

_____

_____

_____

_____

Energy Consumption at Home
Assumptions Game

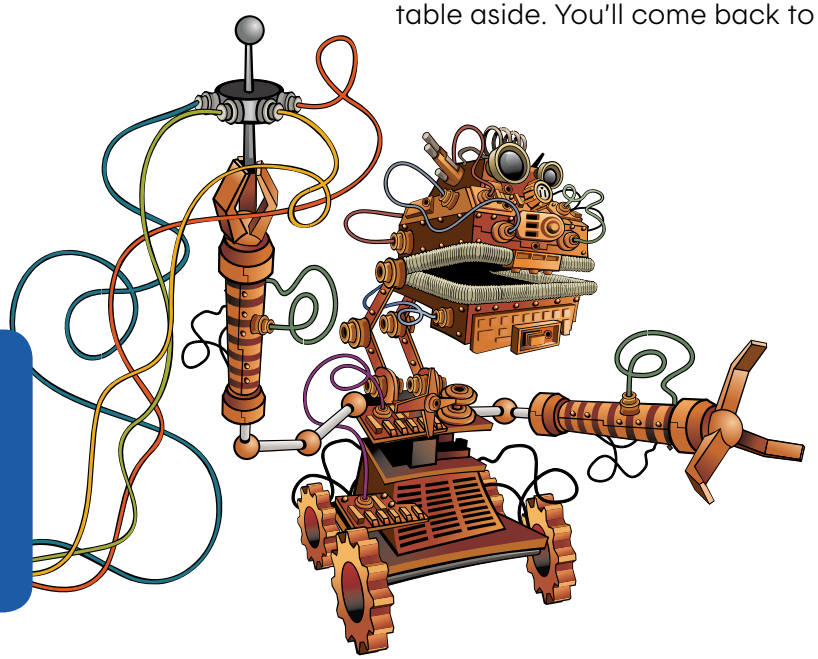
Psst!
Think carefully before making your assumptions!

Your mission

Let's study energy consumption at home. Like any scientist, you will have to proceed step by step:

- First, make your assumptions.
- Second, collect data.
- Third, test your assumptions and draw your conclusions.

Start by making some assumptions. In **column 1** of the **summary table** (pages 44 to 46), for each question, check off the assumption that you feel best reflects **YOUR** situation. Then, put the table aside. You'll come back to it later.



Note

You will need the summary table later to collect and analyze your data.

Summary table (Study of my family's energy consumption at home)

1 Starting assumptions

1. The temperature of our **refrigerator** is:
   - ◯ Too warm
   - ◯ Just right
   - ◯ Too cold
2. The temperature of our **freezer** is:
   - ◯ Too warm
   - ◯ Just right
   - ◯ Too cold
3. During winter, the **nighttime** temperature in my home is:
   - ◯ Sometimes too low
   - ◯ Just right
   - ◯ Sometimes too high

2 Data

1. Temperature of our **refrigerator**:

   _____ °C
2. Temperature of our **freezer**:

   _____ °C
3. During winter, do you or your parents turn down the thermostats before **going to bed**?
   - ◯ Never
   - ◯ Sometimes
   - ◯ Always
   - ◯ We can't change the thermostat.

3 Assumptions tested

1. The temperature of our **refrigerator** is:
   - ◯ Too warm
   - ◯ Just right
   - ◯ Too cold
2. The temperature of our **freezer** is:
   - ◯ Too warm
   - ◯ Just right
   - ◯ Too cold
3. During winter, the **nighttime** temperature in my home is:
   - ◯ Sometimes too low
   - ◯ Just right
   - ◯ Sometimes too high

4 Conclusions

To save energy, I suggest ...

1. We set the **refrigerator** temperature higher.
   - ◯ Yes
   - ◯ No
2. We set the **freezer** temperature higher.
   - ◯ Yes
   - ◯ No
3. We turn down the thermostat(s) **at night** during winter.
   - ◯ Yes
   - ◯ No

1 Starting assumptions

4. During winter, **when we go out**, the temperature in my home is:
   - ◯ Sometimes too low
   - ◯ Just right
   - ◯ Sometimes too high

5. I think my family and I **use**:
   - ◯ Not much hot water
   - ◯ A bit too much hot water
   - ◯ Far too much hot water

2 Data

4. During winter, do you or your parents turn down the thermostats when you **leave** for several hours?
   - ◯ Never
   - ◯ Sometimes
   - ◯ Always

5. During the three days I collected data, my family and I:

   Took _____ showers.

   Took _____ baths.

   Did _____ loads of laundry in hot water.

   Ran the dishwasher _____ times.

3 Assumptions tested

4. During winter, **when we go out**, the temperature in my home is:
   - ◯ Sometimes too low
   - ◯ Just right
   - ◯ Sometimes too high

5. I think my family and I **use**:
   - ◯ Not much hot water
   - ◯ A bit too much hot water
   - ◯ Far too much hot water

4 Conclusions

To save energy, I suggest ...

4. We turn down the thermostat(s) **when we are out**, during winter.
   - ◯ Yes
   - ◯ No

5. We **do our laundry** in warm or cold (rather than hot) water and rinse it in cold water.
   - ◯ Yes
   - ◯ No

   We run the **dishwasher** only when it is full to reduce the number of loads.
   - ◯ Yes
   - ◯ No

1 Starting assumptions

6. We generally leave some electric devices **on** even if no one is using them:
   - ◯ Never
   - ◯ Sometimes
   - ◯ Always

2 Data

6. Number of times these devices were left **on** unnecessarily during the three days I collected data:

   Bedroom light:

   _____ times

   Television(s):

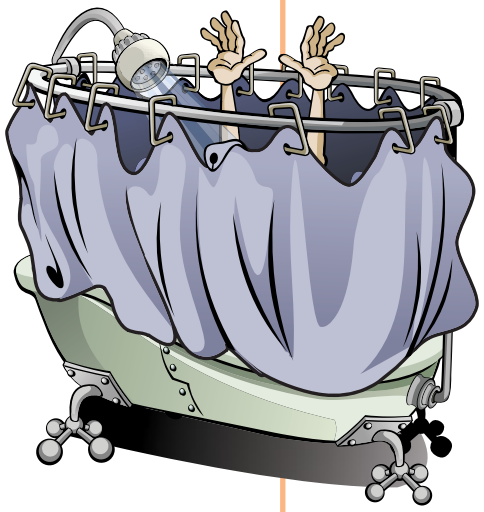
   _____ times

   Computer(s):

   _____ times

3 Assumptions tested

6. We generally leave some electric devices **on** even if no one is using them:
   - ◯ Never
   - ◯ Sometimes
   - ◯ Always



4 Conclusions

To save energy, I suggest ...

6. We avoid wasting energy by leaving electric devices on when they are not in use.
   - ◯ Yes
   - ◯ No ●

Energy Consumption
Collecting Data at Home

Psst!
Remember to use degrees Celsius (°C)!

Your mission

At home, take the measurements and make the observations indicated. You'll use the information later to test your assumptions.

Answer the questions in **column 2** of the **summary table** (pages 44 to 46). Here are some tips to help you:

Question 1

To measure the **refrigerator** temperature, place the thermometer in the refrigerator for 10 minutes (keep the door closed!) and then record the temperature it shows.

Question 2

To measure the **freezer** temperature, place the thermometer in the freezer for 10 minutes (keep the door closed!) and then record the temperature it shows.

Questions 3 and 4

To answer these questions on **heating**, pay close attention to your family's habits, especially when going to bed and leaving in the morning.

Knowledge is power

Electronic thermostats can help you save nearly 10% on heating compared to mechanical thermostats.

You can save even more by programming them or using smart thermostats that program themselves based on your family's habits.

Question 5

Estimate your family's **hot water consumption**. Over three days, how many times did the members of your family take baths or showers? How many laundry and dishwasher loads did they do? Imagine the total number in a week!

Psst!
Ask your parents if you're not sure.

Question 6

Check whether any devices are left on when no one is using them. Over three days, how many times was a bedroom light, television set or computer **left on unnecessarily**? Record your observations in the table below.

At the end of the three days, add up the **total** for each device. Enter these totals in the **summary table** (page 46).

Table

	Approximate **number of times** in a week			
	Day 1	Day 2	Day 3	**Total**
Bedroom light				
Television(s)				
Computer(s)				

Psst!
If you have a question, ask your teacher!

Energy Consumption
Assumptions and Conclusions

Your challenge

Using the **summary table** (pages 44 to 46), test your starting assumptions, draw your conclusions and think about whether the suggested action is right for your family.

Good to know

Hydro-Québec recommends:

- keeping the **refrigerator** temperature between **2°C** and **5°C** and the **freezer** at **-18°C**
- keeping your **home**'s temperature at **17°C** at night and whenever you're away, and **20°C** the rest of the time during winter.

Steps

Test your assumptions

- Examine the data you collected in **column 2** to determine whether the starting assumptions in **column 1** were right or wrong. Then, fill out **column 3** and adjust your initial responses, if necessary.

Draw your conclusions

- In teams of two, **discuss** the **conclusions** about how your families use electricity or any other form of energy.
- **Column 4** lists various ways to save energy. Decide whether they're right for your family.

To guide your discussion, try to answer these questions:

Questions

- What conclusions can you draw from your analysis?
- How would you describe your family's energy consumption (good, fair or bad)?
- Are people in your family energy wise or energy hogs?
- What resolutions should you make?
- What actions are the most important?

Psst!
See the summary table on pages 44 to 46.

Energy consumption during peak hours

Have you ever heard your parents complain about traffic during rush hour? It's the same for energy consumption: there are times in the day when the demand is higher, especially in the winter. These peak periods can lead to "traffic jams" for energy.

In Québec, peak hours in the winter are from 6 to 9 a.m. and from 4 to 8 p.m.

Listen to your teacher explain why Hydro-Québec asks us to use less energy during peak periods in winter.

Can you think of two easy ways to reduce your electricity consumption in the morning and evening?

1. _____

_____

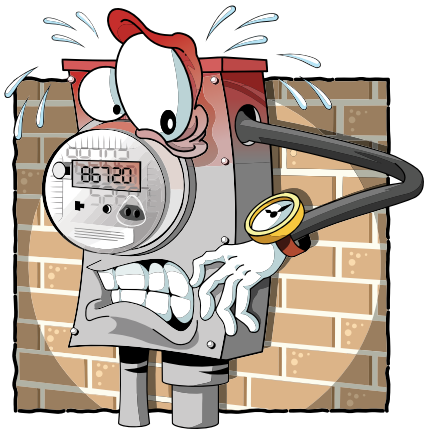
_____

2. _____

_____

_____

_____



Hydro-Québec Video

Doing something for the planet doesn't require too much...energy!

Psst!
Pay close attention to the video.

Your mission

Answer the following questions.

1. What do you think is the main message of the video?

   ◯ The city has gone crazy.
   ◯ Elevators are for people who lack discipline.
   ◯ Let's show what we can do to reduce our energy consumption at home.

2. "We tend to take our energy for granted". What do you think of this statement? Explain why you feel this way.

   ◯ Funny ◯ Who cares?
   ◯ Worrisome ◯ Disgusting
   ◯ Sad ◯ Crazy

   _____

   _____

   _____

   _____

When the narrator says, "Quebecers are among the world's top energy consumers."

3. What does she mean?

   _____

   _____

   _____

4. What do you think?

   _____

   _____

   _____

5. Are you suprised? Why? ◯ Yes ◯ No

   _____

   _____

   _____

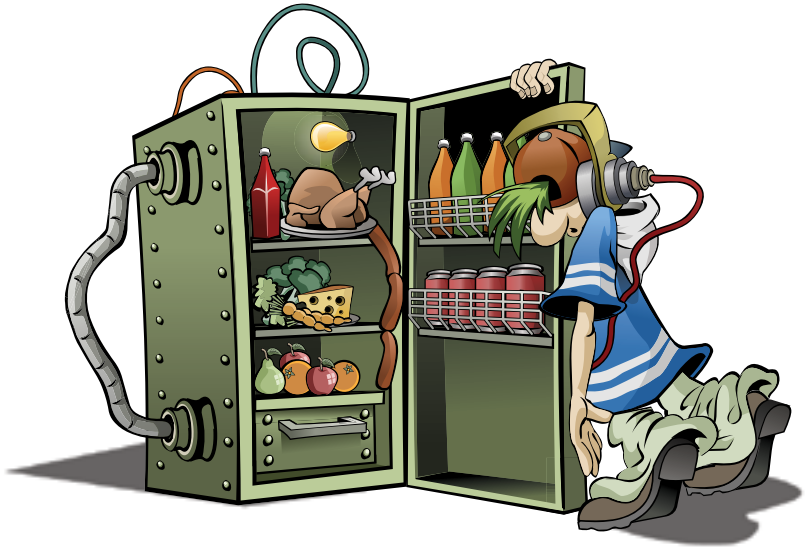
Psst!
Think carefully before you answer!

6. Is it OK to waste a resource if there's lots of it? Why?

7. At the end of the video, the narrator says, "The future of our planet depends on all the little things we do everyday." Is she right? Why?

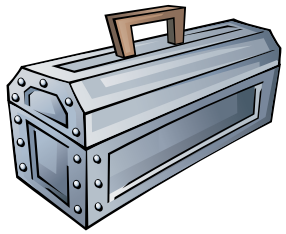
◯ Yes ◯ No

8. What little things can you do to save energy? Can you name two?



Part 5

Ways to Save Energy



Stop the Virus!

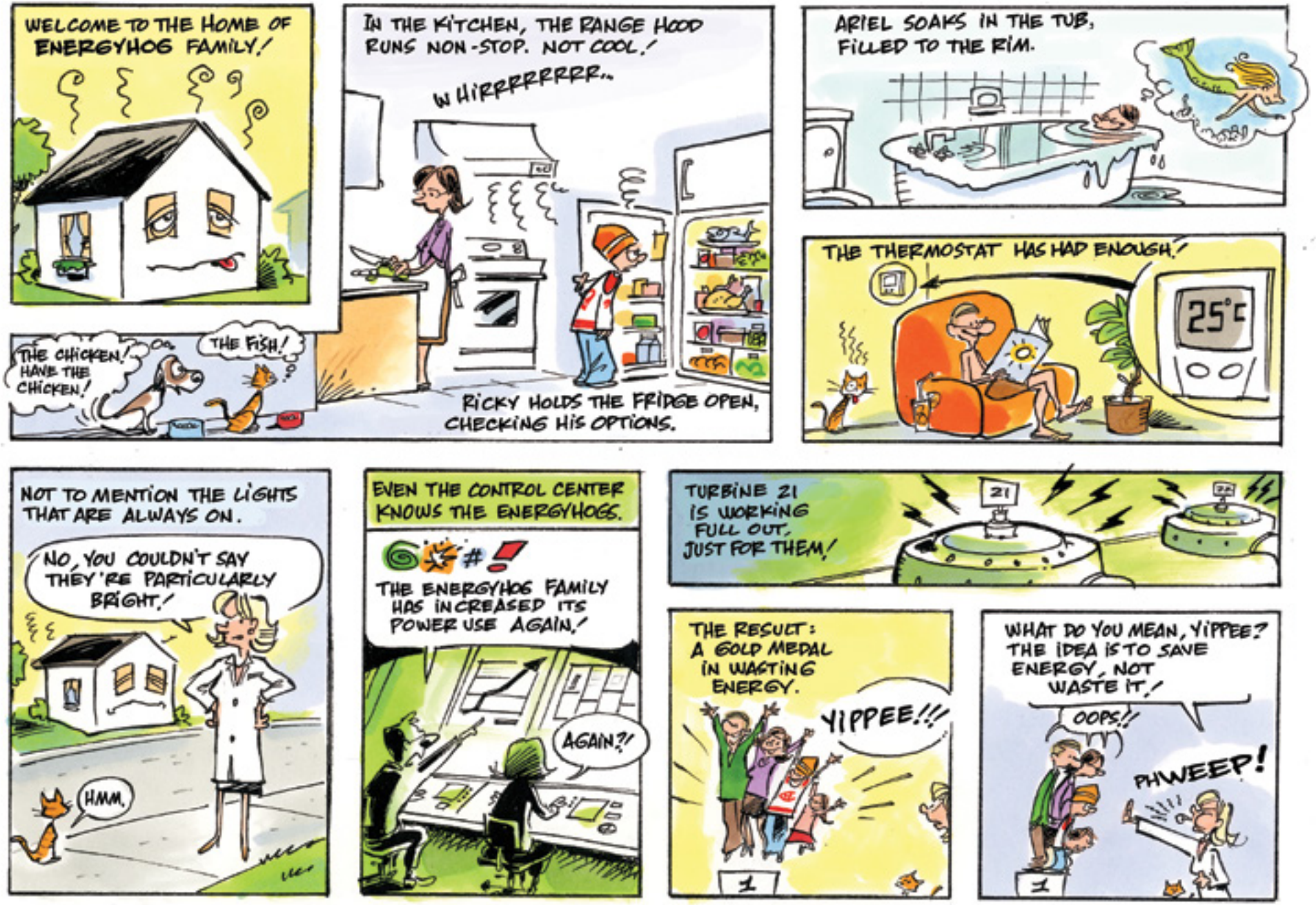
Get Energy Wise

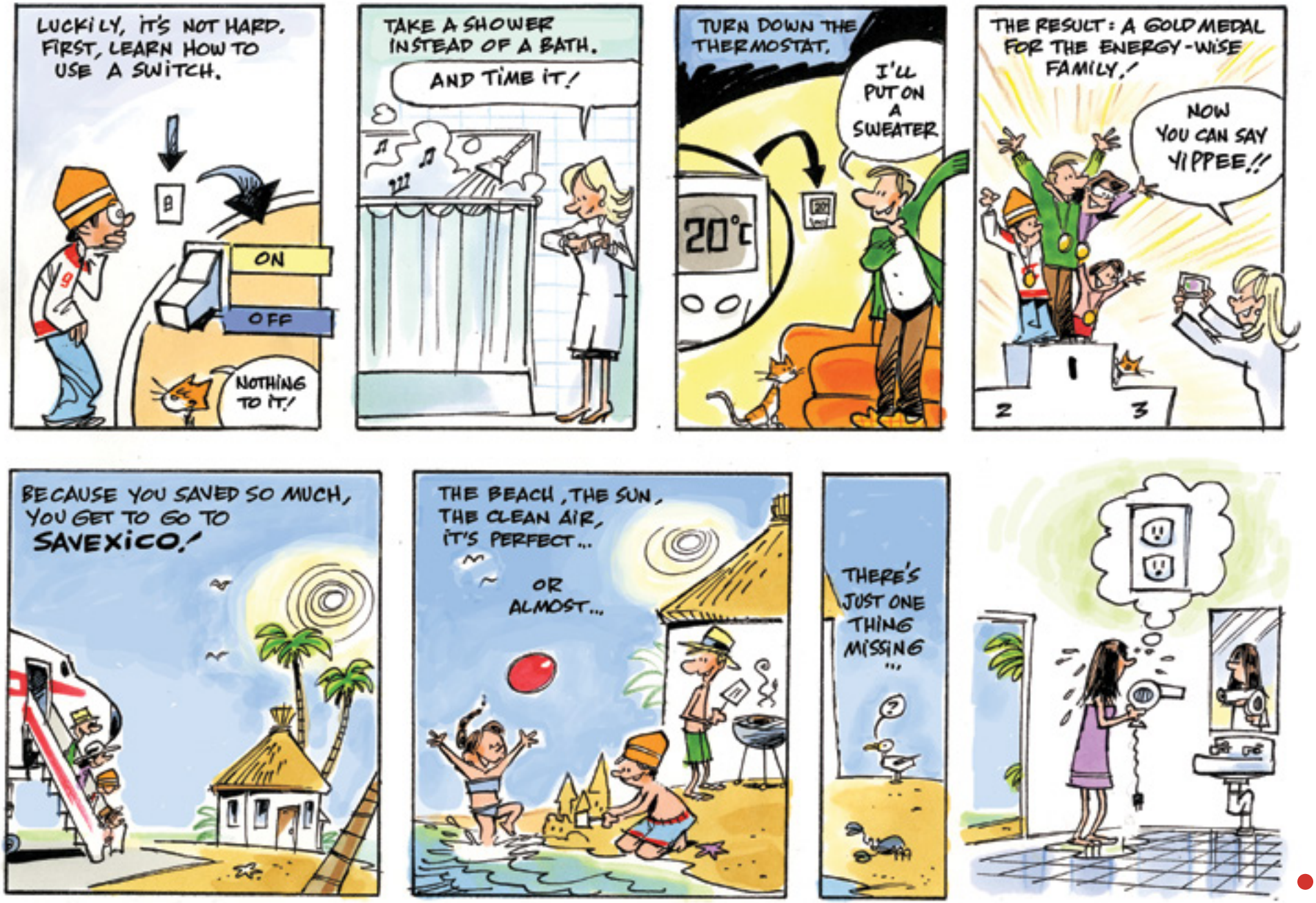
Stop the Virus! Comic Strip

Food for thought

What if it were easier
than you think?

STOP THE VIRUS!




LUCKILY, IT'S NOT HARD. FIRST, LEARN HOW TO USE A SWITCH.
ON
OFF
NOTHING TO IT!
TAKE A SHOWER INSTEAD OF A BATH.
AND TIME IT!
TURN DOWN THE THERMOSTAT.
I'LL PUT ON A SWEATER
20°C
THE RESULT: A GOLD MEDAL FOR THE ENERGY-WISE FAMILY.!
NOW YOU CAN SAY YIPPEE!!
2
1
3
BECAUSE YOU SAVED SO MUCH, YOU GET TO GO TO SAVEXICO.!
THE BEACH, THE SUN, THE CLEAN AIR, IT'S PERFECT...
OR ALMOST...
THERE'S JUST ONE THING MISSING...

Energy-Saving Ideas
Brainstorming

Psst!
Think carefully before you answer!

Your mission

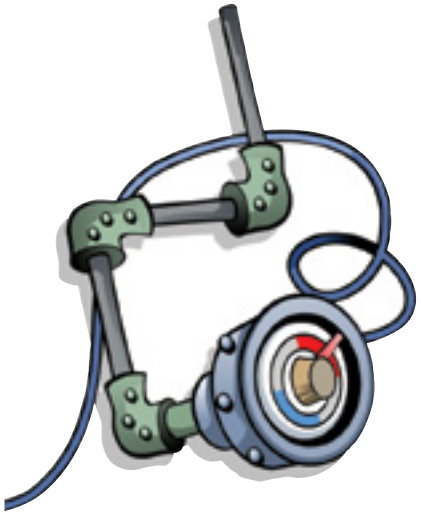
With your teammates, find ways to save energy at home. Write them down on page 59.

Need inspiration?

Start by taking a look at the charts on the next page, and read the *Knowledge is power* box. You can also reread your conclusions in the summary table (pages 44 to 46) and why not think about the many electric appliances and devices in each room at home and your family's energy consumption habits?

Don't forget!

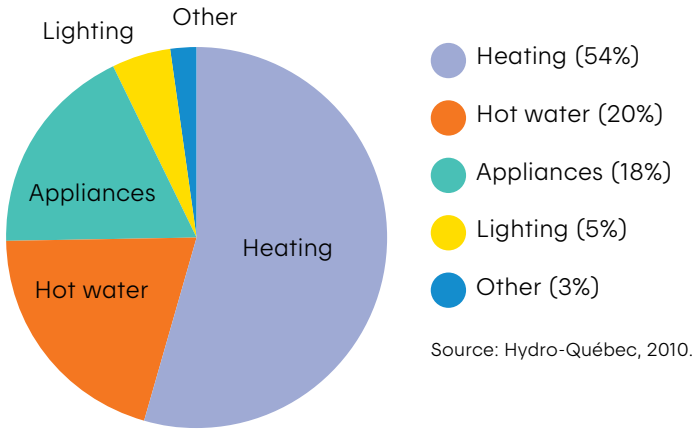
Being energy wise doesn't mean you have to do without energy in your life. Just avoid overusing and wasting it!



Knowledge is power

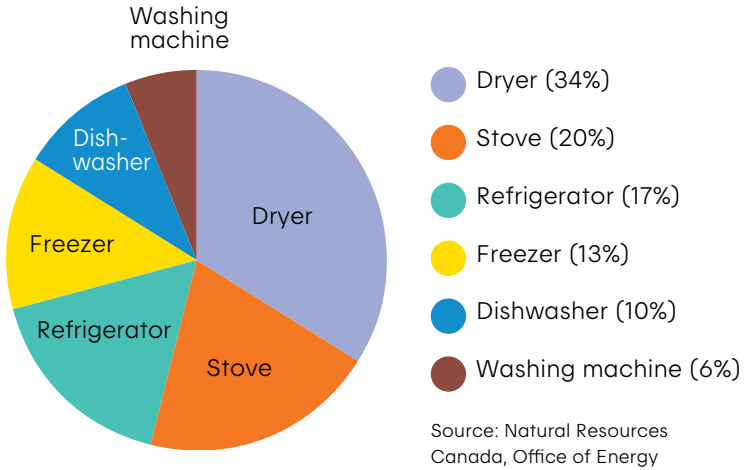
- Baths and showers account for more than one third (35%) of the drinking water we use in our homes.
- A top-loading washing machine uses about 75 litres of water for each load, while a dishwasher uses up to 60 litres.
- To save energy, run your washing machine and dishwasher only when you have a full load.
- Your laundry comes out just as clean when you wash it in cold water as when you wash it in hot or warm water.

Breakdown of Home Energy Consumption



Source: Hydro-Québec, 2010.

Energy Consumption Breakdown by Appliance



Source: Natural Resources Canada, Office of Energy Efficiency, 2012

Psst!
Watch your spelling!

Tips to save energy at home:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Simple, Effective Ways to Save Energy

The ENERGY-WISE Squad Digital Game

Psst!
Find the three situations in which energy is being wasted in each room.

Your challenge

Can you tell what's true and what's false? Join the *ENERGY-WISE Squad* and try to spot situations where energy is being wasted. By finding the best ways to save energy, you'll discover how easy it is to be more energy wise without sacrificing your comfort!

How to play

No doubt you will have an opportunity to try this game in the classroom, but you can also play at home on a computer or tablet.

To start the game, go to **hydroquebec.com/teachers** and click on the link to the Energy-Wise Squad game. Why not challenge your parents, siblings or friends?

Let's Get Started!

Unplugged! Digital Game

Psst!
Remember to explore each room thoroughly!

Your mission

Inspector **OOWatt** needs your help to free your house from the evil clutches of **Terawattus Energivorus**! At the same time, you'll learn how to reduce your day-to-day energy use.

How to play

No doubt you will have an opportunity to try this game in the classroom, but you can also play at home on a computer or tablet.

To start the game, go to **hydroquebec.com/teachers**. Why not challenge your parents, siblings or friends?

Hint

Pay special attention to objects that move or become highlighted in blue.

Wrap-up and Pledge Form

I Promise!

Psst!
If you need some inspiration, look back at the exercises and experiments you've done.

Your mission

On this page, jot down everything you've learned about energy conservation from the exercises and experiments you've been doing. For instance, you can talk about **energy use** in the classroom or at home, how some **electric appliances and devices** are real energy hogs, the **bad habits** that make people waste energy, **tips and tricks** to save energy, **products** that can help you save energy and more.

I hereby certify that I have successfully completed the OOWatt program.

I promise to apply these three energy-saving resolutions:

1. _____

2. _____

3. _____

I also promise to encourage my family to take the following steps to save energy:

1. _____

2. _____

3. _____

Signature: _____

Date: _____

Creating Public Interest Posters

My Voice at School!

Psst!
Watch your spelling!

Your mission

Working in teams of two, design a poster to convince your schoolmates of how important it is to save energy.

Instructions

Your poster should have all the following:

1. A title
2. A slogan or catchy phrase
3. A message
   (useful and concise information)
4. At least one illustration
   (drawings, magazine photos, etc.)

Title: _____

Your slogan should be short and punchy:

_____

_____

Now, using everything you wrote down on the Wrap-up page, compose the **short message** that you want to get across. Suggest two ways to become energy wise.

1. _____

_____

_____

2. _____

_____

_____


OK, OK, you win! I'm through making you waste energy. Goodbyyyyyyeee!
Well done!
I hope you'll keep fighting waste by finding ways to save energy every day.
Thanks to you, we're one step closer to protecting our planet's future!

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