TEACHER'S PACKAGE

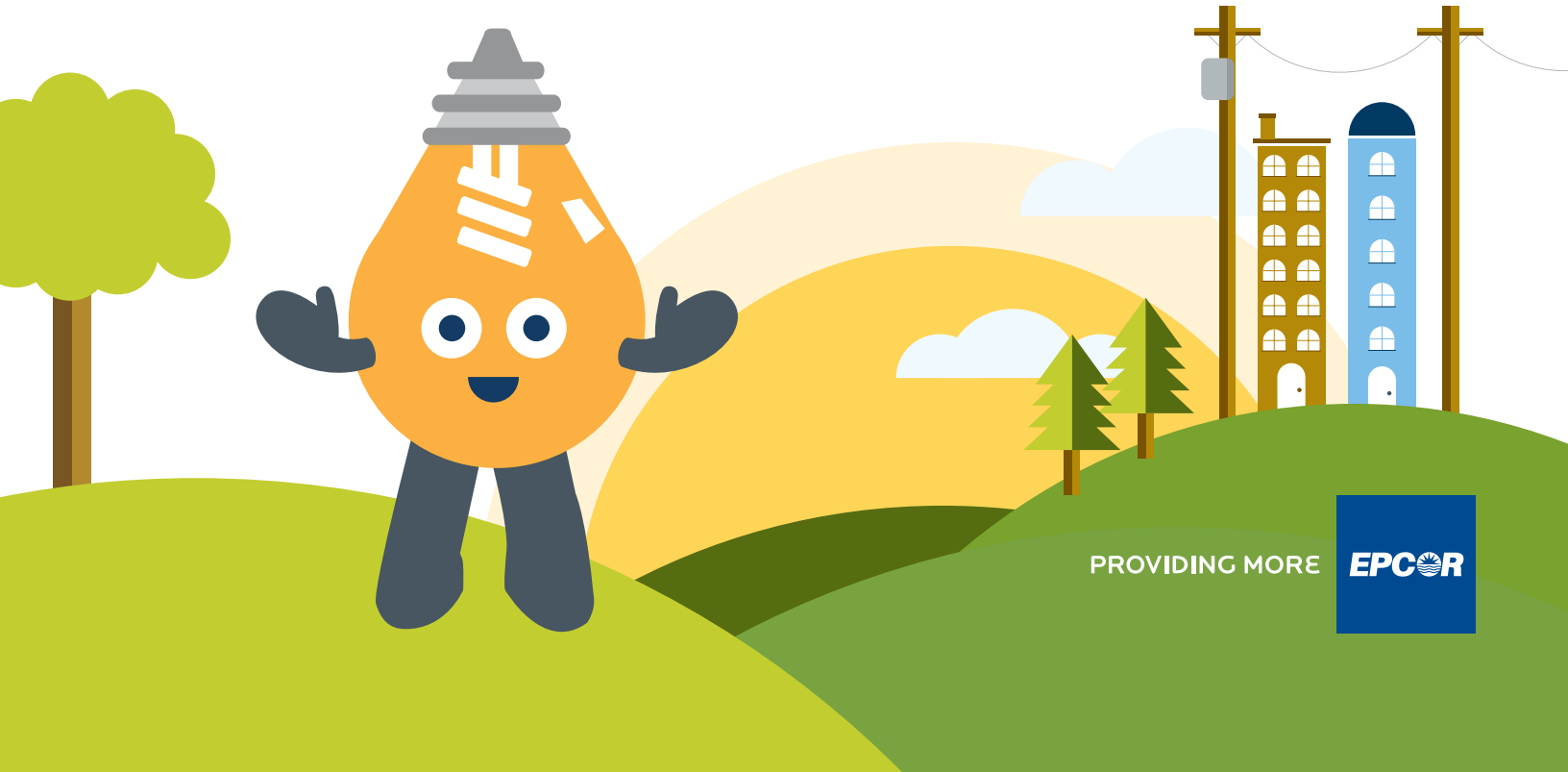
MODULE 1
EPCOR ELECTRICITY 101

Grade 5 Science – Topic A: Electricity and Magnetism

Specific Learner Expectations:

- Students will recognize and appreciate the potential dangers involved in using sources of electrical currents.
- Understand that household electrical currents are potentially dangerous and not a suitable source for experimentation.
- Students will understand that short circuits may cause wires to heat up.
- Demonstrate that a continuous loop of conducting material is needed for uninterrupted flow of current in a circuit.
- Demonstrate electrical conductors – materials that allow electricity to flow through them, and insulators – materials that do not allow electricity to flow through them.
- Recognize and demonstrate that some materials, including resistors are partial conductors of electricity.

Cross curricular competencies: Manage information, identify and solve complex problems, think critically.



SLIDE NO.	SUGGESTED SPEAKING NOTES
1	· Today we're going to learn about electricity. · In Edmonton, EPCOR makes sure electricity travels safely so that you can use it at home and school. EPCOR has been around for over 125 years and they also make sure the water from our taps is safe to drink.
2	· We're going to talk about an electrical circuit, how it works and how to be safe around electricity. · Electricity is a very wonderful AND powerful resource. But we have to do our part to understand and to respect it. If not, we risk it becoming a danger, instead of something to help and enjoy our lives with. · Who here has used electricity today? · What did you use it for? **! Have children raise their hands and then ask a couple of them what they used it for.**
3	· Now, can you imagine how you would be doing those things if we didn't have electricity? · How would you read a book? Would you be able to play video games? How would your mom or dad cook dinner?
4	· What is electricity? · Electricity is extremely useful and extremely powerful. Because of this we wanted to make sure you understand the role of electricity and how to use it wisely and safely. · It is a form of energy that we use to power machines and electrical devices. · You can see electricity in nature, like during a storm when there is lightning. · Can you think of a form of electricity that can be made quickly and sometimes accidentally? **! Have children raise their hands and guess.**

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5	· The answer is static electricity. · It's made by rubbing two objects together, like a balloon against your hair and having your hair stand up. · In the winter you might see or feel sparks when you take off your toque.
6	· Everything around us that has a mass and takes up space is called **matter.** · Apple, person, air, desk, pencil, etc. · All matter has an **electric charge.** **! Solicit responses from students for additional examples.**
7	· The smallest part of matter is an **atom,** and the smallest part of an atom is an **electron.** · Electrons are so tiny you can't even see them with a microscope but they have a very important job – they are the main ingredients needed for making electricity. · Let's see what happens when there is electricity present.
8	· Here is an animation of what happens inside an atom when electricity is present! We've slowed things down a little so you can see what's happening. · When you use an electric appliance – that is what is happening in the wires! · We call this an **electrical current.**
9	· Let's brainstorm things that use electricity in school and at home. **! Have students list items and then have pre-determined graphics appear after they've named a few to see if they captured them all.**
10	· A **circuit** is what we call the path or flow of electricity. · Electrons flow through a circuit, like the one shown here. · The battery acts as a power source where electrons enter the circuit and there are wires for the electricity to safely flow through to illuminate the light. As long as the light is on we know there is an electrical current flowing through the circuit. Let's check it out. **! Play animation on Slide 11**

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11	· When you flip the light switch into the on position, it completes or closes the circuit and the light turns on. · When you put the switch into the off position, it disconnects or opens the circuit. · Normally when you flip the switch for a light, the light comes on immediately. This animation slows things down so that you can see what's happening on the circuit. · (They don't call it the speed of light for nothing!)
12	· Let's look at what happens when the wire becomes disconnected from the battery. **! Play animation** · When a circuit is broken, electricity cannot travel to its destination. It doesn't matter where the break occurs – the result will be the same. The circuit is broken and power won't reach its destination. · When there is a power outage in your neighbourhood, it means there has been a break in the electrical circuit and EPCOR crews are working hard find the break in the circuit and fix it safely.
13	· When the circuit is broken, wires can get so hot they can actually cause fires and even explosions. · **Short circuits** happen when wires are frayed and exposed, and pose a MAJOR risk of electrical fire. · Short circuits occur when two or more wires touch that are not supposed to come into contact. This can result in a very high **current** flowing through the **circuit.** · What do you think we should do with cords that are frayed? **! Solicit responses from students for their thoughts.** · The best and safest thing to do is stop using that cord, have an adult safely remove it from the outlet. You can take it to the ECO center and replace it with a new one. · If you touch the spot with the short circuit there is a possibility that you can get burnt or depending on the amount of current, it could even kill you.

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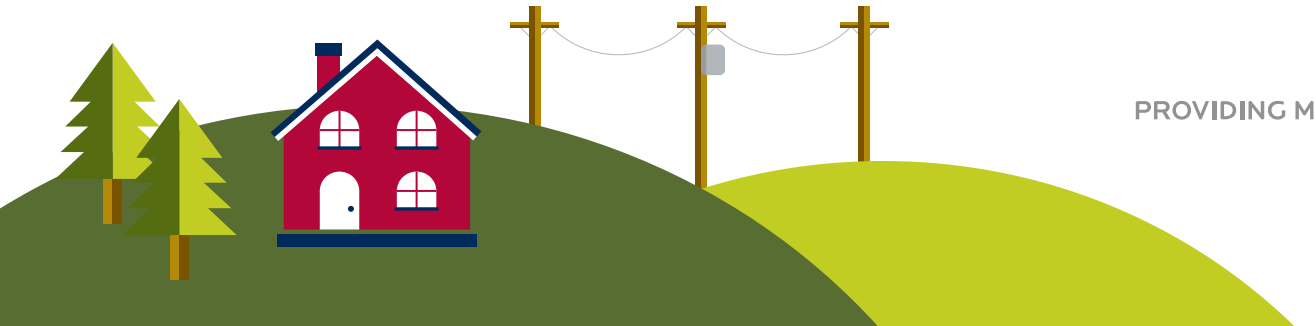
14	· Like we've talked about, electrons travel on a path without beginning or end, continuing to loop forever and ever. Electrons need a **conductor** to flow through. · In the circuit we just saw the conductor is the wire connecting the switch to the light to the battery back to the switch. · Short circuits get in the way of us being able to use and enjoy electricity, and they can be very dangerous. But we can be friends with conductors, because conductors are the tickets to an uninterrupted flow of current in a circuit. They allow our main ingredient, electrons, to flow through. They basically give electrons a 'hall pass' and make a way for them to keep going/flowing. · Can you give me some examples of conductors? **! Solicit responses from students for their thoughts. Using white board or large poster board, write down correct student responses. *You can call on a volunteer writer from the class*** **Hints you can provide: Conductors include most types of metal, copper, silver, aluminum, gold etc. & water, people, animals, trees. Real examples from 'their world' would be awesome – like, jewellery, baseball bats (wooden & aluminum), wooden ruler, steel scissors, and so on.**
15	· **Insulators** are the opposite of conductors – they RESIST the flow of electrons so much that no current flows through it. It's like they give electrons an RT (responsibility tutorial) or detention, or time-out. · Insulators make electrons stop what they normally and naturally do. Can you think of examples of insulators? **! Solicit student responses for insulators.** **Examples: glass (windows, the outer part of a light bulb), porcelain, plastic, and rubber.** **! If students are having difficulty coming up with answers - have them look at your desk, for example, and just list all the conductors and insulators in the 2 columns on the large poster paper.** **! Another fun option might be to divide class into two teams and have a timed contest to see which team can list the most items in the columns. Compare answers**



SLIDE NO.	SUGGESTED SPEAKING NOTES
16	· Electricity has a mind of its own, and will always take the path of least resistance to the ground. It is very powerful and very fast, and we can control the direction of electricity through the use of conductors and insulators. · Because our bodies are at least 60% water – people are great conductors. · This is why when EPCOR crews and electricians work with electricity they use Personal Protective Equipment made to resist the flow of electricity – so they don't become conductors. · The shirts and coveralls these gentlemen are wearing made of special material so that if they come in contact with electricity, the clothes do not act as conductors. They wear leather gloves on top of thick rubber gloves to protect their hands. Both the rubber and the leather act as insulators. · EPCOR also uses resistors on power poles to prevent electricity from escaping down the pole to the ground. You can see one in this photo, here: *(Point to the ceramic object at the top of the photo, you can see the power line coming down behind it.)* · They even use these orange insulators when they are working in order to prevent accidental contact with the power line. *(There is one in the bottom right of the photo and behind the hands of the worker on the right.)*
17	· **Resistors** reduce the amount of electricity that flows through a circuit. · Did you know this is exactly how the volume dials on a stereo works with speakers? · When you turn the dial down, it reduces the amount of electricity that gets to the speaker, making the music you are listening to softer. **! Have on hand a portable radio and demonstrate the role of resistors by turning the volume up and down.** · Another common resistor you may have around home is a dimmer switch. · Let's see what happens to the light in the circuit when we move the light switch up and down. **! Play animation** **Other examples would be dimmer switches on lights, and heating function in toasters when you select different settings like darker and lighter, bread vs. bagel.**

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18	· What happened when we moved the dimmer all the way to the top of the switch? ! **Solicit responses from the class.** · That's right, the light got brighter than when it was in the middle. By moving the switch closer to the on position, more electricity was able to flow through to the light bulb.
19	· The transformers do exactly as their name suggests, they transform – or change – the very high powered or high voltage electricity into usable electricity for your home. · Let's take a look at some transformers you might see around the neighbourhood.
20	· Have you seen these around the city? ! **Have students raise their hands in response.** · These are called substations and once electricity travels from a generation station, it gets to a substation and large transformers lower the voltage to one safe to travel in neighbourhoods. · To stay safe, it's important that you stay outside the fences around the substations.
21	· How many of you have seen the green transformer boxes like this in your neighbourhood or around the school? What about these gray transformers on power poles? ! **Have students raise their hands in response.** · It's important to keep a safe distance from transformers and not to play on or around them. · When a power outage occurs, EPCOR staff may need to easily access to the transformer boxes to correct the problem and restore power back to your neighbourhood.
22	· Let's see how this all works together to get electricity to your house and to our school. ! **Play video in provided link.**