CURRICULUM REVIEW PRESENTATION TO THE LA CAÑADA SCHOOL BOARD

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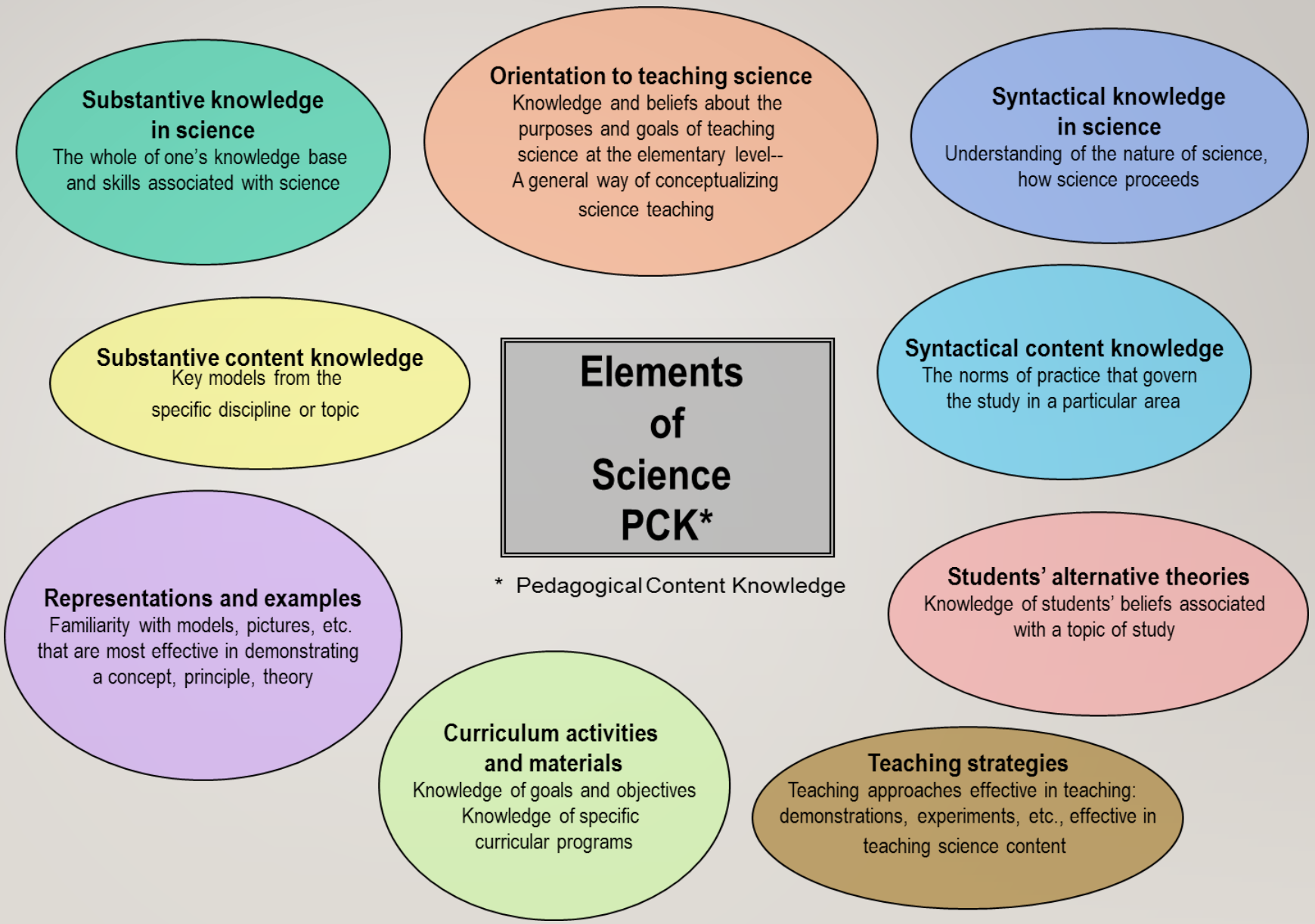
SCIENCE KNOWLEDGE FOR TEACHERS (PCK)



ELEMENTS OF SCIENCE PCK AND CURRICULUM CHOICES

Orientation to teaching science: Knowledge and beliefs about the purposes and goals of teaching science at the elementary level

- Both National Geographic and STEM Scopes curricula reflect appropriate approaches for engaging students in a study of science aligned with students' developmental levels.

ELEMENTS OF SCIENCE PCK AND CURRICULUM CHOICES

Teaching strategies: Teaching approaches, e.g., demonstrations, experiments, etc., effective in teaching science content

- Teaching strategies reflected in the National Geographic and STEMScopes curricula are generally consistent with the California Next Generation Science Standards (CaNGSS).

ELEMENTS OF SCIENCE PCK AND CURRICULUM CHOICES

Curriculum activities and materials: Knowledge of goals and objectives and specific curricular programs

- Given our review and recommendations that problems with the curricula are not so substantial as to warrant not using the curricula in the classroom, we still encourage teachers to be careful consumers of the two different curricula and in the case of STEMScopes, rely more on the continually-updated digital versions of curriculum materials.

ELEMENTS OF SCIENCE PCK AND CURRICULUM CHOICES

Representations and examples: Familiarity with models, pictures, etc. that are most effective in demonstrating a concept, principle, theory

- We found several examples in both curricula in which the authors used substandard examples of a concept or principle from science. We encourage teachers to carefully review examples presented in texts and other materials and to seek out other examples that may better demonstrate a concept or principle from science.

ELEMENTS OF SCIENCE PCK AND CURRICULUM CHOICES

Students' alternative theories: Knowledge of students' beliefs associated with a topic of study

- Given the number of science topics an elementary teacher will teach across the school year, it is unreasonable to expect that teachers will be familiar with the alternative conceptions students may have formed in all topic areas. Teachers can be mindful of the examples (charts, data sets, pictures, examples) presented in textbooks and other materials for their potential to generate misunderstandings in children's thinking.

TYPES OF ERRORS IN CURRICULUM

- **Serious Science Errors** – errors that are incorrect and can encourage students to develop misconceptions.
- **Minor errors that do not lead to significant misconceptions** – many of these are caused by statements that need qualification (e.g. Mammals give live birth)
- **Awkwardly worded but not incorrect -** poorly written statements that are not technically wrong but could be improved
- **Scientific simplifications appropriate for grade level** – some variations from the scientific cannon are intentional because they are better understood in a simple form at lower grades.
- **Pedagogical issues –** some concerns related to a poorly developed scope and sequence to the curriculum, lack of conceptual connections, and inappropriate examples of a concept.

SERIOUS SCIENCE ERRORS - EXAMPLES

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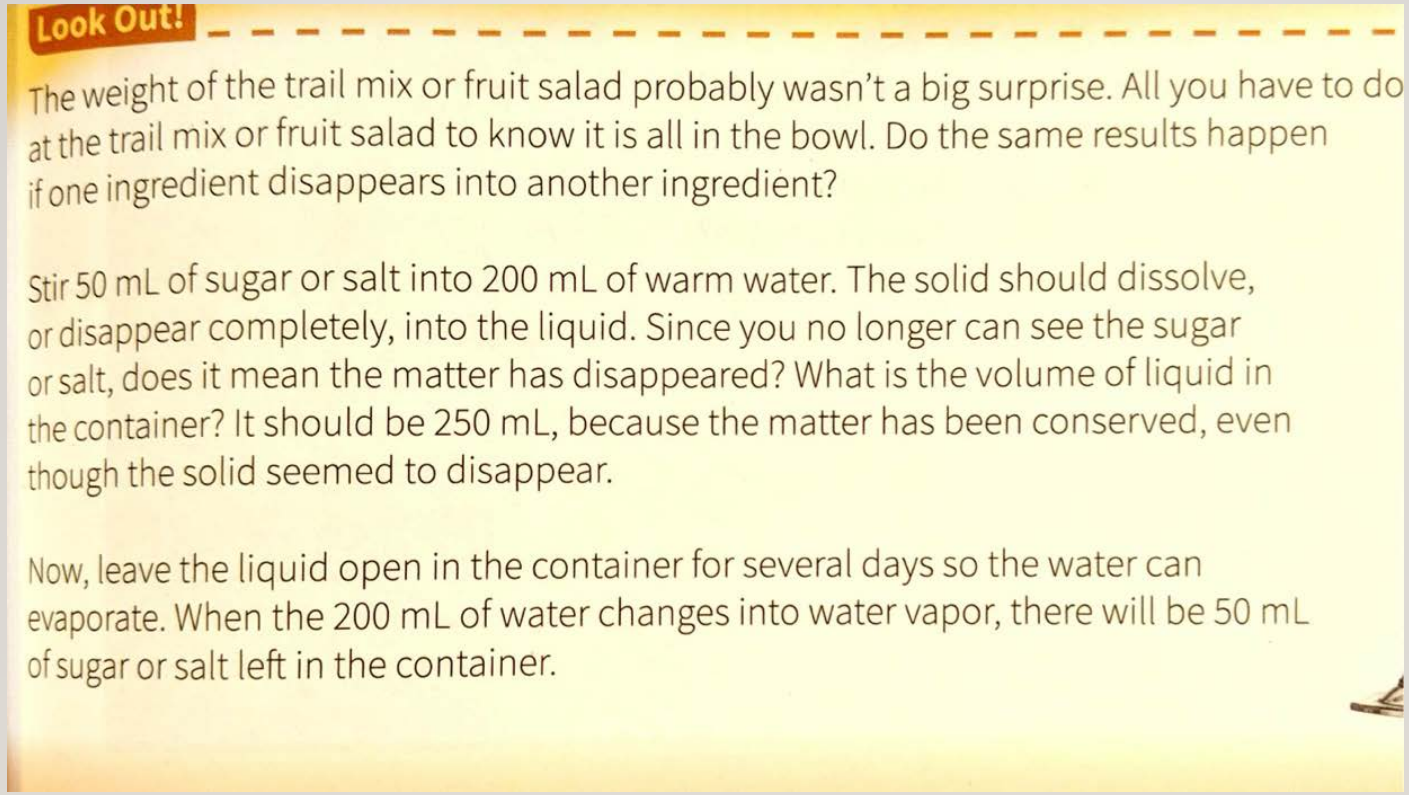


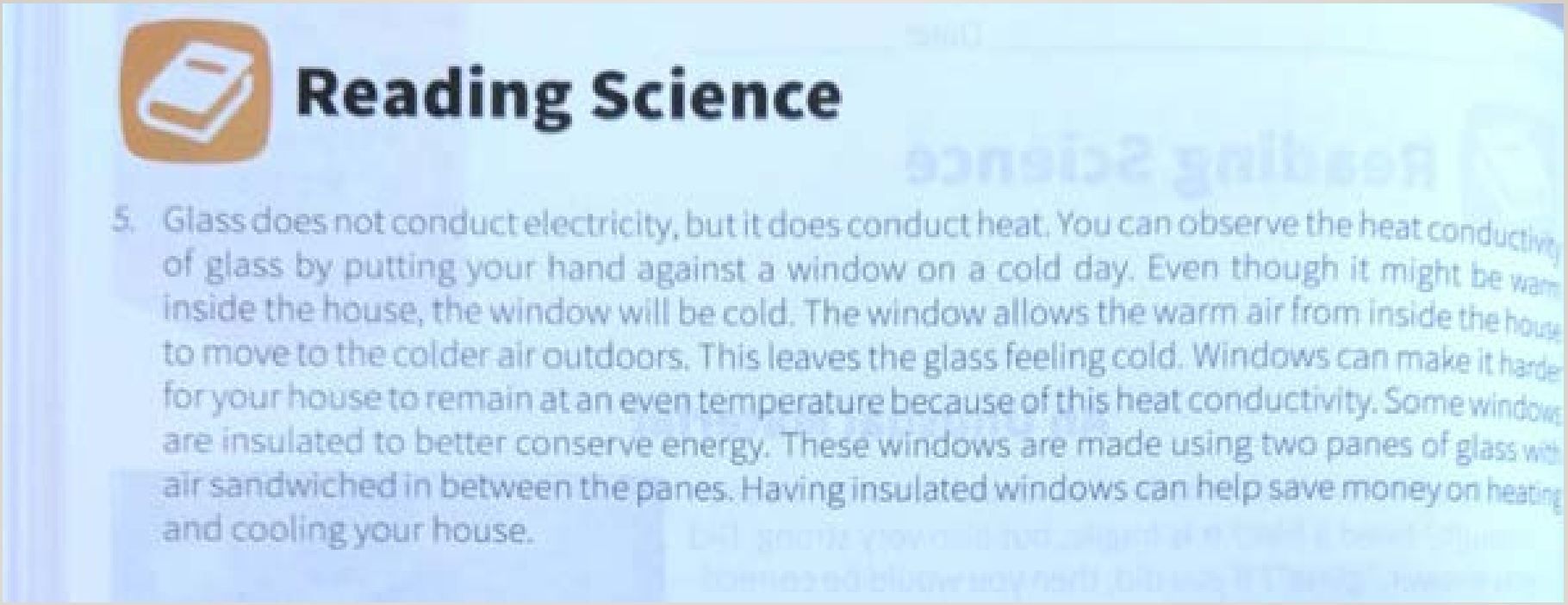
Look Out!

The weight of the trail mix or fruit salad probably wasn't a big surprise. All you have to do at the trail mix or fruit salad to know it is all in the bowl. Do the same results happen if one ingredient disappears into another ingredient?

Stir 50 mL of sugar or salt into 200 mL of warm water. The solid should dissolve, or disappear completely, into the liquid. Since you no longer can see the sugar or salt, does it mean the matter has disappeared? What is the volume of liquid in the container? It should be 250 mL, because the matter has been conserved, even though the solid seemed to disappear.

Now, leave the liquid open in the container for several days so the water can evaporate. When the 200 mL of water changes into water vapor, there will be 50 mL of sugar or salt left in the container.

SERIOUS SCIENCE ERRORS - EXAMPLES



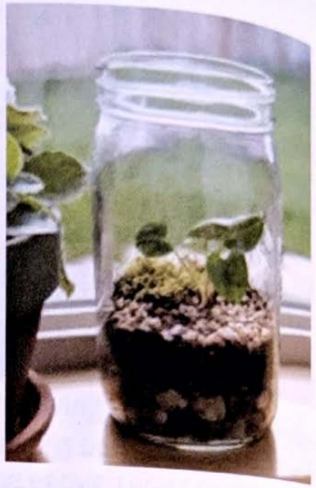
Reading Science

5. Glass does not conduct electricity, but it does conduct heat. You can observe the heat conductivity of glass by putting your hand against a window on a cold day. Even though it might be warm inside the house, the window will be cold. The window allows the warm air from inside the house to move to the colder air outdoors. This leaves the glass feeling cold. Windows can make it harder for your house to remain at an even temperature because of this heat conductivity. Some windows are insulated to better conserve energy. These windows are made using two panes of glass with air sandwiched in between the panes. Having insulated windows can help save money on heating and cooling your house.

MINOR ERRORS - EXAMPLES

Build a Terrarium

Help your child learn more about the diversity of living things by building a terrarium. You can build a terrarium out of nearly any container. A clear container works best so that you and your child can more easily observe the interactions among the plants and animals. Suggestions for the container include a glass jar, water pitcher, aquarium, 2-liter soda bottle, or large, glass bowl.



Before beginning, you can take your child outside to observe parts of a local habitat, such as plants, dirt, and insects, or whatever you come across. Have your child make a list of all the things you will need to include in

the terrarium to make a miniature habitat. As you make the list together, ask your child to explain why each item is being added to the list. Some items will be nonliving, so steer the conversation toward how these things are related to living things. For example, your child may say that soil should be included in the terrarium. Point out that soil is nonliving, and follow up by telling your child that animals such as earthworms add nutrients to the soil that are beneficial to plant growth. Your child may say rocks provide animals with shelter. Point out that logs and other parts of plants can provide shelter too.

MINOR ERRORS - EXAMPLES

What Do You Think?

Look at the table below, which shows information about four different stars. Use the table to answer the questions that follow.

Star	Distance in Light-Years
Sirius	8.6
Alpha Centauri	4.3
Betelgeuse	1,400
Achernar	69

- Which star looks the brightest from Earth? How do you know?
- Rank the stars in order from brightest to dimmest when viewed from Earth. How did you figure out the order?

MINOR ERRORS - EXAMPLES

Try Now

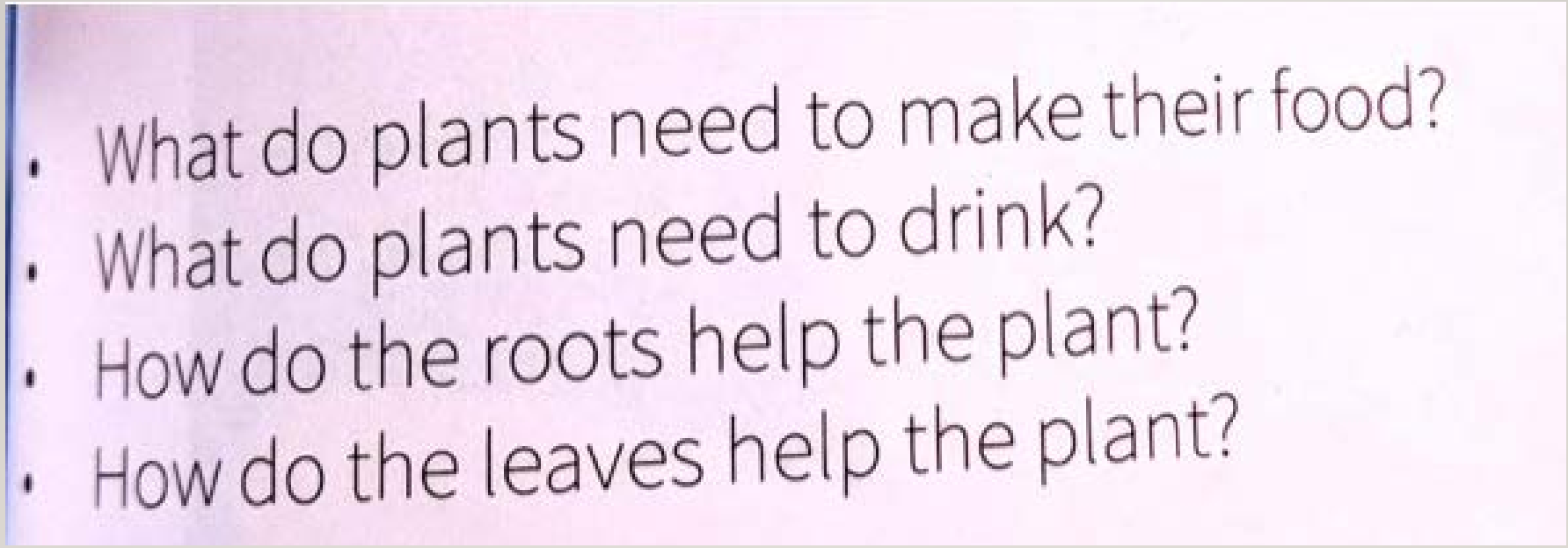
Gravity causes things to fall down toward the center of Earth.

Astronauts aboard a spacecraft have to adapt to the weak force of gravity. In space, loose objects float around, including the astronauts! Use your imagination and write how you would solve the follow problems while working and living in space.

1. How could an astronaut sleep without floating off inside the spacecraft?

2. How could an astronaut keep a blanket from floating away while sleeping?

AWKWARDLY WORDED - EXAMPLES



AWKWARDLY WORDED - EXAMPLES

STEMscopedia

Properties of Matter

Reflect

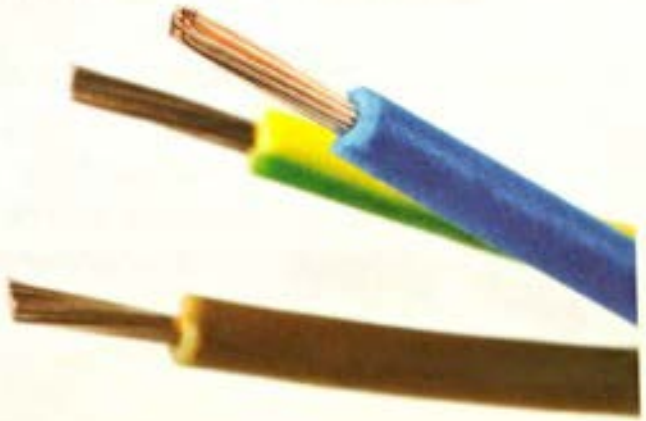
Think about the ingredients you use to bake a cake. Most cake recipes include flour and sugar to make the cake fluffy and sweet!

You need to measure out 2 cups of flour to get started. You notice there are two jars on the counter that have a fluffy, white powder. One is flour, and one is powdered sugar. How can you know which one is which?

SCIENTIFIC SIMPLIFICATIONS APPROPRIATE FOR GRADE LEVEL - EXAMPLES

STEMscopedia

The Ability to Conduct Thermal Energy or Electric Energy: Materials that allow energy to pass through them easily are called conductors. Many metals — including copper, iron, and aluminum — are good conductors of both thermal and electrical energy. Pots and pans are usually made of metal, because they conduct thermal energy well. Wires used in circuits are generally made of copper, because it is a good conductor of electrical energy. Insulators are materials that slow or stop the flow of energy. Wood, plastic, and fabric are good insulators of both thermal and electrical energy.



SCIENTIFIC SIMPLIFICATIONS APPROPRIATE FOR GRADE LEVEL - EXAMPLES

What Do You Think?

Heat changes things in other ways, too. In the examples below, we can see that heat changes the *color*, *size*, and *shape* of other objects. How did heat change these things?

Some changes from heat are reversible.

The burner changed color.

The popcorn changed size.

The candy changed shape and state of matter.

Once the burner cools down, the color will change back to black. When heat is taken away from the chocolate, it will return to a solid. However, the shape will not be the same as before. We call these changes *reversible*. Below are some more examples of reversible changes.

Butter can change back to a solid after heat is removed.

Melted ice cream can be changed back to a solid in the freezer.