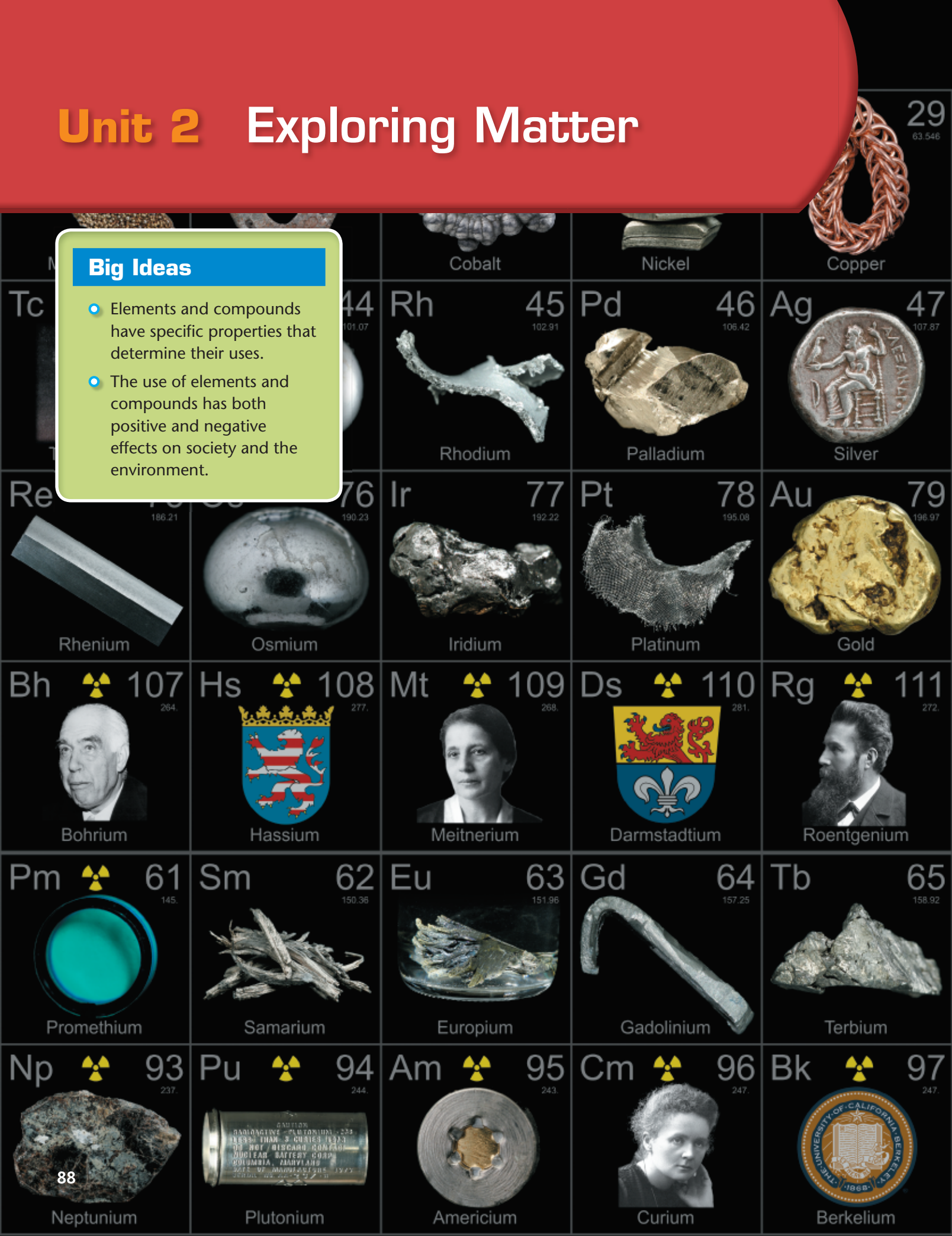
Unit 2 Exploring Matter

Big Ideas

- Elements and compounds have specific properties that determine their uses.
- The use of elements and compounds has both positive and negative effects on society and the environment.



"The Elements"
by singer-songwriter Tom Lehrer

There's antimony, arsenic, aluminum, selenium
And hydrogen and oxygen and nitrogen and rhenium
And nickel, neodymium, neptunium, germanium
And iron, americium, ruthenium, uranium
Europium, zirconium, lutetium, vanadium
And lanthanum and osmium and astatine and radium
And gold and protactinium and indium and gallium
And iodine and thorium and thulium and thallium

There's yttrium, ytterbium, actinium, rubidium
And boron, gadolinium, niobium, iridium
And strontium and silicon and silver and samarium
And bismuth, bromine, lithium, beryllium, and barium

There's holmium and helium and hafnium and erbium
And phosphorus and francium and fluorine and terbium
And manganese and mercury, molybdenum, magnesium
Dysprosium and scandium and cerium and cesium
And lead, praseodymium, and platinum, plutonium
Palladium, promethium, potassium, polonium
And tantalum, technetium, titanium, tellurium
And cadmium and calcium and chromium and curium

There's sulfur, californium, and fermium, berkelium
And also mendelevium, einsteinium, nobelium
And argon, krypton, neon, radon, xenon, zinc, and rhodium
And chlorine, carbon, cobalt, copper, tungsten, tin, and sodium

These are the only ones of which
The news has come to Ha'vard
And there may be many others
But they haven't been discavard

Elements are the building blocks of matter. You and the rest of society depend on elements for your life and your way of life.

How could using elements have positive and negative effects on society and the environment?

Unit 2 At a Glance

In this unit you will learn that elements and compounds have specific properties that determine their uses. You will also learn that the use of these elements and compounds has both positive and negative effects on society and the environment.

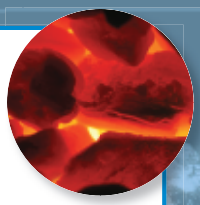
Think about answers to each question as you work through the topic.

Topic 2.1: In what ways do chemicals affect your life?

Key Concepts

- Everything—including you and everything around you—is made up of chemicals.
- Substances have characteristics that make them useful, hazardous, or both.
- Handling chemicals and lab equipment safely and responsibly is a part of your life at school.

Topic 2.6: What are some characteristics and consequences of chemical reactions?

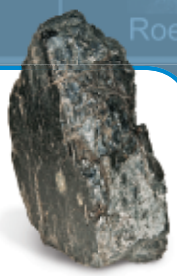


Key Concepts

- Compounds and elements are changed during chemical reactions.
- The properties of substances that make them useful can also make them dangerous.
- There are less-harmful alternatives to many products we use and depend on.

Exploring Matter

Topic 2.5: In what ways do scientists communicate about elements and compounds?



Key Concepts

- Chemical symbols represent elements.
- Chemical formulas are used to represent the types and numbers of atoms in compounds.

Topic 2.2: How do we use properties to help us describe matter?

Key Concepts

- Physical properties describe how matter looks and feels.
- Chemical properties describe how substances can change when they interact with other substances.

Topic 2.3: What are pure substances and how are they classified?

Key Concepts

- Pure substances are elements and compounds.
- Elements include metals and non-metals.

Topic 2.4: How are properties of atoms used to organize elements into the periodic table?

Key Concepts

- Elements are made up of atoms, which are made up of subatomic particles.
- Elements are arranged in the periodic table according to their atomic structure and properties.
- Elements in the same family (group) share similar physical and chemical properties.

Looking Ahead to the Unit 2 Project

At the end of this unit, you will do a scientific investigation about the effects of a common chemical reaction: the rusting of metals. Read pages 156–157. With tips from your teacher, start your project planning folder now.

Get Ready for Unit 2

Concept Check

1. In two minutes, jot down in your notebook all the words you can think of that describe matter. Share your list with a partner and exchange words that you did not have on your individual lists.
2. Examine the beach scene below, and write one example of each of the following in your notebook:
   - **a)** matter in its solid state
   - **b)** matter in its liquid state
   - **c)** matter in its gas state
   - **d)** evaporation
3. Use the words in the box below to answer each question.

rocky road ice cream	fruit punch
helium	

   - **a)** A pure substance is made up of only one kind of particle. Which item in the box is a pure substance?
   - **b)** A mechanical mixture is made up of two kinds of particles that can be seen as separate. Which item in the box is an example of a mechanical mixture?
   - **c)** A solution is made up of two or more kinds of particles but appears to be made up of only one kind of particle. Which item in the box is an example of a solution?
4. Copy the table below into your notebook. Identify each property as physical or chemical. Find examples of matter in the picture of the beach scene below that have these properties (you can use the same example more than once).

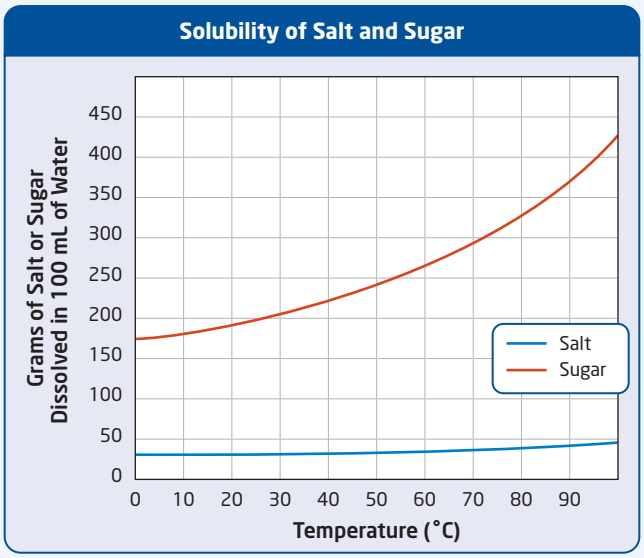
Examples of Physical and Chemical Properties

Clue	Physical or Chemical Property?	Substance
a) Smells sweet		
b) Does not react with water		
c) Feels rough		
d) Is red		

5. Read each statement below and determine whether it describes the particles that make up air or the particles that make up water. Write your answers in your notebook.
   - **a)** particles are close together
   - **b)** particles are spread far apart
   - **c)** particles move freely about one another

Inquiry Check

Solubility is a measure of the ability of a substance to dissolve in another substance. An investigation was conducted to demonstrate the effect of temperature on the solubility of salt and sugar. The results are shown in this graph.



6. **Analyze** How many grams of (a) sugar and (b)salt will dissolve in water at 50°C?

7. **Interpret** Compare the solubility of salt and sugar at 80°C and identify which substance is more soluble than the other.

Numeracy and Literacy Check

8. Mass is the amount of matter in something. Mass is measured in units such as milligrams (mg), grams (g), kilograms (kg), or tonnes (t). Identify which unit would be most appropriate to measure the mass of each of these objects:

a) an aspirin **c)** a dog

b) an ice cream truck **d)** a hamburger

9. Volume is the amount of space taken up by something. Volume is measured in units such as millilitres (mL), litres (L), or kilolitres (kL). Identify which unit would be most appropriate to measure the volume of each of these objects:

a) the amount of ice cream in an ice cream cone

b) the amount of air in a balloon

c) the amount of water in a swimming pool

10. **Calculate** You can use the mass and volume of a substance to determine an important physical property called density. Density is the mass of an object that occupies a certain volume. You can calculate density by dividing the mass of an object by its volume:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

If a sample of ice cream has a mass of 55 g and a volume of 50 mL, what is the density of the ice cream?

11. **Discuss** Draw a three-panel comic strip showing how a forensic scientist might apply knowledge of density to identify a mysterious fragment of an object found at a crime scene.