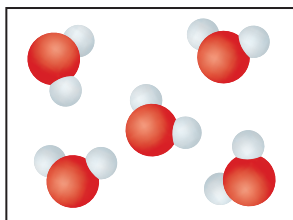
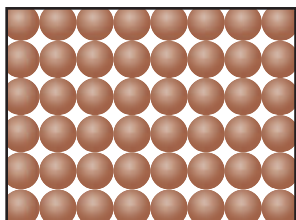


Properties and Changes

Key Ideas

Matter can be classified as pure substances or mixtures.

- Matter has mass and volume.
- Elements and compounds are pure substances.
- Elements have one kind of particle. Compounds have one kind of particle made up of particles of two or more different elements.
- Mixtures have particles from the substances they are made from. In heterogeneous mixtures, you can see the substances. In homogeneous mixtures, the particles are evenly distributed at the microscopic level so the different substances cannot be seen.



Pure substances can be identified by their physical and chemical properties.

- Different substances have different properties.
- Properties are what make substances useful.
- Physical properties of matter are those that you can observe with your senses, measure, or calculate.
- A chemical property describes the behaviour of a substance as it changes into a new substance.



Vocabulary

matter, p. 152

mass, p. 152

volume, p. 152

pure substance, p. 153

mixture, p. 153

element, p. 153

compound, p. 153

heterogeneous mixture, p. 154

homogeneous mixture, p. 154

physical property, p. 157

state, p. 158

melting point, p. 158

boiling point, p. 158

malleable, p. 159

ductile, p. 159

solubility, p. 160

conductivity, p. 160

density, p. 160

chemical property, p. 161

flammability, p. 162

corrosion, p. 162

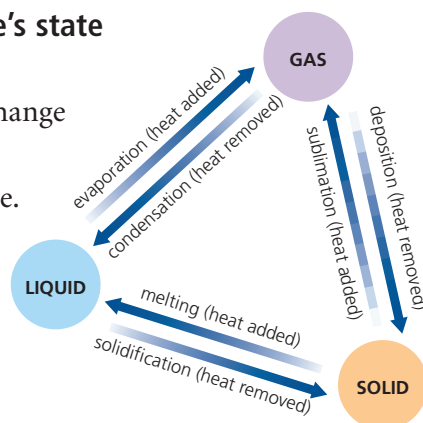
physical change, p. 166

chemical change, p. 168

kinetic molecular theory, p. 172

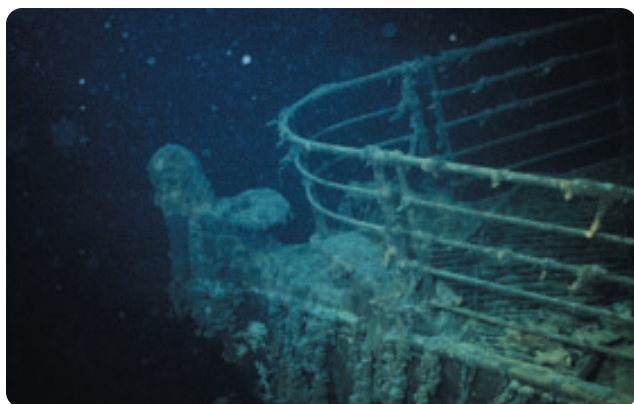
A physical change alters a substance's state or form, but not its composition.

- A change in state or form does not change one substance into another.
- Physical changes are usually reversible.



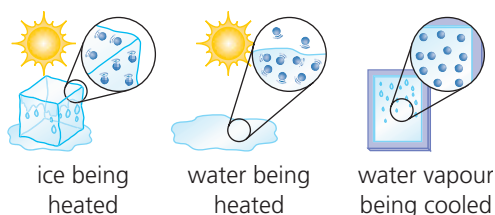
A chemical change alters a substance's composition to create new substances.

- A chemical change results in new substances with new properties.
- Chemical changes are sometimes reversible.



The kinetic molecular theory explains the nature and behaviour of matter.

- All matter is made from particles, and each substance has its own unique particles.
- An increase in energy, such as heat, causes the particles to move faster and farther apart. A decrease in energy causes the reverse.
- The theory can explain physical changes, such as changes of state and dissolving.

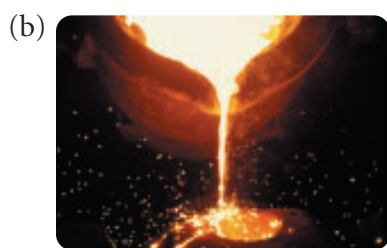
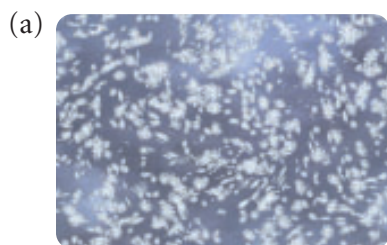


Review Key Ideas and Vocabulary

1. Match each description with the correct term.
Not all terms will be used.

Description	Term
(a) refers to a slow reaction with oxygen	flammable
(b) means the formation of frost	non-flammable
(c) can be made into thin sheets	ductility
(d) freezing of water	melting point
(e) can be found using a formula	corrosion
(f) refers to resistance to burning	density
(g) can be drawn into wires	deposition
	solidification
	malleability

2. What are the two defining properties of matter?
3. Which process does NOT produce a physical change of state?
- melting ice
 - heating water vapour
 - freezing water
 - boiling water
4. Identify the process in each photo as either condensation, deposition, melting, solidification, sublimation, or evaporation.



5. Which statement describes a chemical property?
- The crystals of the substance are a metallic gray.
 - It dissolves in alcohol.
 - It reacts with acid to produce bubbles of gas.
 - It does not conduct electricity.
6. A student investigated the physical and chemical properties of a sample of unknown gas and compared the findings to data from known gases. Which one of the following statements from the report represents a conclusion rather than an experimental observation?
- The gas is colourless.
 - When the gas is tested with limewater, the liquid becomes cloudy.
 - The gas is carbon dioxide.
 - A flaming splint stops burning when placed in the unknown gas.
7. Which statement describing the kinetic molecular theory is incorrect?
- Particles of a gas are moving very quickly in straight-line motion.
 - Particles of a liquid vibrate in one position.
 - Particles of a gas are not attracted to each other.
 - Particles of a gas can overcome gravity.
8. The following box lists some characteristics of solids according to the kinetic molecular theory.

- The particles are very closely packed together.
- The particles are tightly bound to neighbouring particles.
- The particles are arranged in a regular pattern.
- The particles can only vibrate in their positions.
- Heat causes the vibration of the particles to increase.

Write the letter(s) of the characteristic(s) that can explain the following observations.

- Solids do not flow or pour.
- Solids cannot easily be compressed.
- As the temperature is increased, many solids melt and become liquids.
- Some solids form crystals.

- Describe three different examples of chemical changes.
- To determine the density of an irregularly shaped object, a student immersed the object in 21.2 mL of water in a graduated cylinder, causing the level of the water to rise to 27.8 mL. If the object had a mass of 22.4 g, what was the density of the object? (Remember: 1 mL = 1 cm³)
- Write a report about the mixture that surrounds us (the atmosphere). Include the major types of particles and the percentages they contribute. Mention the minor types of gas particles and note their importance to Earth. Include a circle graph to show relative proportions in the mixture.

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Use What You've Learned

- Carbon fibre bicycles have essentially replaced the aluminum and aluminum alloy bikes in the Tour de France. Carbon fibre has a density of 6.24 g/cm³. Aluminum has a density of 2.70 g/cm³. What property of carbon fibre is the most likely reason for the switch? Explain your reasoning.
- It is possible to represent the particles in solids, liquids, and gases accurately in a diagram. Figure 1 illustrates a solid dissolving in a liquid.

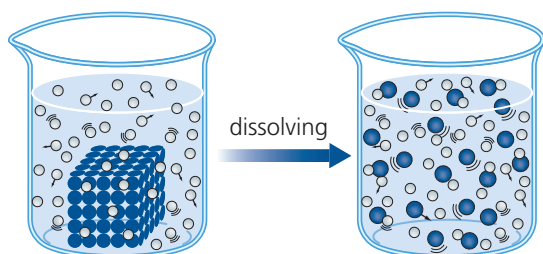


Figure 1

- State two ways in which you think the diagram *is a good representation* of a solid dissolving in a liquid.
 - State two ways in which you think the diagram *is not an accurate representation* of a solid dissolving in a liquid.
- Solder is a soft shiny alloy with a relatively low melting point. It is used by plumbers to seal the joints in copper pipes. They use a propane torch until the metal flows into the joint, then it is allowed to cool and the metal becomes a solid shiny metal again. Is the change in solder a chemical or a physical change? How do you know?
 - What physical properties of gold might explain its use in creating jewellery in almost every culture that discovered it? What chemical property also explains its widespread use?
 - Carbon dioxide cools so much as it is released from a CO₂ fire extinguisher that it comes out as a fine solid—like snow. This cools as well as smothers the fire, but it has an inherent danger. What is it?
 - When water is sprayed on a fire it turns into steam. Explain how this combats the fire in two different ways.
 - A student read that 1 m³ of helium gas could lift a 1 kg mass. He came up with what he thought was a brilliant application of this special property. He decided that he would find a way to compress 50 m³ or 60 m³ of helium into the frame of his bike. He thought that this would enable him to ride more easily and, possibly, allow him to fly. What do you think? Use the kinetic molecular theory to explain why it will or will not work.

Reflect On Your Learning

- How useful was the kinetic molecular theory in helping you understand how certain substances behave? Did it change your thinking in any way?

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