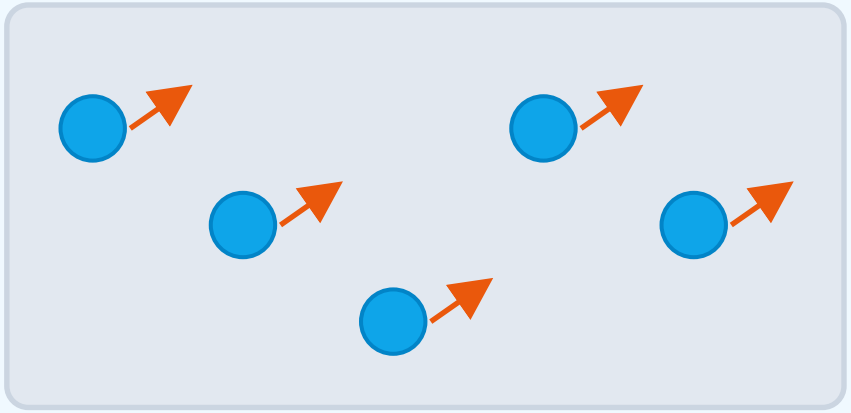
Science 10

Unit A: Energy and matter in chemical change

Particles of matter

Sugar in tea

- Solid sugar disappears into hot tea, the tea tastes sweet, and the glass has gained mass.
- The question is whether the sugar is still there, and what kind of change that was.
- The particle model is how this lesson answers that question.



Particles have space between them and move. Heating increases motion.

Dissolved sugar

- Dissolving sugar in tea is a powerful Grade 10 example of the particle model.
- The sweet taste and unchanged total mass show that sugar particles are still present.
- Those particles spread among water particles. They remain present.
- Dissolving is a physical change: no new chemical substance forms, which is different from burning sugar.

Key terms

particle model

The idea that all matter is made of tiny particles in motion with space between them.

pure substance

Matter with fixed composition (an element or a compound).

mixture

Two or more substances physically combined; composition can vary.

element

A pure substance made of one type of atom (one atomic number).

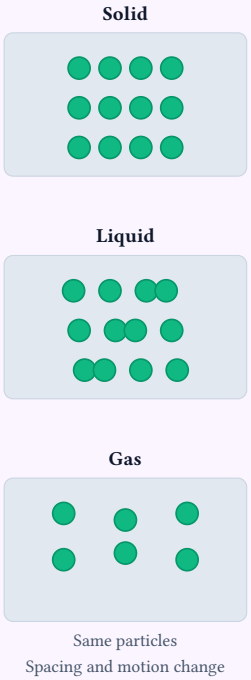
Key terms

compound

A pure substance with two or more elements chemically bonded in fixed ratios.

Particle model of matter

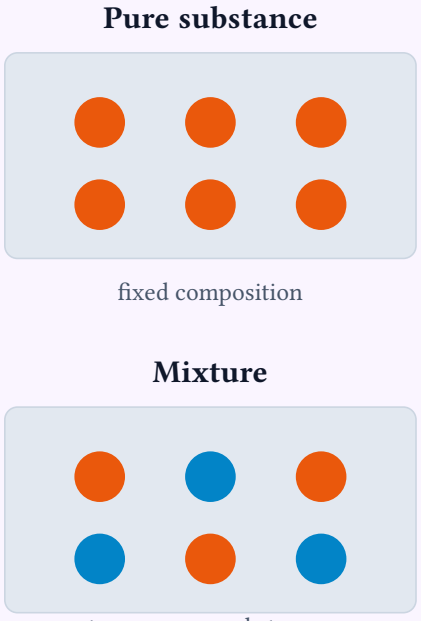
- All matter is made of tiny particles with space between them.
- Those particles move, and they move faster when the thermal energy increases.
- In a solid they stay close and vibrate. In a liquid they slide past one another. In a gas they are far apart and move quickly.



Same particles
Spacing and motion change

Pure substances and mixtures

- Copper and distilled water each have a fixed composition, so each is a pure substance.
- Salt water can be saltier or weaker, because a mixture's composition can vary.
- Salt water looks the same throughout. Gravel mixed with sand looks patchy.

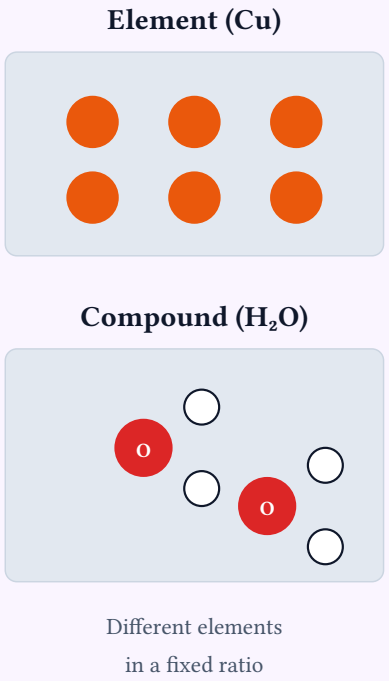


Materials and human needs

- Before contact, First Nations communities used living and non-living materials to meet basic needs.
- Plant extracts for dyes/medicines; minerals for tools; animal products for clothing and shelter.
- Knowledge was tested and passed on: an early form of empirical science.

Elements and compounds

- An element, such as copper or oxygen, is one kind of atom.
- A compound bonds two or more elements in a fixed ratio.
- A physical change keeps the same substances. A chemical change produces new ones.



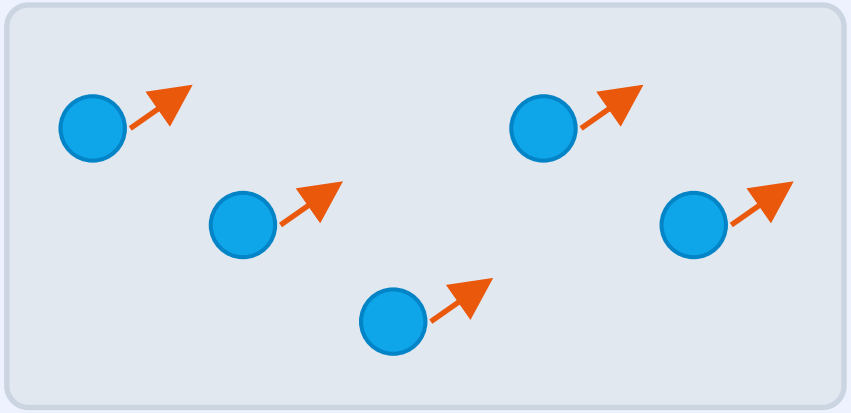
Different elements in a fixed ratio

Classifying samples

- Sort these samples: air, distilled water, salt water, gold, carbon dioxide, and gravel mixed with sand.
- Label each one as an element, a compound, a homogeneous mixture, or a heterogeneous mixture.
- Justify each label with the particle model.

Uses of models

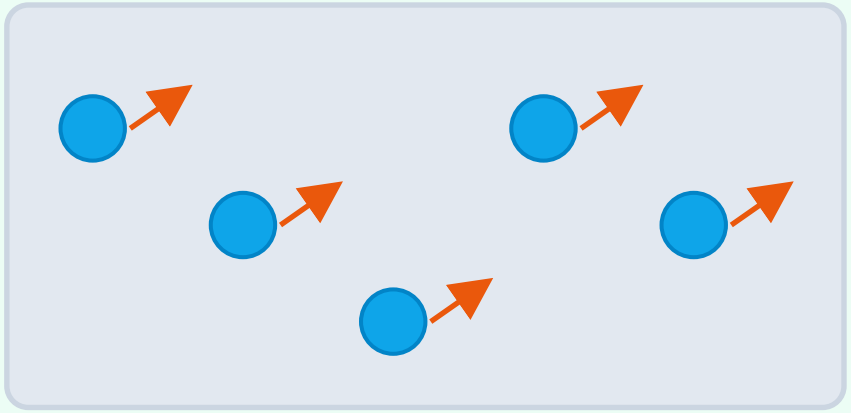
- Science uses models to explain and predict: models are re-vised when evidence demands.
- Technologies (microscopes, mass spectrometers) extend what we can observe.



Particles have space between them and move. Heating increases motion.

Evidence and opinion

- What observation would convince you that matter is made of particles?
- A convincing answer uses an observation other people could repeat.



Particles have space between them and move. Heating increases motion.

Particle-model retrieval check

- Classify copper, distilled water, air, and muddy water as elements, compounds, or mixtures.
- Explain dissolving sugar without saying the sugar disappears.
- State one observation that supports the particle model, even though atoms are too small to see.