

Particles, Elements, Compounds and Mixtures

The particle model, changes of state, classifying substances and separating mixtures.

Name _____ Date _____ Class _____

Learning objective: I can use the particle model and classify substances as elements, compounds or mixtures.

✓ I can describe the three states ✓ I can classify substances ✓ I can choose a separation technique

1 States of matter Complete the table.

State	Arrangement	Movement	Properties
solid	close together in a regular pattern	vibrate in fixed positions	fixed shape and volume
liquid			
gas			

2 Changes of state Name each change.

- solid → liquid: _____
- liquid → solid: _____
- liquid → gas: _____ (or evaporating)
- gas → liquid: _____
- solid → gas without becoming liquid: _____

3 Element, compound or mixture? Classify each substance.

Substance	Element, compound or mixture?
oxygen (O ₂)	
water (H ₂ O)	
air	
iron (Fe)	
carbon dioxide (CO ₂)	
sea water	
sodium chloride (NaCl)	

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4 Separating mixtures Match each technique to the mixture it separates.

1 filtration

☐

A getting salt crystals from salt solution

2 evaporation / crystallisation

☐

B getting pure water from sea water

3 distillation

☐

C separating sand from water

4 chromatography

☐

D separating iron filings from sulfur powder

5 using a magnet

☐

E separating the dyes in a black ink

5 Explain it

- 1 A drop of perfume is released at the front of a classroom. Use the particle model to explain why people at the back soon smell it. [3 marks]

- 2 What is the difference between a compound and a mixture? [3 marks]

- 3 A pure substance melts at one fixed temperature. A sample of 'pure' water melts between -2°C and 0°C . What does this tell you? [2 marks]

- 4 Why can gases be compressed but solids cannot? [2 marks]

6 True or false?

	TRUE	FALSE
1 Particles get bigger when a substance is heated.	☐	☐
2 Diffusion is faster in gases than in liquids.	☐	☐
3 When salt dissolves in water, the salt disappears and its mass is lost.	☐	☐

Answer Key

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Question	Answers
1 States of matter	liquid – Arrangement: close together, irregular arrangement , Movement: move past each other , Properties: fixed volume, takes the shape of its container gas – Arrangement: far apart, random arrangement , Movement: move quickly in all directions , Properties: no fixed shape or volume; spreads out and can be compressed
2 Changes of state	1 melting; 2 freezing; 3 boiling; 4 condensing; 5 sublimation
3 Element, compound or mixture?	oxygen (O ₂) – Element, compound or mixture?: element water (H ₂ O) – Element, compound or mixture?: compound air – Element, compound or mixture?: mixture iron (Fe) – Element, compound or mixture?: element carbon dioxide (CO ₂) – Element, compound or mixture?: compound sea water – Element, compound or mixture?: mixture sodium chloride (NaCl) – Element, compound or mixture?: compound
4 Separating mixtures	1 C; 2 A; 3 B; 4 E; 5 D
5 Explain it	1. Diffusion: perfume particles (in a gas) move randomly and spread out from where there are many of them to where there are few, until they are evenly mixed. 2. In a compound, atoms of different elements are chemically joined in fixed proportions (needs a reaction to separate); in a mixture, the substances are not chemically joined and can be separated by physical methods. 3. It is not pure – it contains impurities (e.g. dissolved salt), which lower the melting point and make it melt over a range. 4. Gas particles are far apart with lots of space between them; solid particles are already touching.
6 True or false?	1 False – the particles move faster and further apart; they do not change size; 2 True ; 3 False – the salt particles spread out between the water particles; the total mass stays the same

Teaching note: accept 'evaporation' for liquid to gas below the boiling point. Oxygen gas (O₂) is an element because both atoms are the same, even though it is a molecule.