Atoms, molecules and elements

Introduction

These questions are designed to help you to develop your understanding of how elements are made up of individual atoms or molecules. Use the icon in the margin to find out which level of understanding the question is developing.

Macroscopic: what we can see. Think about the properties that we can observe, measure and record.

Sub-microscopic: smaller than we can see. Think about the particle or atomic level.

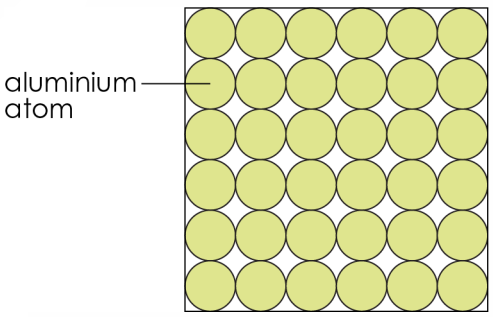
Symbolic: representations. Think about how we represent chemical ideas including symbols and diagrams.

Questions

1. Every element is made up of a different type of atom. Each atom is represented by a circle. The colour does not matter, but different types of atom must have a different colour.
   Complete the labels on the diagrams below with the name of the element represented

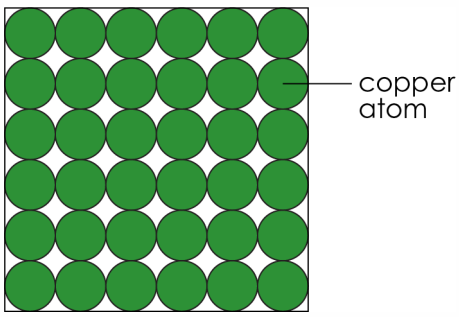
(a)

i.



_____ in the solid state

ii.

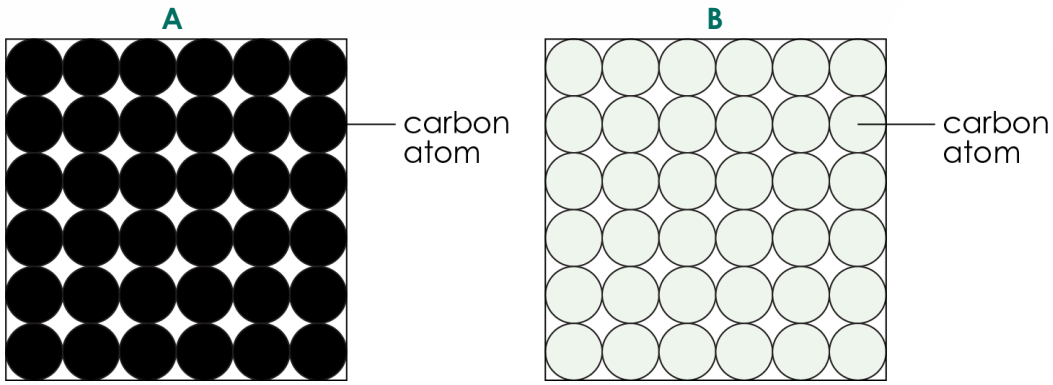


_____ in the solid state

© 2026 Royal Society of Chemistry

(b) Aluminium can be heated until it melts. Draw a diagram of aluminium in the liquid state.

(c) Two students draw diagrams of carbon in the solid state. Which is correct? Tick **one** box.



☐ diagram **A**

☐ diagram **B**

☐ both diagrams

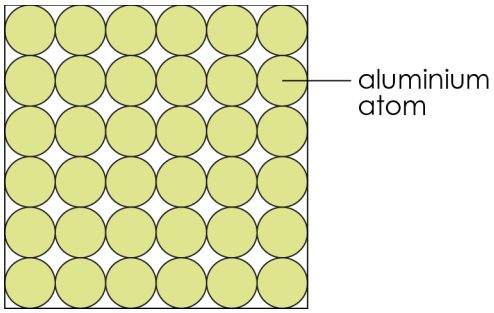
(d) Give one reason for your answer.

_____

_____

© 2026 Royal Society of Chemistry

2. The diagram of aluminium in the solid state represents the arrangement of atoms that make up the element aluminium.



(a) Which real-life sample of aluminium does the diagram represent. Tick one or more boxes.

☐ a sheet of aluminium foil



Image ©: Shutterstock/SergiyKuzmin

☐ a cube of aluminium



Image ©: Shutterstock/Suyog_Sharma

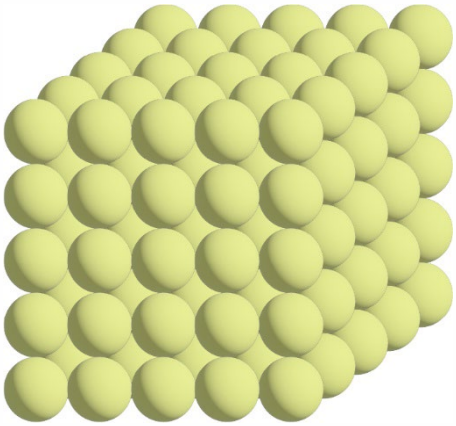
☐ a lump of aluminium



Image ©: Shutterstock/RHJPhtotos

© 2026 Royal Society of Chemistry

(b) This figure shows atoms as spheres in a 3D arrangement.

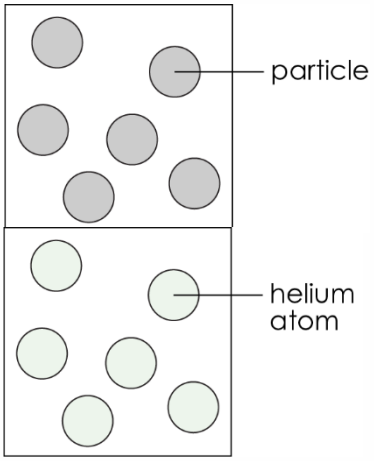


Give one advantage of the 3D version of the particle model.

_____

_____

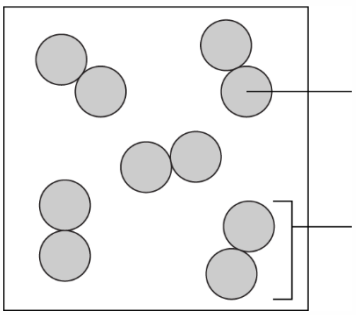
3. The particle model represents a substance in the gas state by arranging the particles far apart.



Some elements, like helium, are made up of individual atoms. The diagram showing the arrangement of helium atoms looks the same as the particle model.

Other elements, like oxygen, are made up of separate molecules. A molecule is a group of atoms that are joined. Oxygen is an element, so each molecule of oxygen is made up of the same type of atoms. The molecular model diagram of oxygen gas looks different to the particle model diagram of a gas.

(a) Label the diagram below to show an atom and a molecule of oxygen.



© 2026 Royal Society of Chemistry

(b) Helium is in the gas state at room temperature. It is represented by its element symbol (He).
Oxygen is also in the gas state at room temperature. It has a chemical formula (O_2)
Complete the table to show if the following elements are made up of individual atoms or molecules. They are all in the gas state at room temperature.

Element	Symbol or formula	Separate atoms or molecules?
helium	He	
oxygen	O_2	
hydrogen	H_2	
neon	Ne	
argon	Ar	
nitrogen	N_2	

(c) Draw a labelled diagram to show the arrangement of atoms in:

i. hydrogen gas

ii. neon gas

© 2026 Royal Society of Chemistry