Abraham Darby Academy

KS3 Chemistry | Particles

Knowledge series | Study Booklet | 2017

Key terms

Boiling: The change of state from liquid to gas that occurs when bubbles of the substance in its gaseous state form throughout the liquid.

Boiling point: The temperature at which a substance boils.

Change of state: The process by which a substance changes states.

Collide: To bump into, or hit, a particle or surface.

Condensation: Water which collects as droplets on a cold surface when humid air is in contact with it.

Diffusion: The movement of liquid or gas particles from a place of high concentration to a place of low concentration.

Evaporate: The change of state from liquid to gas that occurs when particles leave the surface of the liquid.

Freezing: The change of state from liquid to solid.

Gas: In the gas state, a substance can flow and can also be compressed.

Liquid: In the liquid state, a substance can flow but cannot be compressed.

Material: The different types of stuff that things are made from.

Melting: The change of state from solid to liquid.

Melting point: The temperature at which a substance melts.

Mixture: A material whose properties are not the same all the way through.

Particle: The tiny things that all materials are made from. The smallest unit of matter.

Property: Quality of a substance or material that describes its appearance or how it behaves.

Solid: In the solid state, a substance cannot be compressed and it cannot flow.

States of matter: The three forms in which a substance can exist i.e. solid, liquid, and gas.

Sublime: The change of state from solid to gas.

Task: Fill in the blanks in the following passages, using the words below.

solid particles individual iron substances water properties

All substances are made up of tiny parts called _____ .

Different _____ contain different particles. For example, a piece of iron contains particles of _____ , and a glass of _____ contains thousands and thousands of water molecules.

_____

Particles can have certain when they are all together in a substance, but when they are on their own they don't have these properties.

A gold ring has a yellow colour and is _____ at room temperature, but an _____ particle of gold isn't yellow and isn't a solid. It can only have these properties when it is with other gold particles.

Task: Check your knowledge of particles and key terms, by answering the nine questions below. Underline the correct answer for each question.

1. Which of these is the smallest particle?

An atom A molecule A speck of dust

2. Which of these is the correct symbol for magnesium?

MG mg Mg

3. Which statement about atoms and molecules are correct?

- Elements always exist as separate atoms
- Elements always exist as pairs of atoms called molecules
- Elements and compounds can exist as molecules

1. How many different atoms are there in a compound?

One Always two Two or more

2. Approximately how many elements are there?

100 4 1,000,000

6. Which one is a compound?

Water Hydrogen Helium

7. Which of these contains two carbon atoms and six hydrogen atoms?

CH_4 C_2H_6 C_2H_4

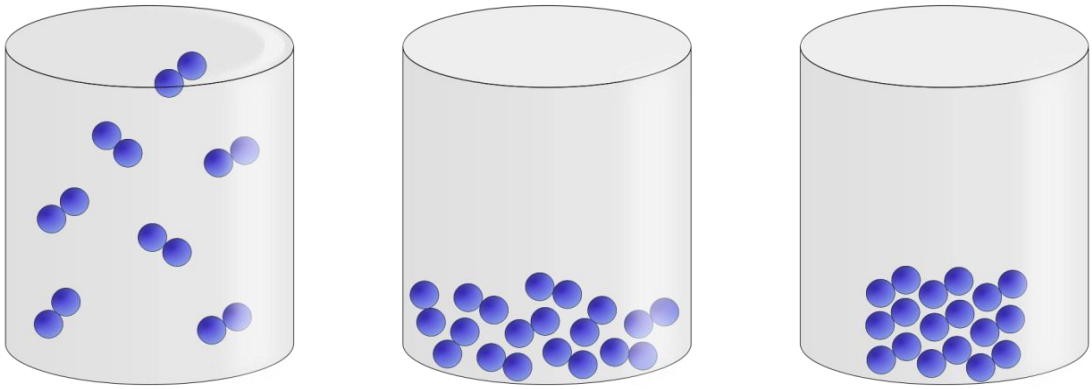
8. Which of these contains four hydrogen atoms?

CH_3OH H_2O H_2O_2

9. How many atoms are there in total in a molecule of sulphur trioxide, SO_3?

Two Three Four

Task: Label each of these three states of matter.



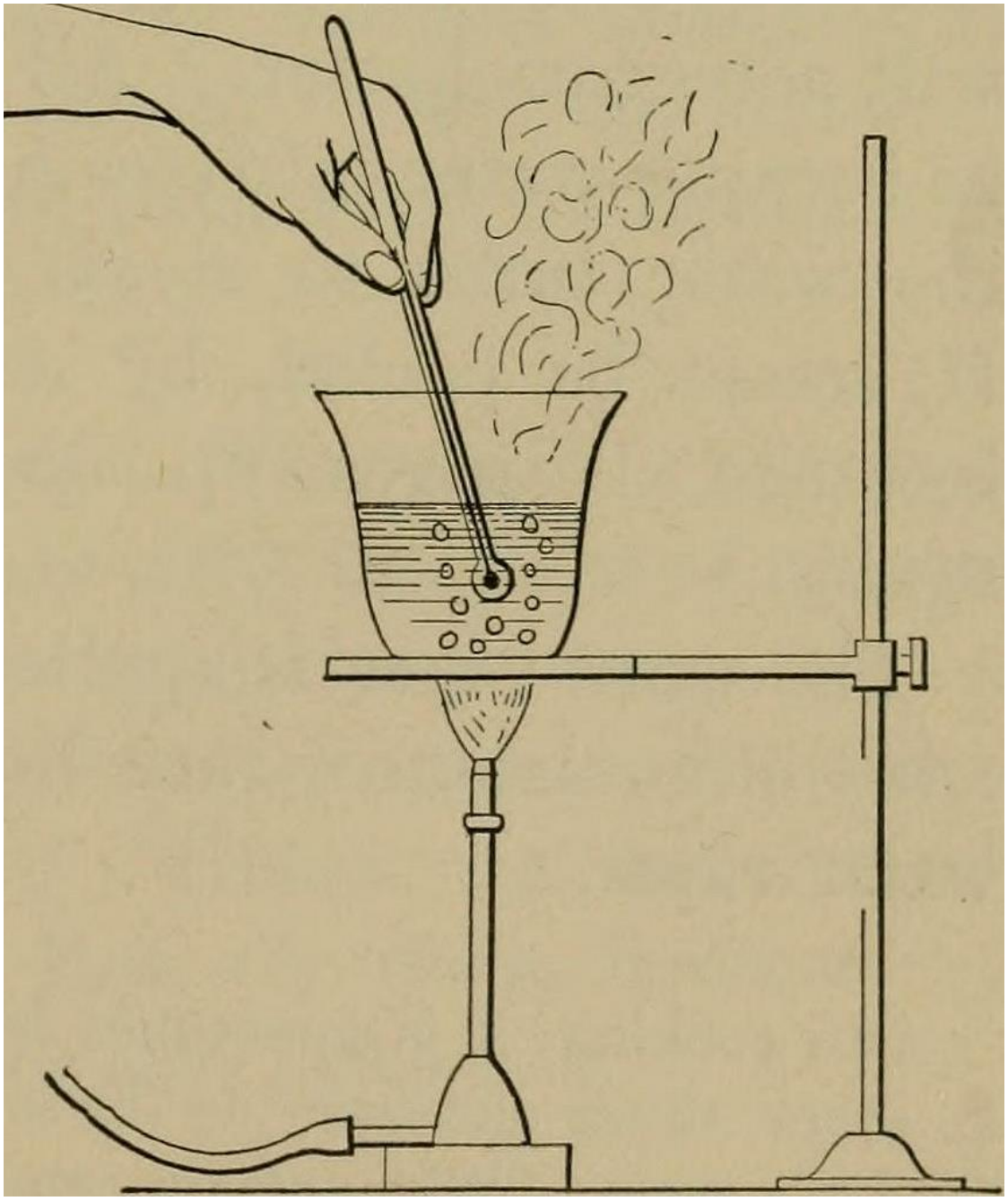
Task: Use the words below to fill in the blanks for each statement.

fast volumes fixed far escape poured touch compressed past fill.

Solid	Liquid	Gas
The particles are in _____ positions. Solids cannot be _____. Solids have fixed _____.	The particles can move _____ one another but cannot _____. Liquids have fixed volume but can be _____.	The particles are very _____ apart and do not _____ one another. The particles move very _____ and can be compressed. Gases _____any space.

Scene: Water is being boiled in a laboratory experiment.

Task: Label the apparatus in diagram below. Label the two states of water in the diagram.



Task: State the boiling point of water in degrees Celsius (°C), and explain what happens to the water molecules as the water is heated until it boils.

Scene: This water downpipe has been damaged by ice forming.

Task: During very cold winters, water pipes and outside taps often split when ice is formed. When the ice thaws, water then escapes and causes flood damage. Provide answers to the following questions:

1) What temperature water freezes in degrees Celsius (°C),

2) What happens to the water particles state when water changes from the liquid to the solid state,

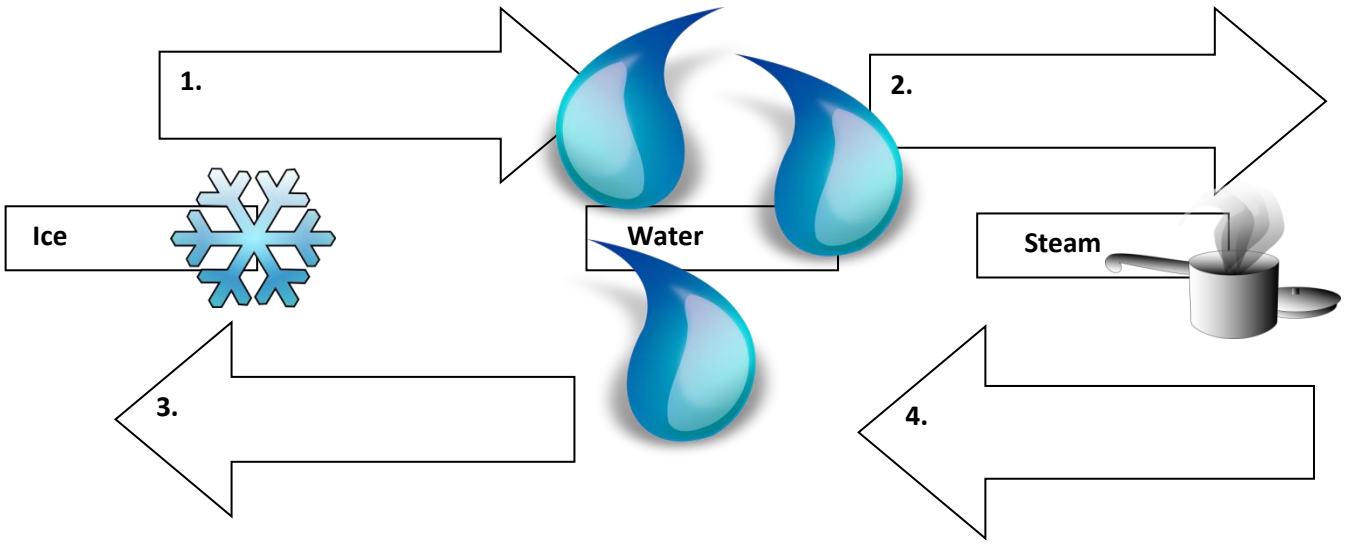
3**)** How does the ice damage pipes and taps?

1)

2)

3)

Task: complete the following diagram and table to show what happens to an ice cube when it is heated up in a saucepan. Label all four arrows (1–4 below) with the name of each change of state and process.

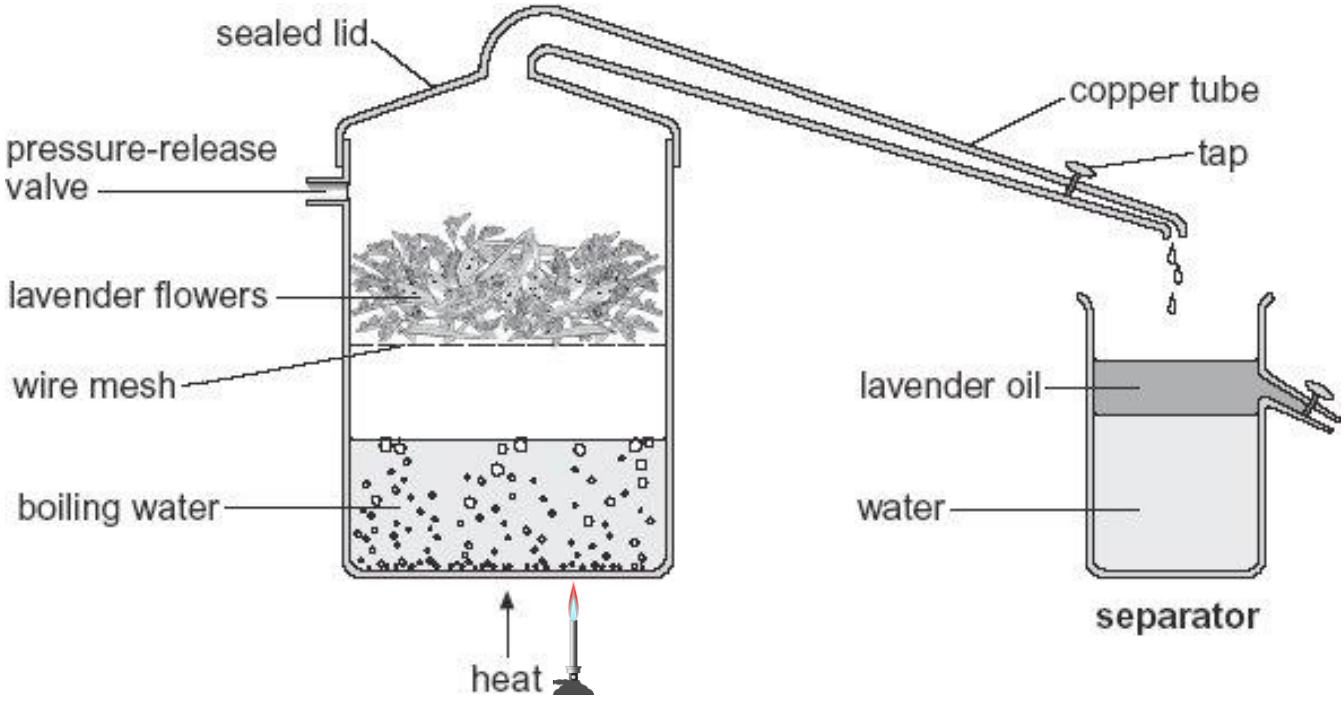


Task: State what happens to both the boiling and freezing temperatures of water when an impurity is introduced into solution, i.e. salt.

Task: Write a short description next to each of the key terms listed in the table below.

solid	
liquid	
atom	
state	
energy	
compound	
temperature	
diffusion	

Scene: Lavender oil is a perfume obtained from lavender flowers. Steam at 100°C is passed through the flowers in the apparatus below. Water vapour mixed with the lavender oil vapour pass down a copper tube towards a separator.



Task: answer these four questions:

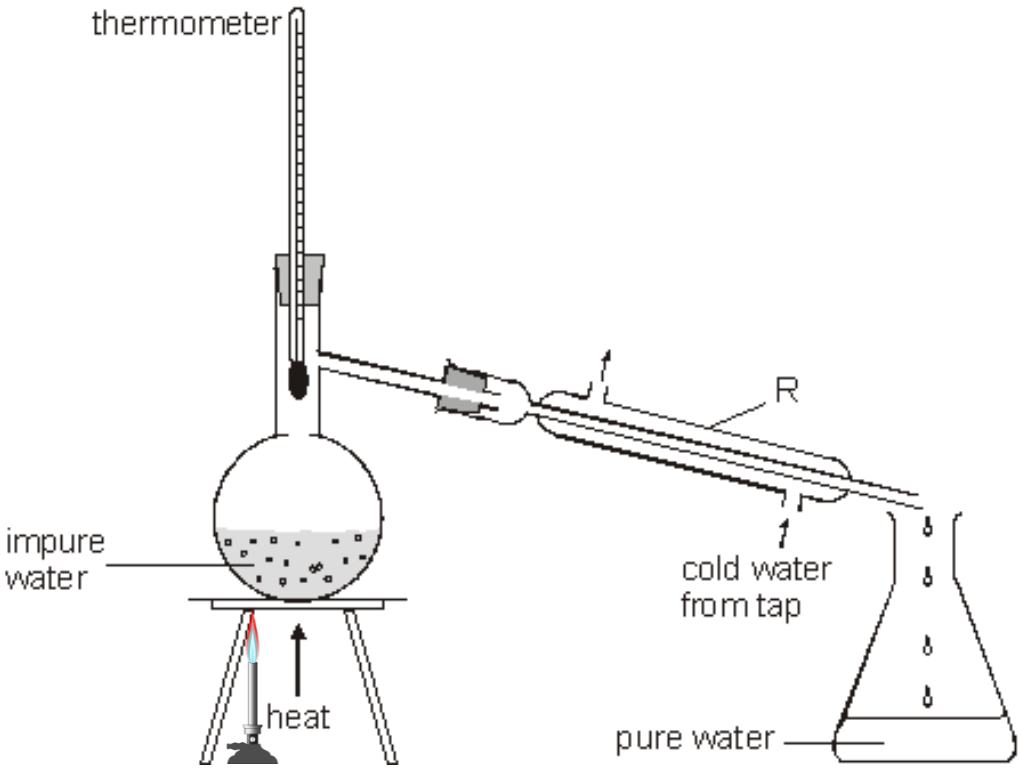
- The lavender flowers are heated in a **container with a sealed** lid. Why must the lid be sealed?

- What would happen if the container did **not** have a pressure-release valve?

- Look at the separator. How does this show that the water is denser than lavender oil?

- Why is the copper tube so long and angled at a gradual (downward) slope?

Scene: The apparatus in the diagram below is used to obtain pure water from impure water.



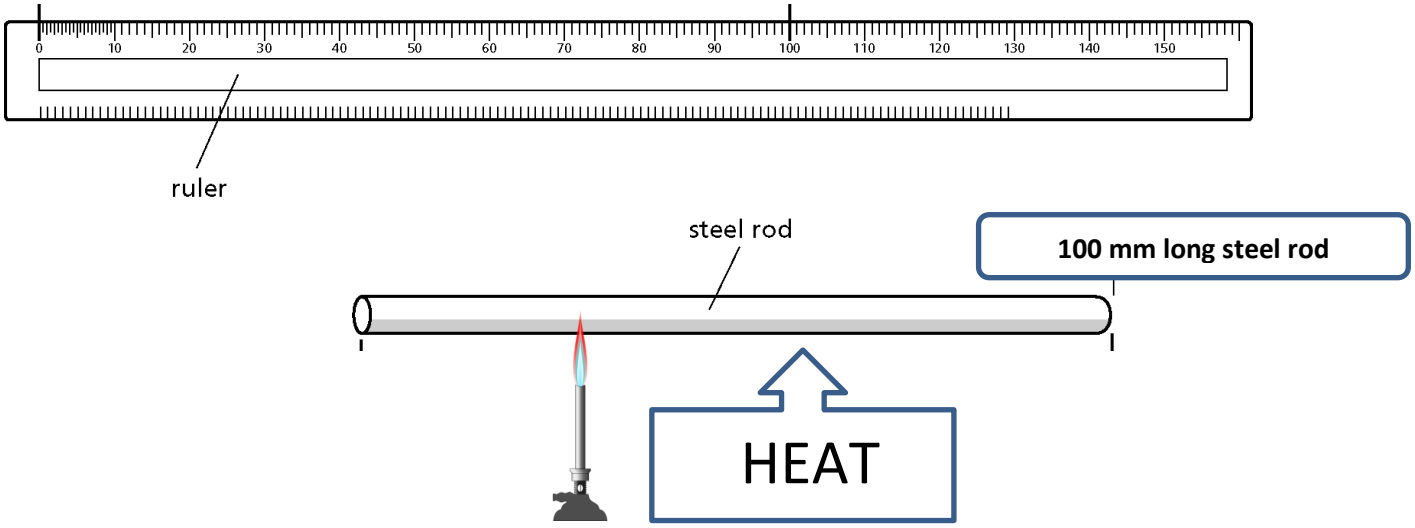
Task: answer these three questions:

- What temperature (°C) would the thermometer show?

- What is the function of the piece of apparatus labelled **R**?

- Give the name of the process which purifies water in this way.

Scene: After first recording its length at room temperature, a steel rod is heated gradually. Every 5 °C rise in temperature, a reading of the rod's length is recorded.

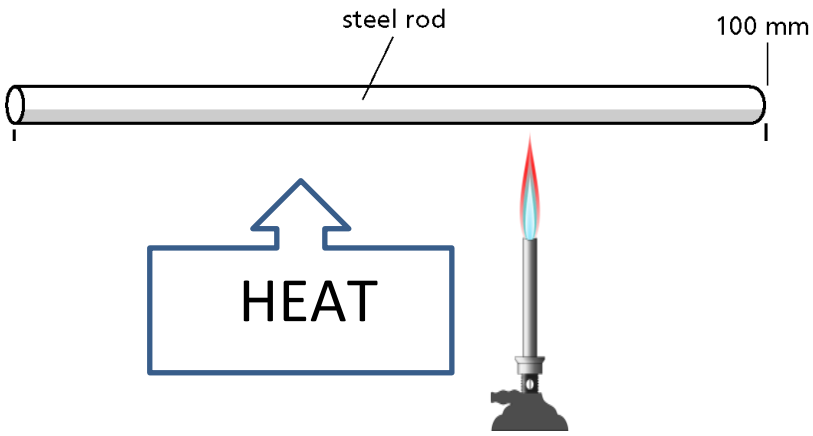


Task: Answer these two questions:

- Name the independent and the dependent variables.

- Sketch a graph to show how the length of the rod changes with temperature. Use a suitable scale. Add labels and label each axis.

Scene: After first recording its length at room temperature, a 100 mm steel rod is heated gradually. Every 5 °C rise in temperature, a reading of the rod's length is recorded.



Task: Explain how the particles in the steel rod react when being gradually heated. Illustrate your answer with a simple diagram(s).

Task: Locate the words from the list at the bottom, in the word-search below.

T R V S C O N D E N S E L O G
T H E O R Y P N M A D G G D E
R S O U L N R U O P A V A E O
I C N O I S U F F I D E S V M
E E Q D V B O I L S D C H A D
V P R E S S U R E Q I N E T P
A E L U C E L O M E D E A O E
P P V S K M E A V T C D T M L
O G M E E I L Z Q E M I E E E
R I A J A L C C E M D V P M D
A T D E T B I S Y E Q E C U O
T E I Z A U T A U Y R N P L M
E E F E D S R K R A T F T O N
F S N O I T A R B I V E O V L
V D I T E M P E R A T U R E U

WORD LIST

PARTICLE	ATOM	DIFFUSION
MOLECULE	EVIDENCE	THEORY
MODEL	GAS	PRESSURE
VIBRATION	DATA	VAPOUR
EVAPORATE	BOIL	CONDENSE
FREEZE	SUBLIME	HEAT
TEMPERATURE	VOLUME	

Scene: The table below records data between two variables in car tyres.

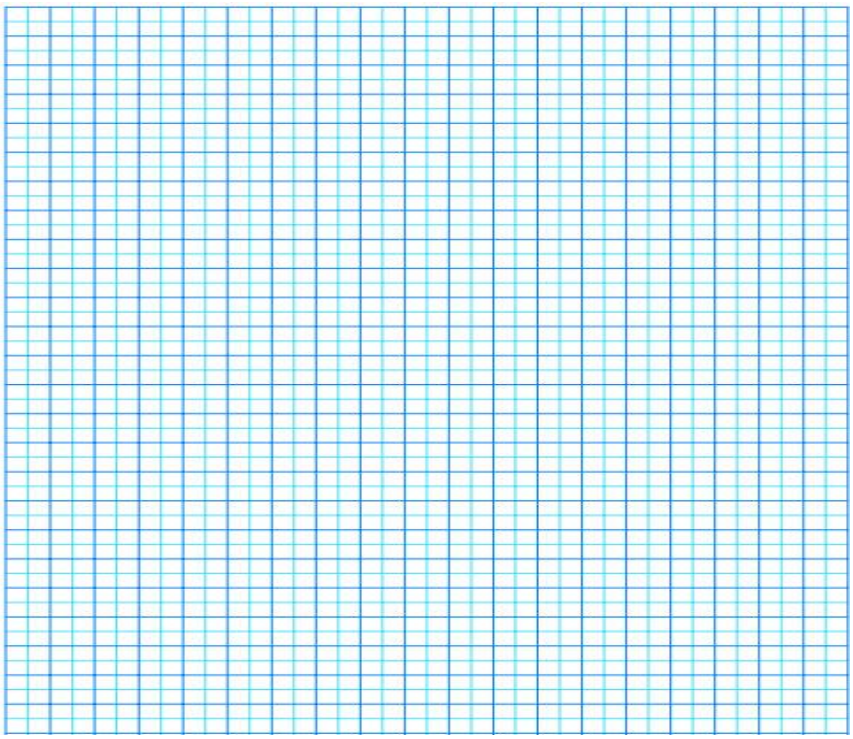
Volume of air in tyre (cm3)	**Pressure of air in tyres (N/cm2)**
100	8
200	
300	24
400	
500	40

Task: answer these four questions;

- Fill in the two blanks values for pressure in the above table.
- What two variables are recorded in the table?

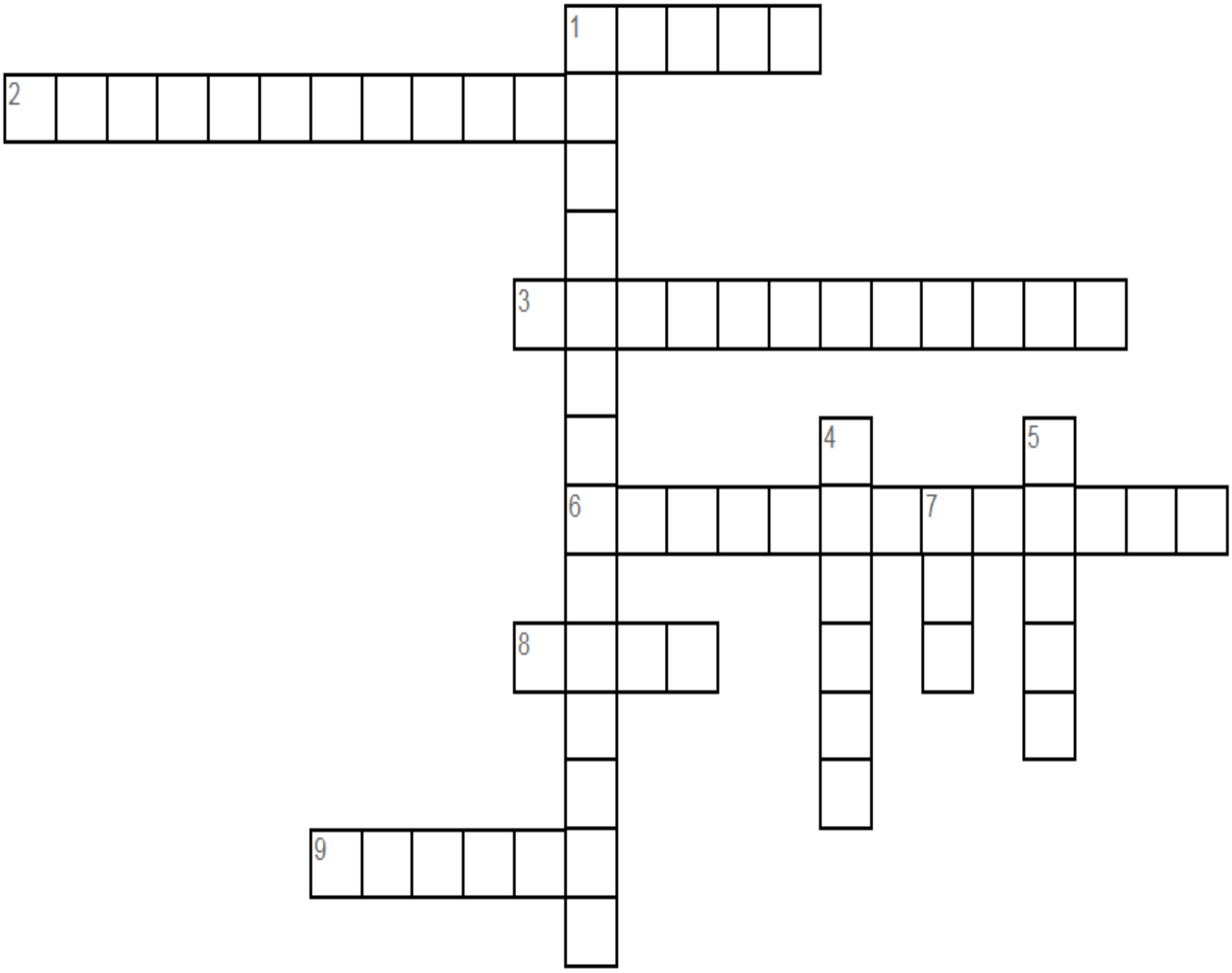
- State a relationship between the two variables.

- Draw a simple line graph below using the data from the table. Use a suitable scale, and label each axis.



Task: Use the clues below to complete the crossword.

Across	Down
1. Has a definite shape and a definite volume **2.** A change from a liquid to a gas **3.** A change from a solid to a liquid **6.** A change from a liquid to a solid **8.** The amount of matter in an object **9.** The amount of space taken up by an object	**1.** Solid, liquid and gas **4.** Has a definite volume but takes the shape of its container **5.** A property of matter **7.** Takes the shape and volume of its container

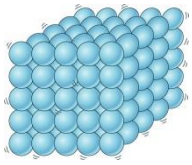
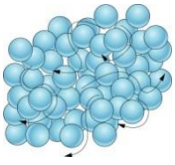
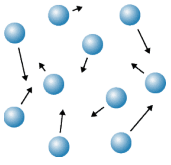


Change of state: Solids, liquids and gases can change between states by simply heating or cooling them.

Task: Complete (fill the gaps) of the changing states table below.

Starting state	**Finishing state**	**Process**
	liquid	Melting
solid	gas	
liquid		freezing
	gas	evaporation
gas	liquid	

Task: Label what each state the three particle diagrams below illustrate, and write down <u>two</u> major properties of each state.

Properties:	**Properties:**	**Properties:**
		

Task: Answer the three questions below.

1. **Complete the table to show the state of each element at room temperature.**

Element	**Melting point (°C)**	**Boiling point (°C)**	**State at room temperature**
Mercury	-39	357	
Chromium	1857	2670	
Neon	-248	-246	
Bromine	-7	59	

2. **Which of these six properties are true for gases? Underline your choices.**

They are magnetic. They can be compressed easily. They have very high boiling points.

They are good electrical conductors. They are good thermal conductors. They have low boiling points.

3. **Explain why shaking the pool balls in the triangle represents a model for movement of particles in a solid.**

NOTES

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