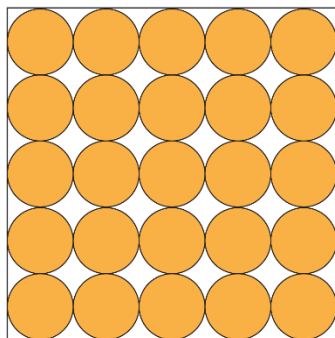
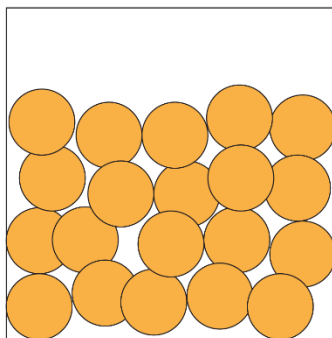


## Particle diagrams

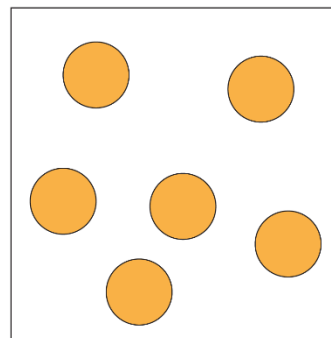
These 2D diagrams represent particles in a solid, a liquid and a gas.



**solid**



**liquid**



**gas**

**1** The circles in the diagrams can represent different types of particles.

(a) Name **two** different particles the circles could represent.

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(2 marks)

(b) Explain why the following features of the particle diagrams are limitations of the particle model:

i. The particles are represented as spheres.

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(1 mark)

ii. The particles are solid.

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(1 mark)

iii. The particles are all the same size.

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(1 mark)

- 2 The diagrams can be used to explain some properties of solids, liquids and gases.

(a) Which diagram(s) suggest each of the following properties?

i. Particles can flow.

\_\_\_\_\_ (1 mark)

ii. Particles vibrate in a fixed position.

\_\_\_\_\_ (1 mark)

iii. Particles can be easily compressed.

\_\_\_\_\_ (1 mark)

iv. Substance has a low boiling point.

\_\_\_\_\_ (1 mark)

(b) Which diagram represents the substance with the strongest forces between the particles?

\_\_\_\_\_ (1 mark)

- 3 The diameter of a helium atom is 0.064 nm. The average distance between helium atoms at standard temperature and pressure (stp) is about 3.0 nm.

(a) Calculate the ratio of the diameter of a helium atom to the distance between helium atoms at stp. Give your answer to three significant figures.

\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(b) Suggest another limitation of the particle diagrams shown by your answers to **question 3(a)**.

\_\_\_\_\_  
\_\_\_\_\_ (1 mark)

- 4 Particle diagrams can be used to show changes of state.

(a) State why changes of state are physical changes and not chemical changes.

\_\_\_\_\_  
\_\_\_\_\_ (1 mark)

(b) Complete the table showing changes of state.

Change of state	Term describing change of state
solid to liquid	
	boiling
gas to liquid	
	freezing
solid to gas	

(5 marks)

(c) Describe how each of the following factors change when a substance changes from a solid, to a liquid and then to a gas:

i. the energy of the particles

(1 mark)

ii. the movement of the particles.

(2 marks)

**5** The particle model assumes that all particles are independent of each other. In fact, there are forces between the particles.

(a) Name the forces between the particles in:

i. solid copper metal

(1 mark)

ii. liquid water

(1 mark)

iii. oxygen gas

(1 mark)

(b) State how the strength of the forces between particles affects the following:

i. melting and boiling points

\_\_\_\_\_

\_\_\_\_\_ (1 mark)

ii. the movement of the particles

\_\_\_\_\_

\_\_\_\_\_ (1 mark)

[Total: 27 marks]



Which question(s) did you get wrong? Why?

What will you do next time you're asked a similar question?