1 Using the particulate model of matter, state one reason for the following behaviour of solids, liquids and gases.

(a) A liquid takes the shape of the container which it occupies. [1]

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(b) A solid cannot be compressed easily. [2]

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(c) Particles of a gas diffuse faster than when it is in liquid or solid state. [2]

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1(a)	• Particles in a liquid can slide about/slide past each other and hence fill the shapes of the container.	1
(b)	• A solid contains particles that are very closely packed/have little spaces between the particles • and in fixed positions hence cannot be compressed.	1 1
(c)	• Particles of a gas move faster • and more randomly/in all directions than particles of solid and liquid, hence diffuse faster	1 1

2 **Fig. 3.1** shows the arrangement of particles of a substance at 200 °C. The substance melts at 1400 °C and boils at 4000 °C.

200 °C

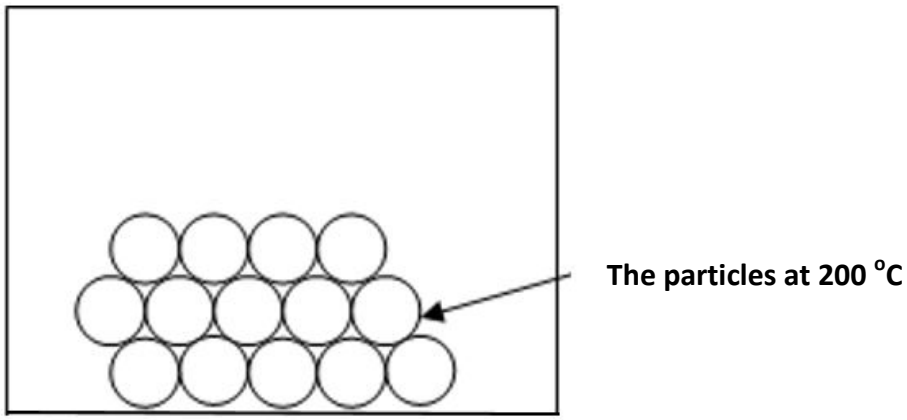
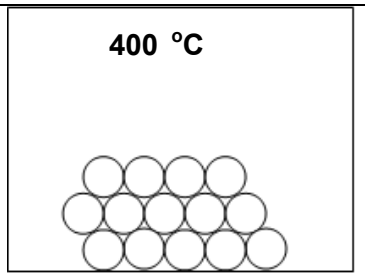
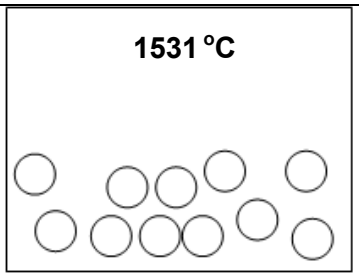


Fig. 3.1

Draw in the boxes below the arrangements of particles for this substance at the given temperature. [2]

400 °C

1531 °C

2	**400 °C** 	**1531 °C** 	1 each Max 2

3 **(a)** Explain why a solid has a fixed shape while a liquid does not have a fixed shape. [2]

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……

(b) Explain why a solid has a fixed volume while a gas does not have a fixed volume. [2]

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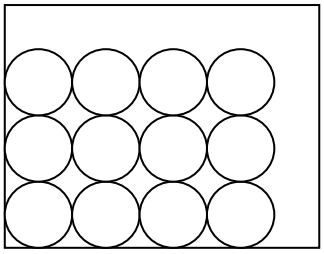
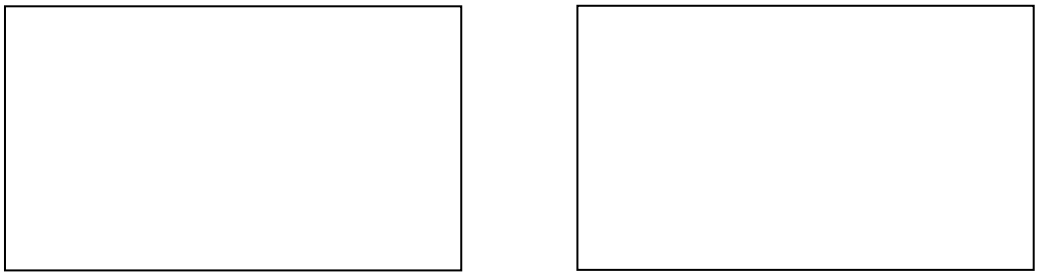
3a	Particles of a solid are held together by **very strong forces of attraction**. The forces of attraction between particles of liquid are **weaker** (Reject: weak) compared to those in a solid / Particles of a liquid are held together by **strong forces of attraction**. [1; compare forces of attraction] Hence solid particles **cannot move about freely / can only vibrate at fixed positions**. Liquid particles can are **not in fixed positions** / **slide over one another**. [1; compare movement]	2
3b	Particles of a solid are held together by **very strong forces of attraction**. The forces of attraction between gas particles are **very weak** (accept: weak). [1; compare forces of attraction] Solid particles are **very closely packed** while particles of a gas are **far apart**. [1; compare space between particles]	2

4) The diagram shows the arrangement of atoms within a certain element **Y** at -230ºC.
The element melts at -219ºC and boils at -183ºC.



(a) Draw in the following boxes the arrangement of atoms of the given temperature. [2]



-177°C **-190°C**

(b) Describe and explain what happen to the **motion** and **arrangement** of particles when element **Y** changes from -177 °C to -220 °C. [3]

4	(a)		**[2]**
	(b)	•At -177°C, the Y particles are in random motion with negligible forces of attraction between the particles. (1m) •At -183°C, the particles lose some energy and become closer together and become more regularly arranged. Y particles slide over one another. Y element is now a liquid. (1m) •At -220°C, the particles move even closer and lose more energy to become regularly arranged. The particles vibrate at its fixed position. Element Y becomes a solid.(1m)	**[3]**

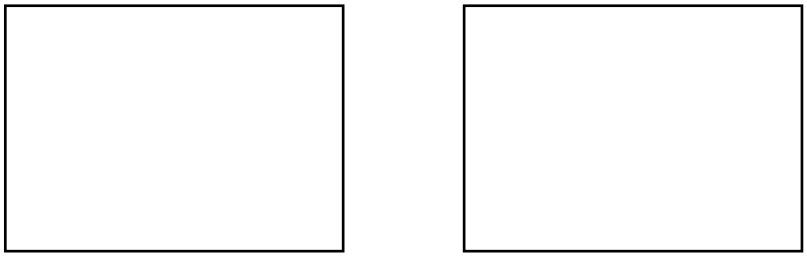
5) Table 9.1 shows the melting and boiling points of some substances.

substance	melting point / °C	boiling point / °C
P	– 100	– 56
Q	– 12	26
R	18	97
S	56	205

(a) Indicate the physical states of each of the substances at 27°C by placing the letters **P**, **Q**, **R** and **S** under the correct headings in the table below. [2]

solid	liquid	gas

(b) Draw the arrangement of particles in substance **P** at – 57 °C and 0 °C respectively. [2]

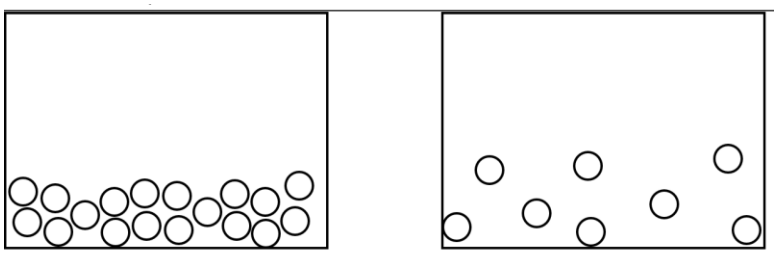


– 57 °C 0 °C

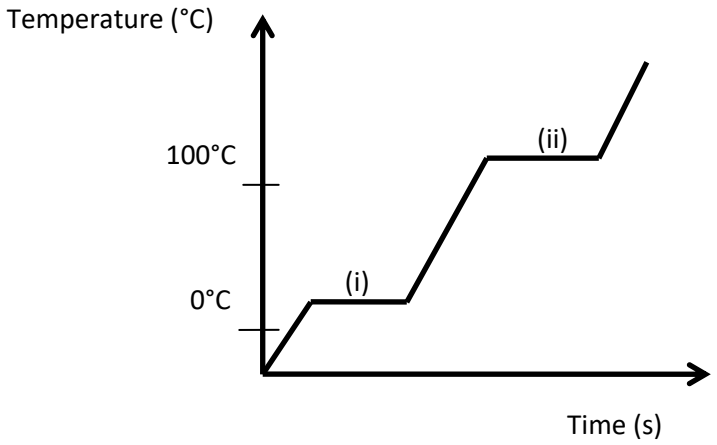
(c) Substance **S** was heated from 100 °C to 180 °C. Predict what would happen to the density of substance **S**. Explain your answer, with reference to its mass and volume.

……

…… [2]

5	a		Solid: S Liquid: R Gas: P and Q	1m for every 2 correct answers.
	b		 	1m each No overlap No diff size of particles
	c		The density of substance S will decrease. When heated from 100 °C to 180 °C, the volume of the substance will increase but the mass will remain unchanged. Mass remains the same because the size of the particles will NEVER change and the number of particles remain the same too. (no particles can be created or destroyed in any process, chemical or physical. Volume changes because ONLY the VACUUM SPACE between the particles change.	1m 1m

1 Refer to the graph for questions **(a)** to **(d)**.



(a) Name the processes occurring at (i) and (ii).

……[2]

(b) Describe the change in the arrangement of the molecules at (i).

……

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…… [2]

(c) Describe the change in the movement of the molecules at (ii).

……

…… [2]

(d) Why were there no observable changes in temperature at (i)?

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…… [1]

1	(a)	(i) melting (ii) boiling Reject: melting point Boiling point	1m 1m
	(b)	At (i), the particles are initially arranged in orderly and packed arrangement and held In fixed positions. As the particles gain energy/temperature increase, the particles are closely packed but not in an orderly/disorderly manner. *Accepted answers:* *Arranged closely together in orderly arrangement(1m)* *Orderly to disorderly arrangement(1m)*	1m 1m
	(c)	At (ii), the particles slide over one another/move in between each other and throughout the liquid, as it gains energy, the particles move in any direction (random) at high speed(rapidly). Accepted answers: Move freely and rapidly/ move fast and random (1m)	1m 1m
	(d)	The heat energy taken in by the solid particles is used to overcome the strong forces of attraction holding them in fixed positions. Particles **gain** heat energy **to overcome** attractive forces and move apart. Gain in heat energy does NOT increase kinetic energy of particles during melting / boiling, so, temperature remains constant at a fixed temperature because temperature is directly proportional to the kinetic energy of the particles.	1m

2 (a) Table 8.1 shows the possible changes in the particles of a substance when the substance undergoes changes in physical states.

Use a tick (√) to indicate the changes that occur during change of state. [2]

Table 8.1

		Put a tick (√)
(i)	attractive forces between particles	
(ii)	distance between particles	
(iii)	mass of particles	
(iv)	motion of particles	
(v)	size of particles	

(b) Table 8.2 shows the melting point and boiling point of bromine.

Table 8.2

substance	melting point / °C	boiling point / °C
bromine	– 7	59

(i) Based on the particulate model of matter, draw the arrangement of bromine particles at –10 °C in the box below. [1]

(ii) Using the particulate model of matter, describe what happens to the bromine particles when the temperature increases from – 10 °C to – 7 °C.

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……[2]

(a) Iodine has a melting point of 113 ^{0}C and a boiling point of 184 ^{0}C.
Fig. 8.3 shows a graph of temperature against time when iodine is heated from 100 ^{0}C to 200 ^{0}C.

(i) Using information provided above, **label on Fig. 8.3** on the temperature axis the **respective melting** and **boiling point** of iodine.

[2]

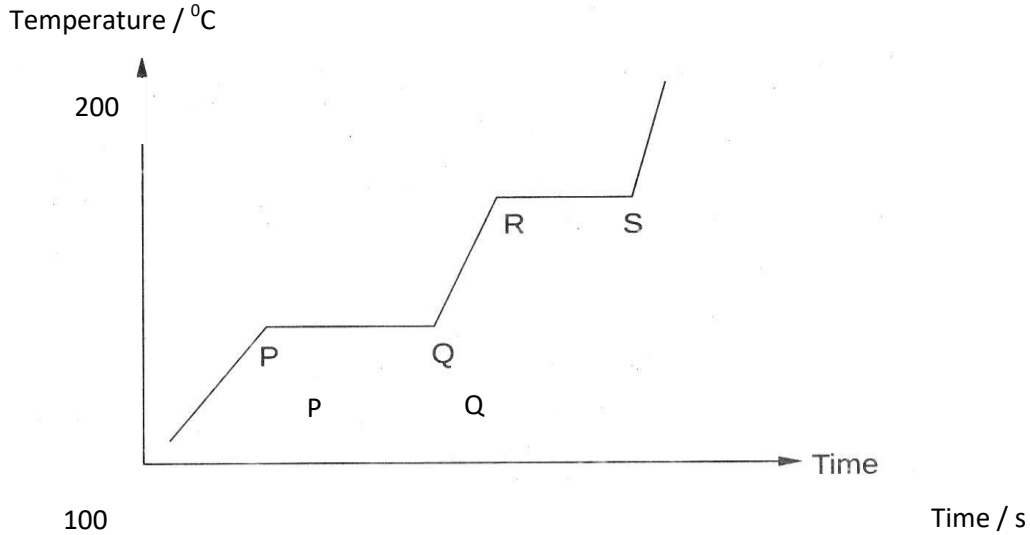

Fig. 8.3

(ii) Briefly explain why there is no change in temperature between P and Q.

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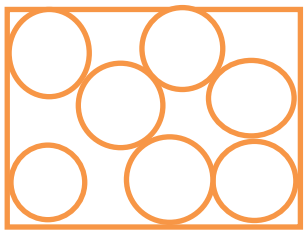
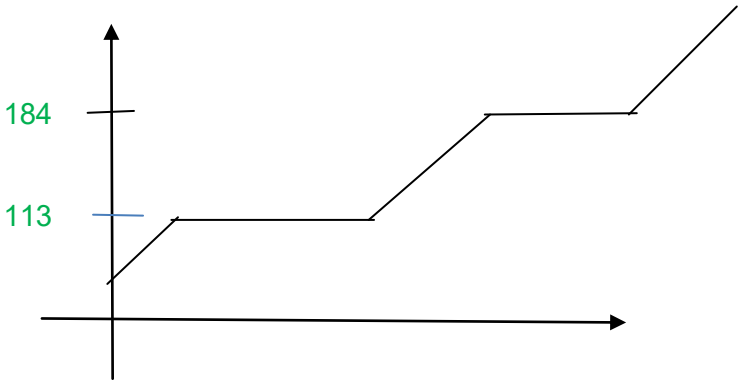
……

……[1]

2(a)	1, II, IV all correct	1,1
(b)(i)		1
(ii)	From -10 ^{0}C to – 7^0 C, particles gain energy and vibrate faster. At – 7°C, the melting point of bromine, the bromine particles will have gained enough thermal energy to overcome the very strong attractive forces and slide past each other to become liquid particles. Temperature remains constant throughout the whole process during change of state. This is because Particles **gain** heat energy **to overcome** attractive forces and move apart. Gain in heat energy does NOT increase kinetic energy of particles during melting / boiling, so, temperature remains constant at a fixed temperature because temperature is directly proportional to the kinetic energy of the particles.	1 1
(c)(i)		Temp – 113 ^{0}C 1m 184 ^{0}C 1m
(ii)	They gain enough thermal energy to break away the forces of attraction between particles. Particles **gain** heat energy **to overcome** attractive forces and move apart. Gain in heat energy does NOT increase kinetic energy of particles during melting / boiling, so, temperature remains constant at a fixed temperature because temperature is directly proportional to the kinetic energy of the particles.	1

3 The melting and boiling points of four substances are given in the following table.

substance	melting point / °C	boiling point / °C
A	15	150
B	- 25	75
C	135	280
D	- 150	-10

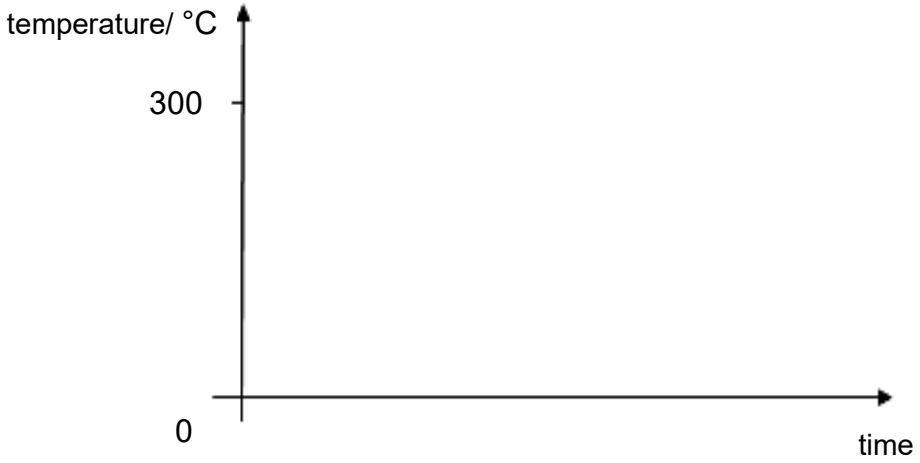
(a) At room temperature, which substance will be in the solid state?

…….. [1]

(b) If all four substances were heated from 0 °C to 100 °C, which substance will change from liquid to gas?

…….. [1]

(c) On the axes below, sketch the heating curve of substance **C** when it is heated from 0 °C to 300 °C. Indicate on the y-axis the melting and boiling points of substance **C**.



[2]

(d) When substance **B** at 90 °C is placed in a beaker of ice, its compressibility decreases. Explain why.

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…… [2]

(e) Would you expect the density of substance **A** at 10 °C to be higher, lower or the same as the density at 20 °C? Explain your answer.

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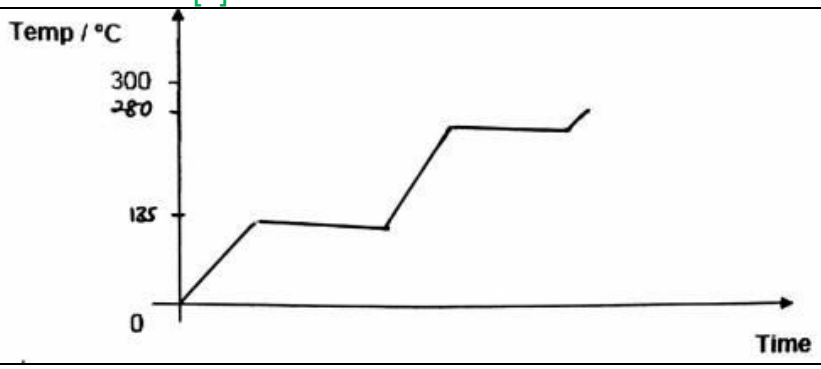
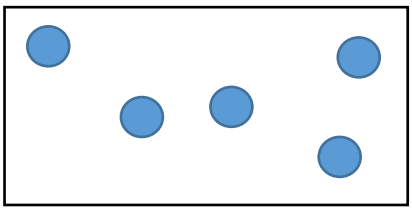
…… [3]

(f) Draw the arrangement of the particles of substance **D** at 0 °C.

[1]

3a	Substance C [1]
3b	Subtstance B [1]
3c	
3d	Substance B at 90 °C will condense into a liquid [1] when placed in a beaker of ice. Liquid particles are closely packed together whereas gas particles are far apart. [1] Hence, its compressibility decrease.
3e	At 10 °C, the substance is a solid whereas at 20 °C, it exists as a liquid. [1] Solid particles are more closely packed as compared to a liquid. [1] Hence, within the same volume, the density of solid particles is higher than the density of liquid particles. [1]
3f	 Drawing of gas particles