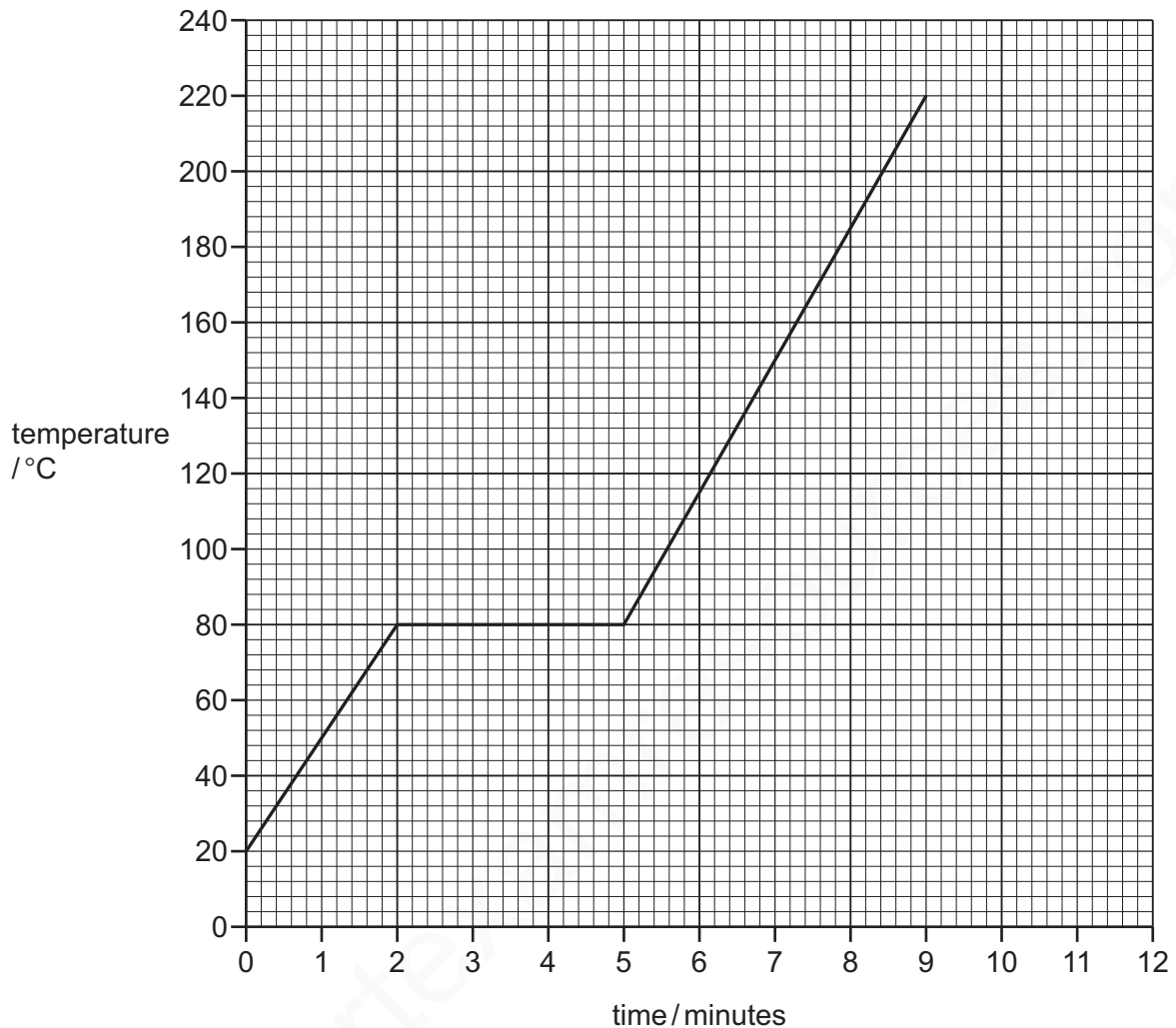


HEATING COOLING CURVE

1 **Z** is a covalent substance. In an experiment, a sample of pure solid **Z** was continually heated for 11 minutes.

The graph shows how the temperature of the sample of pure **Z** changed during the first 9 minutes.



(a) What is the melting point of pure **Z**?

..... °C [1]

(b) The sample of pure **Z** began to boil at 9 minutes. It was boiled for 2 minutes.

Use this information to sketch on the grid how the temperature of the sample of pure **Z** changed between 9 minutes and 11 minutes. [1]

(c) The sample of pure **Z** was continually heated between 2 minutes and 5 minutes.

Explain, in terms of attractive forces, why there was no increase in the temperature of the sample of pure **Z** between 2 minutes and 5 minutes.

.....
.....
..... [2]

(d) Describe how the motion of particles of pure **Z** changed from 0 minutes to 2 minutes.

.....
..... [2]

(e) The experiment was repeated using a solid sample of **impure Z**.

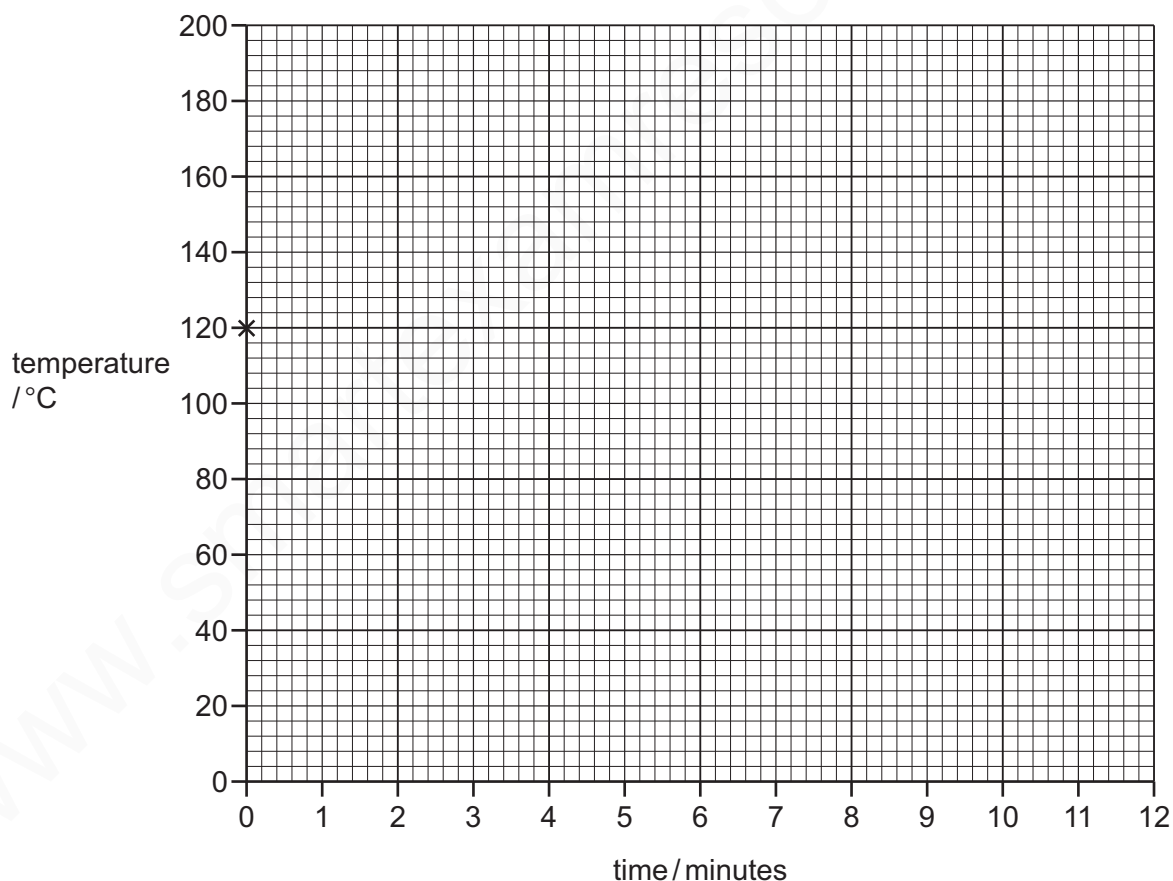
Suggest the differences, if any, in the melting point and boiling point of the sample of **impure Z** compared to the sample of pure **Z**.

melting point

boiling point [2]

(f) A sample of pure **Z** was allowed to cool from 120 °C to 20 °C. The total time taken was 8 minutes.

Starting from point **x**, sketch on the grid how the temperature of the sample of pure **Z** changed between 0 minutes and 8 minutes.



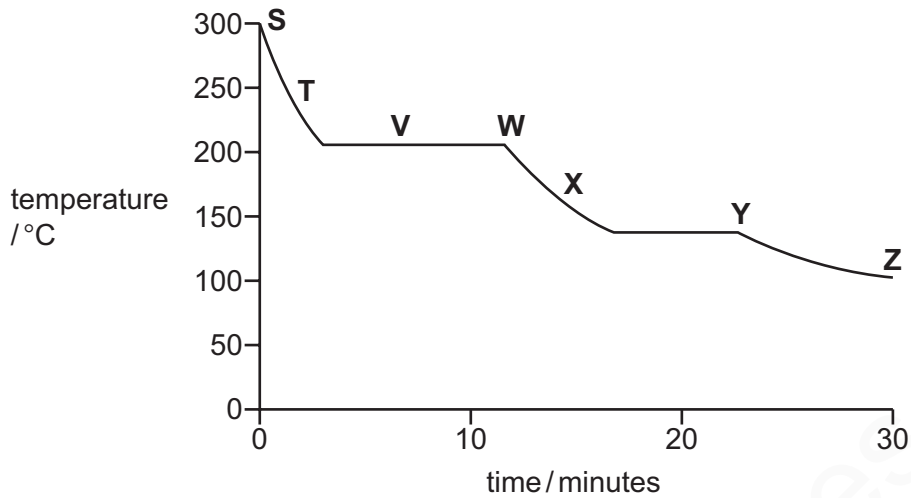
[2]

[Total: 10]

MARKING SCHEME:

(a)	80(°C) (1)	1
(b)	horizontal line from end of graph at minute 9 to minute 11 (1)	1
(c)	energy is used to break bonds / overcome attraction (1) between molecules (1)	2
(d)	vibrations (1) increase (1)	2
(e)	melting point decreases (1) boiling point increases (1)	2
(f)	decrease from 120 °C to 80 °C and horizontal line at 80 °C (1) decrease from horizontal line to finish at 20 °C at 8 mins (1)	2

2 The graph shows how the temperature of a substance changes as it is cooled over a period of 30 minutes. The substance is a gas at the start.



Each letter on the graph may be used once, more than once or not at all.

(a) Which letter, **S, T, V, W, X, Y** or **Z**, shows when

(i) the particles in the substance have the most kinetic energy,
 [1]

(ii) the particles in the substance are furthest apart,
 [1]

(iii) the substance exists as both a gas and a liquid?
 [1]

(b) Use the graph to estimate the freezing point of the substance.
 °C [1]

(c) Name the change of state directly from a solid to a gas.
 [1]

(d) When smoke is viewed through a microscope, the smoke particles in the air appear to jump around.

(i) What term describes this movement of the smoke particles?
 [1]

(ii) Explain why the smoke particles move in this way.

 [2]

[Total: 8]

MARKING SCHEME:

(a)(i)	S	1
(a)(ii)	S	1
(a)(iii)	V	1
(b)	any value in the range 130–145 °C	1
(c)	sublimation	1
(d)(i)	Brownian motion	1
(d)(ii)	nitrogen / oxygen / carbon dioxide / air molecules hit / bombard the smoke particles	1
	(the bombarding particles) move randomly	1