

Q1

0620/22/F/M/22/Q2

Solid, Liquid & Gas · Easy

In which state does 1 dm³ of methane contain the most particles?

- A gas at 100 °C
- B gas at room temperature
- C liquid
- D solid

Q2

0620/23/M/J/24/Q1

Solid, Liquid & Gas · Easy

- 1 Sodium chloride is a liquid at 900 °C.

Which row describes the arrangement and the motion of the particles in sodium chloride at 900 °C?

	arrangement of particles	motion of particles
A	regular	vibrate about a fixed point
B	regular	move randomly
C	random	vibrate about a fixed point
D	random	move randomly

Q3

0620/21/O/N/24/Q1

Solid, Liquid & Gas · Easy

- 1 Which row describes the arrangement and motion of the particles in a liquid?

	arrangement	motion
A	random and particles are touching	moving slowly
B	random with space between all particles	moving slowly
C	an ordered lattice with all particles touching	moving slowly
D	an ordered lattice with space between all particles	moving quickly

Q4

0620/22/O/N/24/Q1

Solid, Liquid & Gas · Easy

- 1 Oxygen melts at -219°C and boils at -183°C .

At which temperature is oxygen a liquid?

- A** -225°C **B** -189°C **C** -175°C **D** 25°C

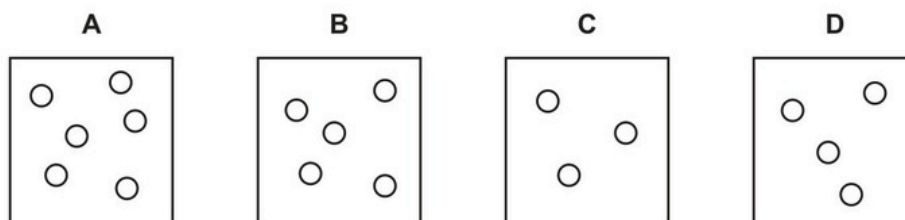
Q5

0620/22/F/M/25/Q1

Solid, Liquid & Gas · Easy

- 1 The diagrams show containers of gas at the same temperature. All containers have the same size.

Which container contains gas at the highest pressure?



Q6

0620/22/O/N/25/Q1

Solid, Liquid & Gas · Easy

- 1 What happens to the volume of a fixed mass of gas when the temperature is increased or the pressure is decreased?

	increased temperature	decreased pressure
A	volume decreased	volume decreased
B	volume decreased	volume increased
C	volume increased	volume decreased
D	volume increased	volume increased

Q7

0620/23/O/N/25/Q1

Solid, Liquid & Gas · Easy

- 1 What happens to the volume of a fixed mass of gas when pressure and temperature are separately increased?

	volume of gas	
	pressure increased	temperature increased
A	increases	increases
B	no change	decreases
C	decreases	increases
D	no change	increases

Q8

0620/23/M/J/23/Q1

Solid, Liquid & Gas · Hard

Nitrogen is heated in a balloon, which expands slightly.

Which statements about the molecules of nitrogen are correct?

- 1 They move further apart.
- 2 They move more quickly.
- 3 They remain the same distance apart.
- 4 Their speed remains unchanged.

A 1 and 2

B 1 and 4

C 2 and 3

D 3 and 4

Q9

0620/21/O/N/23/Q1

Solid, Liquid & Gas · Hard

A gas is placed in a sealed container. The gas has a pressure of one atmosphere and a temperature of 50 °C.

It is heated to 100 °C.

Which row describes the cause of the pressure of the gas and the effect of increasing the temperature of the gas?

	cause of gas pressure	the effect of increased temperature of the gas
A	collisions between gas particles	collisions become less frequent
B	collisions between gas particles	the average speed of the gas particles increases
C	collisions between gas particles and the container	collisions become less frequent
D	collisions between gas particles and the container	the average speed of the gas particles increases

Q10

0620/23/O/N/23/Q1

Solid, Liquid & Gas · Hard

A sample of a gas occupies 340 cm³ at room temperature and pressure.

The temperature and pressure are both increased, but the volume occupied by the gas remains 340 cm³.

Which row describes what happens to the particle speed and the average distance between the particles in the gas when the temperature and pressure are both increased?

	particle speed	average distance between particles
A	unchanged	unchanged
B	unchanged	increased
C	increased	unchanged
D	increased	increased

Q11

0620/21/M/J/24/Q1

Solid, Liquid & Gas · Hard

- 1 A gas is heated. The pressure is kept constant.

Which statement describes the behaviour of the particles in the gas?

- A The particles move faster and become closer together.
- B The particles move faster and become further apart.
- C The particles move more slowly and become closer together.
- D The particles move more slowly and become further apart.

Q12

0620/22/O/N/24/Q2

Solid, Liquid & Gas · Hard

- 2 The pressure of a sample of gas is decreased. The temperature is kept constant.

Which row describes the effects on the particles?

	movement of particles	collisions between particles
A	slower	occur less often
B	slower	occur with more force
C	no change in speed	occur less often
D	no change in speed	occur with more force

Q13

0620/23/O/N/24/Q2

Solid, Liquid & Gas · Hard

- 2 A gas is in a sealed container with a fixed volume.

Which statements describe what happens to the molecules in the gas when the temperature is increased?

- 1 They move more slowly.
- 2 They collide with the walls of the container more frequently.
- 3 They collide with the walls of the container with less force.
- 4 They have greater kinetic energy.

- A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4

Q14

0620/21/M/J/25/Q1

Solid, Liquid & Gas · Hard

- 1 A gas is placed in a sealed container with a fixed volume.

The gas is heated.

Which statements are correct?

- 1 The gas molecules move around faster.
- 2 The gas particles collide with the walls of the container more frequently.
- 3 The pressure in the container decreases.

A 1 and 2 **B** 1 only **C** 2 and 3 **D** 2 only

Q15

0620/23/M/J/25/Q1

Solid, Liquid & Gas · Hard

- 1 Which two changes, when applied **at the same time** to a fixed amount of gas, cause the greatest increase in volume of the gas?

	change in pressure	change in temperature
A	decrease by 10%	decrease by 10%
B	increase by 10%	decrease by 10%
C	decrease by 20%	increase by 10%
D	increase by 20%	increase by 10%

Q16

0620/21/O/N/25/Q1

Solid, Liquid & Gas · Hard

- 1 A sealed balloon contains air.

The temperature of the balloon is increased.

Which row describes how the pressure in the balloon and the kinetic energy of the particles in air change?

	pressure	kinetic energy of particles
A	decreases	decreases
B	increases	decreases
C	decreases	increases
D	increases	increases

Q17

0620/21/M/J/22/Q1

Diffusion · Easy

Which two gases will diffuse at the same rate, at the same temperature?

- A carbon monoxide and carbon dioxide
- B carbon monoxide and nitrogen
- C chlorine and fluorine
- D nitrogen and oxygen

Q18

0620/22/M/J/22/Q1

Diffusion · Easy

Which two gases will diffuse at the same rate, at the same temperature?

- A carbon monoxide and carbon dioxide
- B carbon monoxide and nitrogen
- C chlorine and fluorine
- D nitrogen and oxygen

Q19

0620/23/M/J/22/Q1

Diffusion · Easy

Which two gases will diffuse at the same rate, at the same temperature?

- A carbon monoxide and carbon dioxide
- B carbon monoxide and nitrogen
- C chlorine and fluorine
- D nitrogen and oxygen

Q20

0620/22/O/N/22/Q1

Diffusion · Easy

The rate of diffusion of three gases, ammonia, carbon dioxide and methane, is measured.

What is the order of the rate of diffusion of the gases from slowest to fastest?

- A $\text{CO}_2 \rightarrow \text{NH}_3 \rightarrow \text{CH}_4$
 B $\text{CO}_2 \rightarrow \text{CH}_4 \rightarrow \text{NH}_3$
 C $\text{CH}_4 \rightarrow \text{NH}_3 \rightarrow \text{CO}_2$
 D $\text{NH}_3 \rightarrow \text{CH}_4 \rightarrow \text{CO}_2$

Q21

0620/23/O/N/22/Q1

Diffusion · Easy

Which gas diffuses the most slowly?

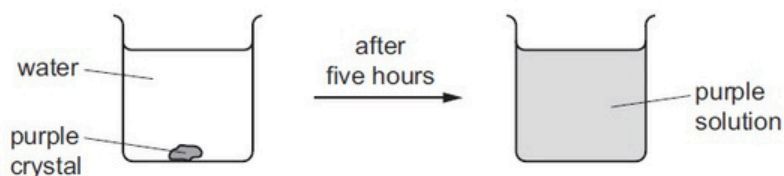
- A CH_4 B CO_2 C H_2 D NH_3

Q22

0620/21/M/J/23/Q1

Diffusion · Easy

The diagram shows the result of dropping a purple crystal into water.



Which processes take place in this experiment?

	chemical reaction	diffusing	dissolving
A	✓	✓	x
B	✓	x	x
C	x	x	✓
D	x	✓	✓

Q23

0620/22/F/M/23/Q2

Diffusion · Easy

Which gas has the fastest rate of diffusion?

A Ar

B C₂H₆

C HCl

D H₂S

Q24

0620/22/M/J/24/Q1

Diffusion · Easy

1 Which gas has the slowest rate of diffusion?

A H₂B NH₃C CH₄D CO₂

Q25

0620/22/F/M/25/Q3

Diffusion · Easy

3 Samples of four gases are released in a room at the same time.

The gases are carbon dioxide, CO₂, hydrogen chloride, HCl, hydrogen sulfide, H₂S, and nitrogen dioxide, NO₂.

Which gas diffuses fastest?

A carbon dioxide

B hydrogen chloride

C hydrogen sulfide

D nitrogen dioxide

Q26

0620/23/O/N/25/Q2

Diffusion · Easy

2 Which gas diffuses most quickly at room temperature and pressure?

A CH₄

B C₂H₆

C CO

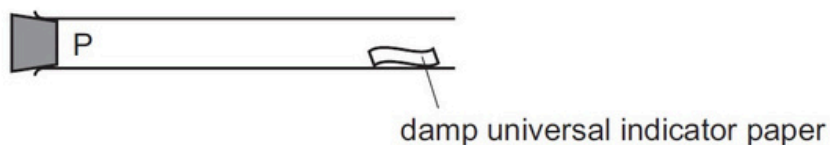
D SO₂

Q27

0620/21/M/J/21/Q1

Diffusion · Hard

A gas is released at point P in the apparatus shown.



Which gas turns the damp universal indicator paper red most quickly?

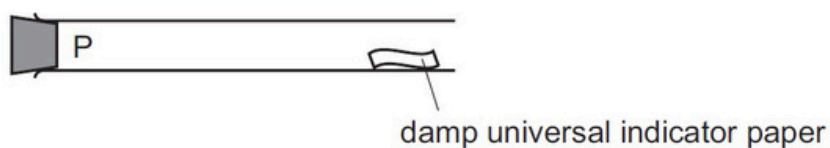
- A ammonia, NH_3
- B chlorine, Cl_2
- C hydrogen chloride, HCl
- D sulfur dioxide, SO_2

Q28

0620/22/M/J/21/Q1

Diffusion · Hard

A gas is released at point P in the apparatus shown.



Which gas turns the damp universal indicator paper red most quickly?

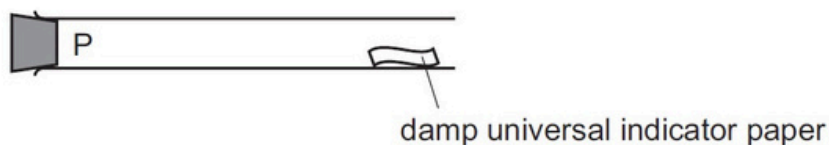
- A ammonia, NH_3
- B chlorine, Cl_2
- C hydrogen chloride, HCl
- D sulfur dioxide, SO_2

Q29

0620/23/M/J/21/Q1

Diffusion · Hard

A gas is released at point P in the apparatus shown.



Which gas turns the damp universal indicator paper red most quickly?

- A ammonia, NH_3
- B chlorine, Cl_2
- C hydrogen chloride, HCl
- D sulfur dioxide, SO_2

Q30

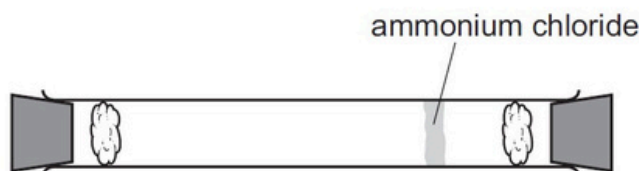
0620/22/O/N/21/Q1

Diffusion · Hard

An experiment is set up as shown.



After several minutes, a white ring of ammonium chloride appears as shown.



Which statement explains the observation after several minutes?

- A Ammonia gas diffuses faster than hydrogen chloride gas because its molecules have a lower molecular mass.
- B Ammonia gas diffuses faster than hydrogen chloride gas because its molecules have a higher molecular mass.
- C Ammonia gas diffuses slower than hydrogen chloride gas because its molecules have a lower molecular mass.
- D Ammonia gas diffuses slower than hydrogen chloride gas because its molecules have a higher molecular mass.

Q31

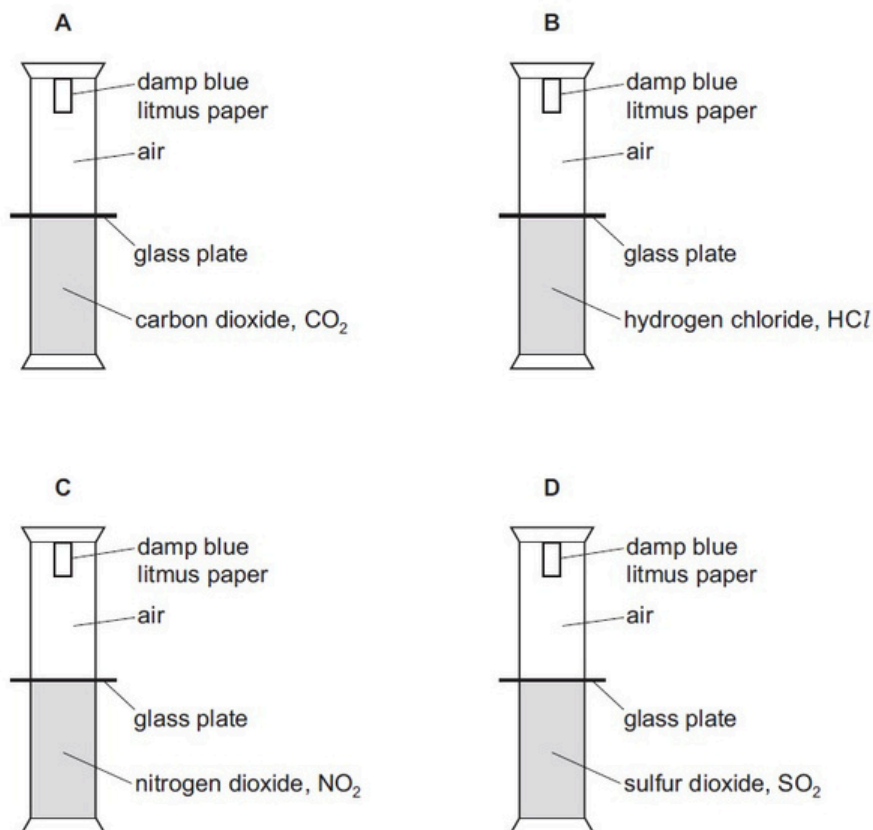
0620/21/O/N/23/Q2

Diffusion · Hard

Four experiments, each containing a different acidic gas, are set up as shown.

The dividing glass plates are removed at the same time.

In which set of apparatus does the litmus turn red first?



Q32

0620/23/O/N/23/Q2

Diffusion · Hard

Which statements about the rate of diffusion of the gases ammonia, carbon monoxide, nitrogen and oxygen are correct?

- 1 Nitrogen and carbon monoxide will diffuse at the same rate.
- 2 Oxygen will diffuse slowest because it is an element, whereas the others are compounds.
- 3 Ammonia will diffuse fastest.

A 1 and 2 B 1 and 3 C 1 only D 2 and 3

Q33

0620/22/F/M/24/Q2

Diffusion · Hard

2 Which statements about diffusion are correct?

- 1 Aqueous ions cannot diffuse in water.
- 2 Diffusion is caused by the random movement of particles.
- 3 Particles spread out in all directions in diffusion.
- 4 Diffusion can only take place in solids and liquids.

A 1 and 2**B** 1 and 4**C** 2 and 3**D** 3 and 4

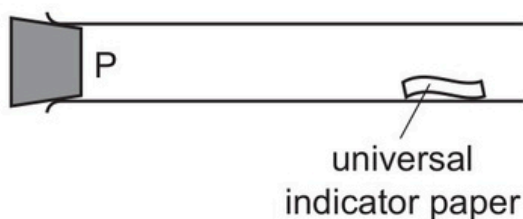
Q34

0620/21/M/J/24/Q3

Diffusion · Hard

3 Hydrogen chloride gas [M_r : HCl, 36.5] is released at P in the apparatus shown.

The universal indicator paper turns red after 38 s.



The experiment is repeated using sulfur dioxide gas [M_r : SO₂, 64].

What is the result for sulfur dioxide gas?

	universal indicator paper turns	time for universal indicator paper to change colour / s
A	blue	26
B	blue	51
C	red	26
D	red	51

Q35

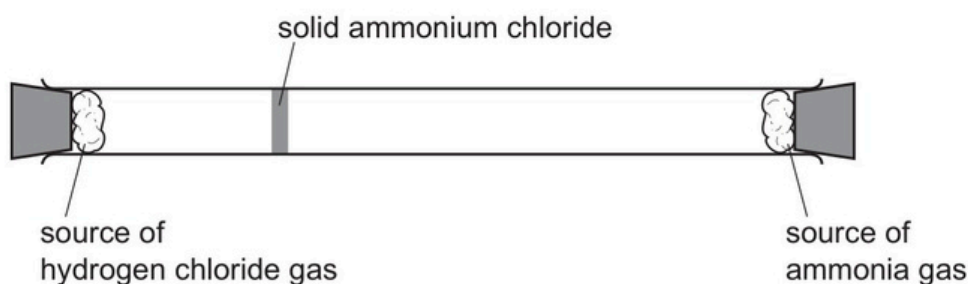
0620/23/M/J/24/Q2

Diffusion · Hard

- 2 Hydrogen chloride gas, HCl , reacts with ammonia gas, NH_3 , to form solid ammonium chloride.

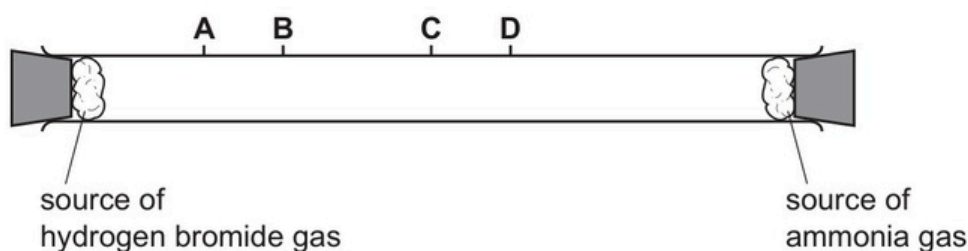
The apparatus is set up as shown.

After a few minutes, a white cloud of solid ammonium chloride forms where the two gases meet.



The experiment is repeated using hydrogen bromide gas, HBr , in place of hydrogen chloride.

How far along the tube does the white cloud of solid ammonium bromide form?



Q36

0620/21/O/N/24/Q2

Diffusion · Hard

- 2 Which gas has the lowest rate of diffusion at room temperature and pressure?
- A the gas produced when ammonium chloride is heated with aqueous sodium hydroxide
 - B the gas which makes up approximately 78% of clean, dry air
 - C the gas produced when sodium carbonate is added to dilute hydrochloric acid
 - D the gas produced when zinc is added to dilute sulfuric acid

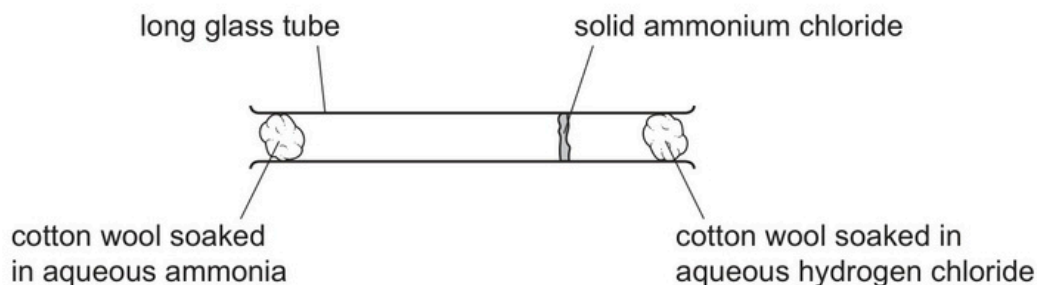
Q37

0620/21/O/N/25/Q2

Diffusion · Hard

- 2 Ammonia gas is reacted with hydrogen chloride gas using the apparatus shown.

Solid ammonium chloride is produced.



Which statement explains why the solid ammonium chloride is formed nearer to the hydrogen chloride?

- A Aqueous ammonia is a base and aqueous hydrogen chloride is an acid.
- B Ammonia molecules diffuse more slowly than hydrogen chloride molecules.
- C Hydrogen chloride has a greater molecular mass than ammonia.
- D Only ammonia molecules diffuse in all directions at the same time.

Q38

0620/22/O/N/25/Q3

Diffusion · Hard

- 3 A student investigates the diffusion of ammonia gas, NH_3 , and hydrogen chloride gas, HCl .

Two sets of apparatus are set up as shown at room temperature and pressure.



The damp red litmus paper in apparatus 1 changes colour after 30 seconds.

How long does it take for the damp blue litmus paper in apparatus 2 to change colour?

- A 21 seconds
- B 30 seconds
- C 64 seconds
- D The damp blue litmus paper does **not** change colour.

Q39

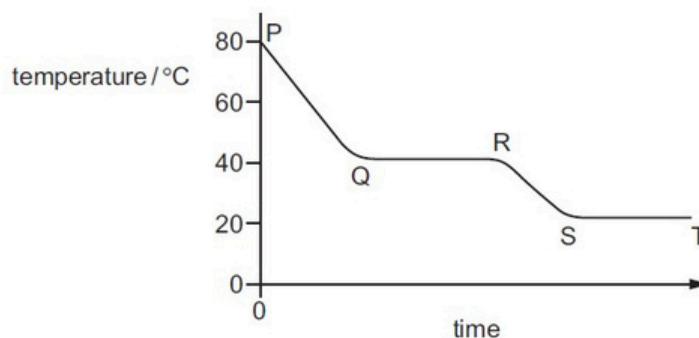
0620/22/F/M/23/Q1

Heating & Cooling Curves · Easy

Substance M is a solid at 30 °C.

The substance is heated to 80 °C and its temperature measured as it cools down to room temperature.

The cooling curve is shown.



Between which times is substance M freezing?

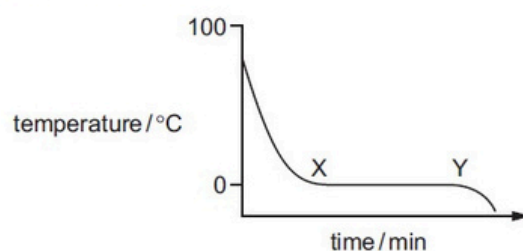
- A** P to Q **B** Q to R **C** R to S **D** S to T

Q40

0620/22/O/N/23/Q1

Heating & Cooling Curves · Easy

Part of a cooling curve for water is shown.



What is occurring between points X and Y?

- A** Steam is condensing into water.
B The temperature of the water is decreasing.
C Ice is melting.
D Particles are losing heat to the surroundings.

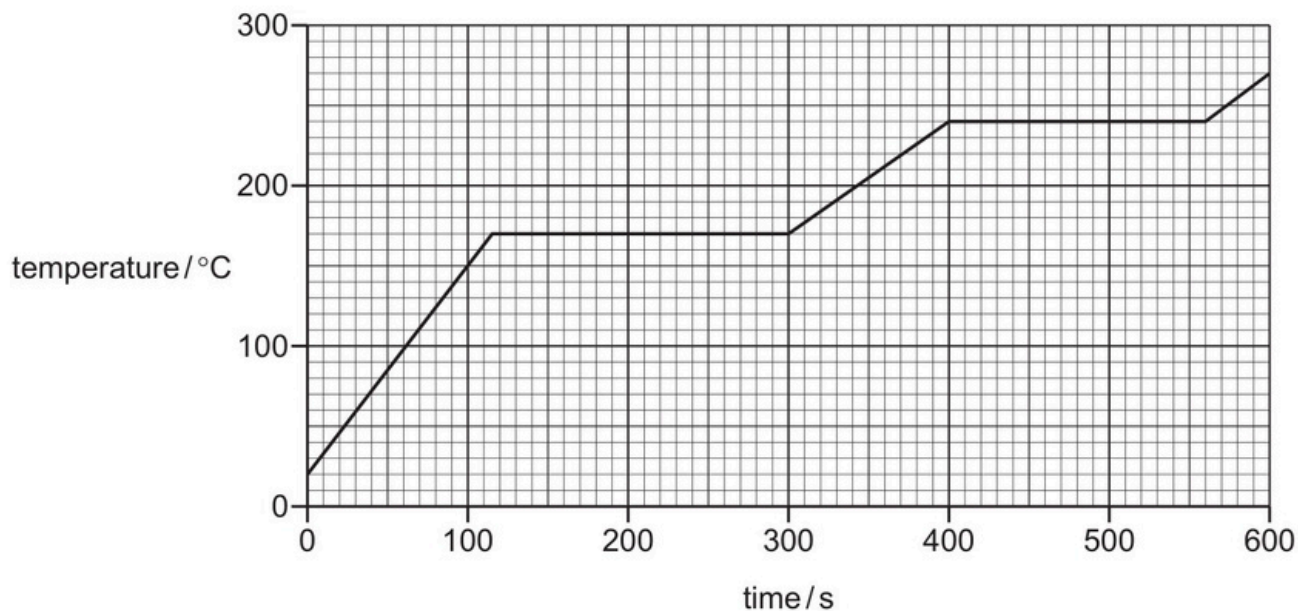
Q41

0620/22/F/M/24/Q1

Heating & Cooling Curves · Easy

- 1 Solid X is heated for 600 seconds.

The graph shows the heating curve that is obtained.



What is the melting point of X?

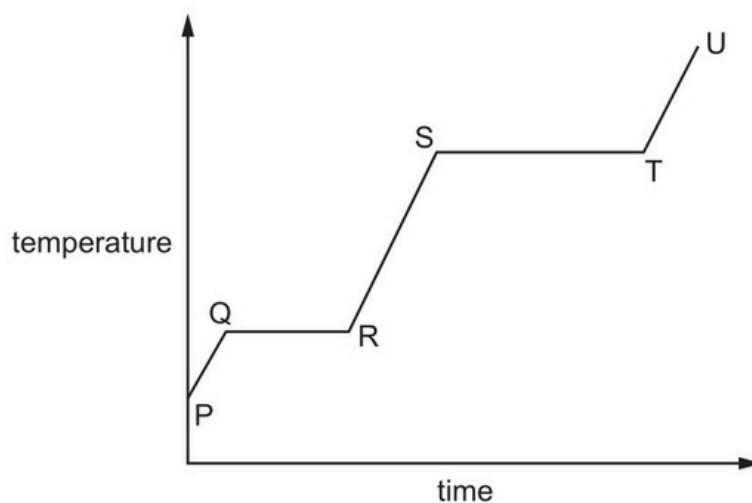
- A** 20 $^{\circ}\text{C}$ **B** 170 $^{\circ}\text{C}$ **C** 240 $^{\circ}\text{C}$ **D** 270 $^{\circ}\text{C}$

Q42

0620/22/O/N/25/Q2

Heating & Cooling Curves · Easy

2 The diagram shows the heating curve for a substance.



Between which two points do the particles of the substance change from being in fixed positions to being mobile?

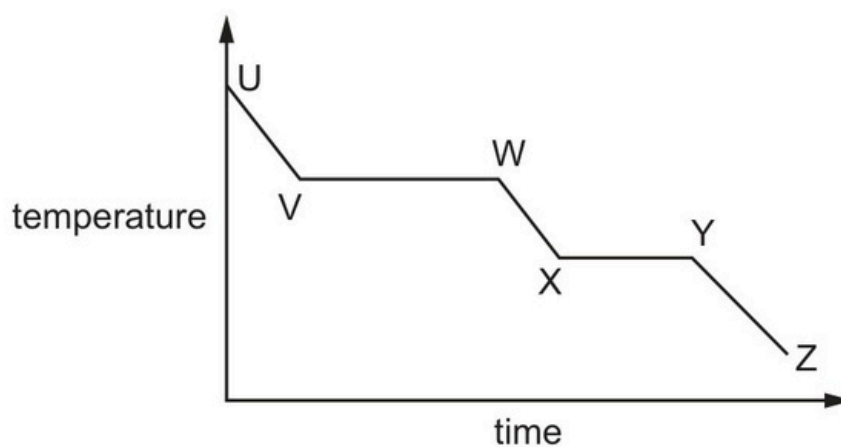
- A** P and Q **B** Q and R **C** S and T **D** T and U

Q43

0620/22/F/M/25/Q2

Heating & Cooling Curves · Hard

2 A cooling curve for a substance is shown.



Which statement is correct?

- A** Between U and V, the substance is condensing.
- B** Between V and W, heat is being absorbed from the surroundings.
- C** Between W and X, the particles are close together and randomly arranged.
- D** Between Y and Z, the substance is changing from a liquid to a solid.

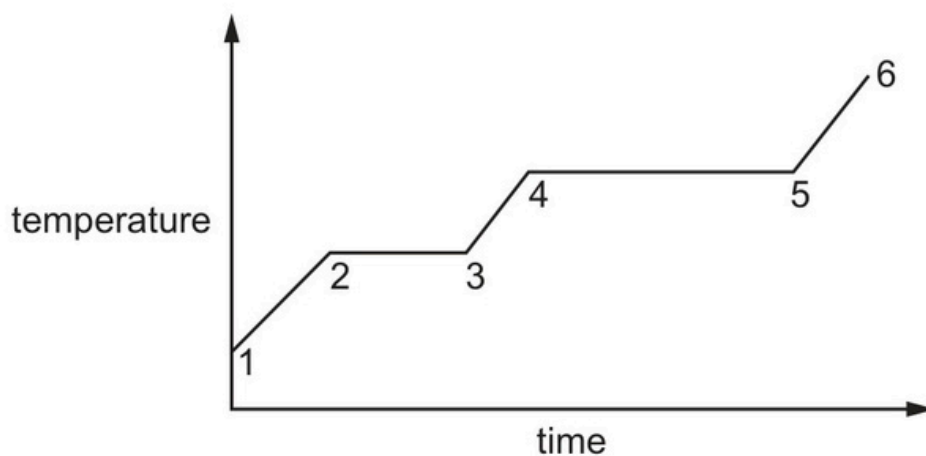
Q44

0620/21/M/J/25/Q2

Heating & Cooling Curves · Hard

- 2 A sample of ethanol is heated at a constant rate.

The heating curve for this sample is shown.



Which statement about the heating curve is correct?

- A Ethanol changes its physical state between 3 and 4.
- B Ethanol condenses between 2 and 3.
- C Energy is absorbed between 3 and 4 but **not** absorbed between 4 and 5.
- D More energy is absorbed between 4 and 5 than between 2 and 3.

Q45

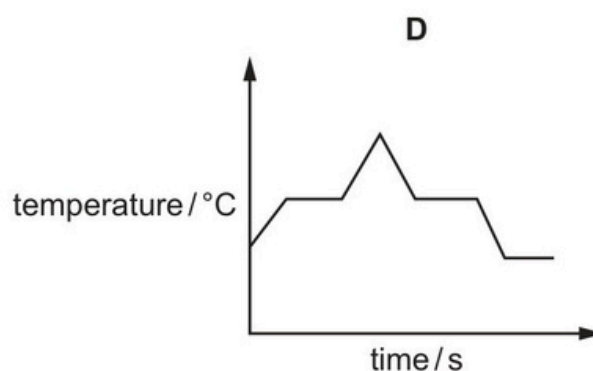
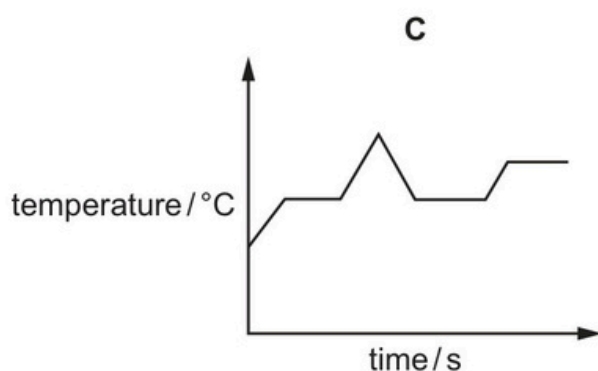
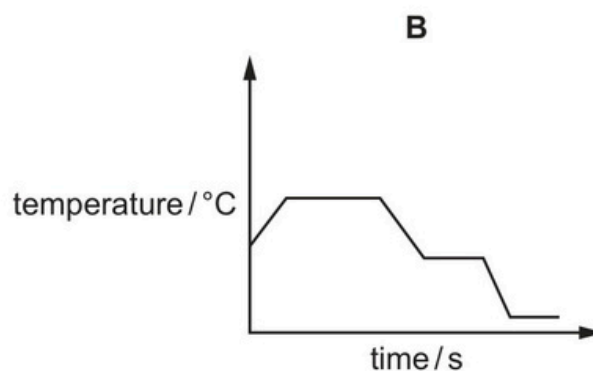
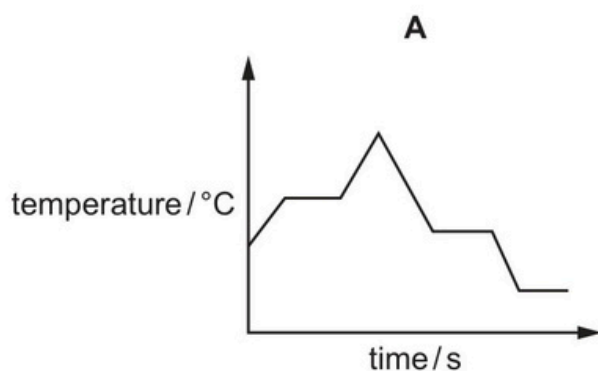
0620/22/M/J/25/Q2

Heating & Cooling Curves · Hard

2 A sample of a liquid, X, is heated to a temperature above its boiling point.

X is then cooled, so that it condenses and then freezes.

Which graph describes the change in temperature of X over time?



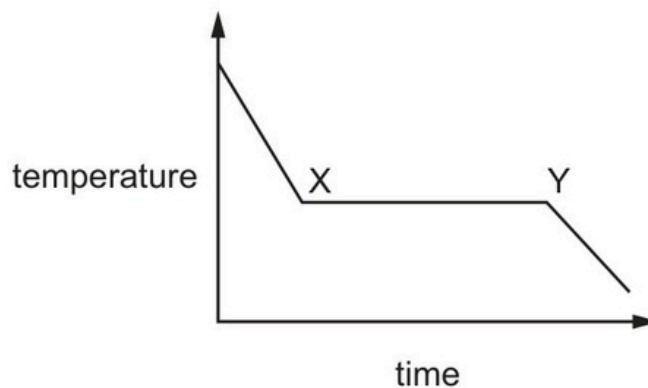
Q46

0620/23/M/J/25/Q2

Heating & Cooling Curves · Hard

- 2 Solid G is heated until it melts. It is then left to cool to room temperature.

The graph shows the cooling curve for G.



Four statements about the cooling curve between X and Y are listed.

- 1 The speed of the molecules of G decreases.
- 2 The molecules of G become less closely packed.
- 3 Thermal energy is released by the molecules of G to the surroundings.
- 4 G changes from solid to liquid.

Which statements are correct?

- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

Q47

0620/22/F/M/21/Q1

Boiling, Melting & Evaporation · Easy

Which row about a change of state is correct?

	change of state	energy change	process
A	solid → liquid	heat given out	melting
B	gas → liquid	heat taken in	evaporation
C	solid → gas	heat taken in	sublimation
D	liquid → solid	heat given out	condensing

Q48

0620/21/O/N/21/Q1

Boiling, Melting & Evaporation · Easy

Decane has a freezing point of -30°C and a boiling point of 174°C .

A small sample of decane is placed in an open beaker in an oven at a temperature of 120°C and at atmospheric pressure for 24 hours.

What happens to the sample of decane?

- A It boils.
- B It evaporates.
- C It melts.
- D It sublimes.

Q49

0620/22/F/M/22/Q1

Boiling, Melting & Evaporation · Easy

Which change of state is an exothermic process?

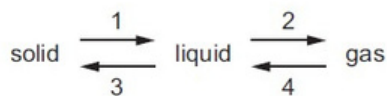
- A condensation
- B evaporation
- C melting
- D sublimation

Q50

0620/21/O/N/22/Q1

Boiling, Melting & Evaporation · Easy

The diagram shows the changes of state between a solid, a liquid and a gas.



In which changes of state is energy being given out?

- A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4

Q51

0620/22/M/J/23/Q1

Boiling, Melting & Evaporation · Easy

Four physical changes of ethanol are listed.

- 1 condensation
- 2 evaporation
- 3 freezing
- 4 boiling

In which changes do the particles move further apart?

- A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4

Q52

0620/23/O/N/24/Q1

Boiling, Melting & Evaporation · Easy

- 1 A sample of ethanol is left in an open beaker at room temperature.

After 24 hours, no ethanol remains in the beaker.

What has happened to the ethanol?

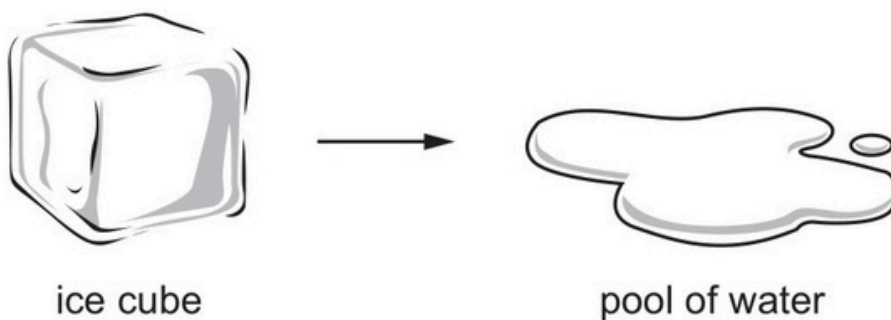
- A It has boiled.
- B It has condensed.
- C It has evaporated.
- D It has frozen.

Q53

0620/22/M/J/25/Q1

Boiling, Melting & Evaporation · Easy

- 1 An ice cube melts.



What happens to the molecules of water in the ice cube?

- A They evaporate.
- B They dissolve.
- C They gain energy.
- D They lose energy.

Q54

0620/23/M/J/21/Q2

Boiling, Melting & Evaporation · Hard

A 1 cm^3 sample of substance X is taken. This is sample 1.

X is then converted to a different physical state and a 1 cm^3 sample is taken. This is sample 2.

Sample 2 contains more particles in the 1 cm^3 than sample 1.

Which process caused this increase in the number of particles in 1 cm^3 ?

- A boiling of liquid X
- B condensation of gaseous X
- C evaporation of liquid X
- D sublimation of solid X

Q55

0620/21/M/J/24/Q2

Boiling, Melting & Evaporation · Hard

- 2 A mixture of ice and water is left to stand and the ice melts.

Which row describes what happens as the ice is melting?

	temperature of mixture	energy change
A	increases	average kinetic energy of particles decreases
B	increases	energy is used to overcome attractive forces
C	stays the same	average kinetic energy of particles decreases
D	stays the same	energy is used to overcome attractive forces

MARKING SCHEME - SOLID, LIQUID & GAS - EASY

Q	Answer	Paper reference
Q1	D	0620/22/F/M/22/Q2
Q2	D	0620/23/M/J/24/Q1
Q3	A	0620/21/O/N/24/Q1
Q4	B	0620/22/O/N/24/Q1

Q	Answer	Paper reference
Q5	A	0620/22/F/M/25/Q1
Q6	D	0620/22/O/N/25/Q1
Q7	C	0620/23/O/N/25/Q1

MARKING SCHEME - SOLID, LIQUID & GAS - HARD

Q	Answer	Paper reference
Q8	A	0620/23/M/J/23/Q1
Q9	D	0620/21/O/N/23/Q1
Q10	C	0620/23/O/N/23/Q1
Q11	B	0620/21/M/J/24/Q1
Q12	C	0620/22/O/N/24/Q2

Q	Answer	Paper reference
Q13	D	0620/23/O/N/24/Q2
Q14	A	0620/21/M/J/25/Q1
Q15	C	0620/23/M/J/25/Q1
Q16	D	0620/21/O/N/25/Q1

MARKING SCHEME - DIFFUSION - EASY

Q	Answer	Paper reference
Q17	B	0620/21/M/J/22/Q1
Q18	B	0620/22/M/J/22/Q1
Q19	B	0620/23/M/J/22/Q1
Q20	A	0620/22/O/N/22/Q1
Q21	B	0620/23/O/N/22/Q1

Q	Answer	Paper reference
Q22	D	0620/21/M/J/23/Q1
Q23	B	0620/22/F/M/23/Q2
Q24	D	0620/22/M/J/24/Q1
Q25	C	0620/22/F/M/25/Q3
Q26	A	0620/23/O/N/25/Q2

MARKING SCHEME - DIFFUSION - HARD

Q	Answer	Paper reference
Q27	C	0620/21/M/J/21/Q1
Q28	C	0620/22/M/J/21/Q1
Q29	C	0620/23/M/J/21/Q1
Q30	A	0620/22/O/N/21/Q1
Q31	B	0620/21/O/N/23/Q2
Q32	B	0620/23/O/N/23/Q2

Q	Answer	Paper reference
Q33	C	0620/22/F/M/24/Q2
Q34	D	0620/21/M/J/24/Q3
Q35	A	0620/23/M/J/24/Q2
Q36	C	0620/21/O/N/24/Q2
Q37	C	0620/21/O/N/25/Q2
Q38	C	0620/22/O/N/25/Q3

MARKING SCHEME - HEATING & COOLING CURVES - EASY

Q	Answer	Paper reference
Q39	B	0620/22/F/M/23/Q1
Q40	D	0620/22/O/N/23/Q1

Q	Answer	Paper reference
Q41	B	0620/22/F/M/24/Q1
Q42	B	0620/22/O/N/25/Q2

MARKING SCHEME - HEATING & COOLING CURVES - HARD

Q	Answer	Paper reference
Q43	C	0620/22/F/M/25/Q2
Q44	D	0620/21/M/J/25/Q2

Q	Answer	Paper reference
Q45	D	0620/22/M/J/25/Q2
Q46	B	0620/23/M/J/25/Q2

MARKING SCHEME - BOILING, MELTING & EVAPORATION - EASY

Q	Answer	Paper reference
Q47	C	0620/22/F/M/21/Q1
Q48	B	0620/21/O/N/21/Q1
Q49	A	0620/22/F/M/22/Q1
Q50	D	0620/21/O/N/22/Q1

Q	Answer	Paper reference
Q51	C	0620/22/M/J/23/Q1
Q52	C	0620/23/O/N/24/Q1
Q53	C	0620/22/M/J/25/Q1

MARKING SCHEME - BOILING, MELTING & EVAPORATION - HARD

Q	Answer	Paper reference
Q54	B	0620/23/M/J/21/Q2

Q	Answer	Paper reference
Q55	D	0620/21/M/J/24/Q2