

# Science

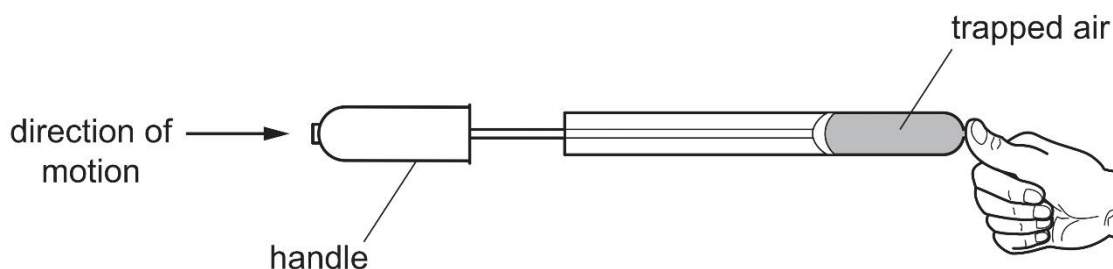
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## Multiple-Choice Questions on the Particle Theory of Matter

1. A student places his thumb firmly on the outlet of a bicycle pump, to stop the air coming out.



What happens to the pressure and what happens to the volume of the trapped air as the pump handle is pushed in?

	pressure	volume
<b>A</b>	decreases	decreases
<b>B</b>	decreases	remains the same
<b>C</b>	increases	decreases
<b>D</b>	increases	remains the same

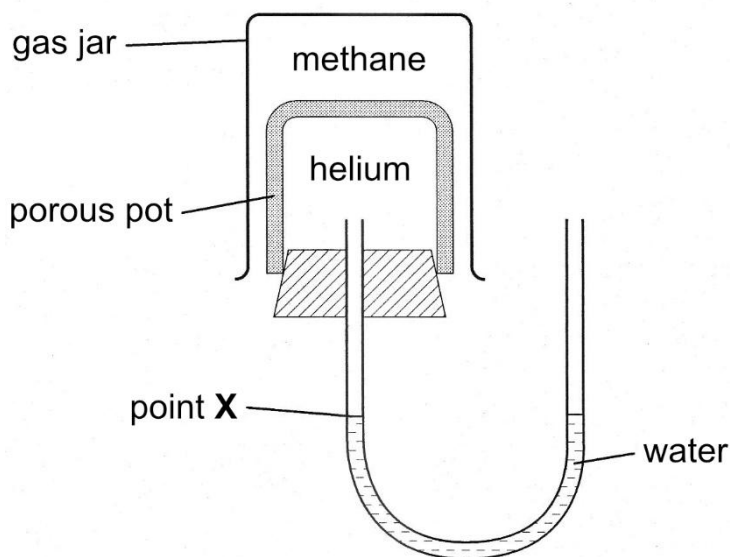
2. During evaporation, molecules escape rapidly from the surface of a liquid. What happens to the average energy of the molecules of the remaining liquid and what happens to the temperature of the remaining liquid?

	average energy of the remaining molecules	temperature of the remaining liquid
<b>A</b>	decreases	decreases
<b>B</b>	decreases	increases
<b>C</b>	stays the same	decreases
<b>D</b>	stays the same	increases

3. Extremely small pollen grains in water are viewed through a microscope. The grains are seen to move continually and randomly. What is the reason for this random movement?
- A The grains are moved by randomly moving water molecules.  
 B The grains are moved by random convection currents in the water.  
 C The grains are moved by random rays of light reflecting off them.  
 D The grains are moved by the random motion of their own atoms.
4. When steam condenses it becomes liquid water. When liquid water solidifies it becomes ice. What happens to the temperature of steam while it is condensing, and what happens to the temperature of water while it is solidifying?

	temperature of steam while it is condensing	temperature of water while it is solidifying
<b>A</b>	decreases	decreases
<b>B</b>	decreases	stays the same
<b>C</b>	stays the same	decreases
<b>D</b>	stays the same	stays the same

5. A student set-up an experiment to compare the rates at which two gases, methane ( $\text{CH}_4$ ) and helium ( $\text{He}$ ), diffuse across a porous pot.



What observation would the student make about the level of the water at point X?

- A Falls and remains at a lower level.  
 B Falls and then returns to point X.  
 C Rises and remains at a higher level.  
 D Rises and then returns to point X.

6. The table lists the melting points and the boiling points of four different substances. Which substance is a liquid at 0°C?

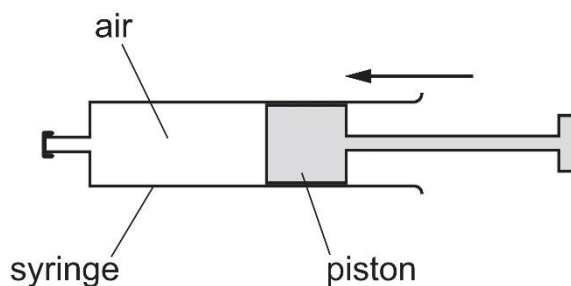
	melting point / °C	boiling point / °C
<b>A</b>	-219	-183
<b>B</b>	-7	58
<b>C</b>	98	890
<b>D</b>	1083	2582

7. A substance can exist in three different states, solid, liquid or gas. Each of the two statements below describes a change of state.
- 1 Particles move closer together but continue to travel through the substance.
  - 2 Particles stop travelling through the substance and just vibrate about fixed positions.

Which changes of state do these statements describe?

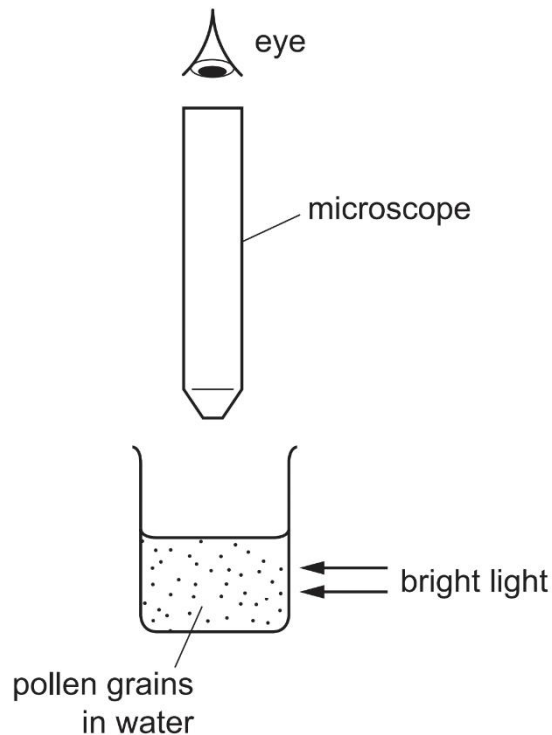
	change 1	change 2
<b>A</b>	condensation	melting
<b>B</b>	condensation	solidification
<b>C</b>	solidification	condensation
<b>D</b>	solidification	melting

8. Air in a sealed syringe is slowly compressed by moving the piston. The temperature of the air stays the same.



- A The pressure of the air decreases because its molecules now travel more slowly.
- B The pressure of the air decreases because the area of the syringe walls is now smaller.
- C The pressure of the air increases because its molecules now hit the syringe walls more frequently.
- D The pressure of the air increases because its molecules now travel more quickly.

9. Very small pollen grains are suspended in water. A bright light shines from the side. When looked at through a microscope, small specks of light are seen to be moving in a random manner.



What are the moving specks of light?

- A Pollen grains being hit by other pollen grains.
  - B Pollen grains being hit by water molecules.
  - C Water molecules being hit by other water molecules.
  - D Water molecules being hit by pollen grains.
10. At  $-39^{\circ}\text{C}$ , liquid mercury solidifies without a change of temperature. Which row shows whether the mercury absorbs or releases energy and what happens to the bonds between the mercury atoms?

	energy	bonds between atoms
A	absorbed	stronger
B	absorbed	weaker
C	released	stronger
D	released	weaker

11. Which row gives the correct name for each change of state shown?

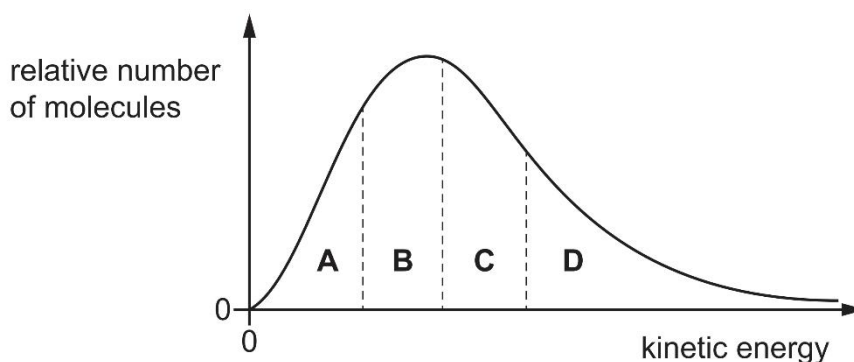
	change of state		
	gas to liquid	liquid to solid	solid to gas
<b>A</b>	condensation	melting	deposition
<b>B</b>	condensation	solidification	sublimation
<b>C</b>	evaporation	melting	deposition
<b>D</b>	evaporation	solidification	sublimation

12. Brownian motion is the random motion of particles due to molecular bombardment.

In which states of matter is Brownian motion observed?

- A** Gases, liquids and solids.
- B** Gases and liquids only.
- C** Gases and solids only.
- D** Liquids and solids only.

13. The diagram shows the relative number of molecules in a liquid that have a given kinetic energy. The graph is divided into sections so that each section contains the same number of molecules. From which section does the greatest number of molecules escape from the liquid per unit time?



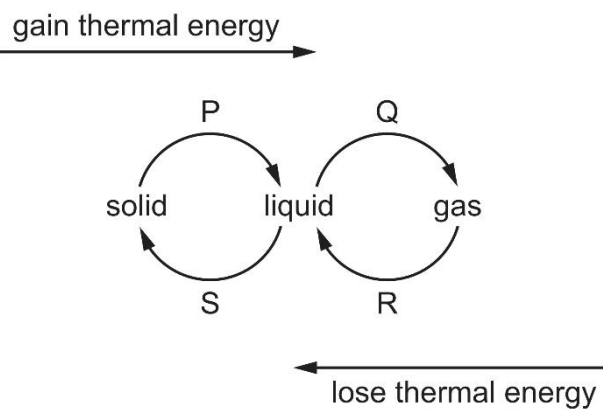
14. A pure liquid is left in an open beaker and some of the liquid molecules escape by evaporation. Which statement about this process is correct?

- A** None of the escaping molecules return to the liquid.
- B** The escaping molecules are generally the more energetic ones.
- C** The rate of escape of the molecules can be increased by increasing the depth of the liquid in the beaker.
- D** The temperature of the remaining liquid is unaffected by the escape of the molecules.

15. When a liquid evaporates, some molecules escape. The temperature of the remaining liquid changes. What is the effect on the temperature and from where do the molecules escape?

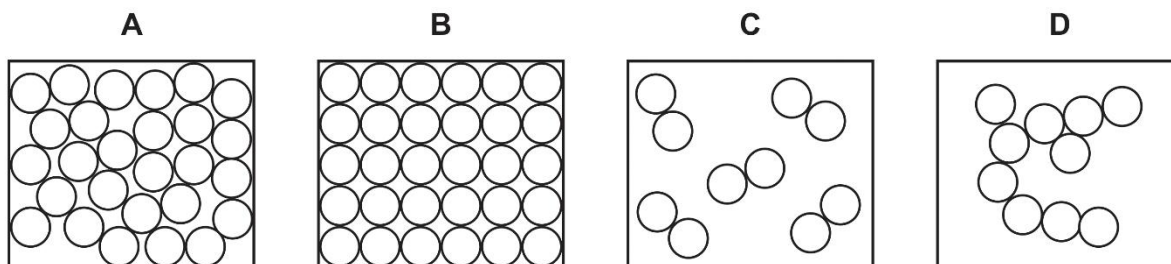
	temperature of liquid	molecules escape from
<b>A</b>	decreases	everywhere within the liquid
<b>B</b>	decreases	the surface only
<b>C</b>	increases	everywhere within the liquid
<b>D</b>	increases	the surface only

16. The diagram shows the changes of state **P**, **Q**, **R** and **S** that occur in solids, liquids and gases when they gain or lose thermal energy. Which change in state is represented by **R**?



- A** Condensation  
**B** Solidification  
**C** Boiling  
**D** Melting
17. A sample of mercury is heated. In which state(s) of matter will its volume increase as its temperature rises?
- A** Gas only  
**B** Liquid and gas only  
**C** Solid and liquid only  
**D** Solid, liquid and gas
18. When water evaporates, what escapes from the surface of the water?
- A** Individual atoms  
**B** Individual molecules  
**C** Individual protons  
**D** Tiny drops of water
19. Which statement is correct?
- A** A solid can flow.  
**B** A solid can be compressed easily.  
**C** A solid has a fixed shape.  
**D** A solid takes the shape of its container.

20. What is the correct particle diagram for a solid?



21. A sealed box contains a fixed mass of gas. Which action results in each molecule of the gas colliding with the walls of the container less frequently and with a smaller force?

- A Decrease the temperature of the gas.
- B Decrease the volume of the container.
- C Increase the temperature of the gas.
- D Increase the volume of the container.

22. Initially, the molecules of a substance are close together. They move past each other and change position. During a specific change of state, the molecules of the substance become slightly closer together and vibrate about fixed positions. What is the change of state?

- A Boiling
- B Condensation
- C Melting
- D Solidification

23. A student writes three statements about what happens when the air in a balloon cools.

- 1 The molecules move closer together.
- 2 The molecules become smaller.
- 3 The mass of the molecules decreases.

Which statement(s) is / are correct?

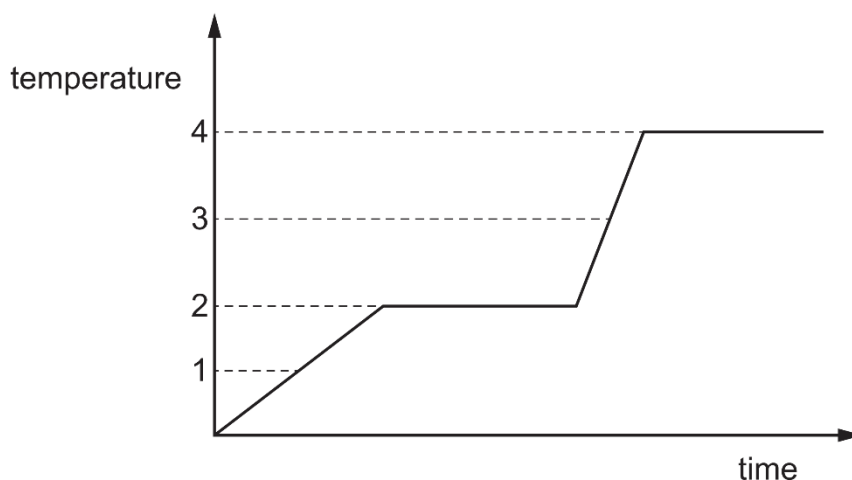
- A 1 only
- B 1 and 2 only
- C 2 and 3 only
- D 1, 2 and 3

24. Steam at  $110\text{ }^{\circ}\text{C}$  condenses on a surface to form water droplets at  $100\text{ }^{\circ}\text{C}$ .

What happens after the steam comes into contact with the surface?

- A The molecules slow down and absorb energy from the surroundings.
- B The molecules slow down and release energy to the surroundings.
- C The molecules stay at the same speed and absorb energy from the surroundings.
- D The molecules stay at the same speed and emit energy to the surroundings.

25. The graph shows how the temperature of a fixed amount of a material changes when heated at a constant rate.



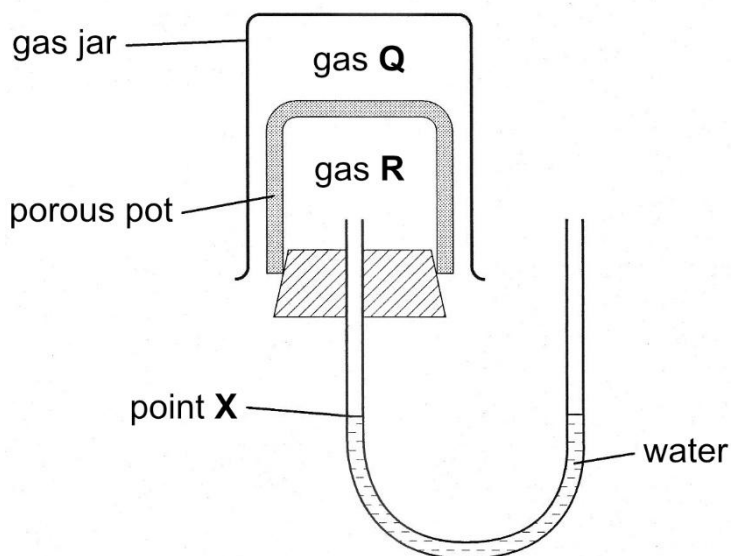
Which row shows the melting point and the boiling point of the material?

	melting point	boiling point
<b>A</b>	1	3
<b>B</b>	1	4
<b>C</b>	2	3
<b>D</b>	2	4

26. A student investigates the melting point of a pure substance. She heats the substance slowly and takes readings of its temperature as the substance starts to melt and when it finishes melting. Which statement is correct?
- A** The temperature decreases slightly as the substance melts.
  - B** The temperature fluctuates as the substance melts.
  - C** The temperature increases as the substance melts.
  - D** The temperature stays the same as the substance melts.
27. Kinetic particle theory states that all matter is composed of extremely small particles which are in a constant state of random motion. Which one of the following is the **best** evidence to support the kinetic particle theory?
- A** Gases can be compressed.
  - B** Liquids have a fixed volume but no fixed shape.
  - C** The aroma of a perfume can be smelt throughout an entire room.
  - D** A solid will expand on heating.



28. A student set-up an experiment to investigate the rates at which different gases diffuse through a porous pot. A diagram of the student's experiment is shown below.



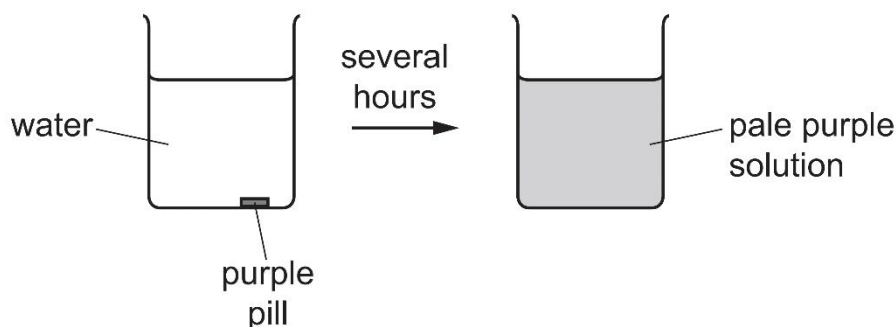
Which two gases would **not** cause the level of the water at point X to change?

	gas Q	gas R
A	hydrogen ( $H_2$ )	nitrogen ( $N_2$ )
B	carbon dioxide ( $CO_2$ )	argon (Ar)
C	ethene ( $C_2H_4$ )	carbon monoxide (CO)
D	oxygen ( $O_2$ )	neon (Ne)

29. Why does neon gas, Ne, diffuse faster than carbon dioxide gas,  $CO_2$ ?
- A Neon atoms have the lower mass.
  - B Neon does not form molecules.
  - C Neon is a noble gas.
  - D Neon is less dense than air.
30. Why does a balloon full of helium gas become smaller as the temperature changes from  $30\text{ }^\circ\text{C}$  to  $10\text{ }^\circ\text{C}$ ?
- A The gas condenses to a liquid and so takes up less space.
  - B The gas particles become smaller at lower temperatures.
  - C The gas particles diffuse through the balloon and escape.
  - D The gas particles move more slowly so reducing the pressure.

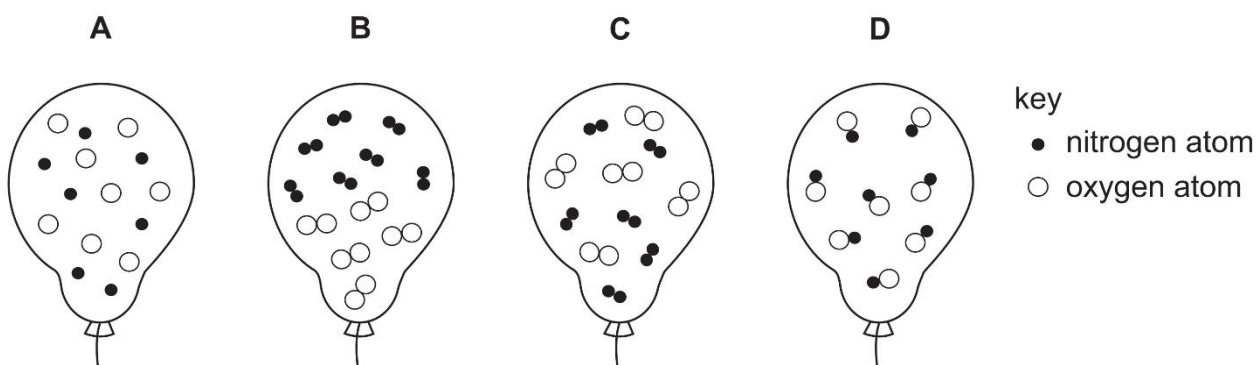
31. Which statement explains why the gases propane,  $C_3H_8$ , and carbon dioxide,  $CO_2$ , diffuse at the same rate at room temperature and pressure?
- A Both are denser than air.
  - B Both compounds contain carbon.
  - C Both molecules contain covalent bonds.
  - D They have the same relative molecular mass,  $M_r$ .

32. A purple pill is placed in a beaker of water. The beaker is left for several hours. The diagram shows the appearance of the water when the pill is added and several hours later.



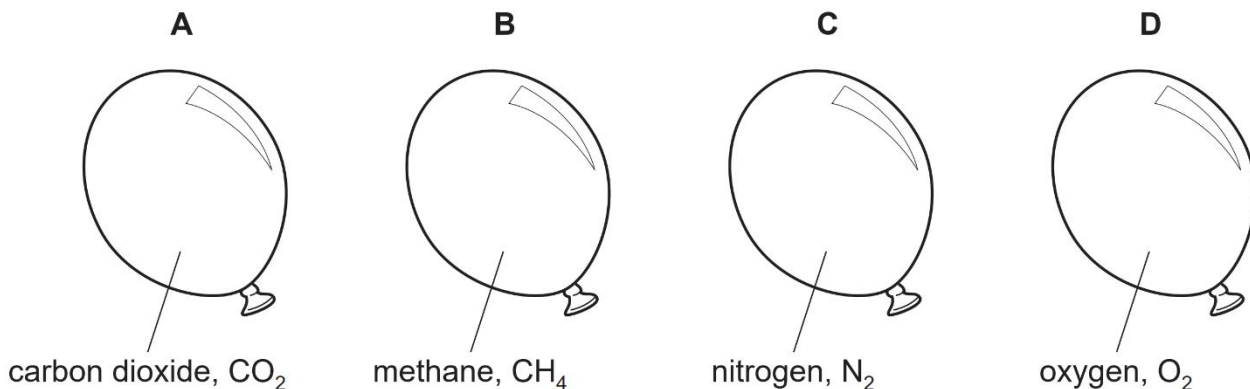
Which statement explains why this change occurs?

- A Diffusion occurs because the pill is coloured.
  - B Diffusion occurs faster at higher temperatures.
  - C Diffusion occurs from an area of high concentration to one of lower concentration.
  - D Gases diffuse faster than liquids.
33. Which diagram shows the arrangement of particles inside a balloon containing a mixture of the gases nitrogen and oxygen?

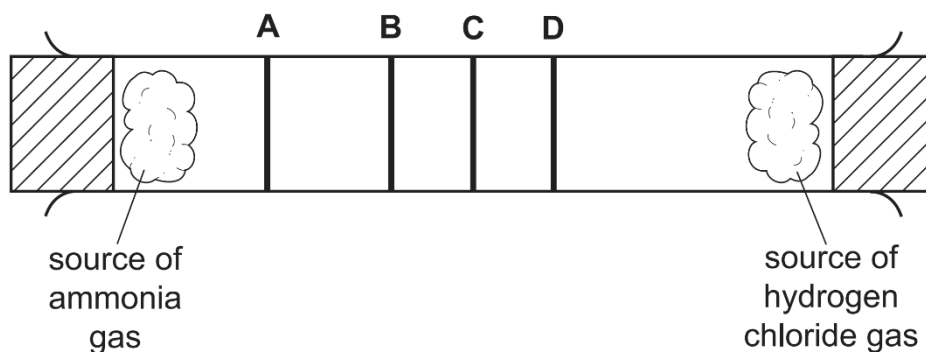


34. Which statement is **not** correct?
- A Energy is released when a liquid changes into a solid.
  - B Particles move faster in the gaseous state than in the liquid state.
  - C The carbon atoms in gaseous methane are further apart than those in liquid methane.
  - D There is a large decrease in the volume of a solid metal when pressure is applied to it.

35. An inflated balloon goes down because gas molecules can diffuse through the rubber. Four balloons are filled with different gases at the same temperature and pressure. Which balloon would go down quickest?

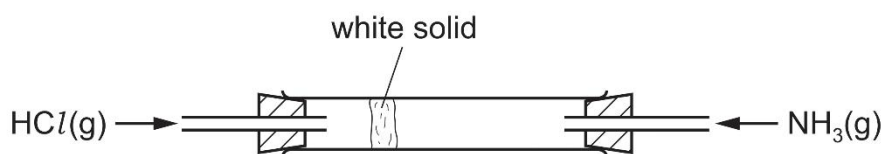


36. The diagram shows the apparatus used to compare rates of diffusion of ammonia,  $\text{NH}_3$ , and hydrogen chloride,  $\text{HCl}$ . At which labelled position did a white deposit of ammonium chloride form?



37. What can be deduced about two gases that have the same relative molecular mass,  $M_r$ ?
- A They have the same boiling point.
  - B They have the same number of atoms in one molecule.
  - C They have the same rate of diffusion at room temperature and pressure.
  - D They have the same solubility in water at room temperature.
38. A gas cylinder is placed in each of the four corners of a square room. Each cylinder contains a different gas stored under the same pressure. The gases are released at exactly the same time. Which gas will reach the centre of the room first?
- A Ammonia,  $\text{NH}_3$
  - B Argon, Ar
  - C Carbon monoxide, CO
  - D Chlorine,  $\text{Cl}_2$

39. Two gases, ammonia and hydrogen chloride, at an equal pressure, are allowed to enter the apparatus shown.



After a time, a white solid forms on the inside of the tube.

Which statements explain why a white solid forms in the position shown?

1 Ammonia and hydrogen chloride react to form solid ammonium chloride.

2 Ammonia diffuses faster than hydrogen chloride.

3 Ammonia has a lower relative molecular mass than hydrogen chloride.

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

40. Hydrogen sulfide,  $\text{H}_2\text{S}$ , and hydrogen chloride,  $\text{HCl}$ , are both gases at temperatures above  $-50\text{ }^\circ\text{C}$ . Which gas will diffuse most rapidly at the temperature given?

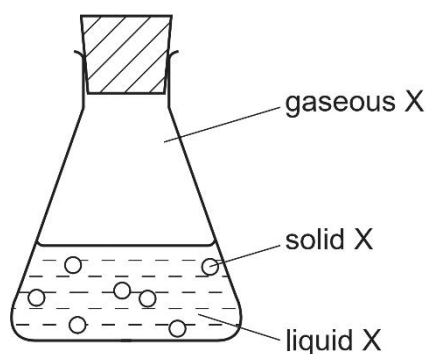
**A** Hydrogen chloride at  $-40\text{ }^\circ\text{C}$

**B** Hydrogen chloride at  $-20\text{ }^\circ\text{C}$

**C** Hydrogen sulfide at  $-40\text{ }^\circ\text{C}$

**D** Hydrogen sulfide at  $-20\text{ }^\circ\text{C}$

41. The conical flask contains compound **X** which is present in solid, liquid and gaseous states.



Which statement is correct?

**A** A gaseous **X** molecule has a lower mass than a liquid **X** molecule.

**B** Energy is released when **X** changes from a liquid to a solid.

**C** Liquid **X** is at a higher temperature than solid **X**.

**D** Liquid **X** molecules vibrate about fixed positions.

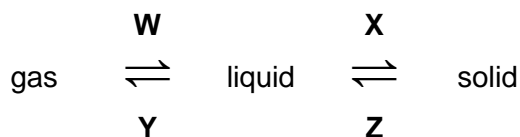
42. Impurities change the melting and boiling points of substances.

Sodium chloride is added to a sample of pure water.

How does the addition of sodium chloride affect the melting point and the boiling point of the water?

	melting point	boiling point
<b>A</b>	increases	increases
<b>B</b>	decreases	decreases
<b>C</b>	increases	decreases
<b>D</b>	decreases	increases

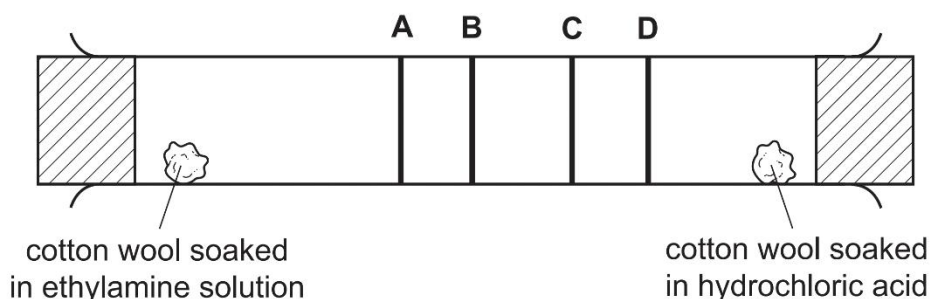
43. In which changes of state do the particles move further apart?



- A** W and X      **B** W and Z      **C** X and Y      **D** Y and Z

44. Ethylamine gas,  $\text{C}_2\text{H}_5\text{NH}_2$ , and hydrogen chloride gas,  $\text{HCl}$ , react together to form a white solid, ethylamine hydrochloride.

At which position in the tube would a ring of solid white ethylamine hydrochloride form?



45. Which statements are correct?

- 1 The volume of a gas at constant pressure increases as the temperature increases.
- 2 The rate of diffusion of a gas increases as the temperature increases.
- 3 The pressure of a gas at constant volume decreases as the temperature increases.

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

46. Why does a balloon full of helium gas become smaller as the temperature changes from 30 °C to 10 °C?

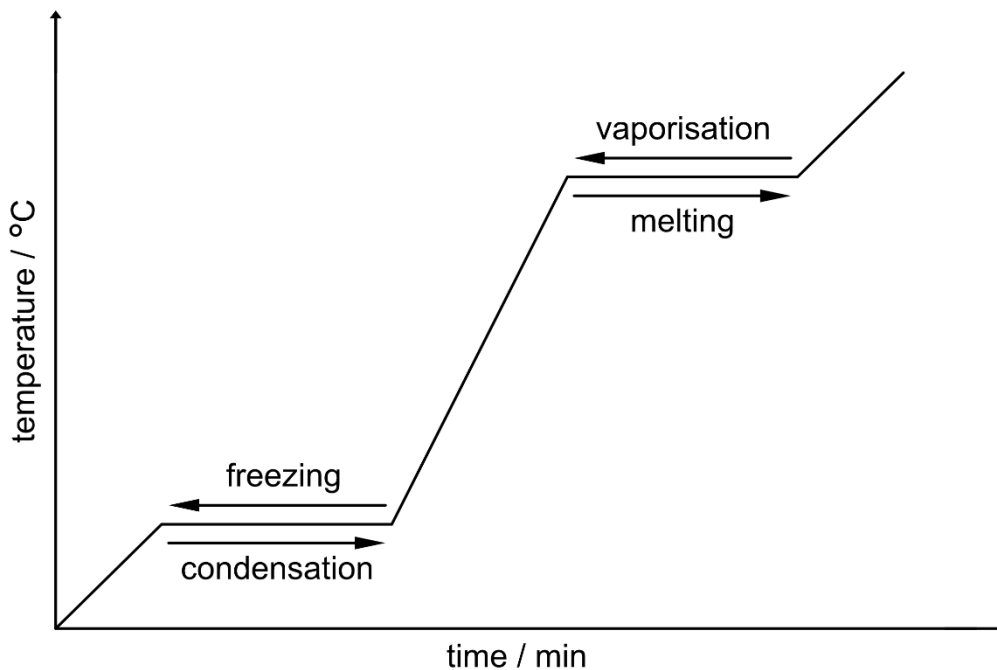
- A The gas condenses to a liquid and so takes up less space.
- B The gas particles become smaller at lower temperatures.
- C The gas particles diffuse through the balloon and escape.
- D The gas particles move more slowly so reducing the pressure.

47. The rate of diffusion of carbon dioxide, CO<sub>2</sub>, and methane, CH<sub>4</sub>, is investigated at two different temperatures, one high and one low.

Which row correctly shows the gas that diffuses faster and the temperature at which diffusion takes place most rapidly?

	gas	temperature
A	carbon dioxide	high
B	carbon dioxide	low
C	methane	high
D	methane	low

48. The graph shows the temperature of a solid as it is heated.



Which change is labelled correctly?

- A Condensation
- B Freezing
- C Melting
- D Vaporisation

- Scan the QR Code below to view the answers to this assignment.



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