1 A liquid flows continuously through a chamber that contains an electric heater. When the steady state is reached, the liquid leaving the chamber is at a higher temperature than the liquid entering the chamber. The difference in temperature is Δt.

Which of the following will increase Δt with no other change?

A Increasing the volume flow rate of the liquid

B Changing the liquid to one with a lower specific heat capacity

C Using a heating element with a higher resistance

D Changing the liquid to one that has a higher density

(Total 1 mark)

2 The temperature of a hot liquid in a container falls at a rate of 2 K per minute just before it begins to solidify. The temperature then remains steady for 20 minutes by which time all the liquid has all solidified.

What is the quantity $\frac{\text{Specific heat capacity of the liquid}}{\text{Specific latent heat of fusion}}$?

A $\frac{1}{40}\,\text{K}^{-1}$

B $\frac{1}{10}\,\text{K}^{-1}$

C $10\ \text{K}^{-1}$

D $40\ \text{K}^{-1}$

(Total 1 mark)

3 A fixed mass of gas occupies a volume V. The temperature of the gas increases so that the root mean square velocity of the gas molecules is doubled.
What will the new volume be if the pressure remains constant?

A $\frac{V}{2}$ ☐

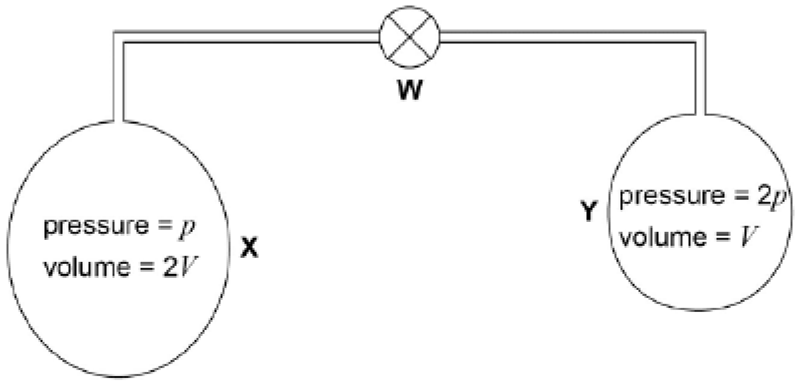
B $\frac{V}{\sqrt{2}}$ ☐

C $2V$ ☐

D $4V$ ☐

(Total 1 mark)

4 **X** and **Y** are two gas bottles that are connected by a tube that has negligible volume compared with the volume of each bottle.



Initially the valve **W** is closed.

X has a volume $2V$ and contains hydrogen at a pressure of p.
Y has a volume V and contains hydrogen at a pressure of $2p$.
X and **Y** are both initially at the same temperature.

W is now opened. Assuming that there is no change in temperature, what is the new gas pressure?

A $\frac{2}{3}p$ ☐

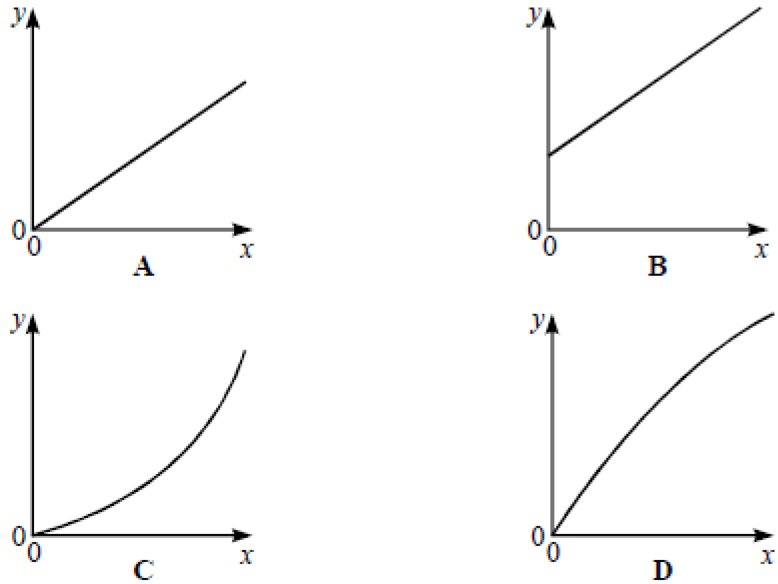
B $\frac{5}{3}p$ ☐

C $\frac{4}{3}p$ ☐

D $\frac{3}{2}p$ ☐

(Total 1 mark)

5 Which one of the graphs below shows the relationship between the internal energy of an ideal gas (y-axis) and the absolute temperature of the gas (x-axis)?



(Total 1 mark)

6 The temperature of a room increases from 283K to 293K. The r.m.s. speed of the air molecules in the room increases by a factor of

A 1.02

B 1.04

C 1.41

D 2.00

(Total 1 mark)

7 A fixed mass of an ideal gas initially has a volume V and an absolute temperature T. Its initial pressure could be doubled by changing its volume and temperature to

A V/2 and 4T

B V/4 and T/2

C 2V and T/4

D 4V and 2T

(Total 1 mark)

8 A car of mass M travelling at speed V comes to rest using its brakes. Energy is dissipated in the brake discs of total mass m and specific heat capacity c. The rise in temperature of the brake discs can be estimated from

A $\frac{mV^2}{2Mc}$

B $\frac{2MV^2}{mc}$

C $\frac{MV^2}{2mc}$

D $\frac{2mc}{MV^2}$

(Total 1 mark)

9 Which one of the following is **not** an assumption about the properties of particles in the simple kinetic theory?

A $< c^2 >$ is the average speed of the particles

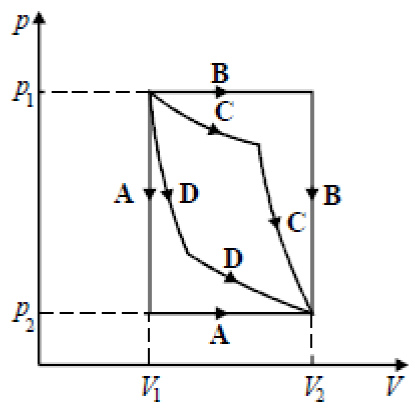
B The forces between the particles are negligible except when particles collide

C The time spent by particles in collision is negligible compared with the time spent between collisions

D The volume of the particles is negligible compared to the volume of the container

(Total 1 mark)

10 The diagram shows a p-V graph for a fixed mass of gas. The volume increases from V_1 to V_2 while the pressure falls from p_1 to p_2.

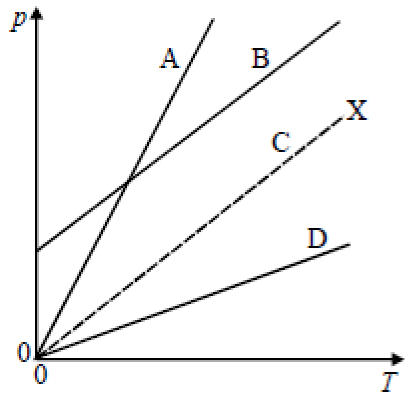


Which one of the paths **A**, **B**, **C** or **D** will result in the greatest amount of work being done by the gas?

(Total 1 mark)

11 In the diagram the dashed line **X** shows the variation of pressure, p, with absolute temperature, T, for 1 mol of an ideal gas in a container of fixed volume.

Which line, **A**, **B**, **C** or **D** shows the variation for 2 mol of the gas in the same container?



(Total 1 mark)

12 A raindrop of mass m falls to the ground at its terminal speed v. The specific heat capacity of water is c and the acceleration of free fall is g. Given that 25% of the energy is retained in the raindrop when it strikes the ground, what is the rise in temperature of the raindrop?

A $\frac{mv^2}{8c}$

B $\frac{v^2}{4mc}$

C $\frac{mg}{4c}$

D $\frac{v^2}{8c}$

(Total 1 mark)

13 At a certain temperature, the root-mean-square speed of the molecules of a fixed volume of an ideal gas is c. The temperature of the gas is changed so that the pressure is halved. The root-mean-square speed of the molecules becomes

A $\frac{c}{4}$

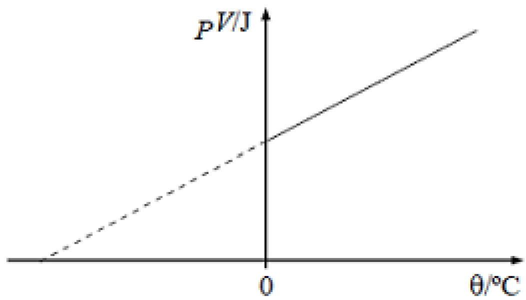
B $\frac{c}{2}$

C $\frac{c}{\sqrt{2}}$

D 2c

(Total 1 mark)

14 The graph shows the relation between the product *pressure* × *volume*, pV, and temperature, θ, in degrees celsius for 1 mol of an ideal gas for which the molar gas constant is R.



Which one of the following expressions gives the gradient of this graph?

A $\frac{1}{273}$

B $\frac{pV}{\theta}$

C $\frac{pV}{(\theta - 273)}$

D R

(Total 1 mark)

15 A 1.0 kΩ resistor is thermally insulated and a potential difference of 6.0 V is applied to it for 2.0 minutes. The thermal capacity of the resistor is 9.0 J K^{-1}. The rise in temperature, in K, is

A 1.3×10^{-3}

B 8.0×10^{-3}

C 0.48

D 0.80

(Total 1 mark)

Mark schemes

1	B	[1]
2	A	[1]
3	D	[1]
4	C	[1]
5	A	[1]
6	A	[1]
7	B	[1]
8	C	[1]
9	A	[1]
10	B	[1]
11	A	[1]
12	D	[1]
13	C	[1]
14	D	[1]
15	C	[1]