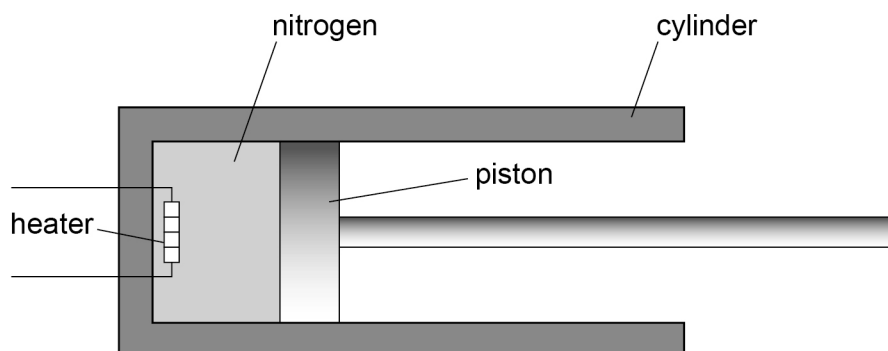


Section AAnswer **all** questions in this section.**0 1**

Figure 1 shows a perfectly insulated cylinder containing 0.050 kg of liquid nitrogen at a temperature of 70 K.

A heater transfers energy at a constant rate of 12 W to the nitrogen.

A piston maintains the pressure at 1.0×10^5 Pa during the heating process.

Figure 1**not to scale**

0	1	.	1
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The nitrogen is heated from 70 K and is completely turned into a gas after 890 s.

Calculate the specific heat capacity of liquid nitrogen.
Give an appropriate unit for your answer.

specific latent heat of vaporisation of nitrogen = $2.0 \times 10^5 \text{ J kg}^{-1}$

boiling point of nitrogen = 77 K

[5 marks]

specific heat capacity = _____ unit = _____

Question 1 continues on the next page

Turn over ►



0	1	.	2
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The work done by the nitrogen in the cylinder when expanding due to a change of state is **X**.

The energy required to change the state of the nitrogen from a liquid to a gas is **Y**.

Deduce which is greater, **X** or **Y**.

density of liquid nitrogen at its boiling temperature = 810 kg m^{-3}

density of nitrogen gas at its boiling temperature = 3.8 kg m^{-3}

[4 marks]

9



0 2 . 1 State what is meant by the internal energy of a gas.

[2 marks]

0 2 . 2 Absolute zero of temperature can be interpreted in terms of the ideal gas laws or the kinetic energy of particles in an ideal gas.

Describe these two interpretations of absolute zero of temperature.

[2 marks]

Question 2 continues on the next page

Turn over ►



0 2 . 3

A mixture of argon atoms and helium atoms is in a cylinder enclosed with a piston. The mixture is at a temperature of 310 K.

Calculate the root mean square speed (c_{rms}) of the argon atoms in the mixture.

$$\text{molar mass of argon} = 4.0 \times 10^{-2} \text{ kg mol}^{-1}$$

[3 marks]

$$c_{\text{rms}} = \underline{\hspace{10cm}} \text{ m s}^{-1}$$

0 2 . 4

Compare the mean kinetic energy of the argon atoms and the helium atoms in the mixture.

[1 mark]

0 2 . 5

Explain, in terms of the kinetic theory model, why a pressure is exerted by the gas on the piston.

[3 marks]



Do not write
outside the
box

0 2 . 6

The mixture of gases in the cylinder stays the same.

Explain, using the kinetic theory model, **two** changes that can be made independently to reduce the pressure exerted by the gas.

[3 marks]

14

Turn over ►



Section B

Each of Questions **07** to **31** is followed by four responses, **A**, **B**, **C** and **D**.

For each question select the best response.

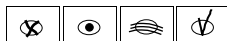
Only **one** answer per question is allowed.

For each question completely fill in the circle alongside the appropriate answer.

CORRECT METHOD



WRONG METHODS



If you want to change your answer you must cross out your original answer as shown.



If you wish to return to an answer previously crossed out, ring the answer you now wish to select as shown.



You may do your working in the blank space around each question but this will not be marked.
Do **not** use additional sheets for this working.

07

Brownian motion

[1 mark]

- A** makes it possible to see the motion of air molecules.
- B** is caused by the collisions of smoke particles.
- C** is caused by collisions between air molecules and smoke particles.
- D** occurs because air is a mixture of gases and the molecules have different masses.

Turn over for the next question

Turn over ►

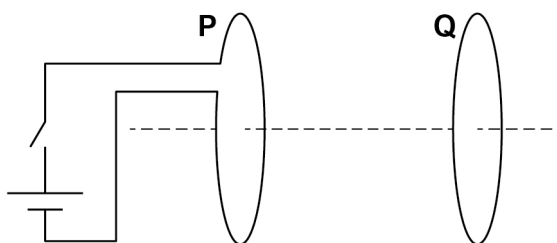


2 5 Which is **not** an assumption about gas particles in the kinetic theory model for a gas?

[1 mark]

- A** They collide elastically with the container walls.
- B** They have negligible size compared to the distance between the container walls.
- C** They travel between the container walls in negligibly short times.
- D** They collide with the container walls in negligibly short times.

2 6 A coil **P** is connected to a cell and a switch.
A second closed coil **Q** is parallel to **P** and is arranged on the same axis.



When the switch is closed, coil **Q** experiences a force.

Which row describes the force on **Q**?

[1 mark]

	Force	Direction of force	
A	increases to constant value	to left	<input type="radio"/>
B	increases to constant value	to right	<input type="radio"/>
C	increases then decreases	to left	<input type="radio"/>
D	increases then decreases	to right	<input type="radio"/>

Turn over ►

