Ideal Gas Molecules

Question Paper

Level	GCSE
Subject	Physics
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1P)
Topic	Solids, Liquids and Gases
Sub-Topic	Ideal Gas Molecules
Booklet	Question Paper

Time Allowed: **56 minutes**

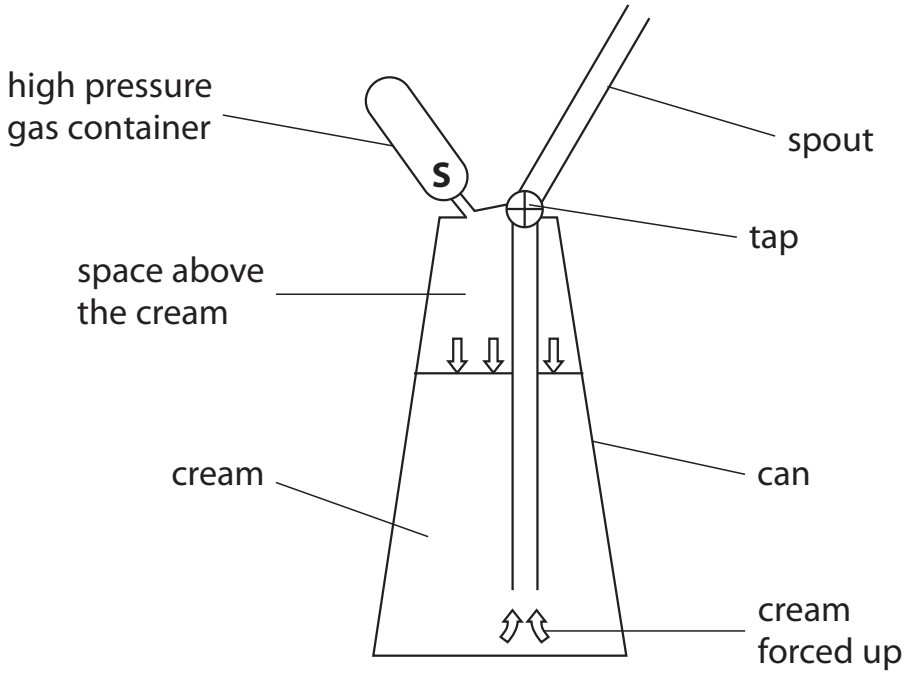
Score: **/47**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	70%	60%	55%	50%	<50%

1. The diagram shows a can that produces whipped cream using gas at high pressure.



The volume of the high pressure gas container is 10 cm^3.

The pressure of the gas is 10 000 kPa.

When the seal at **S** is broken, the gas is released into the space above the cream.

The gas expands to a total volume of 270 cm^3.

(a) Calculate the new pressure of the gas.

(2)

Pressure = ... kPa

(b) As the gas expands into the space above the cream, its temperature decreases.

Using ideas about molecules, explain how this affects the pressure of the gas.

(3)

(c) Some of the gas molecules dissolve into the cream.

(i) Suggest how this affects the pressure of the gas in the space above the cream.

(2)

(ii) When the tap is opened, the pressure of the gas forces the cream out of the spout. The pressure outside the can is less than it is inside.

Suggest what happens to the dissolved gas as the cream leaves the can.

(1)

(Total for Question 1 = 8 marks)

2. Compressed air from a can is used to clean computer keyboards.

(a) Use ideas about particles to explain how a gas causes a pressure on the inside of a container.

(3)

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(b) The can has a warning sign on it.

WARNING Pressurised container Do not expose to temperatures above 50 ºC

(i) How would increasing the temperature of the compressed air affect the pressure in the can?

(1)

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(ii) Explain your answer.

(2)

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(c) The can has a volume of 400 cm^3 and the pressure of the compressed air inside is 5 times atmospheric pressure.

Calculate the volume that the air would occupy if it were all released to atmospheric pressure.

(2)

Volume = ... cm^3

(Total for Question 2 = 8 marks)

3. (a) Temperature can be measured using different scales.

Complete the table by inserting the missing temperatures.

(2)

Temperature	Boiling point of liquid nitrogen	Boiling point of water
in °C		100
in Kelvin	77	

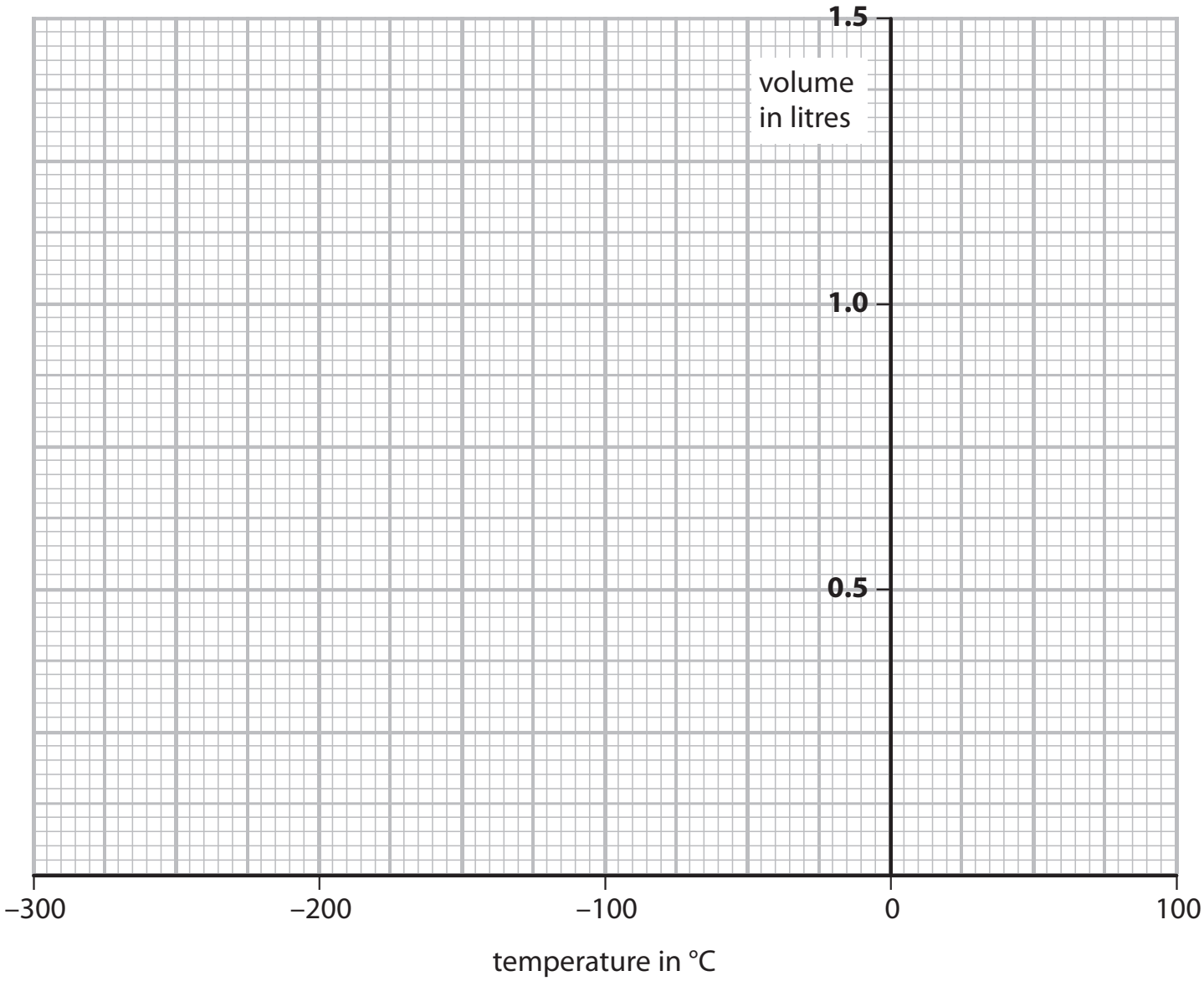
(b) Some students measure the volume of a sample of gas at different temperatures.

The table below shows their results.

Temperature in °C	Volume in litres
– 20	0.95
0	0.85
50	1.20
80	1.30
100	1.40

(i) Draw a graph to show how the volume of gas varies with temperature.

(3)



(ii) Circle the anomalous point on your graph.

(1)

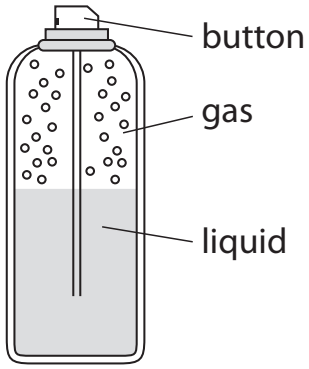
(iii) Use your graph to find the temperature of the gas when its volume is zero.

(1)

temperature = ... °C

(Total for Question 3 = 7 marks)

4. A spray-can contains gas particles that are constantly moving.



(a) (i) How do the gas particles produce a pressure on the walls of the spray-can?

(3)

(ii) A student presses the button and some liquid leaves the can.

The student concludes

I think that the gas pressure in the spray-can decreases as the liquid leaves the can.

Evaluate this conclusion.

(3)

(b) What happens to the average speed of the gas particles when the spray-can is warmed by the sun on a hot day?

(1)

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(Total for Question 4 = 7 marks)

5. (a) A diver breathes air from a cylinder when he is under water.

(i) The cylinder contains 8 litres of air at 200 times atmospheric pressure.

The air is released from the cylinder at normal atmospheric pressure.

The diver needs 16 litres of air per minute.

Calculate the maximum amount of time that the diver can breathe under water using this cylinder.

(3)

time = ... minutes

(ii) When the diver breathes out, bubbles are released.

Suggest why the bubbles expand as they rise to the surface.

(2)

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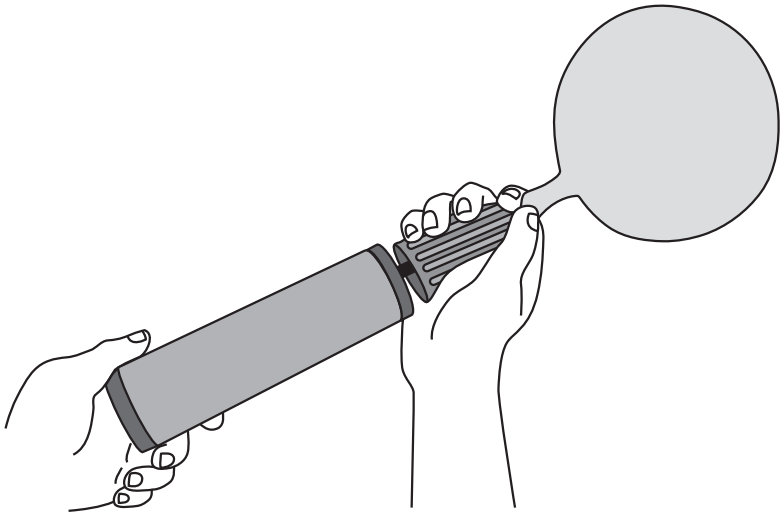
(b) A student wants to investigate how the volume of a balloon changes with pressure.



(i) Suggest how the student could measure the volume of an inflated balloon.

(2)

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(ii) The student plans to measure the pressure of the air in the balloon.

> To measure the pressure in the balloon I will count how many times I push the pump. The same amount of air goes into the balloon with each push.
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> When there is twice as much air in the balloon the pressure will be twice as high, so the pressure will be proportional to the number of times I push the pump.

Explain why the student's plan will not work.

(2)

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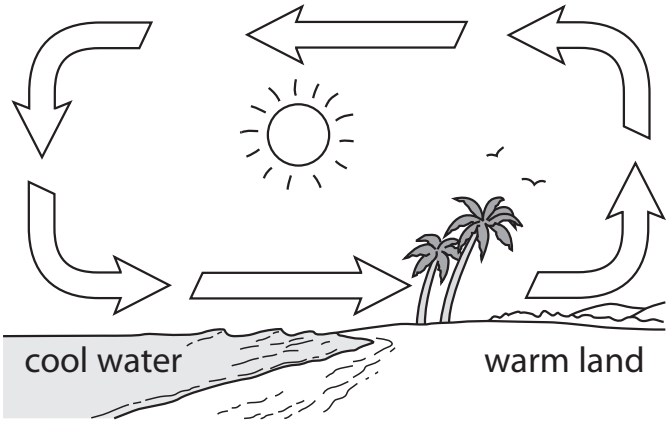
(Total for Question 5 = 9 marks)

6. The diagram shows how air moves near the coast on a warm day.



(a) Explain why air moves as shown on the diagram.

(5)

(b) Explain how Brownian motion provides evidence that air is made of small particles.

(3)

(Total for Question 6 = 8 marks)

7 John Leslie was a scientist who investigated heat and thermometers.

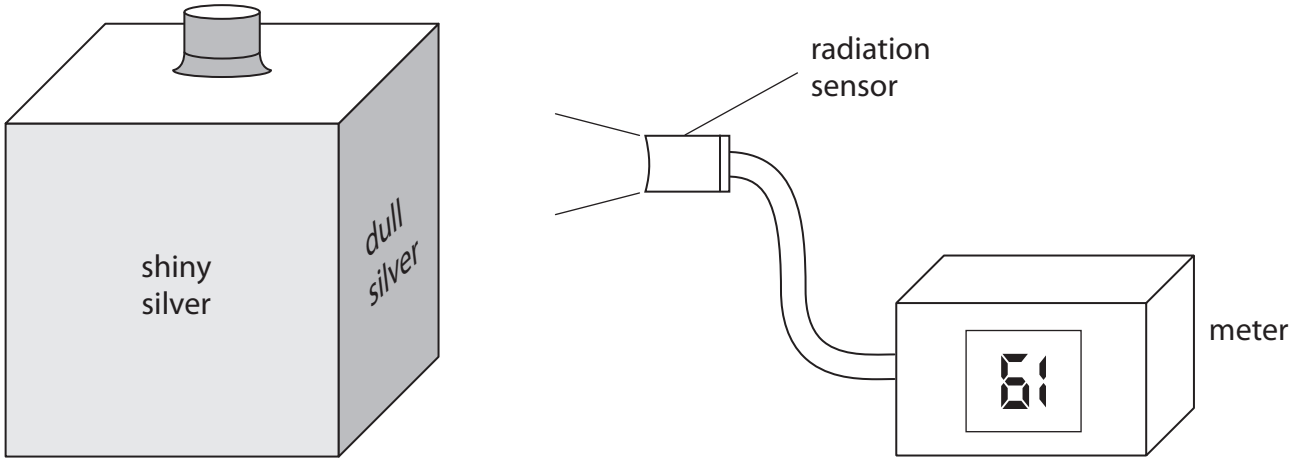
He experimented with a hollow metal cube. The cube had different surfaces on each side and was filled with boiling water.

(a) A student uses a modern version of Leslie's cube to investigate how the surface of a hot object affects the radiation emitted.

She uses a cube with four different vertical surfaces.

She fills the cube with boiling water so that the temperature of each surface is the same.

She uses the radiation sensor to measure the radiation emitted from each surface.



(i) The student's results are shown below.

Draw a line linking each surface colour with its correct meter reading.

One has been done for you.

(2)

surface colour	meter reading
shiny black	87
dull black	61
dull silver	70
shiny silver	47

(ii) The temperature of each surface is the same, but the radiation sensor gives a different reading for each surface.

What can you conclude from this?

(1)

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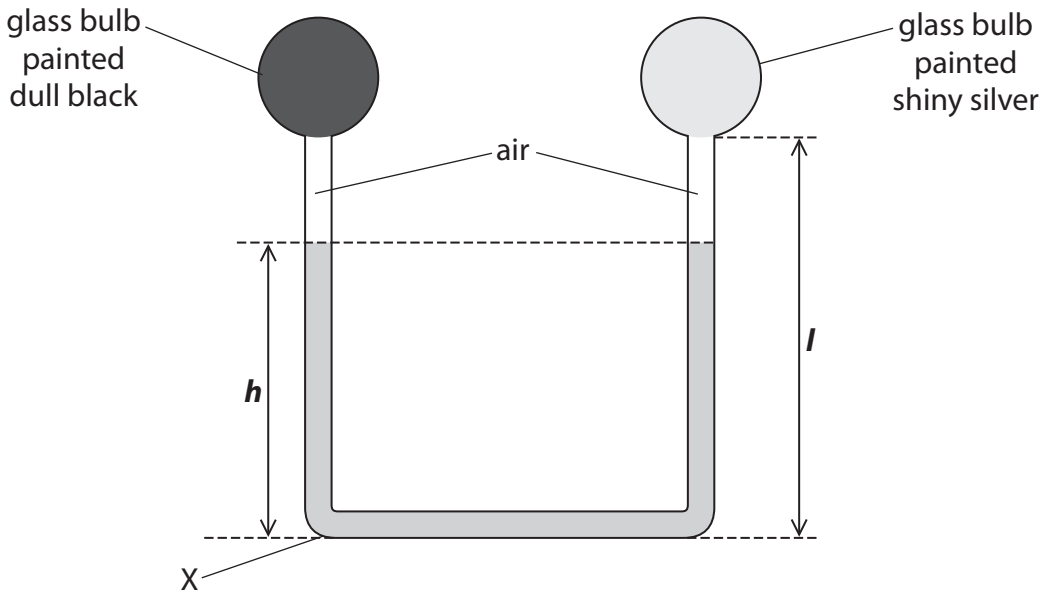
(b) John Leslie also invented a differential thermometer.

The diagram shows this thermometer.

The bulbs are filled with air and are connected by a tube which contains liquid.



(i) State the equation linking pressure difference, height, density and *g*.

(1)

(ii) The density of the liquid is 1260 kg/m^3.

Calculate the pressure due to the liquid at X when the height, *h*, of the column of liquid is 0.25 m.

Give the unit.

(3)

pressure = ... unit .....

(iii) The student places the differential thermometer in bright sunlight for a few minutes.

She observes that the liquid level

- falls on the side of the dull black bulb making *h* lower
- rises on the side of the shiny silver bulb

Use ideas about heat transfer and particle theory to explain these observations.

(3)

(iv) Explain what would happen to the levels of the liquid if the student repeated the experiment with a denser liquid in the thermometer.

(2)

QUESTION 7 CONTINUES ON THE NEXT PAGE

(v) Two students discuss the effect of changing the length, *l*, of the tube on both sides, while keeping the total volume of liquid constant.

If the length of the tube is increased, the thermometer can measure higher temperatures.

Changing the length of the tube will not make any difference to the range of temperatures that the thermometer can measure.

Explain which of these ideas is correct.

(2)

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(Total for Question 7 = 14 marks)