PEARSON EDEXCEL IGCSE PHYSICS · 4PH1

# PHYSICS



## EXAM QUESTION PACK

### SECTION 5: SOLIDS, LIQUIDS AND GASES (PACK 1)

| SCORE | PERCENTAGE |
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STEMUP

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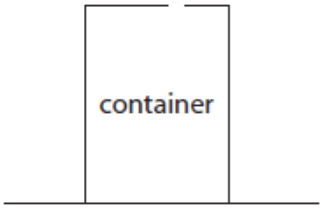
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Q1.

The diagram shows an empty metal container that has a hole in the top.




(a) Describe how the air molecules in the container exert a pressure on its inner walls.

**(3)**

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(b) The container is heated for a long time.

Explain what happens to the number of air molecules in the container.

**(2)**

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(c) A lid is placed on the hot container.

The lid seals the hole and the container is allowed to cool.

As the container cools, it collapses.




Explain why the container collapses.

**(2)**

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**(Total for question = 7 marks)**

Q2.

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross and then mark your new answer with a cross ☒.**

(a) Which of these astronomical objects is the largest?

**(1)**

☒ **A** a comet

☒ **B** the Earth

☒ **C** the Moon

☒ **D** the Sun

(b) Which of these types of radiation is the most ionising?

**(1)**

☒ **A** alpha

☒ **B** beta

☒ **C** gamma

☒ **D** ultraviolet

(c) Which of these is the unit for resistance?

**(1)**

☒ **A** ampere

☒ **B** ohm

☒ **C** volt

☒ **D** watt

(d) Which of these parts of the electromagnetic spectrum has the shortest wavelength?

**(1)**

☒ **A** infrared

☒ **B** microwave

☒ **C** ultraviolet

☒ **D** x-ray

(e) Which of these temperatures is the same as 0 °C?

**(1)**

☒ **A** -273 K

☒ **B** 3 K

☒ **C** 273 K

☒ **D** 373 K

**(Total for question = 5 marks)**

Q3.

Scientific balloons are tested in a laboratory before they are used.

(a) In the first test the pressure of the air inside the balloon is 120 kPa.

The balloon is sealed and has a volume of 92 $m^3$.

(i) The pressure of the air inside the balloon is reduced to 64 kPa by reducing the external air pressure.

Calculate the new volume of the balloon.

**(2)**

volume = ..... $m^3$

(ii) Give an assumption that is made in the calculation.

**(1)**

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(b) The pressure of the air in the balloon is returned to 120 kPa.

The temperature of the air inside the balloon is 290 K.

The balloon is tested again, changing the temperature of the air and keeping the volume of the balloon constant.

(i) Explain why the pressure of the air in the balloon decreases when the temperature of the air decreases.

**(3)**

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(ii) Calculate the temperature of the air when the pressure of the air in the balloon is 64 kPa.

Give your answer in kelvin.

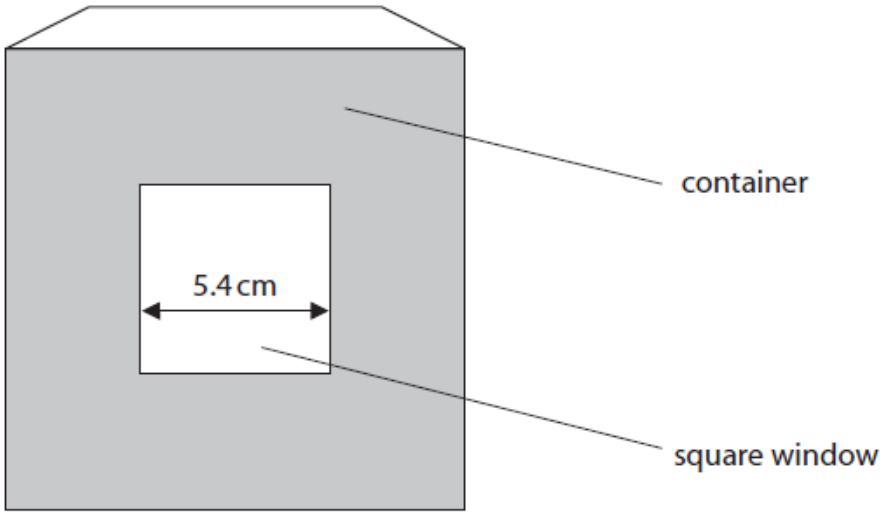
**(3)**

temperature = ..... K

**(Total for question = 9 marks)**

Q4.

The diagram shows a container used to cool gases to very low temperatures.




(a) The gas inside the container is at a temperature of −251 °C.

(i) Calculate the temperature, in kelvin, of the gas.

**(1)**

temperature = ..... K

(ii) Explain why the gas in the container cannot be cooled below a temperature of −273 °C.

**(2)**

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(b) The gas in the container exerts a pressure of 7500 Pa on the inner surface of the container.

The container has a square window of side length 5.4 cm.

Calculate the force the gas exerts on the inner surface of the square window.

**(5)**

force = ..... N

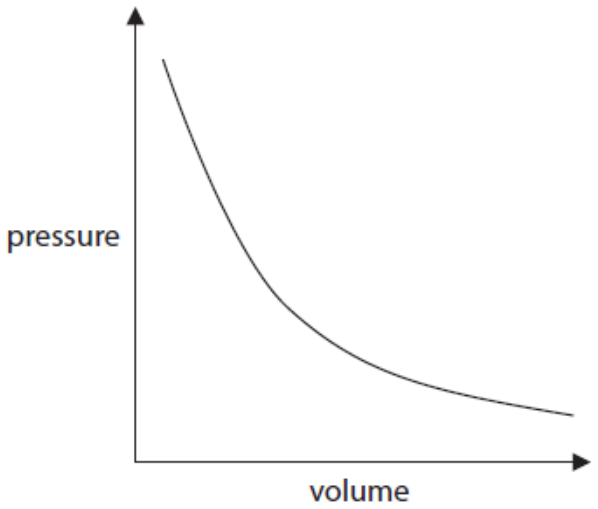
**(Total for question = 8 marks)**

Q5.

A glass contains fizzy water.

Bubbles of carbon dioxide form at the bottom of the glass and rise to the surface.

(a) The graph shows the relationship between the volume of a bubble and the pressure of the gas in the bubble.




(i) Describe the relationship shown by the graph.

**(2)**

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(ii) State the formula linking pressure difference, height, gravitational field strength and density.

**(1)**

(iii) The depth of the fizzy water in the glass is 22 cm.

The density of the fizzy water is 1080 kg/$m^3$.

Calculate the pressure difference at the bottom of the glass due to the fizzy water.

**(2)**

pressure difference = ..... Pa

(iv) Calculate the pressure of the gas in the bubble when the bubble is at the bottom of the glass.

[atmospheric pressure = 101 000 Pa]

**(1)**

pressure = ..... Pa

(v) When a bubble is at the top of the glass, the pressure of the gas in the bubble is equal to 101 000 Pa and the bubble has a volume of 0.084 $cm^3$.

Calculate the volume of the gas in the bubble when the bubble is at the bottom of the glass.

Assume the temperature of the gas remains constant.

**(3)**

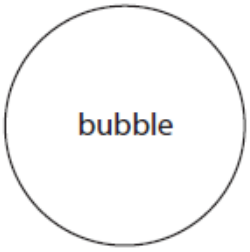
volume = ..... $cm^3$

(b) A force called upthrust acts vertically upwards on the bubble.

When the bubble is released, it accelerates vertically upwards.

Draw two labelled arrows on the diagram to show the forces on the bubble as it is released.

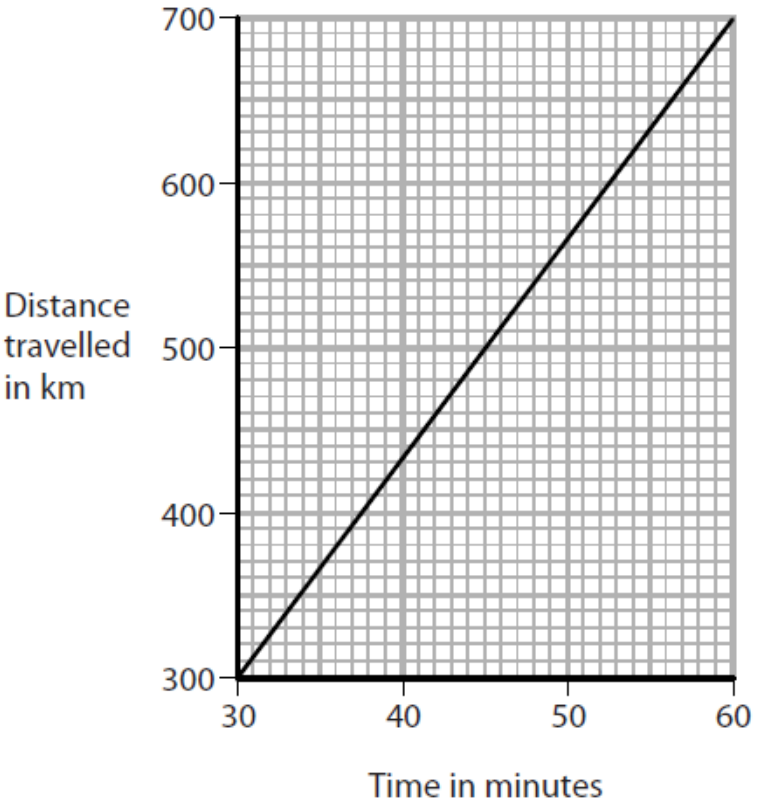
**(3)**




**(Total for question = 12 marks)**

Q6.

The graph shows how the distance travelled by an aeroplane changes during part of its journey.




(a) (i) State the formula linking average speed, distance moved and time taken.

**(1)**

(ii) Calculate the average speed of the aeroplane during this part of its journey.

Give a suitable unit.

**(4)**

average speed = ..... unit .....

(b) During the flight, the height of the aeroplane decreases.

As the height of the aeroplane decreases, the temperature outside the aeroplane increases.

Explain how the air pressure outside the aeroplane changes as the height of the aeroplane decreases.

**(3)**

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**(Total for question = 8 marks)**

Q7.

This question is about gas pressure.

(a) The diagram shows a cylinder containing propane gas.



(Source: © VitaminCo/Shutterstock)

The propane gas is stored in the cylinder at a pressure of $1.03 \times 10^6$ Pa.

(i) State the formula linking pressure, force and area.

**(1)**

(ii) The cylinder has an internal surface area of 1.13 $m^2$.

Calculate the force exerted on the walls of the cylinder by the propane gas.

**(3)**

force = ..... N

(iii) Explain why the pressure exerted by the propane gas acts equally in all directions.

**(2)**

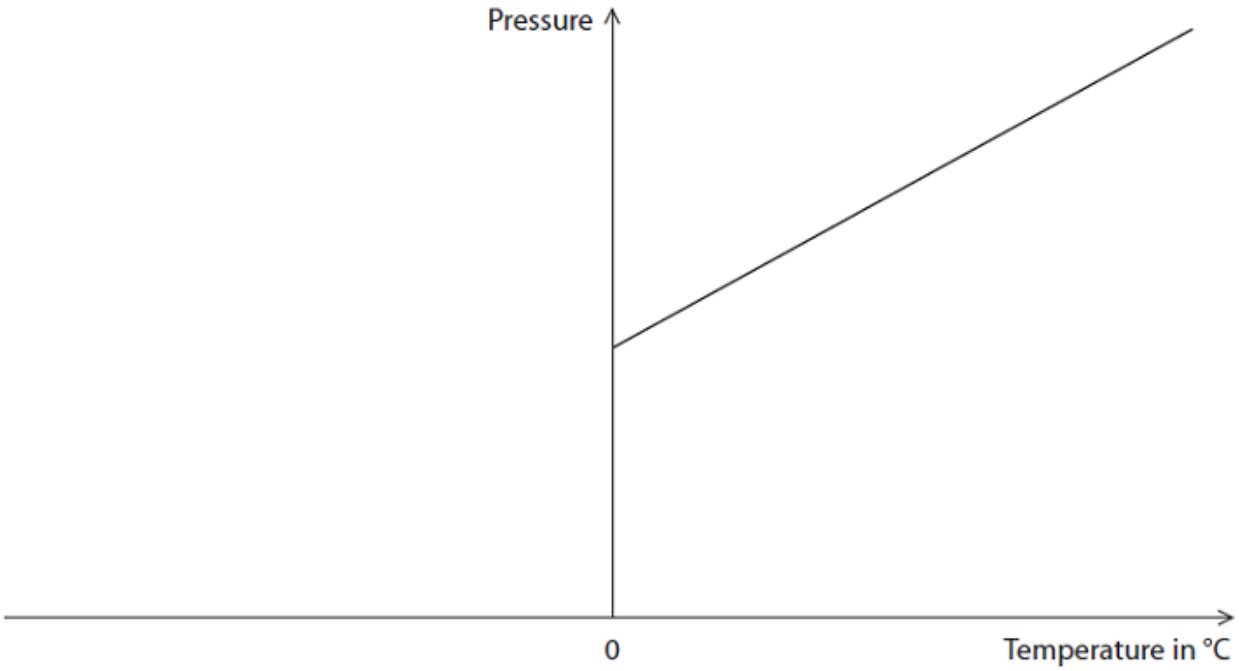
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(b) The graph shows how the pressure of a gas varies with its temperature.




(i) Describe how the graph can be used to show that there is a minimum value of temperature, known as absolute zero.

**(2)**

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(ii) Give the value of absolute zero in °C.

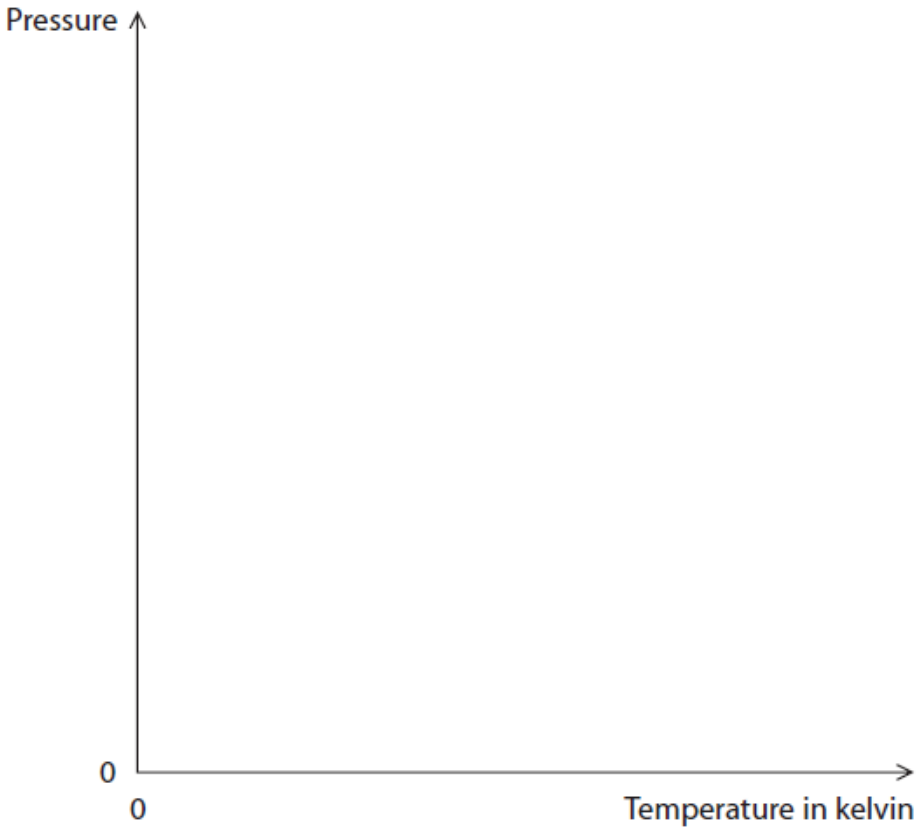
**(1)**

absolute zero = ..... °C

(iii) Temperature can also be measured in kelvin.

On the axes below, sketch a graph to show how the pressure of a gas varies with its kelvin temperature.

**(2)**

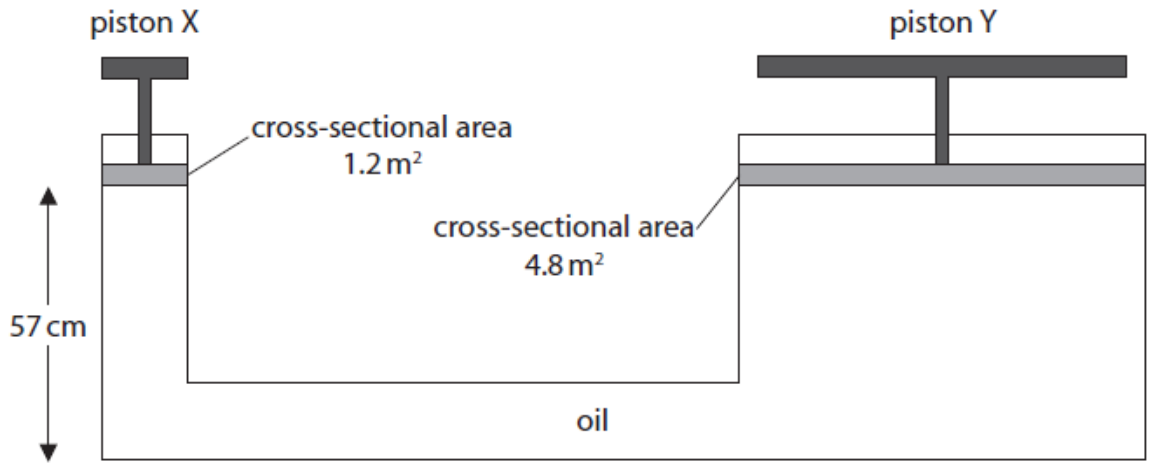



**(Total for question = 11 marks)**

Q8.

The diagram shows a device called a hydraulic lift.

The hydraulic lift consists of a tube of oil with a piston at each end.




(a) Calculate the pressure difference between the bottom of piston X and the bottom of the oil.

[density of oil = 820 kg/m$^3$]

**(3)**

pressure difference = ..... Pa

(b) A 24 kg mass is placed on piston X.

(i) Calculate the weight of the 24 kg mass.

Give the unit.

**(3)**

weight =..... unit.....

(ii) Calculate the extra pressure on the oil due to the mass.

**(2)**

extra pressure = ..... Pa

(iii) The oil transfers the same extra pressure to piston Y.

Calculate the force acting upwards on piston Y due to the extra pressure.

**(3)**

force = ..... N

(c) Piston Y starts at rest, rises slowly and then comes to rest.

State how the following energy stores have changed from before the motion to after the motion is complete.

**(4)**

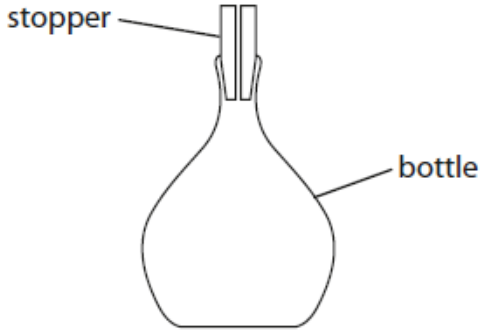
| Energy store | Change |
|---|---|
| gravitational potential energy of piston X | |
| gravitational potential energy of piston Y | |
| chemical energy of piston Y | |
| kinetic energy of piston Y | |

**(Total for question = 15 marks)**

Q9.

A student uses a bottle and a stopper to find the density of an unknown liquid.

The stopper fits tightly into the bottle and has a small diameter hole through it.




(a) This is the student's method.

- use a balance to find the mass of the bottle and stopper
- completely fill the bottle with water
- insert the stopper and dry the outside of the bottle
- use the balance to find the mass of the full bottle and stopper

These are the student's results.

mass of empty bottle and stopper = 63.4 g

mass of full bottle and stopper = 112.9 g

Use the student's results to determine the volume of the water in the bottle.

Give your answer to three significant figures.

[density of water = 0.998 g/cm$^3$]

**(4)**

volume = ..... cm$^3$

(b) The student empties the bottle and then dries it.

He refills the bottle with the unknown liquid.

He measures the mass of the full bottle and stopper as 143.8 g.

Calculate the density of the unknown liquid.

**(3)**

density of unknown liquid = ..... g/cm$^3$

(c) Another student uses a measuring cylinder to find the volume of the unknown liquid.

Discuss the advantages and disadvantages of using each method to find the volume of the

unknown liquid.

**(3)**

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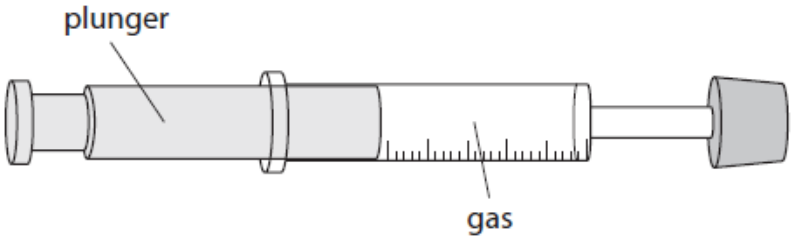
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**(Total for question = 10 marks)**

Q10.

A gas is contained inside a sealed syringe.




(a) The plunger is pushed so that the gas is compressed and its volume reduces at constant temperature.

Explain why decreasing the volume changes the pressure of the gas in the syringe.

You should use ideas about particles in your answer.

**(3)**

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(b) The plunger of the syringe is released and the gas returns to its original pressure of 100 kPa.

The plunger is then held in position so that the volume of the gas cannot change.

The gas is now heated and its temperature increases.

Describe how the average kinetic energy of the gas particles changes when the temperature of the gas increases.

**(3)**

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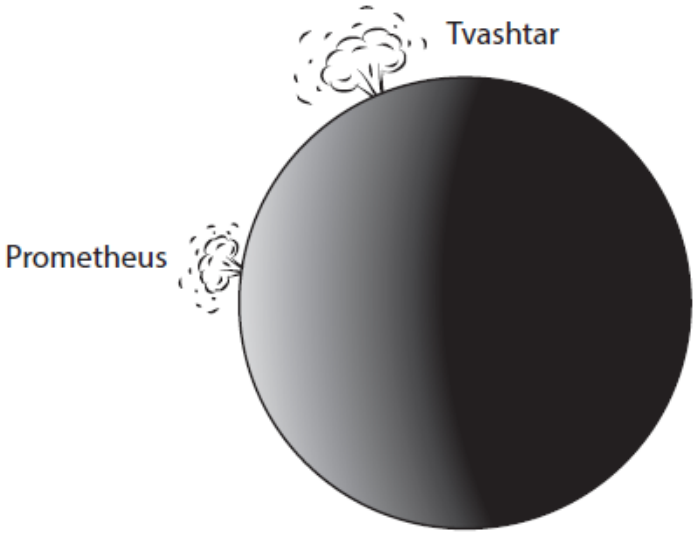
**(Total for question = 6 marks)**

Q11.

This is a question about Io, a moon of Jupiter.

The diagram shows two jets of gas from volcanoes on Io.

One jet of gas is from the volcano Prometheus and the other is from the volcano Tvashtar.




(a) Gas particles in the Prometheus jet leave the surface of Io and move vertically upwards.

The particles reach their maximum height when their speed is zero.

Some particles in the Prometheus jet reach a maximum height of 92 km.

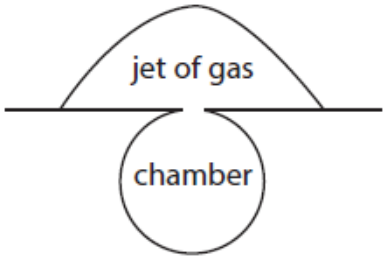
Calculate the initial speed of these particles as they leave the surface of Io.

[acceleration due to gravity on Io = 1.8 m/s$^2$]

**(3)**

initial speed = ..... m/s

(b) Before the gas particles leave the surface of Io, they are trapped in a chamber.




(i) Explain how the gas particles exert a pressure on the walls of the chamber.

**(3)**

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(ii) The Tvashtar chamber has the same volume as the Prometheus chamber and contains the

same number of molecules of the same type of gas.

The temperature of the gas in the Prometheus chamber is 1200 K.

The temperature of the gas in the Tvashtar chamber is 1600 K.

The pressure of the gas in the Prometheus chamber is 8.2 kPa.

Calculate the pressure of the gas in the Tvashtar chamber.

**(3)**

pressure = ..... kPa

(iii) Explain why the pressure inside the chambers increases when the temperature increases.

Use ideas about particles in your answer.

**(3)**

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(iv) Explain why the particles from the Tvashtar chamber reach a greater maximum height than the particles from the Prometheus chamber.

**(3)**

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**(Total for question = 15 marks)**

Q12.

A student investigates how much pressure she exerts on the ground when she is standing up.

(a) The weight of the student is 520 N.

(i) State the formula linking weight, mass and gravitational field strength (*g*).

**(1)**

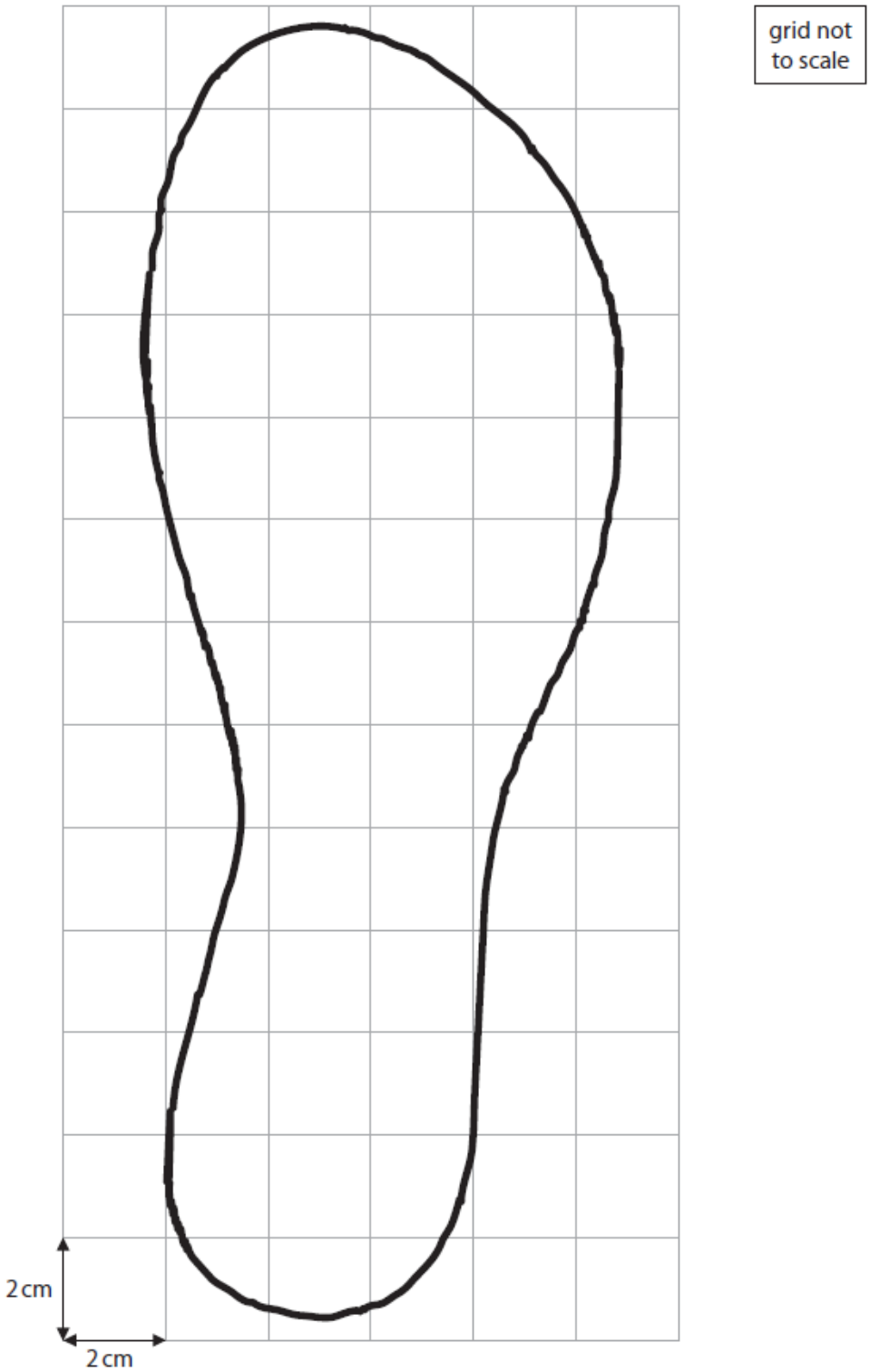
(ii) Calculate the mass of the student.

**(2)**

mass = ..... kg

(b) The student measures the area of one of her feet when it is in contact with the ground.

She draws around her foot on a piece of squared paper.




(i) The squares on the paper have a side length of 2 cm.

Estimate the area of the student's foot in contact with the ground.

**(4)**

area = ..... $cm^2$

(ii) State the formula linking pressure, force and area.

**(1)**

(iii) The weight of the student is 520 N.

Calculate the pressure the student exerts on the ground when she is standing on **both** feet.

Give the unit.

**(3)**

pressure = ..... unit .....

**(Total for question = 11 marks)**

Q13.

Hailstones are small pieces of ice that sometimes fall to the ground during storms.

(a) (i) Describe how to determine the density of a hailstone.

Assume that hailstones are spherical.

**(4)**

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(ii) The mean volume of a hailstone is 1.1 $cm^3$.

The mean mass of a hailstone is 0.94 g.

Calculate the mean density of a hailstone.

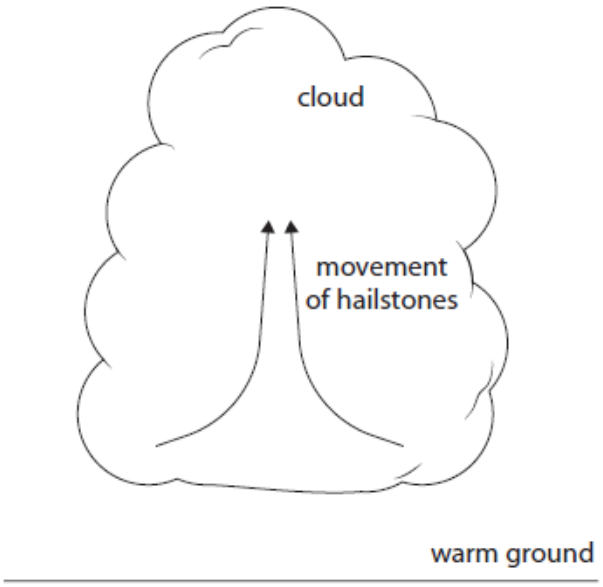
Give the unit.

**(3)**

density =..... unit .....

(b) Hailstones can be lifted to the top of clouds.

The diagram shows the movement of some hailstones in a cloud.




Suggest how hailstones are lifted to the top of the cloud by convection.

**(2)**

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**(Total for question = 9 marks)**

Q14.

A student needs to identify a sample of an unknown liquid.

She decides to do this by finding the density of the liquid.

(a) Describe how the student should measure the mass of the liquid.

**(2)**

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(b) Describe how the student should use a measuring cylinder to obtain an accurate measurement of the liquid's volume.

**(2)**

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(c) The table gives the values of the densities for some liquids.

| Liquid | Density in g/cm$^3$ |
|---|---|
| brine | 1.23 |
| glucose | 1.44 |
| olive oil | 0.82 |
| pure water | 1.00 |
| sodium hydroxide | 1.25 |
| sunflower oil | 0.92 |

The student measures the mass of the sample of unknown liquid as 150 g and the volume as 163 cm$^3$.

Deduce the name of the unknown liquid.

**(3)**

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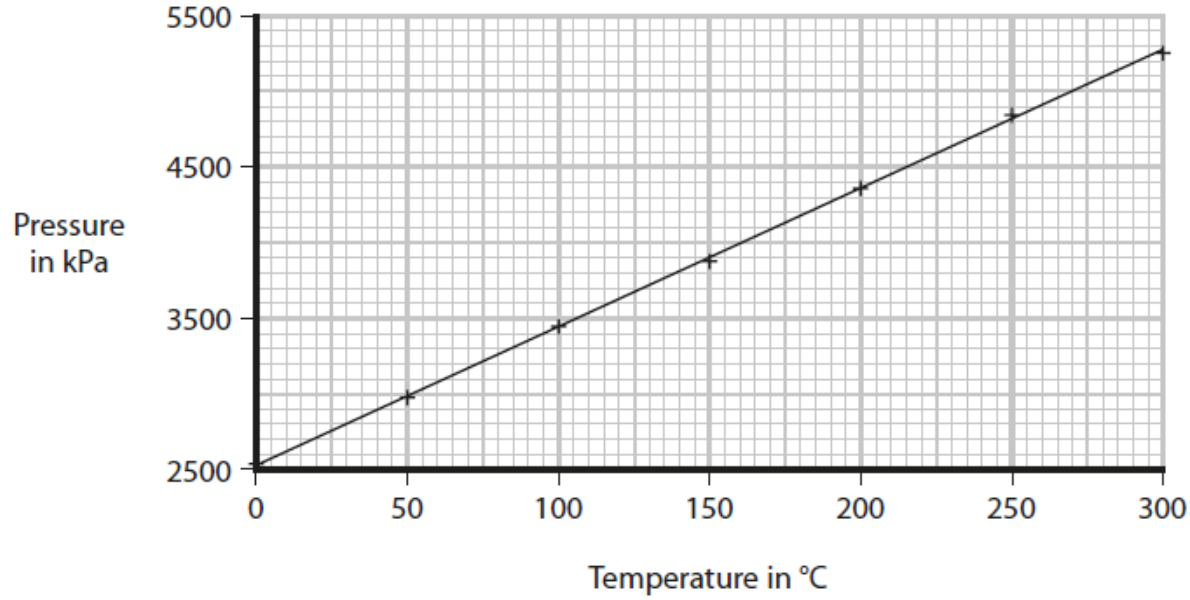
**(Total for question = 7 marks)**

Q15.

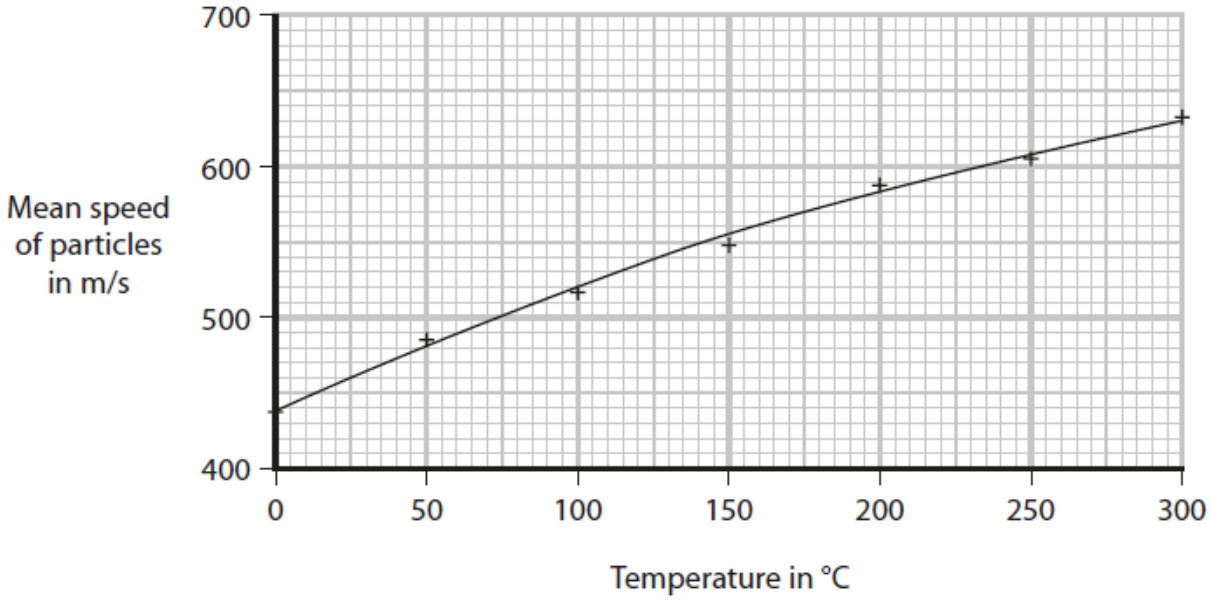
A student uses a computer simulation to investigate the motion of particles in a gas.

He records the pressure of the gas and the mean speed of the particles in the gas at different temperatures.

The graphs show his results.




**Graph 1**




**Graph 2**

(a) Give a reason why the student does not start the *y*-axis scale from zero on either of his

graphs.

**(1)**

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(b) Describe the relationships shown by the graphs.

**(3)**

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(c) Explain why the value of temperature chosen in the simulation should not decrease below –273 °C.

**(2)**

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(d) The student then calculates the kinetic energy of a single gas particle at each temperature.

(i) Using the curve of best fit on graph 2, determine the mean speed of a gas particle when the gas temperature is 100 °C.

**(1)**

mean speed = ..... m/s

(ii) The mass of a single gas particle is $5.3 \times 10^{-26}$ kg.

Calculate the average kinetic energy of a gas particle when the temperature of the gas is 100 °C.

**(3)**

kinetic energy = ..... J

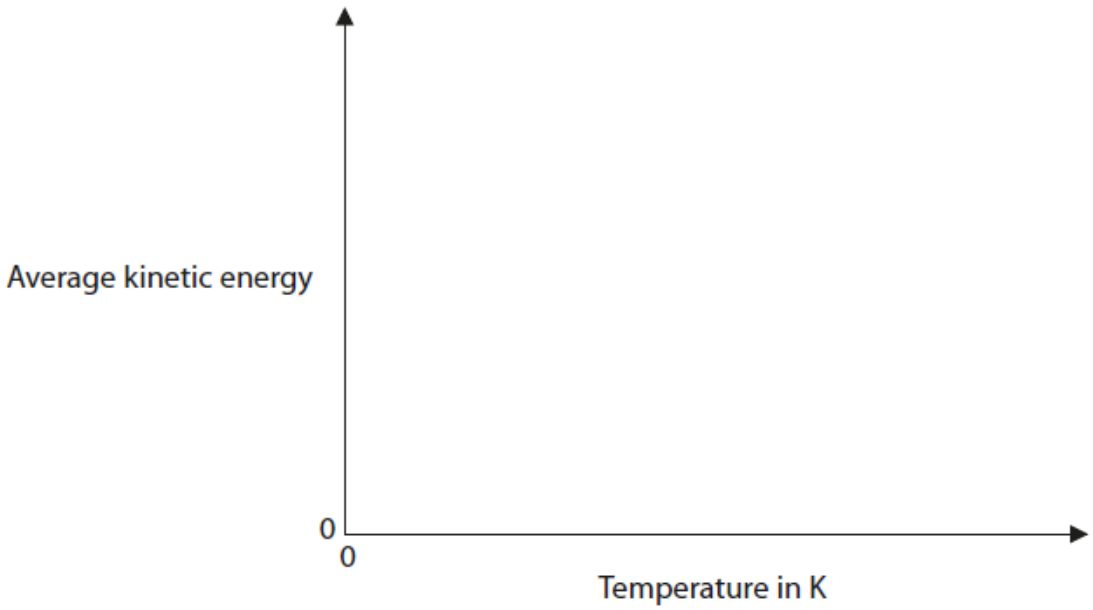
(iii) Calculate the temperature of the gas in kelvin when its temperature is 100 °C.

**(1)**

temperature = ..... K

(iv) On the axes, sketch a graph of the average kinetic energy of the gas particles against temperature in kelvin.

**(2)**




**(Total for question = 13 marks)**

Q16.

This question is about nuclear fission.

(a) The isotope uranium-235 can be made to undergo nuclear fission.

Describe the process of nuclear fission for uranium-235.

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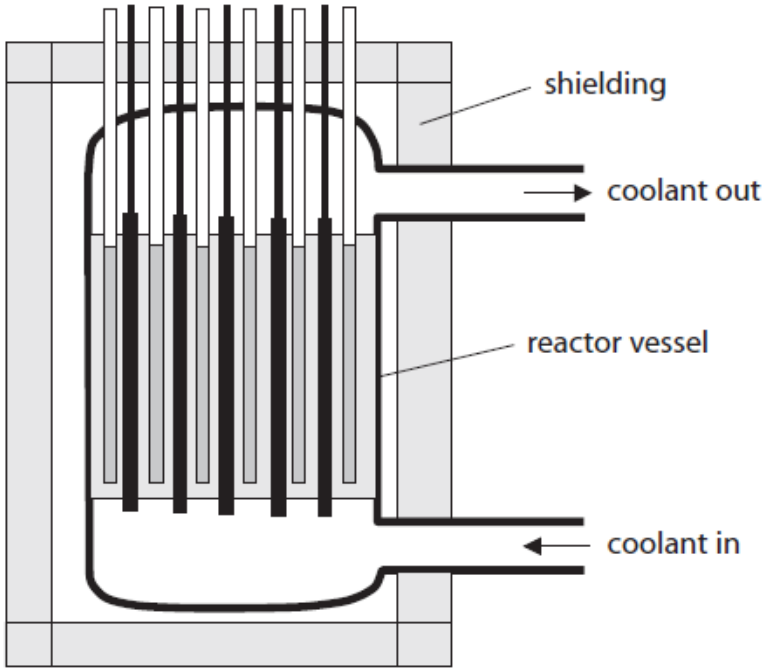
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(b) Some power stations use the nuclear fission of uranium-235 to generate electricity.

Fission takes place inside a nuclear reactor.




(i) Explain why a nuclear reactor is usually surrounded by thick concrete.

**(2)**

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(ii) The coolant from the nuclear reactor is used to heat steam to a very high temperature.

Steam is water in the gas state.

Using ideas about particles, explain why a pressure is exerted on the tubes containing the steam.

**(3)**

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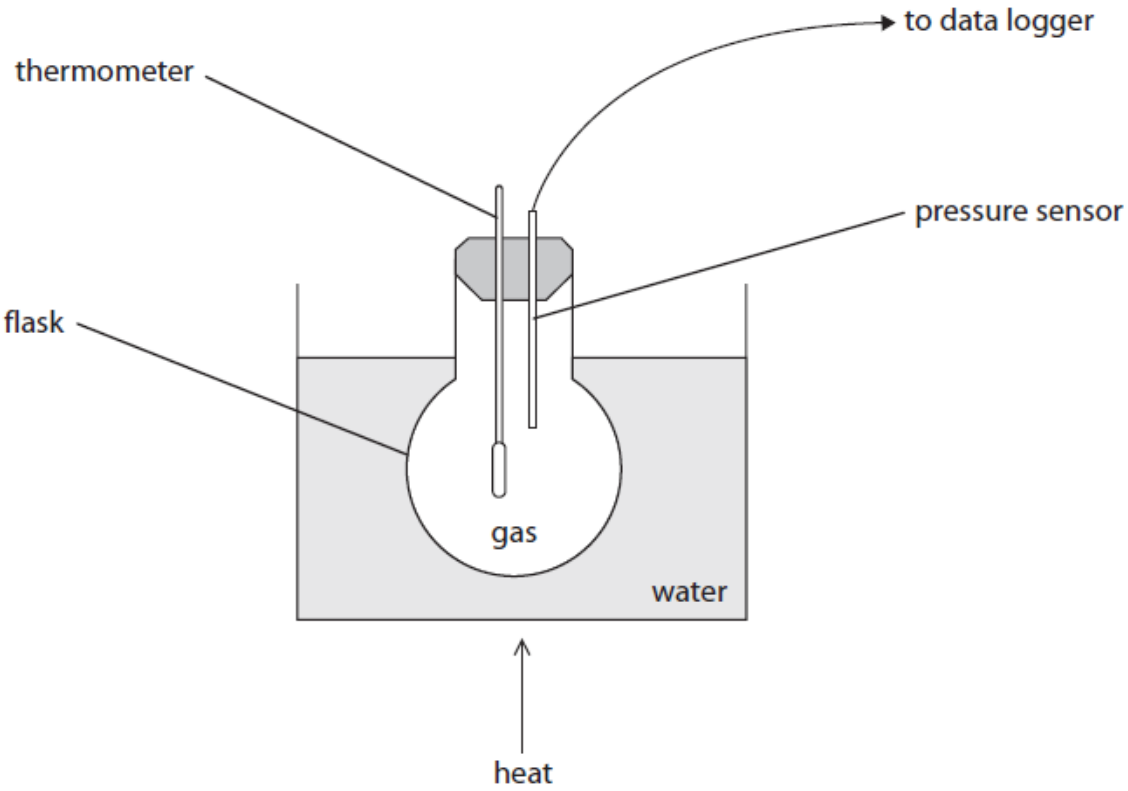
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**(Total for question = 9 marks)**

Q17.

The diagram shows apparatus used to investigate how the pressure of a gas varies with temperature.




(a) The volume of the gas is kept constant by the flask.

The volume of the gas is a control variable.

State why it is important to keep a control variable constant throughout the investigation.

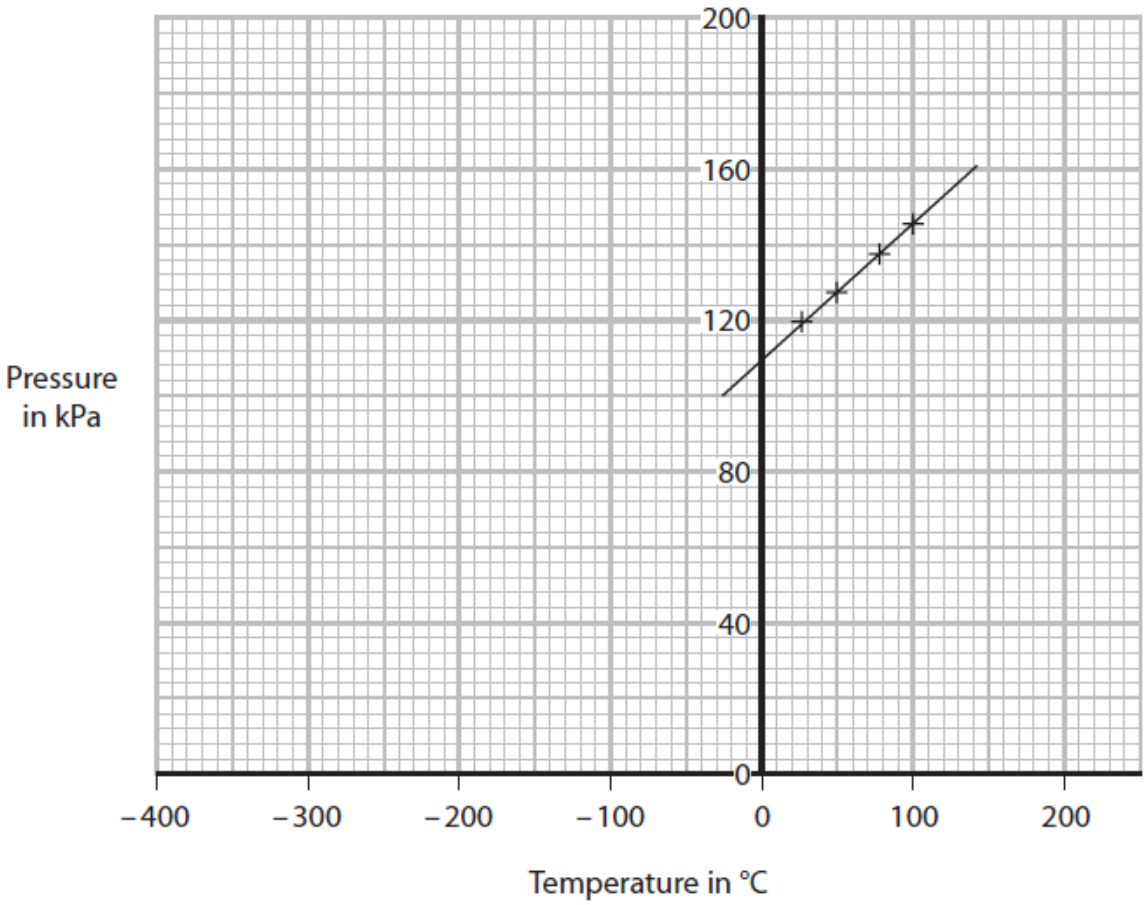
**(1)**

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(b) The pressure of the gas changes as its temperature increases.

The graph shows the results.




(i) Explain how these results show that there is a linear, but not proportional, relationship between the pressure of the gas and its temperature in °C.

**(2)**

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(ii) Use the graph to determine the value for absolute zero.

**(2)**

temperature = ..... °C

(iii) Explain how the pressure of the gas changes as its temperature increases.

Include ideas about particles in your answer.

**(3)**

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(c) The pressure of the gas is 112 kPa when its temperature is 35 °C.

The gas is heated to 340 °C using some different apparatus.

(i) Calculate the pressure of the gas when its temperature is 340 °C.

Assume the gas has a constant volume.

**(4)**

pressure = ..... kPa

(ii) The volume of the gas is constant in the investigation.

Give the name of the other quantity that must be constant for the calculation to be correct.

**(1)**

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**(Total for question = 13 marks)**

Q18.

(a) Diagram 1 shows a plastic bottle containing water.

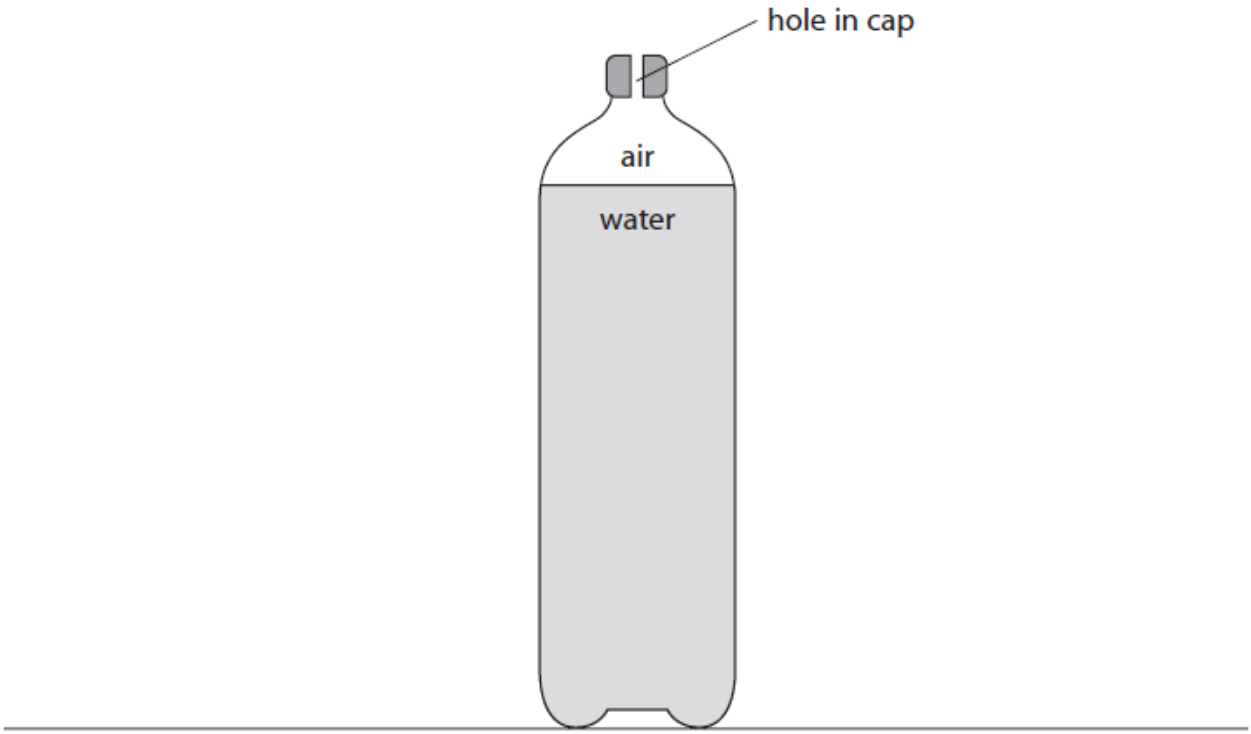



**Diagram 1**

(i) State the formula linking pressure difference, height, density and gravitational field strength, *g*.

**(1)**

(ii) The pressure difference between the surface of the water and the water at the bottom of the bottle is 2300 Pa.

Calculate the depth of water in the bottle.

Give your answer in cm.
[density of water = 1000 kg / $m^3$]

**(3)**

depth = ..... cm

(b) Three holes are made in the bottle at positions A, B and C.

Diagram 2 shows the path of the water leaving the bottle from hole B.

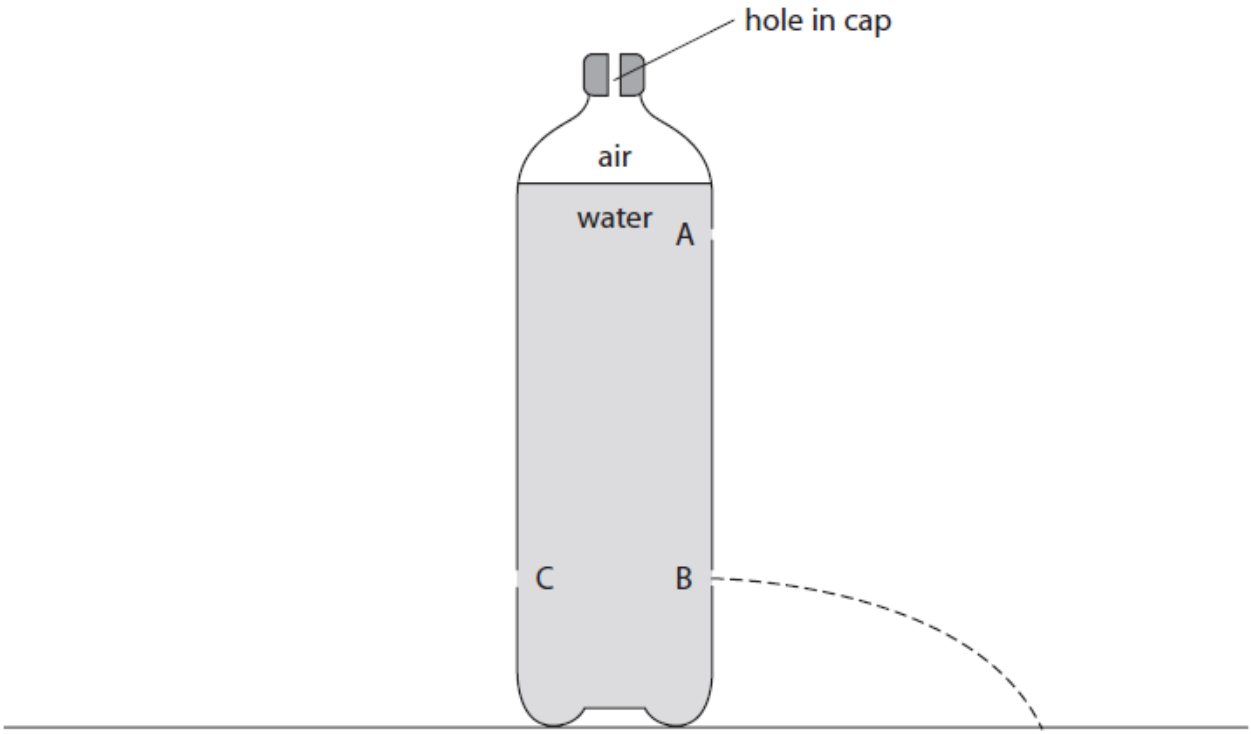



**Diagram 2**

(i) Draw a line on diagram 2 to show the path of the water leaving the bottle from hole A.

**(1)**

(ii) Explain the path of the water leaving the bottle from hole A.

**(2)**

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(iii) Hole C is at the same depth in the bottle as hole B but on the opposite side of the bottle.

Explain the shape of the path of the water leaving the bottle from hole C.

**(3)**

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(iv) Suggest why there is a hole in the cap of the bottle.

**(1)**

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**(Total for question = 11 marks)**

Q19.

This question is about pressure in gases.

(a) Photograph 1 shows an open conical flask containing air.



**Photograph 1**

The air in the flask is heated to a temperature of 85 °C.

(i) Calculate the temperature of the air in the flask in kelvin.

**(1)**

temperature = ..... K

(ii) Describe how the motion of the molecules in the flask changes when the temperature of the air inside the flask increases.

**(2)**

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(iii) The pressure of the air in the flask does not change when the temperature of the air increases.

State what happens to the number of air molecules in the flask when the temperature of the air inside the flask increases.

**(1)**

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(b) Photograph 2 shows a boiled egg, without its shell, placed in the top of the conical flask containing hot air.

The flask is no longer being heated.

The egg seals the flask so that no air escapes.

Photograph 3 shows the egg and the flask a short time later.



**Photograph 2**



**Photograph 3**

Explain why the egg moves down into the flask and then stops moving.

Refer to ideas about pressure in your answer.

**(4)**

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**(Total for question = 8 marks)**

Q20.

A student uses a syringe containing trapped air to investigate pressure.

Diagram 1 shows the apparatus he uses.

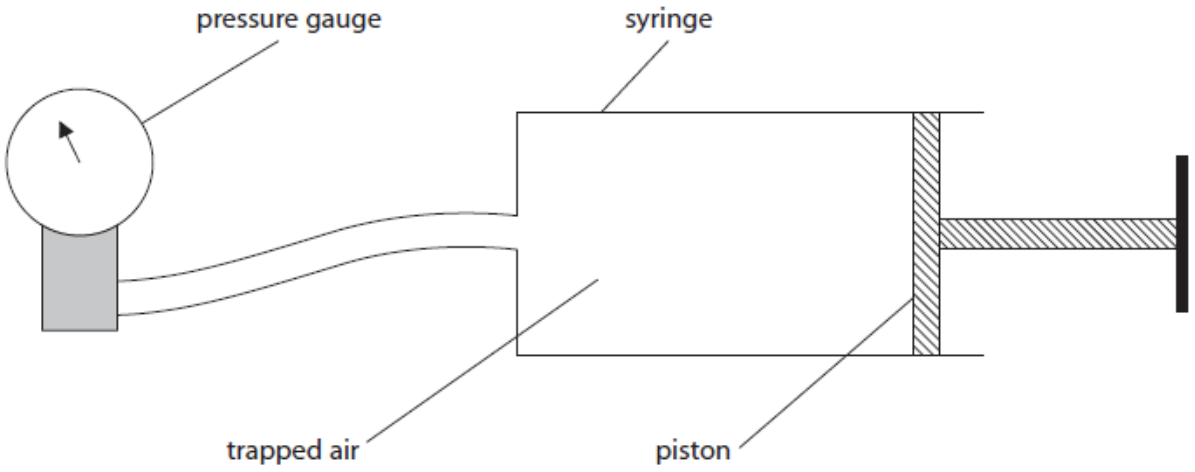
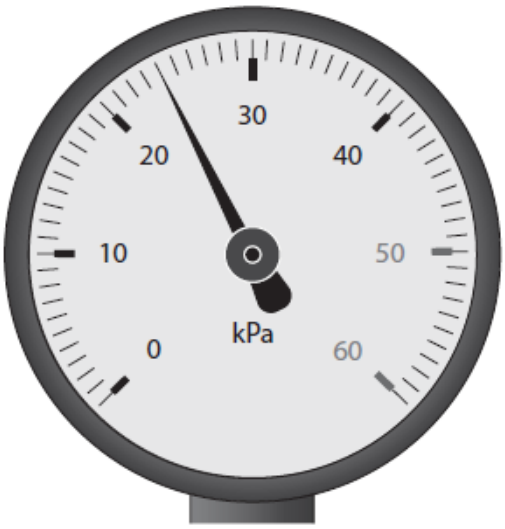



**Diagram 1**

(a) Diagram 2 shows the pressure gauge when the piston is at its initial position.




© Lubos Chlubny/Shutterstock

**Diagram 2**

Determine the reading on the pressure gauge.

**(1)**

pressure = ..... kPa

(b) The piston is pushed in so that the volume of trapped air in the syringe is halved. The temperature of the trapped air remains constant.

Explain how the reading on the pressure gauge will change when the piston is pushed in.

**(3)**

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(c) The position of the piston is then fixed so that the volume of trapped air in the syringe is now constant.

The air in the syringe is then cooled.

(i) State how the motion of air particles inside the syringe changes when the air is cooled.

**(1)**

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(ii) Explain how the pressure of the trapped air inside the syringe changes when the air is cooled.

Refer to particles in your answer.

**(3)**

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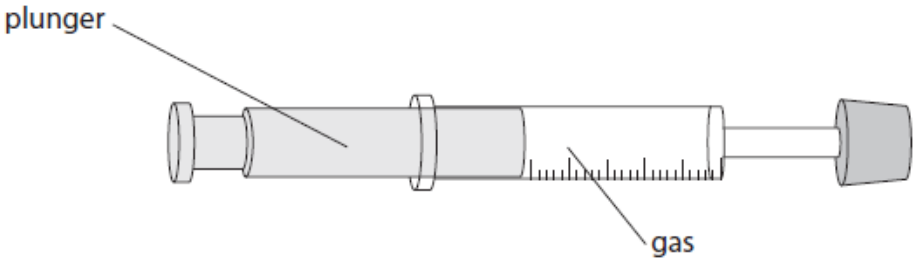
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**(Total for question = 8 marks)**

Q21.

A gas is contained inside a sealed syringe.




(a) The plunger is pushed so that the gas is compressed and its volume reduces at constant temperature.

(i) Before compression, the gas pressure is 100 kPa and the volume of the gas is 7.5 $cm^3$.

After compression, the volume of the gas is 5.0 $cm^3$.

Calculate the pressure of the gas after compression.

**(3)**

pressure = ..... kPa

(ii) Explain why decreasing the volume changes the pressure of the gas in the syringe.

You should use ideas about particles in your answer.

**(3)**

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(b) The plunger of the syringe is released and the gas returns to its original pressure of 100 kPa.

The plunger is then held in position so that the volume of the gas cannot change.

The gas is now heated and its temperature increases.

(i) Describe how the average kinetic energy of the gas particles changes when the temperature of the gas increases.

**(3)**

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(ii) The temperature of the gas increases from 20 °C to 65 °C.

Calculate the pressure of the gas after it is heated.

**(4)**

pressure = ..... kPa

**(Total for question = 13 marks)**

Q22.

Diagram 1 shows an ice cube floating at rest in a beaker of water.

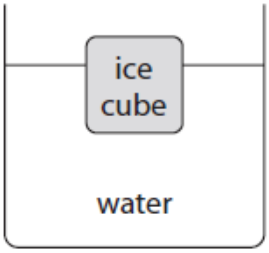



**Diagram 1**

(a) State the value of the resultant force on the ice cube.

**(1)**

resultant force = ..... N

(b) Diagram 2 shows the ice cube pushed down into the water by force X.

The ice cube is at rest in this new position.

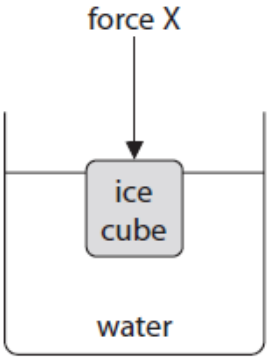



**Diagram 2**

(i) State the formula linking pressure difference, height, density and gravitational field strength.

**(1)**

(ii) The bottom of the ice cube is 0.041 m below the surface of the water.

The density of water is 1000 kg/m$^3$.

Show that the pressure difference between the bottom of the ice cube and the surface of the water is about 400 Pa.

**(2)**

(iii) State the formula linking pressure, force and area.

**(1)**

(iv) The area of the base of the ice cube is 0.0017 m$^2$.

Calculate the upward force on the bottom of the cube from the water due to the pressure difference.

**(2)**

upward force = ..... N

(v) Explain why the ice cube will accelerate upwards when force X is removed.

**(2)**

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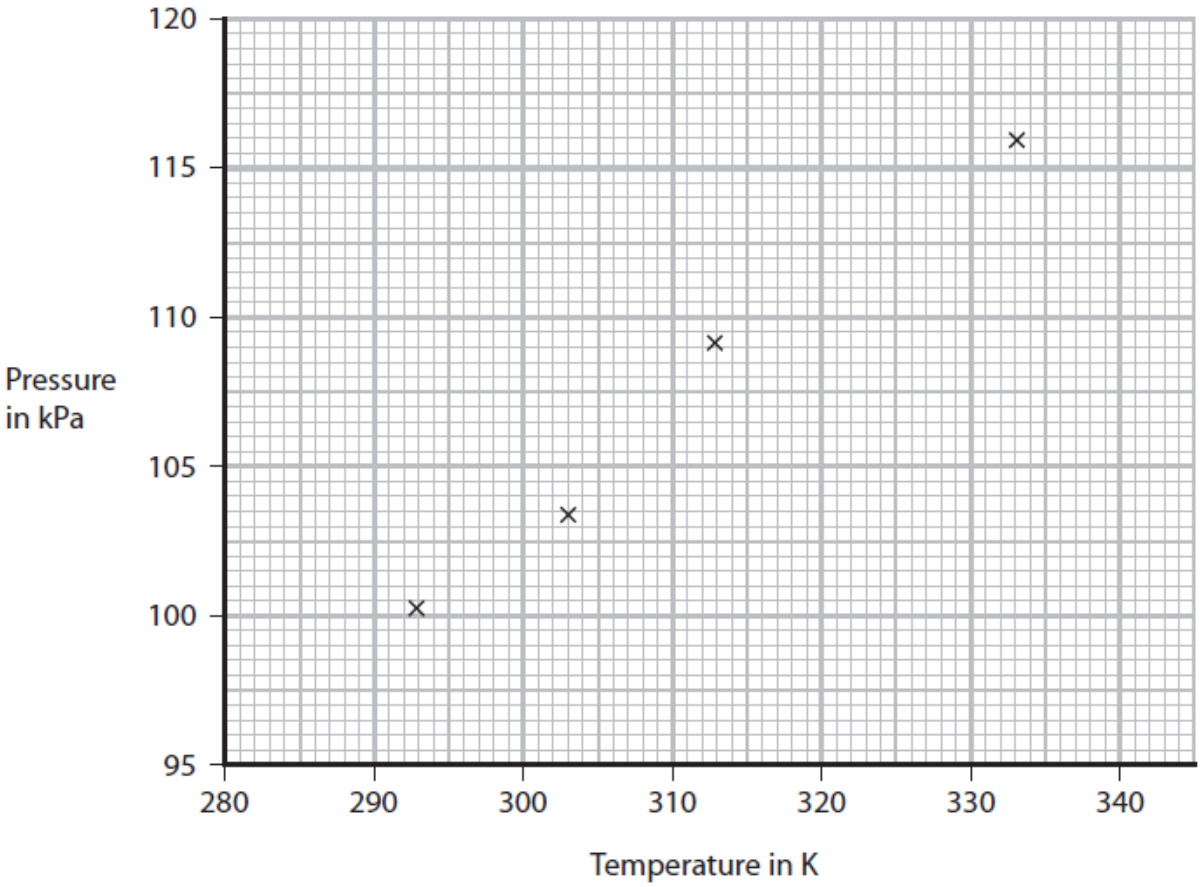
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**(Total for question = 9 marks)**

Q23.

A student investigates the relationship between the pressure of a gas and its temperature.

The graph shows the student's data.




(a) The table shows some additional data.

| temperature in °C | temperature in K | pressure in kPa |
|---|---|---|
| 50 | | 112 |

(i) Calculate the temperature in kelvin for the additional data.

**(1)**

temperature = ..... K

(ii) Plot this additional data on the graph.

**(1)**

(iii) Draw the line of best fit on the graph.

**(1)**

(b) The average kinetic energy (KE) of a gas molecule is calculated for the gas at two temperatures.

Determine the value of the expression

$$\frac{\text{average KE of a gas molecule at 500K}}{\text{average KE of a gas molecule at 250K}}$$

**(1)**

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(c) Explain how gas molecules exert a pressure on the walls of a container.

**(3)**

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(d) The student reduces the volume of the gas container slowly so that the gas does not increase in temperature and no gas escapes.

The student then repeats the investigation.

Explain what effect this change would have on the line of best fit on the graph.

**(3)**

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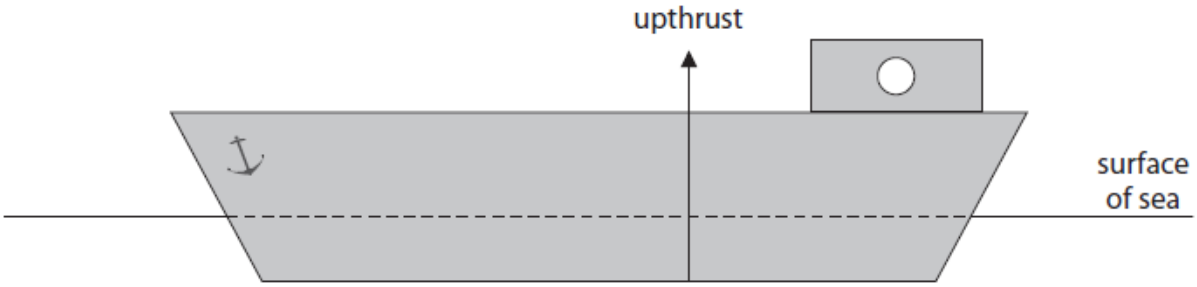
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**(Total for question = 10 marks)**

Q24.

A ship floats on the sea.




(a) The ship floats because of the forces acting on it.

(i) The upward force acting on the ship is called upthrust.

This force is shown on the diagram.

Draw another labelled arrow on the diagram to show the other vertical force acting on the ship.

**(2)**

(ii) Forces are vector quantities.

State what is meant by the term **vector quantity**.

**(2)**

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(iii) Give another example of a vector quantity.

**(1)**

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(b) The upthrust force acting on the ship is proportional to the pressure difference between the bottom of the ship and the surface of the sea.

The pressure acting on the ship at the surface of the sea is 100 kPa.

(i) State the formula linking pressure difference, height, density and gravitational field strength ($g$).

**(1)**

(ii) The bottom of the ship is 15.8 m below the surface of the sea.

Show that the pressure acting on the bottom of the ship is approximately 260 kPa.

[density of seawater = 1030 kg/m$^3$]

**(3)**

(iii) Explain why the bottom of the ship is deeper below the surface of the sea when the ship is fully loaded with cargo.

**(2)**

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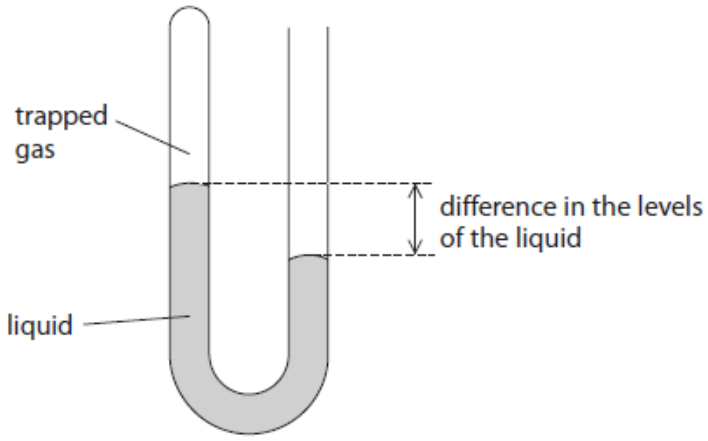
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**(Total for question = 11 marks)**

Q25.

The diagram shows a manometer, a device used for measuring differences in pressure.




(a) One side of the manometer has some trapped gas. The other side is left open to the atmosphere.

The difference in pressure can be calculated using this formula.

[difference in pressure = height × density × 10]

The density of the liquid is $1.3 \times 10^4$ kg/m $^3$.

The difference in the levels of the liquid is 3.8 cm.

Calculate the difference in pressure between the atmosphere and the trapped gas.

**(3)**

difference in pressure = ..... Pa

(b) The temperature and pressure of the trapped gas increase when it is warmed.

(i) Explain, in terms of particles, why the pressure of the trapped gas increases.

**(3)**

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(ii) The pressure of the trapped gas in the manometer is $9.95 \times 10^4$ Pa and the temperature is 16 °C.

Calculate the new pressure of the trapped gas if the temperature increases to 32 °C.

[assume volume of the trapped gas remains constant]

**(4)**

new pressure = ..... Pa

**(Total for question = 10 marks)**

Q26.

The photograph shows a mechanic pumping air into a car tyre.



(Source: Rido/Shutterstock)

(a) Before being pumped into the tyre, some air has a volume of 0.0043 $m^3$ at a pressure of 100 kPa.

The pressure of this air inside the tyre is 270 kPa.

Calculate the volume of this air inside the tyre, assuming the temperature of the air does not change.

Give your answer in standard form.

**(3)**

volume = ..... $m^3$

(b) The car is fitted with a tyre pressure monitoring system.

A warning light will show in the car if the air pressure in the tyre falls below 250 kPa.

(i) Using ideas about particles, explain why the air pressure inside the tyre is lower on a cold winter day than on a warm summer day.

**(3)**

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(ii) The air pressure in the tyre is 270 kPa when the air temperature is 20 °C.

On a cold winter day, the temperature is 2 °C.

Determine whether the tyre pressure warning light will show in the car on the cold winter day.

[assume tyre volume does not change]

**(4)**

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**(Total for question = 10 marks)**

Q27.

The photograph shows a truck with a crane that is used to move large bags of building materials.




(Source: © Alistair Petrie/Alamy Stock Photo)

(a) (i) State the formula linking work done, force and distance moved.

**(1)**

(ii) A bag of building materials has a weight of 8750 N.

Calculate the work done on the bag when it is lifted a vertical distance of 230 cm from the ground until it is stationary again.

Give the unit.

**(3)**

work done = ..... unit .....

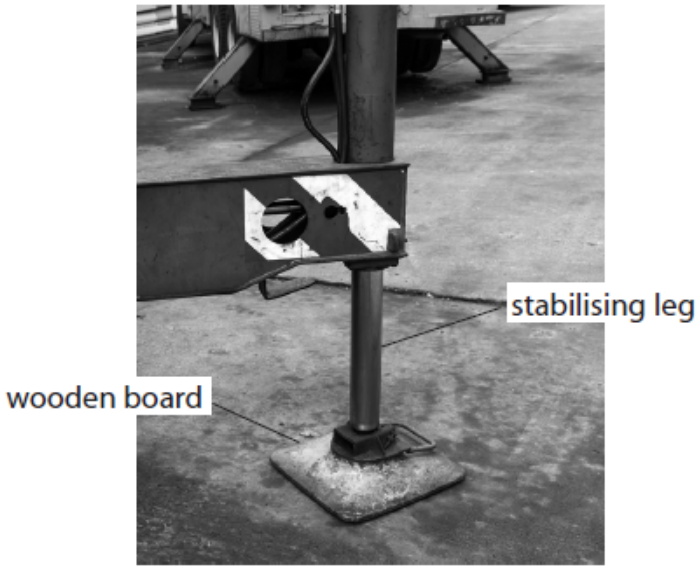
(iii) The crane takes 7.0 s to lift the bag.

Calculate the mean power output of the crane when it is lifting the bag.

**(2)**

mean power output = ..... W

(b) The truck has a stabilising leg which is positioned on a wooden board.




(Source: © JARIRIYAWAT/Shutterstock)

(i) Give a reason why the wooden board is used.

**(1)**

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(ii) State the formula linking pressure, force and area.

**(1)**

(iii) The wooden board is a square with side length 0.50 m.

The pressure the board exerts on the ground is 148 kPa.

Calculate the force exerted by the board on the ground.

**(4)**

force = ..... N

**(Total for question = 12 marks)**