1 The photograph shows a car tyre that needs to be inflated.



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The tyre exerts a pressure on the road of 270 kPa.

The area of the tyre touching the road is 0.016 m^2.

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

(1)

(ii) Calculate the force exerted on the road by the tyre.

Give the unit.

(4)

force = ... unit .....

(b) Use ideas about molecules to explain why the air inside the tyre exerts pressure.

(3)

(c) Air is pumped into the tyre to inflate it.

This increases the temperature and the pressure of the air in the tyre.

Use ideas about molecules to explain why the air pressure in the tyre increases.

(3)

(Total for Question 1 = 11 marks)

2 The volume of a piece of brass is 16.3 cm^3.

A student measures its mass using an electronic balance.

The mass of the brass is 138 g.

(a) (i) State the equation linking density, mass and volume.

(1)

(ii) Calculate the density of brass.

Give the unit.

(3)

density = ... unit .....

(b) The student notices that the electronic balance has a zero error, so it shows mass readings that are all slightly too small.

This means that the density value is

(1)

☒ **A** incorrect and slightly too large

☒ **B** incorrect and slightly too small

☒ **C** correct because the student used three significant figures

☒ **D** correct because the mass of the block is more than zero

(Total for Question 2 = 5 marks)

3 (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)

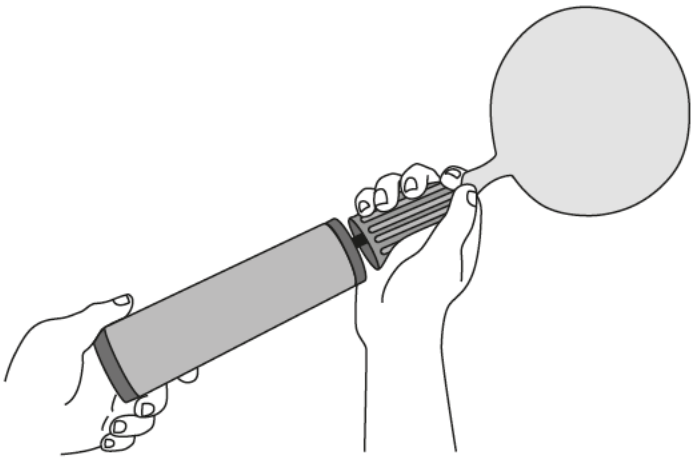
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(b) A student wants to investigate how the volume of a balloon changes with pressure.



(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.
>
> 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 3 = 9 marks)

4 Kalpana finds a small stone.

To help her identify the type of stone, Kalpana decides to find its density.

Kalpana explains why she thinks this will help.



Her friend, Christine, disagrees.



(a) Who is correct Kalpana or Christine?

(2)

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Explain your answer.

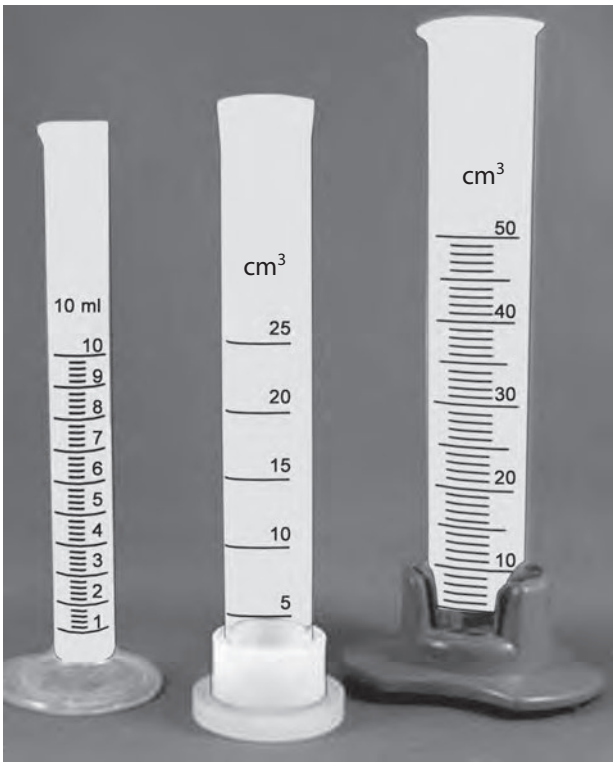
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(b) Kalpana uses a measuring cylinder to find the volume of water displaced by the stone.

She has three measuring cylinders to choose from.



A **B** **C**

(i) Which measuring cylinder would give the most **precise** measurement? Explain your answer.

(2)

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(ii) The most precise measuring cylinder may not give an **accurate** reading.

Suggest why.

(1)

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(c) The table shows the measurements that Kalpana makes.

Mass of stone in g	Volume of stone in cm^3
54	23

(i) State the equation linking density, mass and volume.

(1)

(ii) Calculate the density of the stone.

State your answer to an appropriate number of significant figures.

Give the unit.

(3)

Density ..... Unit .....

(d) (i) How can Kalpana use her value of density to identify the type of stone?

(2)

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(ii) Kalpana may still be unsure about the type of stone.

Suggest why.

(1)

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(Total for Question 4 12 marks)

5 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 °C

(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 5 8 marks)

6 A student measures the density of water.

She uses a measuring cylinder and an electronic balance.



(a) State the equation linking density, mass and volume.

(1)

(b) A correct unit for density is

(1)

- ☒ **A** g/cm
- ☒ **B** kg/cm
- ☒ **C** g/cm^2
- ☒ **D** g/cm^3

(c) Complete the table to show what is measured by an electronic balance.

(1)

Measuring instrument	What it measures
measuring cylinder	volume
electronic balance	

(d) Describe how the student should use each instrument to make her measurements as accurate as possible.

(4)

Measuring cylinder

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Electronic balance

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(e) The student wants to make sure her experiment is a fair test.

(i) State **one** factor that she should keep the same throughout her experiment.

(1)

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(ii) Why is it important that she keeps this factor constant?

(1)

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(Total for Question 6 = 9 marks)