GCSE Physics

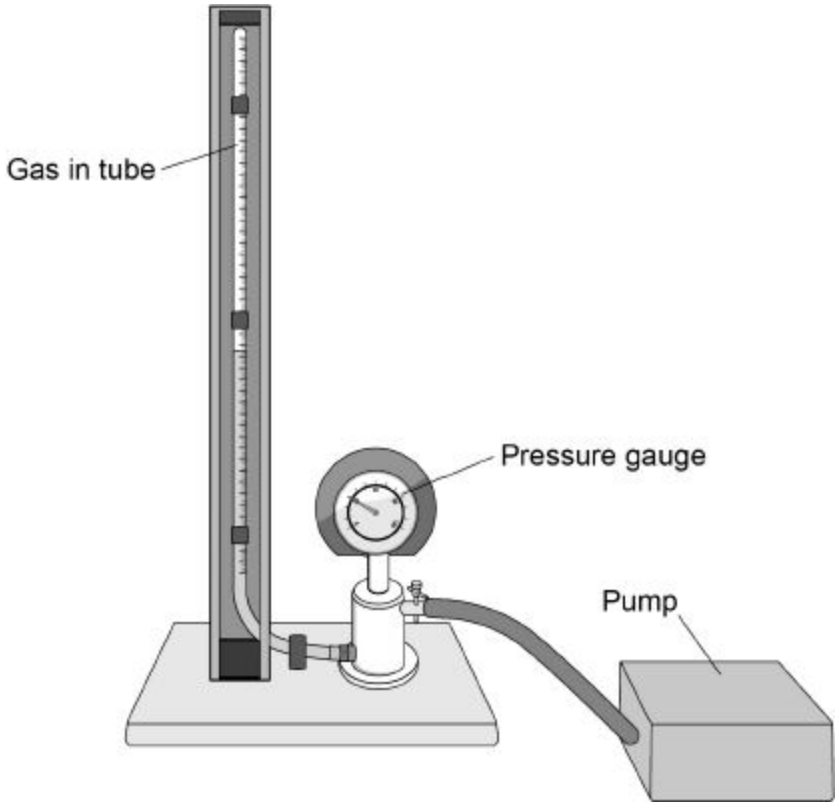
Pressure

Question Paper

Time available: 55 minutes
Marks available: 47 marks

1. A student investigated how the pressure exerted by a gas varied with the volume of the gas. **Figure 1** shows the equipment the student used.

Figure 1



A pump was used to compress the gas in a tube. As the volume of the gas decreases, the pressure of the gas increases.

(a) The student only recorded one set of results.

Give **two** reasons why taking repeat readings could provide more accurate data.

1. _____

_____

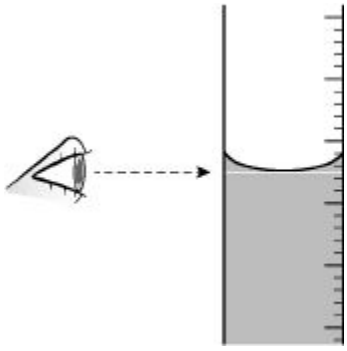
2. _____

_____

(2)

(b) **Figure 2** shows the position of the student's eye when taking volume measurements.

Figure 2



Explain what type of error would be caused if the student's eye was **not** in line with the level of the liquid in the tube.

_____

_____

_____

_____

(2)

(c) If the gas is compressed too quickly the temperature of the gas increases.

Explain how the temperature increase would affect the pressure exerted by the gas.

_____

_____

_____

_____

(2)

(d) One of the student's results is given below.

pressure = 1.6×10^5 Pa
volume = 9.0 cm^3

Calculate the volume of the gas when the pressure was 1.8×10^5 Pa.

The temperature of the gas was constant.

Volume = _____ cm^3

(3)

(e) **Figure 3** shows a person using a bicycle pump to inflate a tyre.

Figure 3

The internal energy of the air increases as the tyre is inflated.

Explain why.

_____

_____

_____

_____

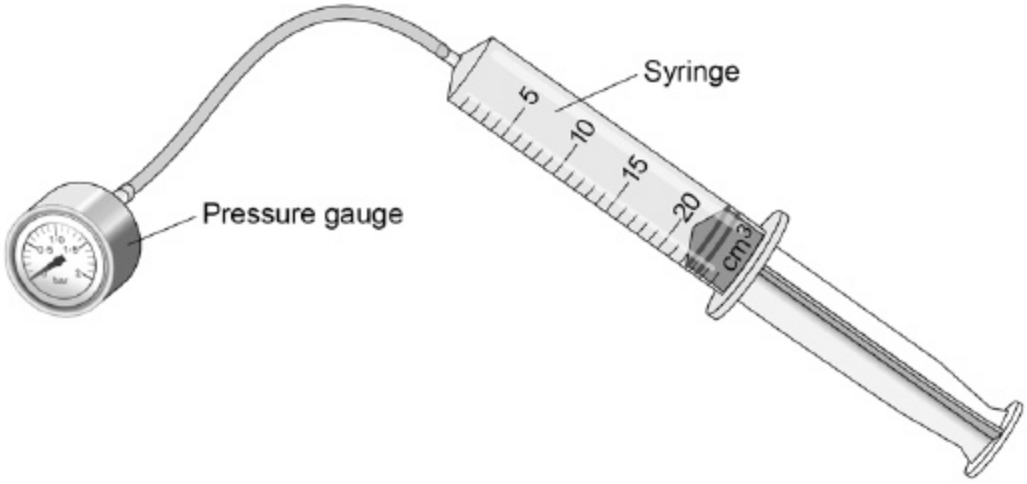
(2)

(Total 11 marks)

2. A student investigated how the pressure of a gas varied with the volume of the gas.

The mass and temperature of the gas were constant.

The diagram shows the equipment the student used.



(a) What is the range of the syringe?

Tick **one** box.

0 to 1 cm^3 ☐

0 to 5 cm^3 ☐

0 to 20 cm^3 ☐

0 to 25 cm^3 ☐

(1)

(b) What type of variable was the mass of gas?

Tick **one** box.

Control ☐

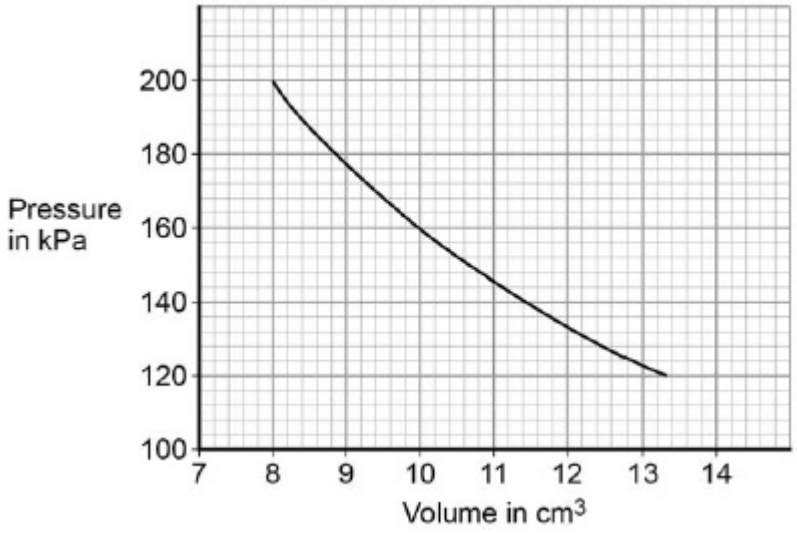
Dependent ☐

Independent ☐

(1)

The student compressed the gas in the syringe and read the pressure from the pressure gauge.

The graph shows the student's results.



(c) The student concluded that when the pressure was multiplied by the corresponding volume the answer was the same.

Use data from the graph to show that the student's conclusion was correct.

_____

_____

_____

_____

_____

_____

(2)

(d) Complete the sentences.

Choose the answers from the box.

Each answer may be used once, more than once or not at all.

decreases	**increases**	**remains the same**

When the gas is compressed, the volume of gas in the syringe _____ .

So the number of collisions each second between the gas particles inside the syringe and the inside surface of the syringe _____ .

This means the force exerted on the inside surface of the container walls _____ .

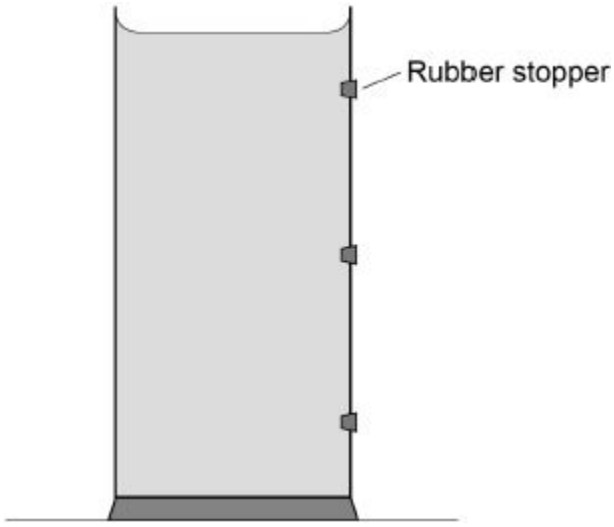
(3)

(Total 7 marks)

3. **Figure 1** shows a container filled with water.

The three holes in the side of the container are sealed with rubber stoppers.

Figure 1



(a) The water exerts a force of 27 N on the bottom of the container.
The cross-sectional area of the bottom of the container is 0.009 m^2.

Calculate the pressure exerted by the water on the bottom of the container.

Use the equation:

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

Choose the unit.

kg/m^3	**N/m**	**Pa**

_____

_____

_____

_____

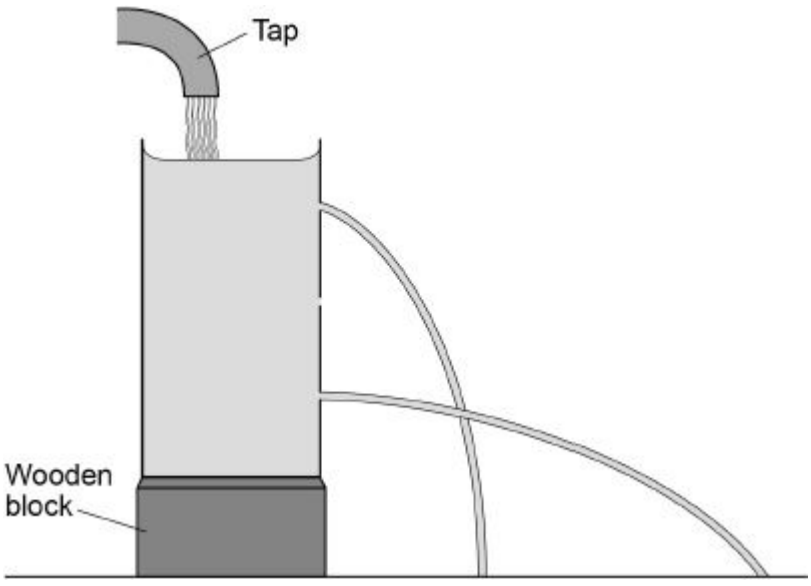
Pressure = _____ Unit = _____

(3)

The container is put under running water from a tap and the three rubber stoppers removed.

Figure 2 shows the path taken by the water escaping from the top and bottom holes.

Figure 2



(b) Complete **Figure 2** to show the path taken by the water escaping from the centre hole.

(1)

(c) What can be concluded from **Figure 2** about the pressure in a liquid?

_____

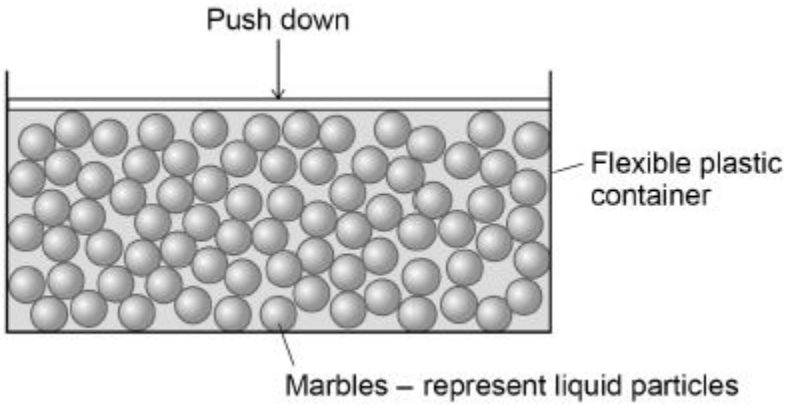
_____

(1)

(d) **Figure 3** shows a simple model of a liquid.

When a force pushes down on the marbles, the marbles push the sides and bottom of the container outwards.

Figure 3



What can be concluded from this model about the pressure in a liquid?

_____

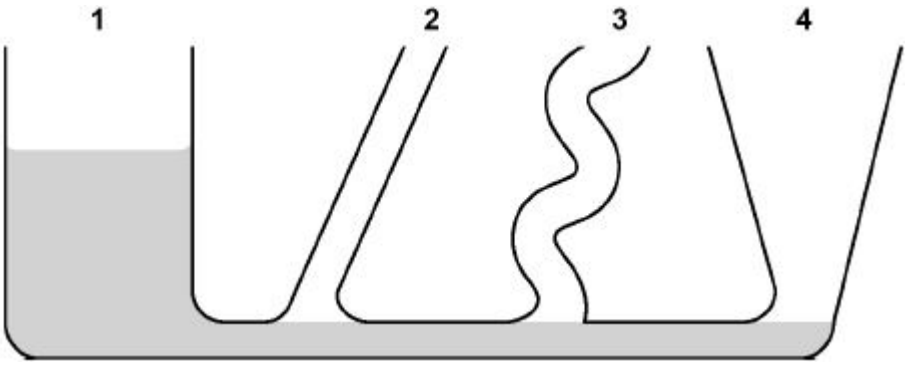
_____

(1)

(Total 6 marks)

4. The diagram below shows an unusually shaped container.

The container has four vertical tubes of different shape and size.



Water is poured into the container up to the level shown in tube **1**.

(a) Complete the diagram above to show the height of the water in tubes **2**, **3** and **4**.

(1)

(b) The further a swimmer dives below the surface of the sea, the greater the pressure on the swimmer.

Explain why.

_____

_____

_____

_____

(2)

(c) A person swims from a depth of 0.50 m to a depth of 1.70 m below the surface of the sea.

density of the sea water = 1030 kg/m^3

gravitational field strength = 9.8 N/kg

Calculate the increase in pressure on the swimmer.

Give the unit.

Use an equation from the Physics Equation Sheet.

_____

_____

_____

_____

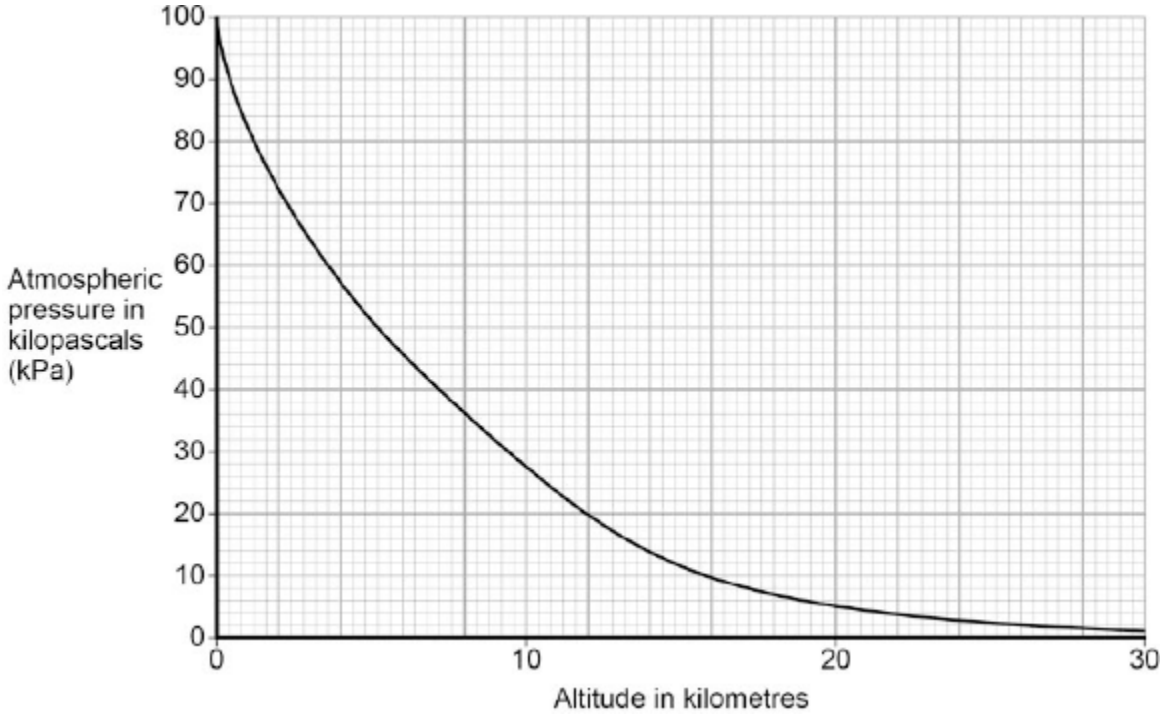
Increase in pressure = _____ Unit _____

(4)

(Total 7 marks)

5. **Figure 1** shows how atmospheric pressure varies with altitude.

Figure 1



(a) Explain why atmospheric pressure decreases with increasing altitude.

_____

_____

_____

_____

_____

_____

(3)

(b) When flying, the pressure inside the cabin of an aircraft is kept at 70 kPa.

The aircraft window has an area of 810 cm^2.

Use data from **Figure 1** to calculate the resultant force acting on an aircraft window when the aircraft is flying at an altitude of 12 km.

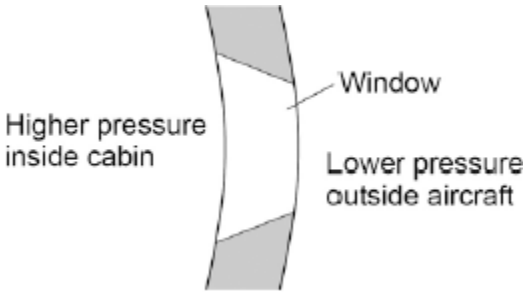
Give your answer to two significant figures

Resultant force = _____ N

(5)

(c) **Figure 2** shows the cross-section of one type of aircraft window.

Figure 2



Explain why the window has been designed to have this shape.

(2)

(Total 10 marks)

6. Mountain bike riders use brakes to slow down.

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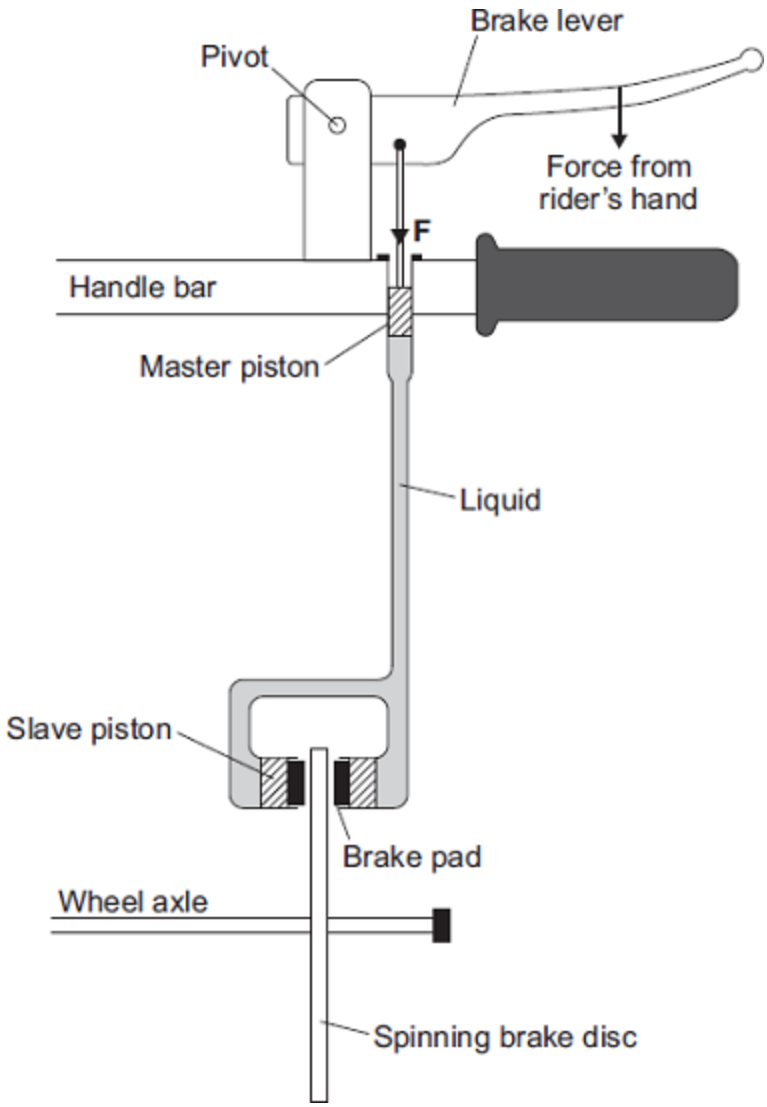
Some mountain bikes use liquid-filled pipes to transmit the force from the rider's hand on the brake lever to the brake pads. These brakes are called hydraulic brakes.



(a) Draw a ring around the correct answer to complete each sentence.

(i) Liquids can be used to transmit the forces in a brake system,

because liquids

are incompressible.
can flow.
take the shape of the container.

(1)

(ii) The pressure in the liquid is transmitted

against force **F** only.
downwards only.
in all directions.

(1)

(b) When the rider's hand pulls on the brake lever, the force **F** applied to the liquid by the master piston is 80 N. The cross-sectional area of this piston is 50 mm^2.

Calculate the pressure, in N/mm^2, exerted on the liquid by the master piston.

_____

_____

_____

Pressure = _____ N/mm^2

(2)

(c) The unit N/mm^2 is **not** the usual unit of pressure.

Which unit is usually used when calculating pressure?

Draw a ring around the correct answer.

N Nm^2 Pa

(1)

(d) The rider applies a larger force to the brake lever. How would this increase in force affect the pressure in the liquid?

_____

(1)

(Total 6 marks)