

PHYSICS



EXAM QUESTION PACK

4.5.5.2 ATMOSPHERIC PRESSURE

SCORE

/42

PERCENTAGE

%

STEMUP

These questions belong to AQA, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by AQA. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with AQA and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. AQA has not endorsed, approved or been involved in the production of it. AQA and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

AQA publishes its past papers, mark schemes and examiner reports. Always check the current specification at aqa.org.uk before you revise, because content and wording can change between series.

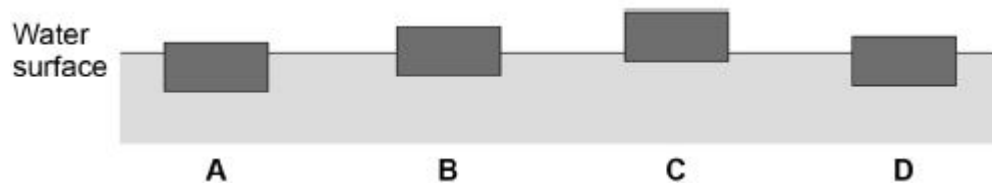
If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

Q1.

Figure 1 shows four blocks of different materials floating on water.

The four blocks are the same volume.

Figure 1



- (a) Which of the blocks has the smallest weight?

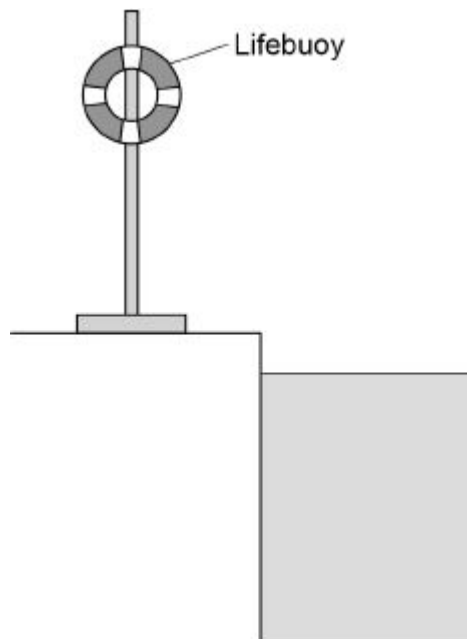
Tick **one** box.

A ☐ B ☐ C ☐ D ☐

(1)

Figure 2 shows a lifebuoy next to a deep swimming pool.

Figure 2



- (b) The lifebuoy has a mass of 2.5 kg.
gravitational field strength = 9.8 N/kg
Calculate the weight of the lifebuoy.

Use the equation:

$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

Weight = _____ N

(2)

- (c) When thrown into the water the lifebuoy floats. The two forces acting on the lifebuoy are the weight of the lifebuoy downwards and upthrust upwards.

How big is the upthrust on the lifebuoy compared to the weight of the lifebuoy?

Tick **one** box.

The upthrust is greater than the weight.

☐

The upthrust is less than the weight.

☐

The upthrust is the same as the weight.

☐

(1)

- (d) Write down the equation which links acceleration, mass and resultant force.

(1)

- (e) A rope is used to pull the lifebuoy to the side of the swimming pool.

A resultant force of 4.0 N acts on the lifebuoy.

The mass of the lifebuoy is 2.5 kg.

Calculate the acceleration of the lifebuoy.

Acceleration = _____ m/s²

(3)

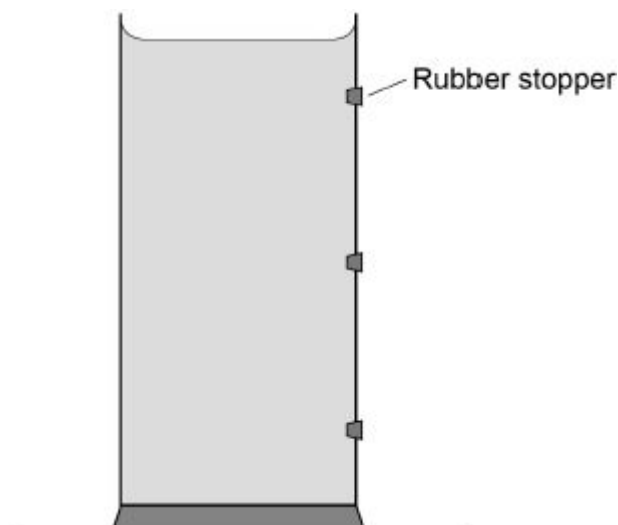
(Total 8 marks)

Q2.

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 m².

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/m³	N/m	Pa
-------------------------	------------	-----------

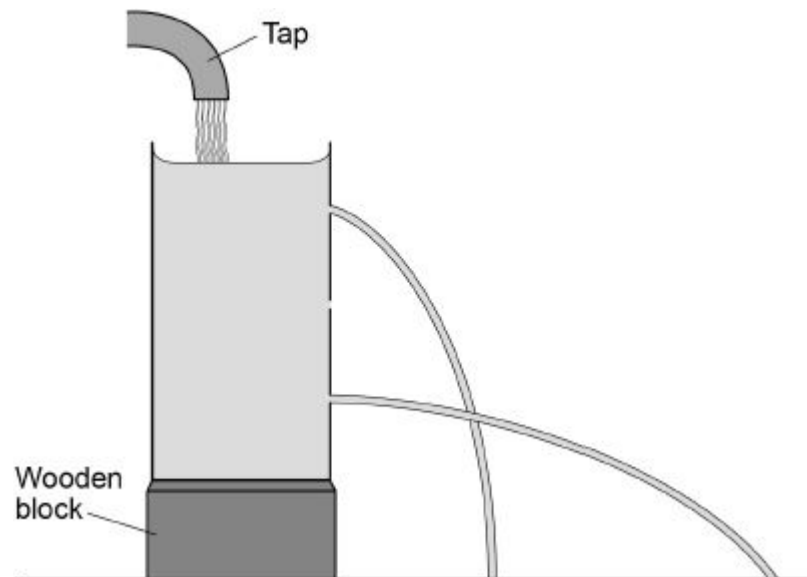
Pressure = _____ Unit = _____

(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)

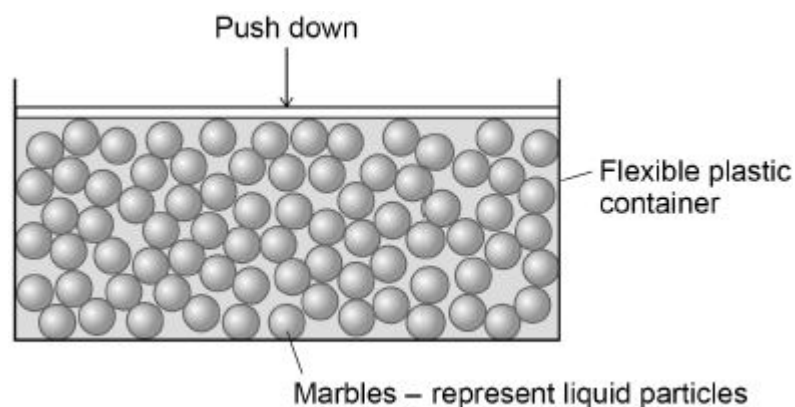
- (c) What can be concluded from **Figure 2** about the pressure in a liquid?

(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?

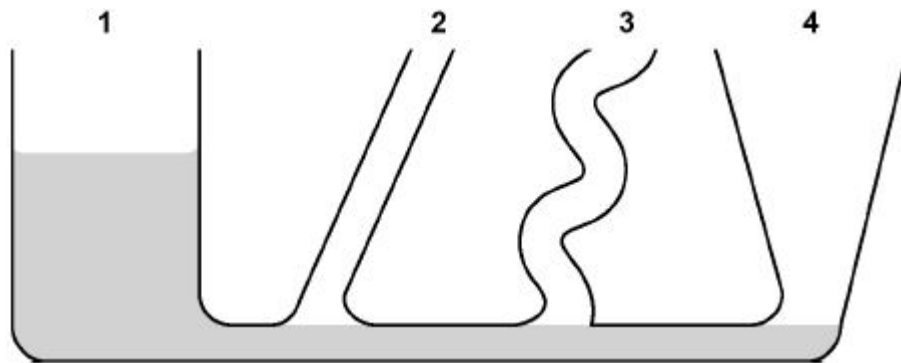
(1)

(Total 6 marks)

Q3.

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 _____

Q4.

Figure 1 shows a boat floating on the sea. The boat is stationary.

Figure 1



(a) **Figure 2** shows part of the free body diagram for the boat.

Complete the free body diagram for the boat.

Figure 2



(2)

(b) Calculate the mass of the boat.

Use the information given in **Figure 2**.

gravitational field strength = 9.8 N/kg

Give your answer to **two** significant figures.

Mass = _____ kg

(4)

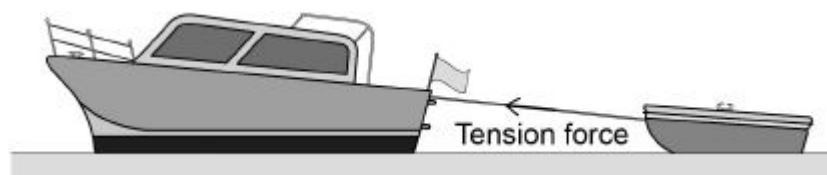
- (c) When the boat propeller pushes water backwards, the boat moves forwards.
The force on the water causes an equal and opposite force to act on the boat.

Which law is this an example of?

(1)

- (d) **Figure 3** shows the boat towing a small dinghy.

Figure 3



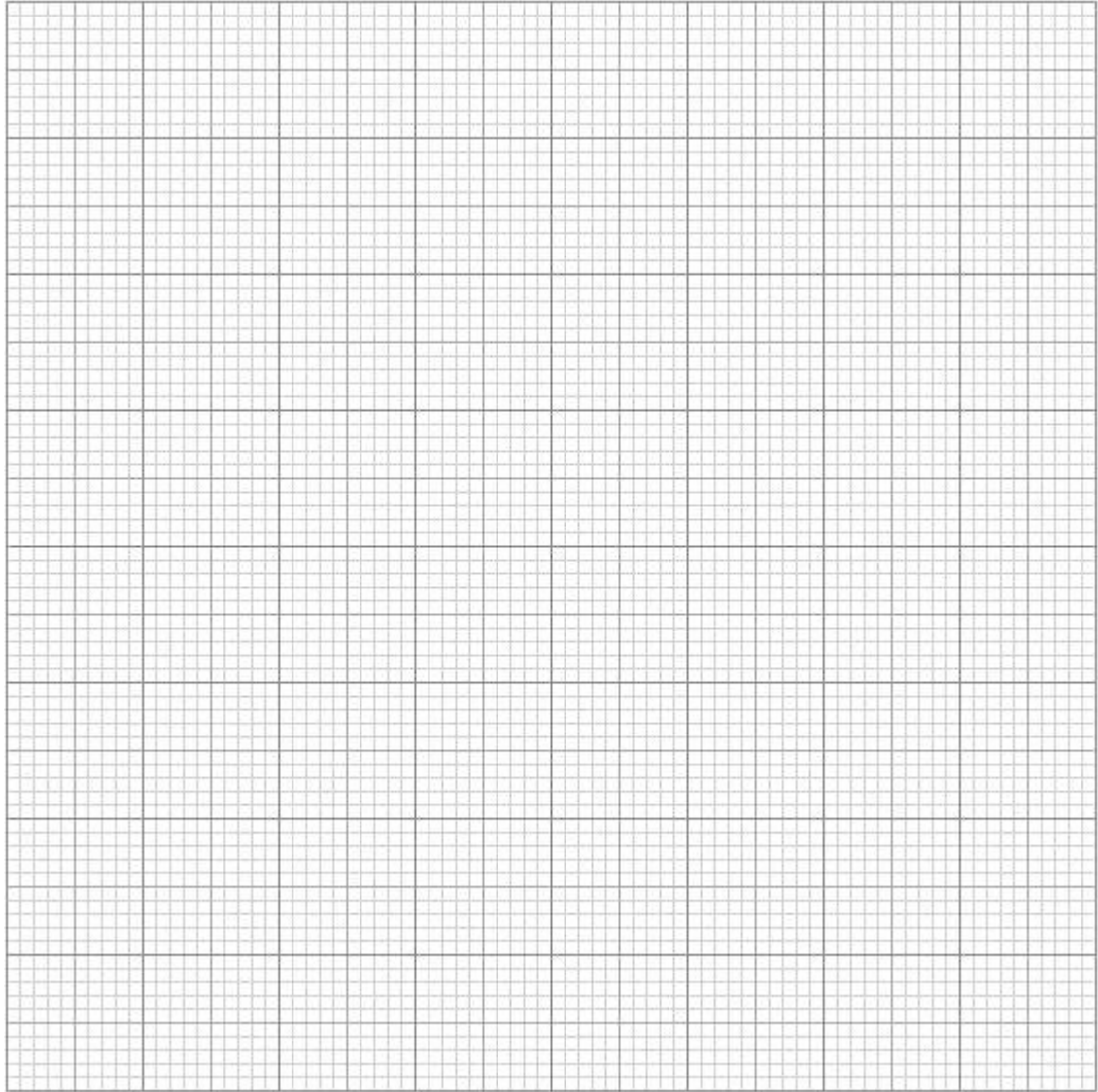
The tension force in the tow rope causes a horizontal force forwards and a vertical force upwards on the dinghy.

horizontal force forwards = 150 N
vertical force upwards = 50 N

Figure 4 shows a grid.

Draw a vector diagram to determine the magnitude of the tension force in the tow rope and the direction of the force this causes on the dinghy.

Figure 4



Magnitude of the tension force in the tow rope = _____ N

Direction of the force on the dinghy caused
by the tension force in the tow rope = _____

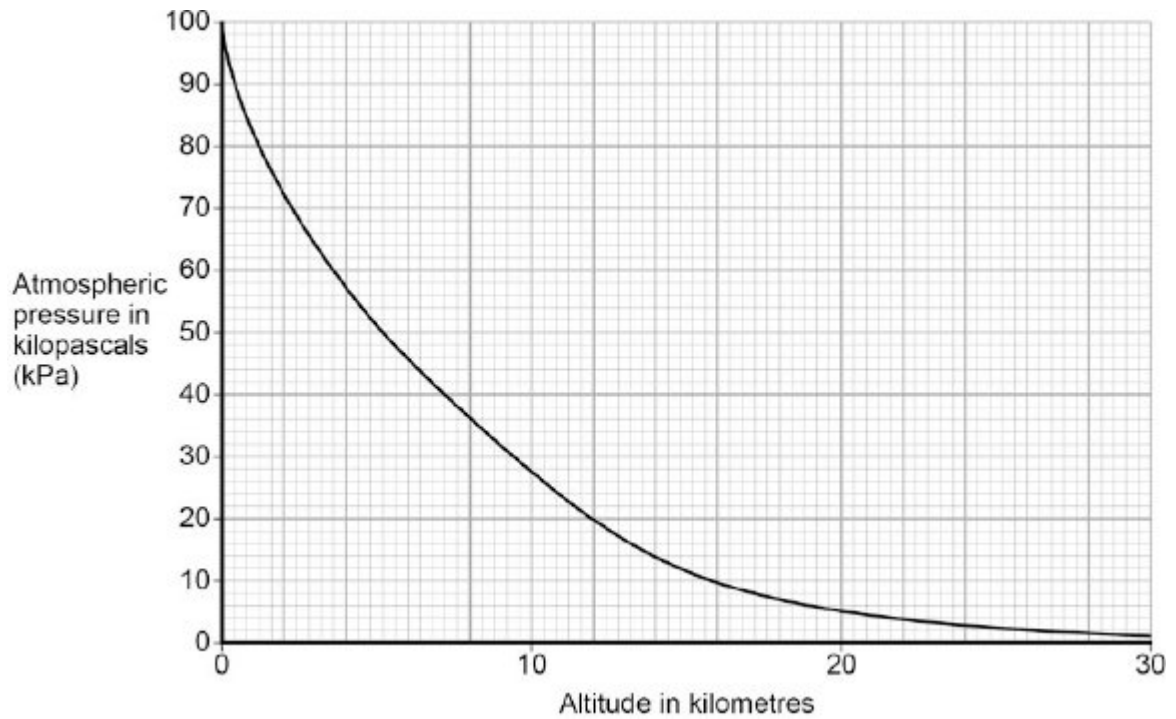
(4)

(Total 11 marks)

Q5.

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.

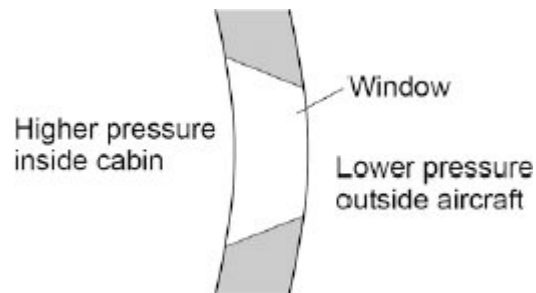
Give your answer to two significant figures

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)

Mark schemes

Q1.

(a) C 1

(b) weight = 2.5×9.8 1

weight = 24.5 (N)

an answer of 24.5 rounded to 25 scores 2 marks

1

an answer of 24.5 scores 2 marks

(c) the upthrust is the same as the weight 1

(d) (resultant) force = mass $\times$ acceleration

allow $F = m a$

1

(e) $4.0 = 2.5 \times a$ 1

$$a = \frac{4.0}{2.5}$$

1

$a = 1.6 \text{ (m/s}^2\text{)}$

1

an answer of 1.6 scores 3 marks

[8]

Q2.

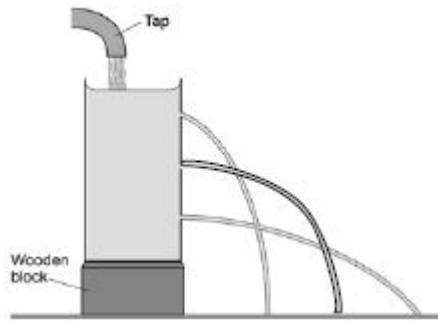
(a) $p = \frac{27}{0.009}$ 1

$p = 3000$ 1

Pa 1

an answer of 3000 scores 2 marks

(b)



the water path hits the surface somewhere between the other two paths

1

- (c) pressure increases with depth

allow when the pressure is higher, the water travels further

1

- (d) pressure acts in all directions

or

pressure causes a force on (all) the surfaces

ignore liquids cannot be compressed

1

[6]

Q3.

- (a) all heights drawn the same as tube 1

judge by eye

1

- (b) increasing depth increases the height / mass / volume (of the water column) above the swimmer

allow more water above (the swimmer)

more water is insufficient

1

increasing the weight / force (of water) acting on the swimmer

1

- (c) increase in depth = 1.2 (m)

1

$$(\Delta) p = 1.2 \times 1030 \times 9.8$$

allow either 0.50 or 1.70 for 1.2

1

$$(\Delta) p = 12112.8$$

allow a correctly rounded answer

allow a correct calculation using either 0.50 or 1.70

1

pascals **or** Pa

*do **not** accept pa*

allow N/m²

an answer of 12 112.8 scores 3 marks

[7]

Q4.

- (a) arrow of equal size pointing vertically upwards

judged by eye

ignore horizontal arrows if equal and opposite

horizontal arrows of unequal length negates this mark

labelled 'upthrust'

ignore buoyancy

ignore 25 kN

- (b) weight = 25 kN

allow 24 to 25 kN inclusive

$$25\,000 = \text{mass} \times 9.8$$

or

$$m = \frac{25000}{9.8}$$

allow their W correctly converted and substituted

$$m = 2551 \text{ kg}$$

allow correctly calculated value using their converted W

allow a value correctly calculated with W in kN

$$m = 2600 \text{ kg}$$

allow a calculated answer correctly rounded to 2 significant figures

an answer of 2600 scores 4 marks

- (c) Newton's 3rd law (of motion)

- (d) vertical force (50 N) drawn

and

horizontal force (150 N) drawn to the same scale

resultant tension force in the correct direction

shown by an arrowhead

value of the tension force in the range 156 N–160 N

allow a calculated value of 158

value of direction in the range 18° – 20° (from the horizontal)

allow 70° to 72° (from the vertical)

allow a bearing in the range 288 to 290

1

[11]

Q5.

- (a) air molecules colliding with a surface create pressure

1

at increasing altitude distance between molecules increases

or

at increasing altitude fewer molecules (above a surface)

1

so number of collisions with a surface decreases

or

or so always less weight of air than below (the surface)

1

- (b) atmospheric pressure = 20 kPa from graph **and** conversion of 810 cm^2 to 0.081 m^2

allow ecf for an incorrect value clearly obtained from the graph

1

$$5 \times 10^4 = \frac{F}{0.081}$$

$$0.081$$

1

$$F = 5 \times 10^4 \times 0.081$$

1

$$4050$$

1

$$4100 \text{ (N)}$$

1

allow 4100 (N) with no working shown for 5 marks

allow 4050 with no working shown for 4 marks

- (c) force from air pressure acting from inside to outside bigger than force acting inwards

1

so keeps the window in position

1

[10]