Pressure

Question Paper 1

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	General Physics
Sub-Topic	Pressure
Paper Type	(Extended) Theory Paper
Booklet	Question Paper 1

Time Allowed: **62 minutes**

Score: **/52**

Percentage: **/100**

1 A large stone block is to be part of a harbour wall. The block is supported beneath the surface of the sea by a cable from a crane. Fig. 2.1 shows the block with its top face a distance *h* beneath the surface of the sea.

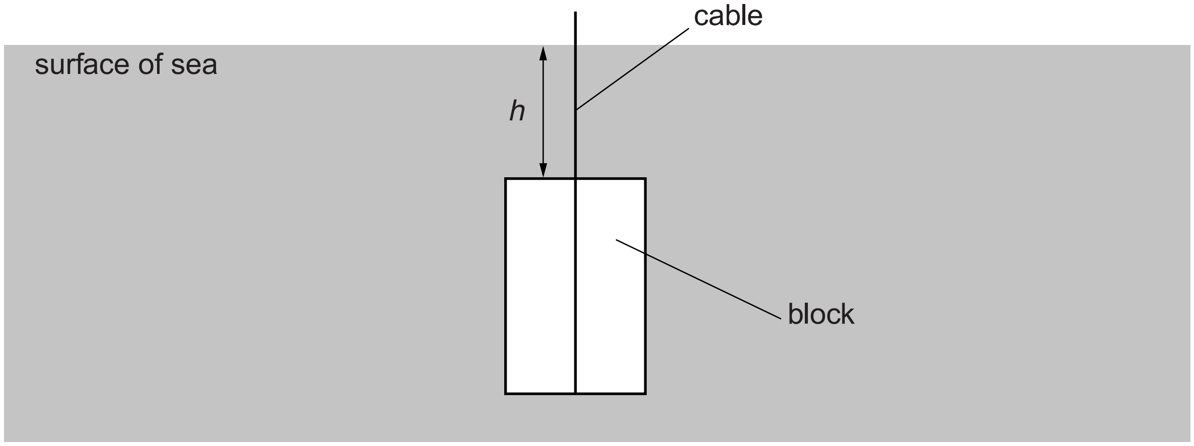


Fig. 2.1

The force acting downwards on the top face of the block, due to the atmosphere and the depth *h* of water, is 3.5×10^4 N.

(a) The top face of the block has an area of $0.25\,m^2$.

(i) Calculate the pressure on the top face of the block.

pressure = ... [2]

(ii) The atmospheric pressure is 1.0×10^5 Pa.

Calculate the pressure on the top face of the block due to the depth *h* of water.

pressure = ... [1]

(iii) The density of sea water is $1020\,kg/m^3$.

Calculate the depth *h*.

h = ... [2]

(b) Suggest two reasons why the tension force in the cable is not 3.5×10^4 N.

1. ....

2. ....
[2]

(c) The block is lowered so that it rests on the sea-bed.

State what happens to the tension force in the cable.

.... [1]

[Total: 8]

2 **(a)** Fig. 3.1 shows an oil can containing only air at atmospheric pressure.

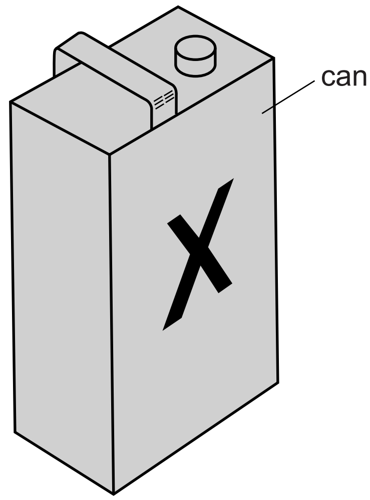


Fig. 3.1

Atmospheric pressure is 1.0×10^5 Pa.

The pressure of the air in the can is reduced by means of a pump. The can collapses when the pressure of the air in the can falls to 6000 Pa.

(i) Explain why the can collapses.

....

....[1]

(ii) The surface area of face X of the can is $0.12\,m^2$.

Calculate the resultant force on face X when the can collapses.

force = ...[3]

(b) Mercury is poured into a U-shaped glass tube. Water is then poured into one of the limbs of the tube. Oil is poured into the other limb until the surfaces of the mercury are at the same level in both limbs.

Fig. 3.2 shows the result.

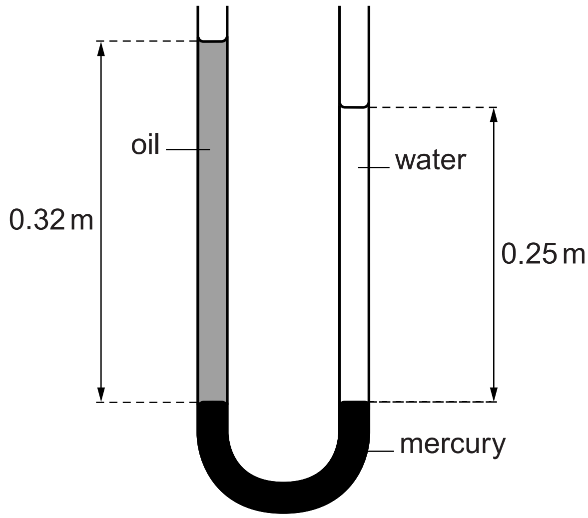


Fig. 3.2

(i) State a condition that must be true in order for the mercury surfaces to be at the same level in both limbs of the tube.

....[1]

(ii) The height of the water column is 0.25 m. The height of the oil column is 0.32 m. The density of water is 1000 kg / m^3.

Calculate

1. the pressure exerted by the water on the surface of the mercury,

pressure = ...[2]

2. the density of the oil.

density = ...[2]

[Total: 9]

3 **(a)** **(i)** Define *pressure*.

.... [1]

(ii) A closed box contains a gas.

Explain, in terms of molecules, how the gas exerts a pressure on the walls of the box.

....

....

....

....

.... [3]

(b) Fig. 6.1 shows a flask connected to a pump and also to a manometer containing mercury.

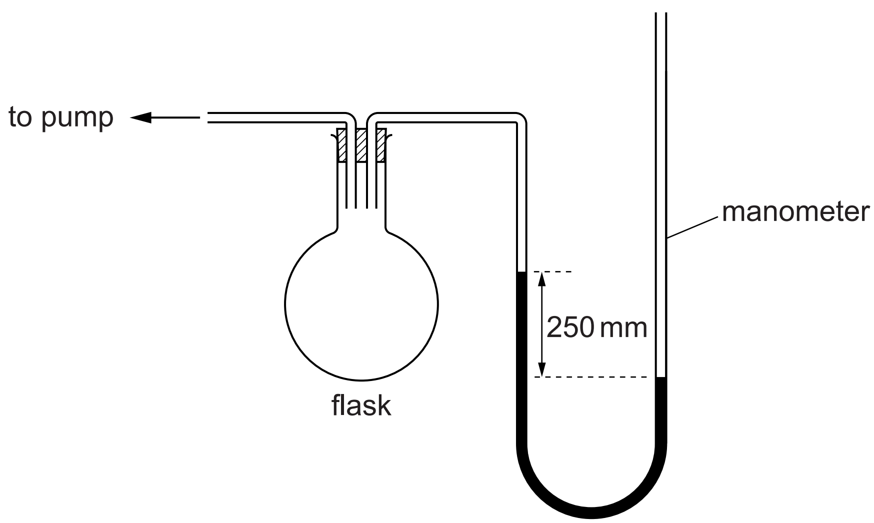


Fig. 6.1

The right-hand tube of the manometer is open to the atmosphere.

The pump has been operated so that the mercury levels differ, as shown, by 250 mm. The density of mercury is 13 600 kg / m^3.

(i) Calculate the pressure, in Pa, due to the 250 mm column of mercury.

pressure = ... [2]

(ii) The pressure of the atmosphere is 1.02×10^5 Pa.

Calculate the pressure of the air in the flask.

pressure = ... [1]

[Total: 7]

4 **(a)** Complete the following statements by writing appropriate words in the spaces.

The pressure of a gas in a sealed container is caused by the collisions of

.... with the container wall.

An increase in the temperature of the gas increases the pressure because the

.... of the .... increases.

The force on the wall due to the gas is the pressure multiplied by the ....

of the wall. [2]

(b) A mountaineer takes a plastic bottle containing some water to the top of a mountain. He removes the cap from the bottle, drinks all the water and then replaces the cap, as shown in Fig. 6.1.

On returning to the base of the mountain, he finds that the bottle has collapsed to a much smaller volume, as shown in Fig. 6.2.

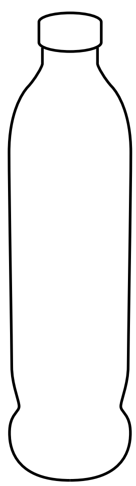


Fig. 6.1

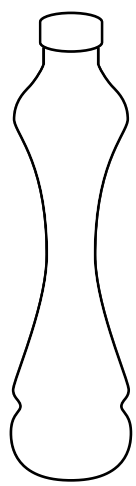


Fig. 6.2

(i) Explain why the bottle collapsed.

....

....

....

.... [2]

(ii) At the top of the mountain the atmospheric pressure was 4.8×10^4 Pa and the volume of the bottle was $250\,cm^3$.

Calculate the volume of the bottle at the base of the mountain where the pressure of the air inside the bottle is 9.2×10^4 Pa. Assume no change of temperature.

volume = ... [3]

[Total: 7]

5 A diver is at a depth of 25 m beneath the surface of a lake. He carries a cylinder of high-pressure air on his back.

(a) **(i)** Explain how the air molecules exert a pressure on the inside surface of the cylinder.

....

....

....

.... [3]

(ii) The diver gradually uses up the air in the cylinder. Explain why the pressure falls.

....

....

.... [1]

(b) The density of the water in the lake is 1000 kg / m^3 and the atmospheric pressure at the surface is 1.0×10^5 Pa.

Calculate the total pressure 25 m beneath the surface of the lake.

total pressure = ... [3]

[Total: 7]

6 During a period of hot weather, the atmospheric pressure on the pond in Fig. 3.1 remains constant. Water evaporates from the pond, so that the depth *h* decreases.

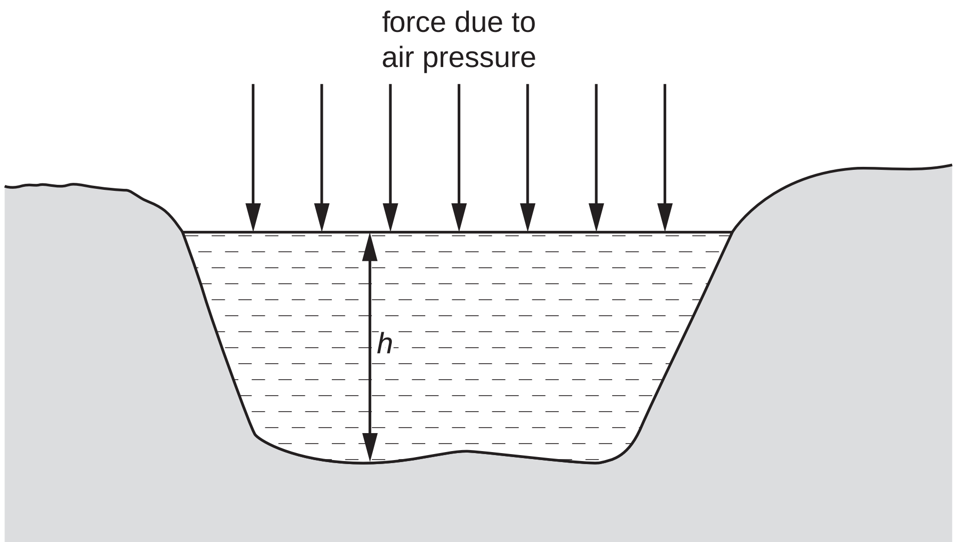


Fig. 3.1

(a) Study the diagram and state, giving your reason, what happens during this hot period to

(i) the force of the air on the surface of the pond,

....

....[1]

(ii) the pressure at the bottom of the pond.

....

....[1]

(b) On a certain day, the pond is 12 m deep.

(i) Water has a density of 1000 kg / m^3.

Calculate the pressure at the bottom of the pond due to the water.

pressure due to the water = ...[2]

(ii) Atmospheric pressure on that day is 1.0×10^5 Pa.

Calculate the total pressure at the bottom of the pond.

total pressure = ...[1]

(iii) A bubble of gas is released from the mud at the bottom of the pond. Its initial volume is $0.5\,cm^3$.

Ignoring any temperature differences in the water, calculate the volume of the bubble as it reaches the surface.

volume = ...[2]

(iv) In fact, the temperature of the water is greater at the top than at the bottom of the pond.

Comment on the bubble volume you have calculated in **(b)(iii)**.

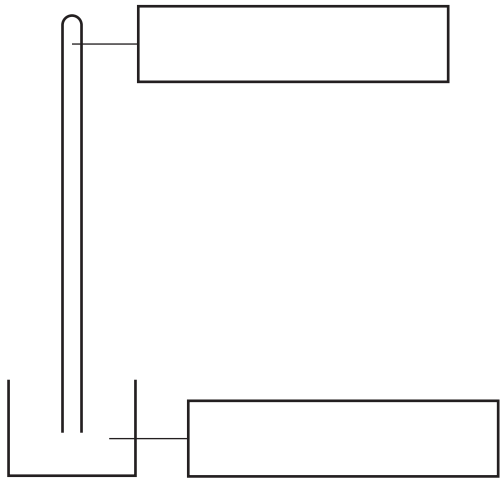
....

....

....[1]

[Total: 8]

7 **(a)** Complete Fig. 4.1 to show a simple mercury barometer. Insert the correct labels in the boxes. Label with the letter *h* the measurement required to calculate the pressure of the atmosphere.



[3]

Fig. 4.1

(b) The value of *h* taken using this barometer is 0.73 m. The density of mercury is 13 600 kg / m^3. Calculate the value of the atmospheric pressure suggested by this measurement. Use g = 10 m / s^2.

atmospheric pressure = ...[2]

(c) Standard atmospheric pressure is 0.76 m of mercury. Suggest a reason why the value of *h* in **(b)** is lower than this.

....

....[1]

[Total: 6]