Pressure – 2019 June

1. 0625/31/M/J/19/No.4

Fig. 4.1 shows a pin. Fig. 4.2 shows a person pushing the pin into a wall.

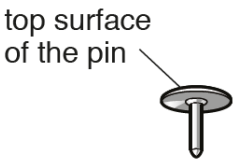


Fig. 4.1

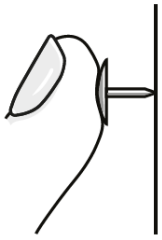


Fig. 4.2

(a) (i) The area of the top surface of the pin is 1.8 cm^2. The person applies a force of 50 N.

Calculate the pressure exerted on the top surface of the pin.

pressure = ... N/cm^2 [3]

(ii) The area of the top surface of the pin is 500 times larger than the area of the point. Calculate the value of the pressure exerted by the point on the wall.

pressure = ... N/cm^2 [1]

(b) Fig. 4.3 shows a simple device for measuring atmospheric pressure.

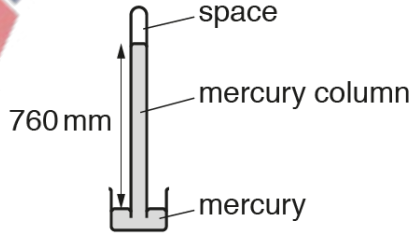


Fig. 4.3

(i) State the name given to the device shown in Fig. 4.3.

..... [1]

(ii) State what, if anything, is in the space at the top of the tube, above the mercury column.

..... [1]

(iii) Fig. 4.3 shows normal atmospheric pressure. Suggest a possible value for the height of the mercury column when atmospheric pressure decreases. Include the unit.

reading = ... [1]

[Total: 7]

2. 0625/32/M/J/19/No.4

A student places a balloon filled with air next to a window, as shown in Fig. 4.1. The Sun warms the air in the balloon.

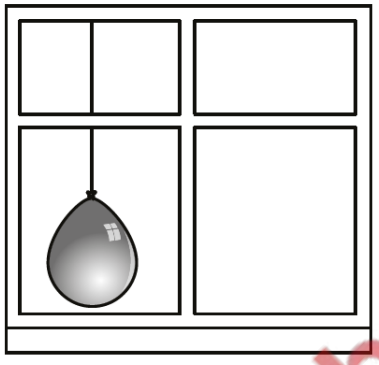


Fig. 4.1

(a) **(i)** Suggest what happens to the balloon as the air in it becomes hotter than the surroundings.

..... [1]

(ii) Use ideas about molecules to explain your answer to **(a)(i)**.

.....

.....

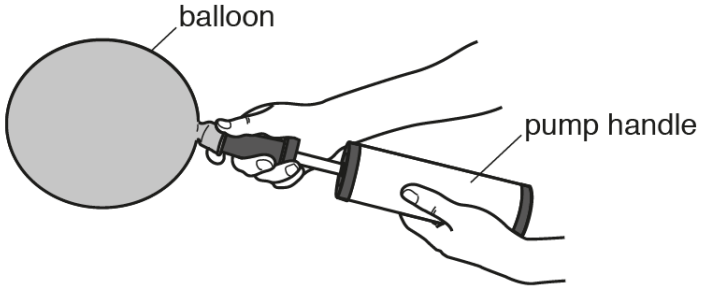
.....

.....

..... [3]

(b) The student uses a pump to inflate another balloon.

Fig. 4.2 shows the student inflating a balloon.



The student applies a force of 30 N to the pump handle. The force acts on an area of 12 cm^2.

Calculate the pressure on the pump handle. Include the unit.

pressure = ... [4]

[Total: 8]

3. 0625/41/M/J/19/No.3

A cube of side 0.040 m is floating in a container of liquid. Fig. 3.1 shows that the surface of the liquid is 0.028 m above the level of the bottom face of the cube.

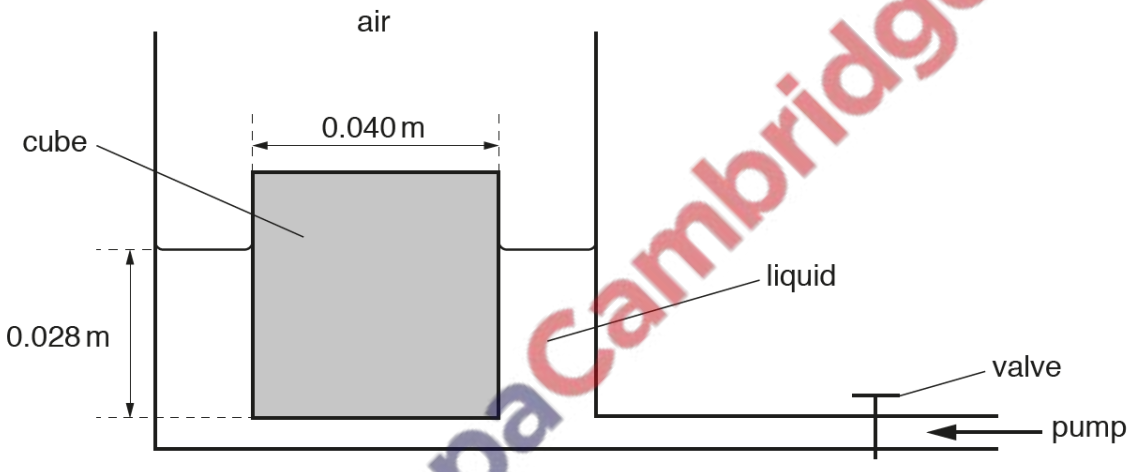


Fig. 3.1

The pressure of the air above the cube exerts a force on the top face of the cube. The valve is closed.

(a) Explain, in terms of air molecules, how the force due to the pressure of the air is produced.

.....

.....

.....

..... [3]

(b) The density of the liquid in the container is 1500 kg / m^3.

Calculate:

(i) the pressure due to the liquid at a depth of 0.028 m

pressure = ... [2]

(ii) the force on the bottom face of the cube caused by the pressure due to the liquid.

force = ... [2]

(c) The valve is opened and liquid is pumped into the container. The surface of the liquid rises a distance of 0.034 m.

The cube remains floating in the liquid with its bottom face 0.028 m below the surface of the liquid.

(i) Calculate the work done on the cube by the force in **(b)(ii)**.

work done = ... [2]

(ii) Suggest **one** reason why this is **not** an efficient method of lifting up the cube.

.....

..... [1]

[Total: 10]

4. Fig. 3.1 shows a small submarine submerged below the surface of the sea.

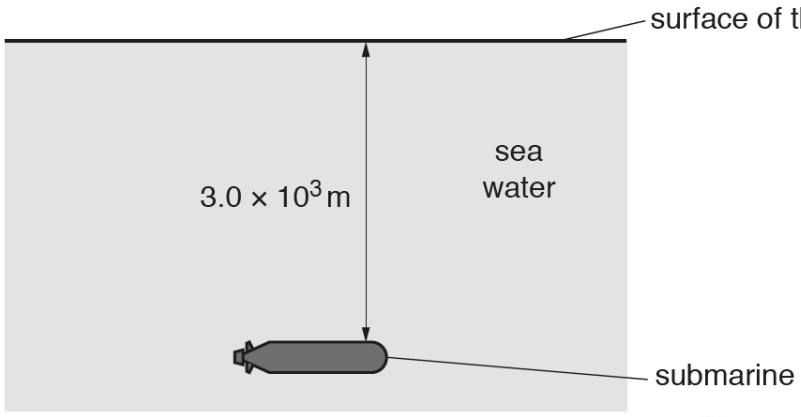


Fig. 3.1

(a) The density of sea water is 1030 kg/m^3.

Calculate the pressure due to the sea water on the top of the submarine when it is 3.0×10^3 m below the surface.

pressure = ... [2]

(b) The submarine emits a pulse of sound to detect other objects in the sea. The speed of sound in sea water is 1500 m/s. An echo is received with a time delay of 0.50 s after the original sound is emitted.

(i) Calculate the distance between the submarine and the other object.

distance = ... [3]

(ii) Another pulse of sound is emitted through the air when the submarine is on the surface.

An echo is received from a second object that is in the air. This echo is received 0.50 s after the pulse of sound is emitted.

Compare the distance of the second object from the submarine with the distance calculated in **(b)(i)**. Tick **one** box. Give a reason for your answer.

distance is smaller ☐

distance is the same ☐

distance is larger ☐

Reason ..... [1]

[Total: 6]

(a) Fig. 4.1 shows a mercury barometer. The tube containing the mercury is vertical.

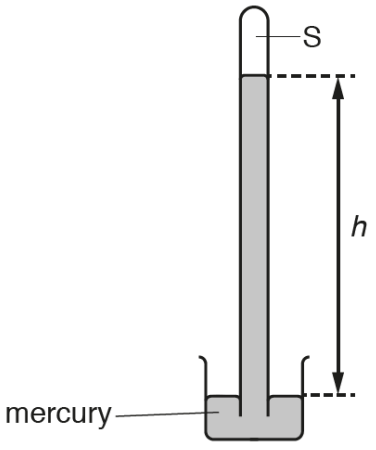


Fig. 4.1

(i) The height *h* indicates a value of the atmospheric pressure.

State what is contained in the space labelled S.

..... [1]

(ii) On a particular day the atmospheric pressure is 1.02×10^5 Pa. The density of mercury is 13 600 kg / m^3.

Calculate the value of *h* indicated by the barometer.

h = ... [2]

(iii) The tube containing mercury is now tilted so that it makes an angle of 10° with the vertical. After tilting, there continues to be a space above the mercury in the tube.

State and explain whether the vertical height of mercury in the tube is smaller, the same, or greater than the value calculated in **(a)(ii)**.

.....

.....

..... [2]

(b) Another mercury barometer in the same room at the same time shows a lower value of *h* than the barometer in **(a)**.

Suggest and explain a reason for the lower value.

.....

.....

..... [2]

[Total: 7]