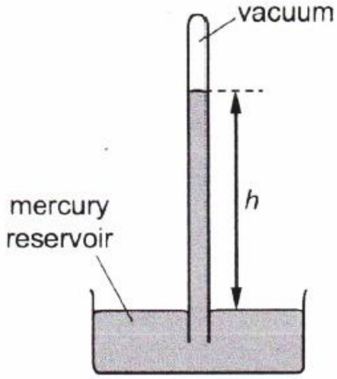
1. March/2020/Paper_12/No.12

Diagram 1 shows a tube sealed at one end and partly immersed in mercury. The tube has a diameter *d*. The top of the mercury in the tube is a height *h* above the mercury reservoir.

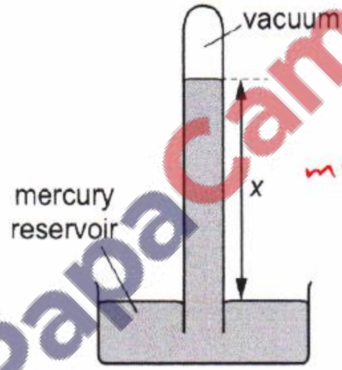
diagram 1



mercury barometer 1

Diagram 2 shows a similar arrangement with a tube that has a diameter 2*d*.

diagram 2



mercury barometer 2

What is the relationship between *h* and *x*?

A $x = 2h$

B $x = h$

C $x = \frac{h}{2}$

D $x = \frac{h}{4}$

- mercury barometer measures the atmospheric pressure.

$P = \rho \times g \times h$.

ρ - density of mercury
g - gravity
h - height.

- Pressure does not depend on the diameter of the tube, but on the height of the tube.

- So for both barometers, the height will be the same

$h = x$

2. March/2020/Paper_12,22/No.13,14

A skier is standing still on a flat area of snow.

W = 550N (Force)

A = 0.015 m²

Pressure = Force / Area.

P = 550N / 0.015 m²

= 36,666 N/m²

≃ 37,000 N/m². (2 s.f)

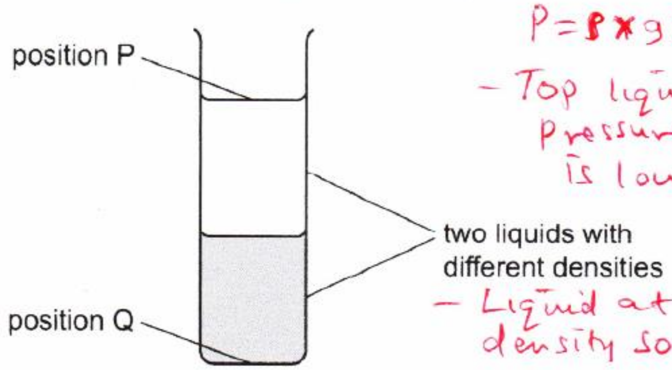
The weight of the skier is 550 N. The total area of his skis in contact with the ground is 0.015 m^2.

What is the pressure exerted on the ground by the skier?

A 0.83 N/m^2 **B** 8.3 N/m^2 **C** 3700 N/m^2 **D** 37 000 N/m^2

3. March/2020/Paper_22/No.15

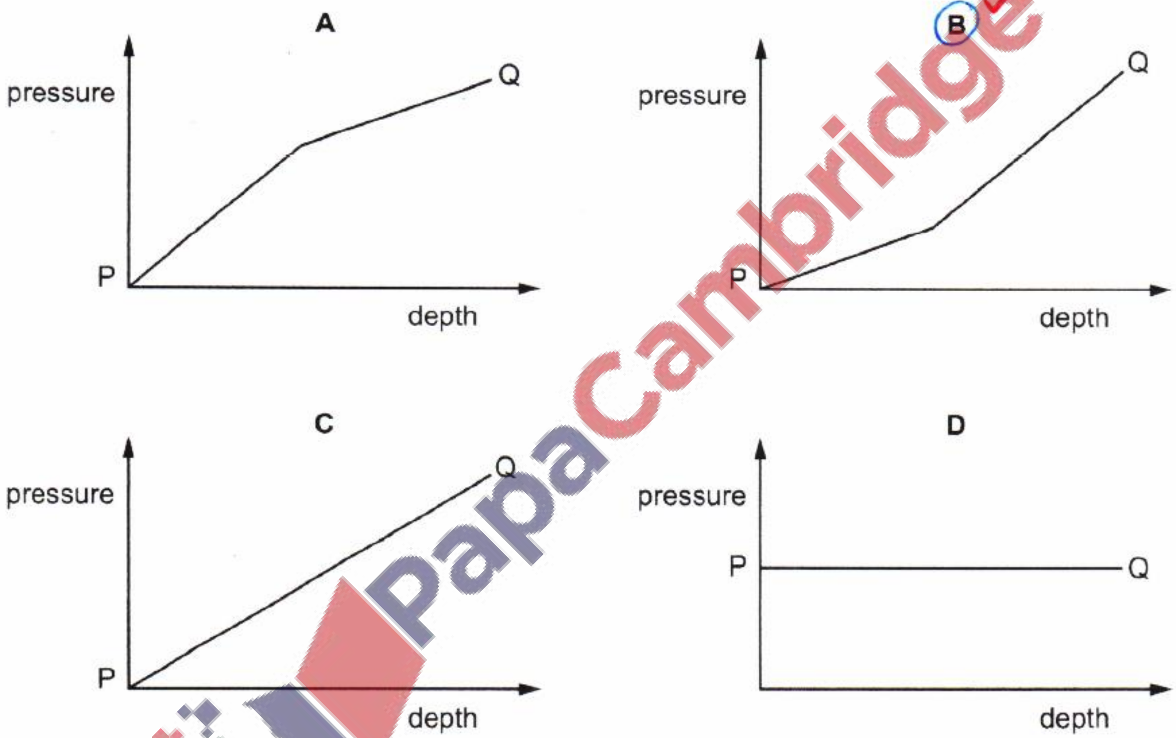
A tall cylinder is partly filled with two liquids which do not mix. The two liquids have different densities. A student measures the pressure due to the liquids at different depths.



$P = \rho \times g \times h$

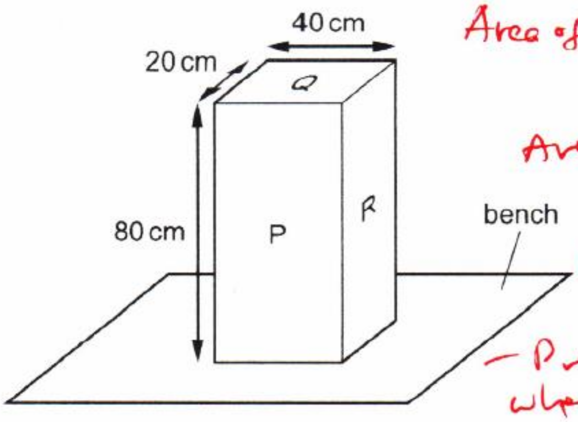
- Top liquid (P) has less pressure, since density is lower
- Liquid at Q has high density so more pressure

Which graph shows how the liquid pressure varies between positions P and Q?



4. June/2020/Paper_11/No.12

The diagram shows a solid block resting on a bench. The dimensions of the block are shown.



Area of P = 80 × 40
= 3200 cm²

Area of Q = 20 × 40
= 800 cm²

Area of R = 80 × 20
= 1600 cm²

– Pressure is smallest when area is larger

On which labelled surface should the block rest to produce the smallest pressure on the bench?

A P

B Q

C R

D P, Q and R produce the same pressure

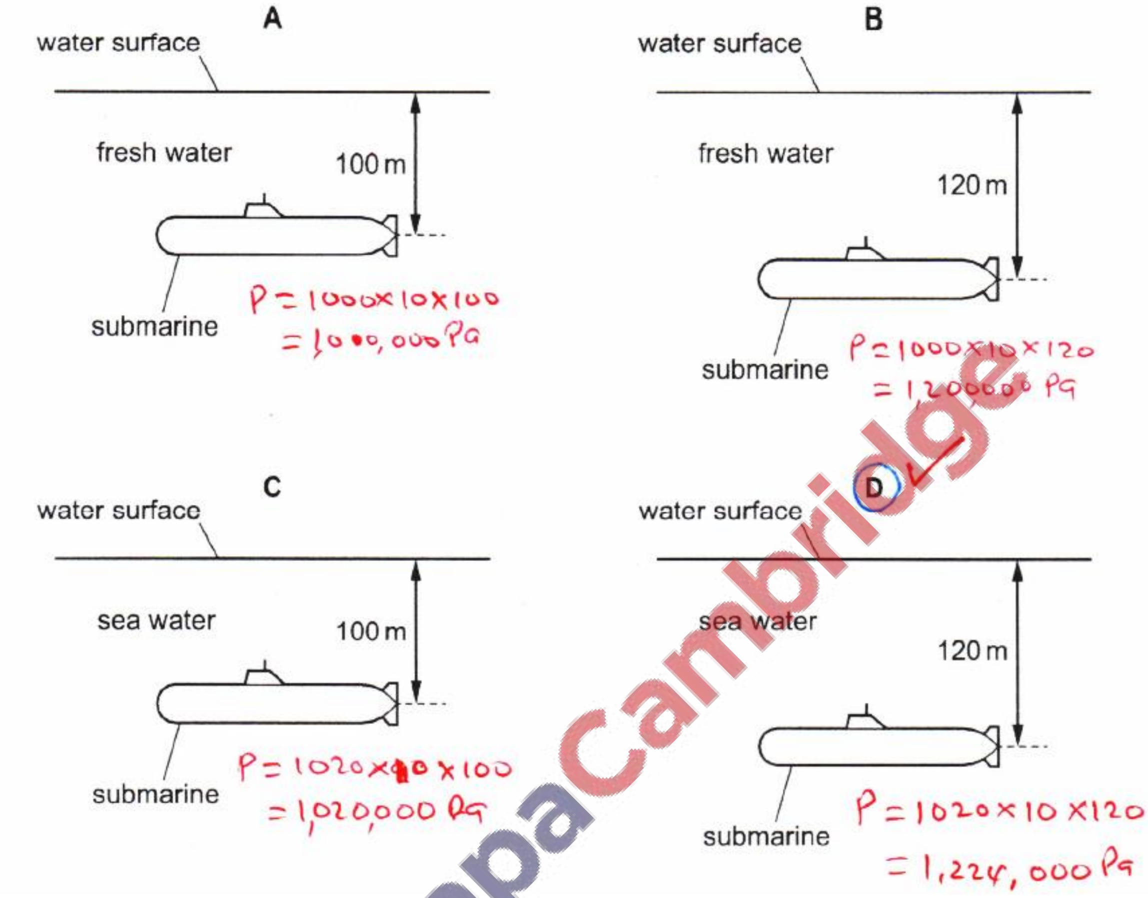
– The P with area of 3200 cm² will have smallest pressure

5. June/2020/Paper_11/No.13

Four submarines are submerged. The density of fresh water is 1000 kg/m^3 and the density of sea water is 1020 kg/m^3.

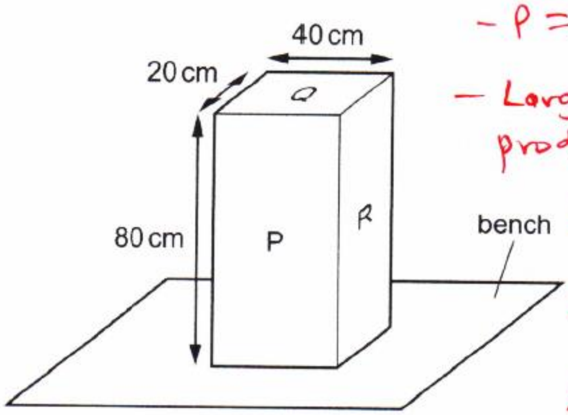
$P = \rho \times g \times h.$

Which submarine experiences the greatest pressure due to the water?



6. June/2020/Paper_12/No.12

The diagram shows a solid block resting on a bench. The dimensions of the block are shown.



– $P = \frac{F}{A}$

– Largest area will produce least pressure

Area of P = 80×40 = 3200 cm²

Area of Q = 20×40 = 800 cm²

Area of R = 80×20 = 1600 cm²

On which labelled surface should the block rest to produce the smallest pressure on the bench?

A P ✓

B Q

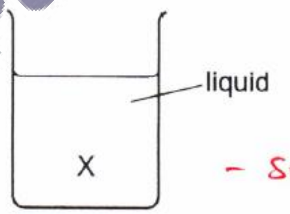
C R

D P, Q and R produce the same pressure

– P has largest area, so it will produce the least pressure.

7. June/2020/Paper_12/No.13

A beaker contains a liquid.



Pressure = ρ × g × h

– g = 10 m/s² is a constant

– So pressure depends on density and depth (h).

On what does the liquid pressure at position X depend?

A both the density of the liquid and the depth of X below the surface ✓

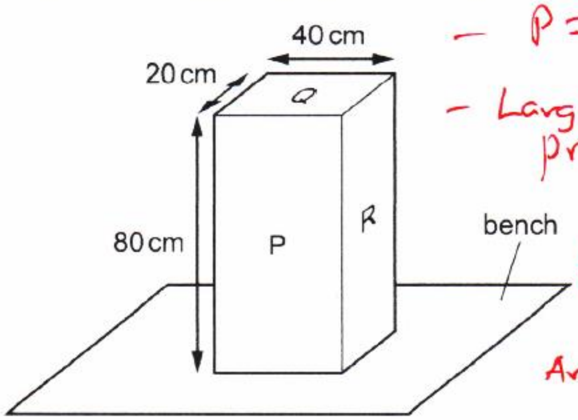
B both the surface area of the liquid and the depth of X below the surface

C both the surface area of the liquid and the volume of the liquid

D the depth of X below the surface only

8. June/2020/Paper_13,21,22,23/No.12

The diagram shows a solid block resting on a bench. The dimensions of the block are shown.



- $P = \frac{F}{A}$
- Largest area will produce smaller pressure

Area of P = 80×40 = 3200 cm²

Area of Q = 20×40 = 800 cm²

On which labelled surface should the block rest to produce the smallest pressure on the bench?

Area of R = 80×20 = 1600 cm²

- P has largest area, so it will produce the least pressure.

(A) P ✓

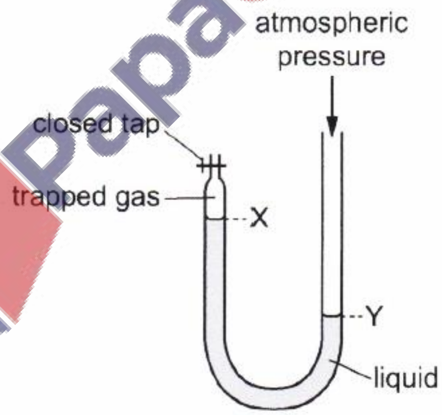
B Q

C R

D P, Q and R produce the same pressure

9. June/2020/Paper_13/No.13

The diagram shows a U-shaped glass tube, closed at one end by a tap. The glass tube contains a liquid as shown.



Some of the trapped gas is removed.

What will happen to the levels X and Y?

The pressure of the trapped gas will now be less than the atmospheric pressure
- The atmospheric pressure will push the liquid down at Y and the liquid will rise up at X.

	level X	level Y
(A) ✓	higher	lower
B	higher	higher
C	lower	higher
D	lower	lower

10. June/2020/Paper_21/No.13

The pressure due to the liquid on an object immersed in that liquid is 4500 Pa.

The density of the liquid is 900 kg / m^3.

What is the depth of the object below the surface of the liquid?

A 0.5 cm **B** 2.0 cm **C** 50 cm **D** 200 cm

ρ = 900 kg/m³
P = 4500 Pa
g = 10 N/kg

P = gρh.
h = P / (ρ×g)

h = 4500 / (900×10)
= 0.5 m.
= 50 cm

11. June/2020/Paper_22/No.13

An object is 60 cm below the surface of a liquid. The pressure due to the liquid at this depth is 9000 Pa.

What is the density of the liquid?

A 15 kg / m^3 **B** 540 kg / m^3 **C** 1500 kg / m^3 **D** 54 000 kg / m^3

h = 0.6 m.
g = 10 N/kg

P = ρ×g×h.
ρ = P / (g×h)

ρ = 9000 / (10×0.6)
= 1500 kg/m³

12. June/2020/Paper_23/No.13

A pipe full of water connects a water supply on a hill to a tap lower down the hill.

The length of the pipe is 500 m. The height of the supply above the tap is 100 m.

The density of the water is 1000 kg / m^3. The effect of atmospheric pressure is negligible.

What is the water pressure at the tap?

A 100 000 Pa

B 500 000 Pa

C 1 000 000 Pa

D 5 000 000 Pa

P = ρ × g × h
= 1000 × 10 × 100
= 1,000,000 Pa

for h, use the height, not the length of pipe

13. June/2020/Paper_23/No.14

When a molecule rebounds from a wall, a force is exerted on the wall.

What causes this force?

A the kinetic energy gained by the molecule

B the kinetic energy lost by the molecule

C the change of momentum of the molecule ✓

D the change of speed of the molecule

Force = $\frac{\text{change in momentum}}{\text{time}}$

$F = \frac{mv - mu}{t}$.

$F \propto$ change in momentum.

14. June/2020/Paper_31/No.4(c)

(c) Skis are strapped to a skier's feet and are longer and wider than the skier's feet.

Explain how the skis prevent the skier from sinking into soft snow.

– Skis have a large surface area.

– This creates less pressure on snow

– Less pressure means, skier does not sink [2]

15. June/2020/Paper_32/No.3

Fig. 3.1 shows an archer pulling the string of a bow.

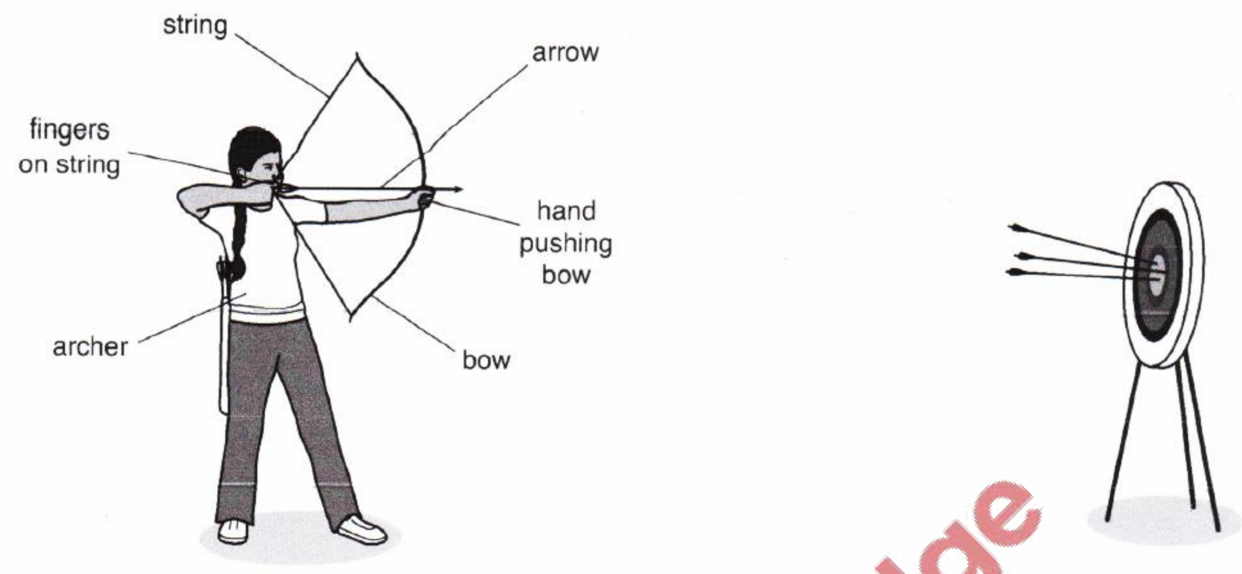


Fig. 3.1

(a) The archer uses a force of 120 N. The force acts on an area of $0.5\,cm^2$ on the archer's fingers.

Calculate the pressure on the archer's fingers.

$P = \frac{F}{A}$

$= \frac{120N}{0.5\,cm^2}$

$= 240\ N/cm^2$

pressure on fingers = ...240...... N/cm^2 [3]

(b) The archer's other hand is pushing the bow with the same force of 120 N. This force acts on a larger area than the force in **(a)**.

State whether the pressure on this hand is greater than, the same as or less than the pressure on the fingers holding the string.

......Pressure is less, since force is acting on large area. ...... [1]

(c) State the type of energy stored in the bow when the archer bends it as shown in Fig. 3.1.

......elastic potential energy. ...... [1]

[Total: 5]

16. June/2020/Paper_41/No.3

Fig. 3.1 shows gas trapped in the sealed end of a tube by a dense liquid.

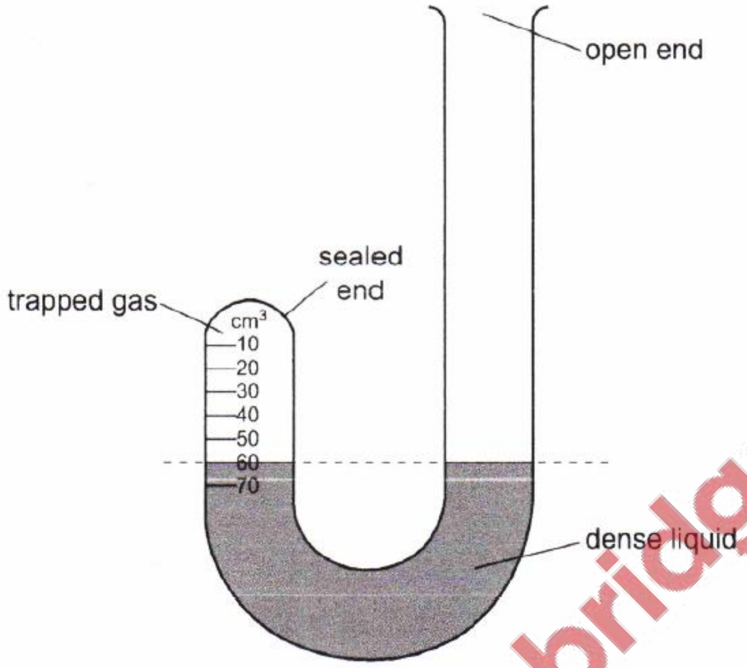


Fig. 3.1

The scale marked on the sealed end of the tube is calibrated to read the volume of gas trapped above the liquid surface. Fig. 3.1 shows that initially the volume V_1 of the gas is $60\,cm^3$.

The pressure of the atmosphere is 1.0×10^5 Pa.

(a) State how Fig. 3.1 shows that the pressure of the trapped gas is equal to the pressure of the atmosphere.

- The liquid levels in the two sides of the U-tube are equal [1]

(b) Explain, in terms of the momentum of its molecules, why the trapped gas exerts a pressure on the walls of the tube.

- The gas molecules collide with the walls of the tube. They bounce off and this causes change in momentum, and creates a force
- The force cause gas pressure. [3]

(c) More of the dense liquid is poured into the open end of the tube. The level of the liquid surface in both the sealed and the open ends of the tube rises as shown in Fig. 3.2. The temperature of the trapped gas and atmospheric pressure both remain constant.

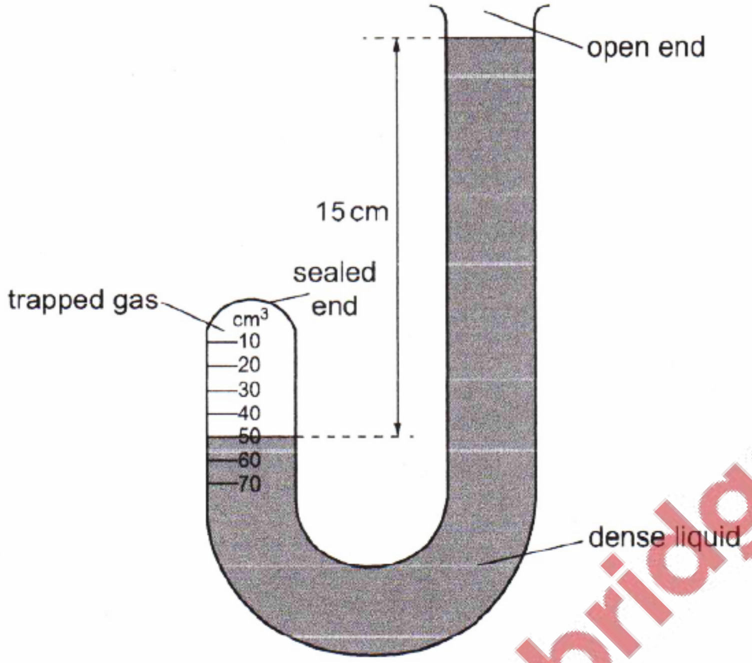


Fig. 3.2

(i) In the sealed end of the tube, the volume V_2 of the trapped gas is 50 cm^3. In the open end of the tube, the liquid surface is 15 cm above the new level in the sealed tube.

Calculate the pressure p_2 of the trapped gas.

$V_1 = 60 cm^3$
$P_1 = 1.0 \times 10^5$ Pa
$V_2 = 50 cm^3$
$P_2 = ?$
$P_1 V_1 = P_2 V_2$

$P_2 = \frac{P_1 \times V_1}{V_2}$
$= \frac{1.0 \times 10^5 \times 60 cm^3}{50 cm^3}$
$= 1.2 \times 10^5$ Pa

pressure p_2 = ... 1.2×10^5 Pa. .... [2]

(ii) Calculate the density of the liquid in the tube.

$h = 15 cm = 0.15 m$
$g = 10 N/kg$
$\rho = ?$

$P_2 = P_{atm} + h\rho g$
$h\rho g = P_2 - P_{atm}$
$= 1.2 \times 10^5 - 1.0 \times 10^5$
$= 0.2 \times 10^5$ Pa

$h\rho g = 0.2 \times 10^5$
$\rho = \frac{0.2 \times 10^5}{0.15 \times 10}$
$= 13,333 kg/m^3$
$\approx 1.3 \times 10^4$

density = ... $1.3 \times 10^4 kg/m^3$ .... [2]

[Total: 8]

17. June/2020/Paper_43/No.2

A scientist fills a container with sea water. The container has dimensions 30 cm × 30 cm × 40 cm.
The density of sea water is 1020 kg/m^3.

0.3 m 0.3 m 0.4 m

(a) Calculate the mass of the sea water in the container.

$V = 0.3 \times 0.3 \times 0.4$
$= 0.036\ m^3$

$\rho = \frac{m}{V}$

$m = \rho \times V = 1020 \times 0.036$
$= 36.72\ kg$

mass = ...37 kg........ [3]

(b) Fig. 2.1 shows a submarine. The submarine is fully submerged in the sea.

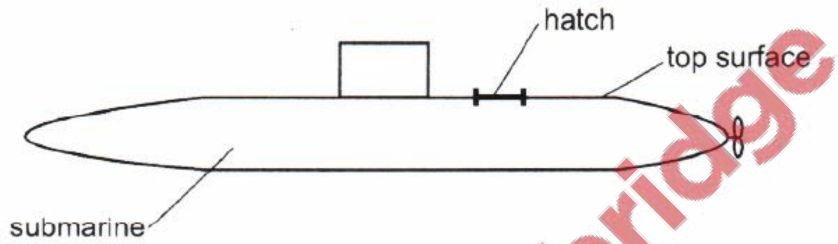


Fig. 2.1

(i) The atmospheric pressure is 100 kPa and the total pressure on the top surface of the submarine is 500 kPa.

Calculate the depth of the top surface of the submarine below the surface of the sea.

Pressure due to water
$= 500 - 100$
$= 400\ kPa$

$P = g \times \rho \times h$

$h = \frac{P}{g \times \rho}$

$h = \frac{400 \times 10^3}{1020 \times 10}$
$= 39\ m$

depth = ...39 m........ [3]

(ii) A hatch (an opening door) on the top surface of the submarine has an area of 0.62 m^2.

Calculate the downward force on the hatch due to the total pressure on the top surface of the submarine.

$F = \frac{P}{A}$

$= \frac{500 \times 10^3\ Pa}{0.62\ m^2}$

$= 310,000\ N$

$\approx 310\ kN$

force = ...310,000 N........ [2]

[Total: 8]