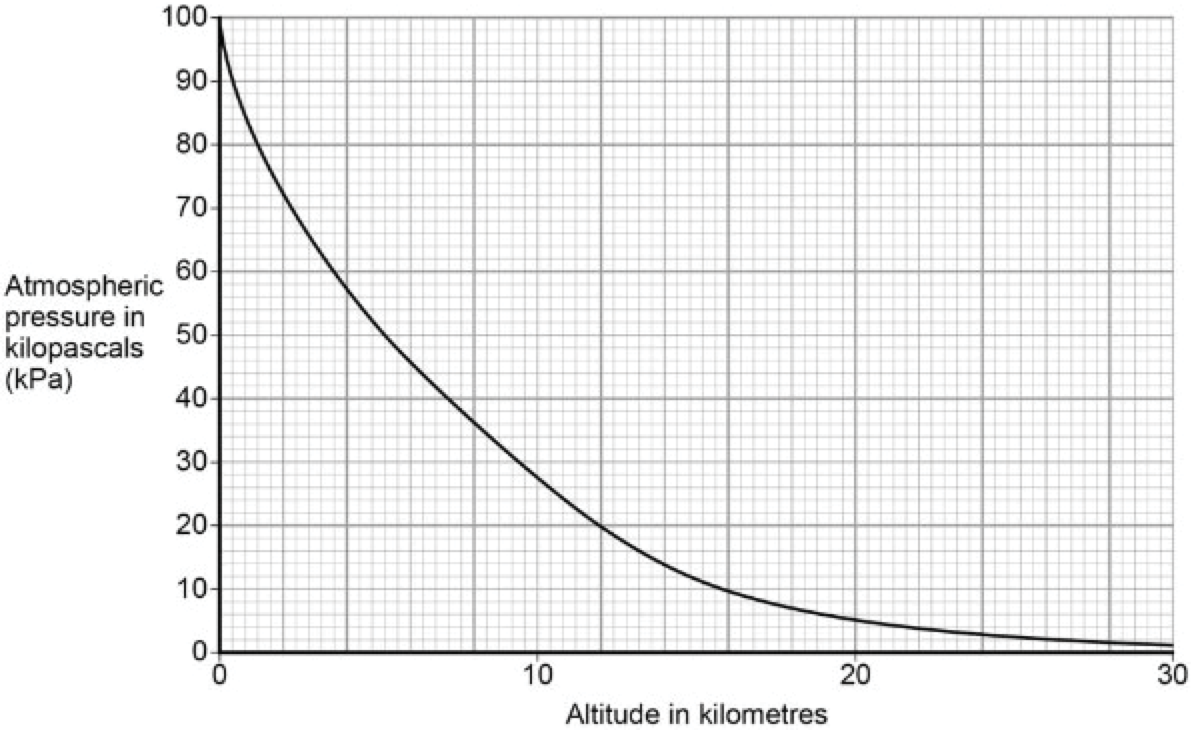
Eduqas Physics GCSE Topic 3.2: Pressure and pressure differences in fluids

Questions by topic

1.

Figure 17 shows how atmospheric pressure varies with altitude.

Figure 17

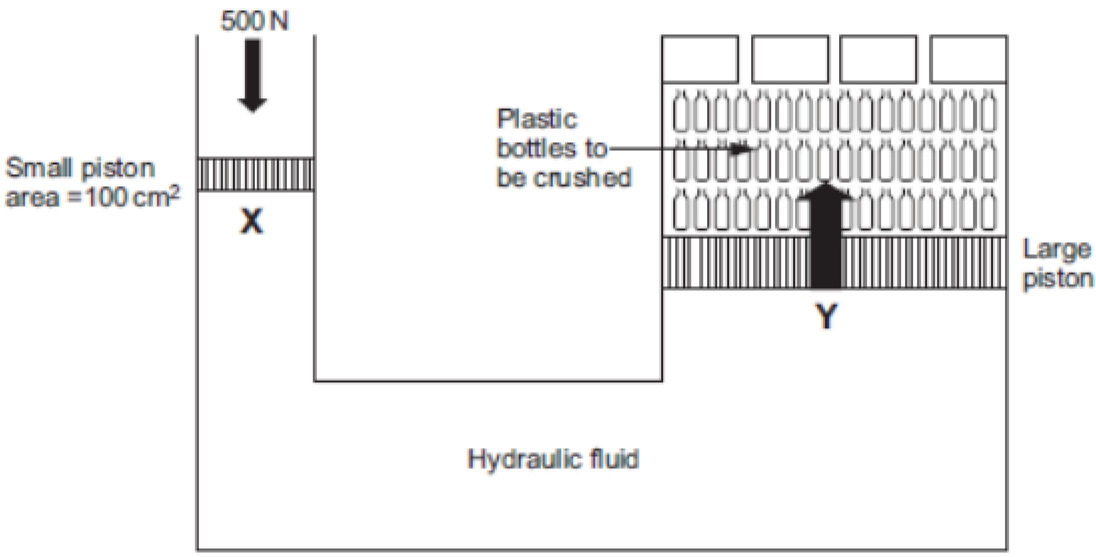


1 Explain why atmospheric pressure decreases with increasing altitude.

[3 marks]

2. In Wales about 725 000 plastic bottles are used each day. Plastic bottles that are collected by local councils need to be transported to recycling plants that are based all around Wales. 250 plastic bottles are crushed into a single small bale. This makes it much easier to transfer them to the recycling factory.

A hydraulic press, as shown in the diagram, can be used. It is designed to exert a large force on the plastic bottles to crush them into a compact single bale. Only a relatively small force needs to be applied at **X** to crush the plastic bottles at **Y**. The pressure applied on the big piston at **Y** will be the same as the pressure exerted at **X**, however the area of the piston at **Y** is 15 times larger than the area of the piston at **X**.



(a) If all of the plastic bottles used each day in Wales are crushed, how many small bales would be produced in **one week**? [2]

number of small bales = ……………………

(b) Tick (✓) the box that shows the correct calculation of the pressure exerted by the small piston on the hydraulic fluid at **X**. [1]

$\text{pressure} = \frac{\text{force}}{\text{area}} = 500 \times 100 = 50\,000\ \text{N/cm}^2$ ☐

$\text{pressure} = \frac{\text{force}}{\text{area}} = \frac{500}{100} = 5\ \text{N/cm}^2$ ☐

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(c) Use information from the text and the equation:

force = pressure × area

to calculate the force applied to crush the plastic bottles at **Y**. [2]

force = ... N

(d) The hydraulic press develops a leak. Hydraulic fluid is expensive. A worker at the recycling factory suggests that replacing the hydraulic fluid with air would save money. Explain why the hydraulic press will no longer work if air is used. [2]

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....

7

3 (part (c) HIGHER).

Fig. 3.1 shows an oil tank that has a rectangular base of dimensions 2.4 m by 1.5 m.

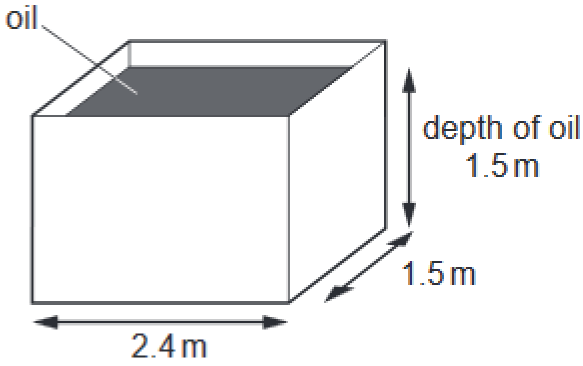


Fig. 3.1

The tank is filled with oil of density 850 kg / m^3 to a depth of 1.5 m.

(a) Calculate

(i) the pressure exerted by the oil on the base of the tank,

pressure = ... [2]

(ii) the force exerted by the oil on the base of the tank.

force = ... [2]

(b) The force calculated in **(a)(ii)** is the weight of the oil.

Calculate the mass of oil in the tank.

mass = ... [1]

(c) When he is checking the level of oil in the tank, a man drops a brass key into the oil and it sinks to the bottom of the oil.

(i) State what this shows about the density of brass.

.... [1]

(ii) Explain how attaching the key to a piece of wood could prevent the key from sinking.

....

....

.... [1]

[Total: 7]

4 (part (b) HIGHER).

Fig. 1.1 shows a side view of a large tank in a marine visitor attraction.

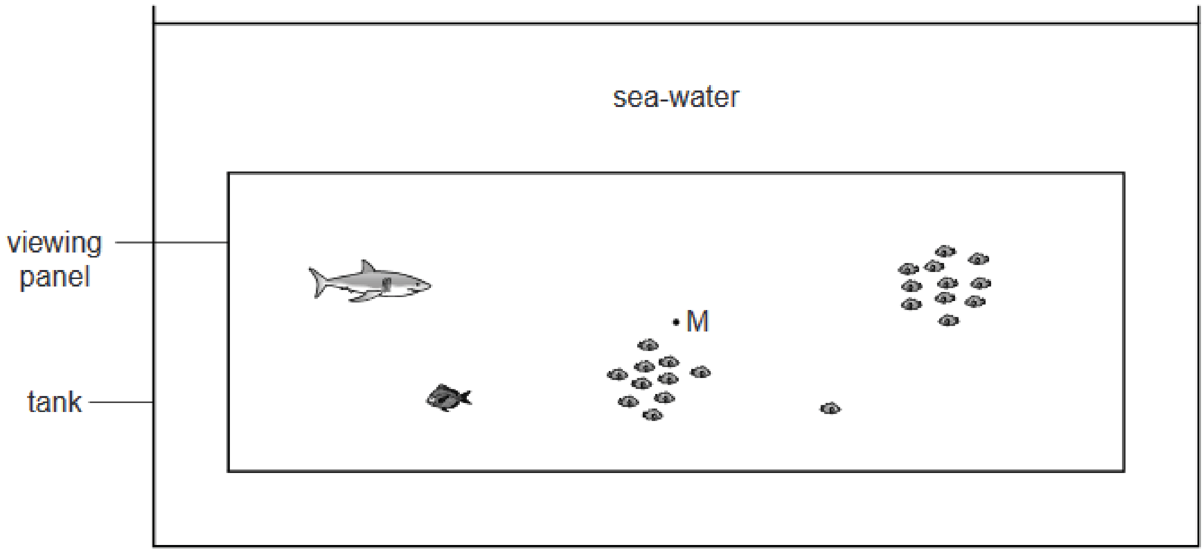


Fig. 1.1 (not to scale)

The tank is 51 m long and 20 m wide. The sea-water in the tank is 11 m deep and has a density of 1030 kg / m^3.

(a) Calculate the mass of water in the tank.

mass = ... [3]

(b) The pressure at point M, halfway down the large viewing panel, is 60 kPa more than atmospheric pressure.

Calculate the depth of M below the surface of the water.

depth = ... [2]

(c) The viewing panel is 32.8 m wide and 8.3 m high.

Calculate the outward force of the water on the panel. Assume that the pressure at M is the average pressure on the whole panel.

force = ... [2]

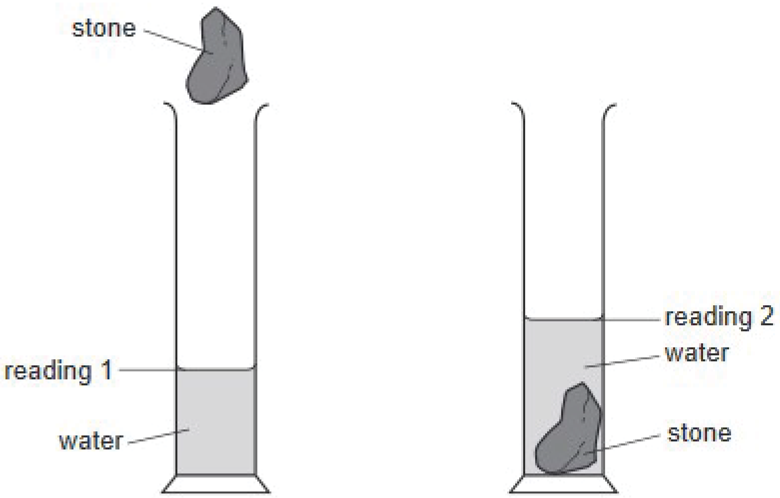
[Total: 7]

5.

A student wishes to determine the density of an irregularly-shaped stone.

First he finds the mass of the stone. Next he lowers the stone into a measuring cylinder containing water.

The diagrams show the measuring cylinder before and after the stone is lowered into it.



How should the student calculate the density of the stone?

A mass of stone × reading 2

B mass of stone × (reading 2 – reading 1)

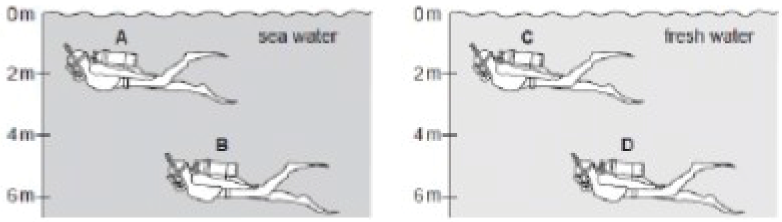
C mass of stone ÷ reading 2

D mass of stone ÷ (reading 2 – reading 1)

6 (HIGHER).

The diagrams show two divers swimming in the sea and two divers swimming in fresh water. Sea water is more dense than fresh water.

On which diver is there the greatest pressure?



7.

*(d) Figure 26 shows the submarine stationary and submerged at a depth of 10 m.

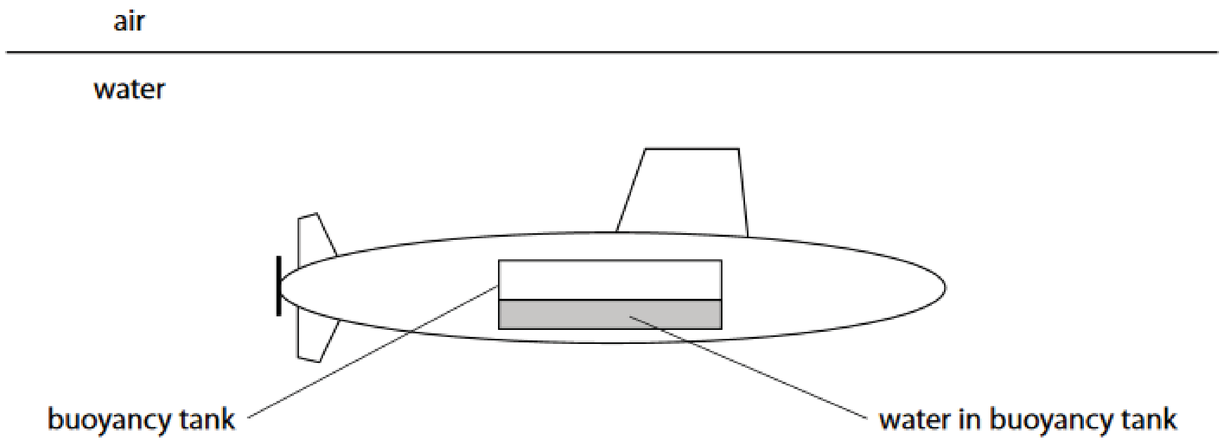


Figure 26

Explain how pumping water into and out of the buoyancy tank affects the depth of the submarine below the surface.

(6)

8 (part (b) HIGHER).

(a) Figure 2 shows a tank for holding water.

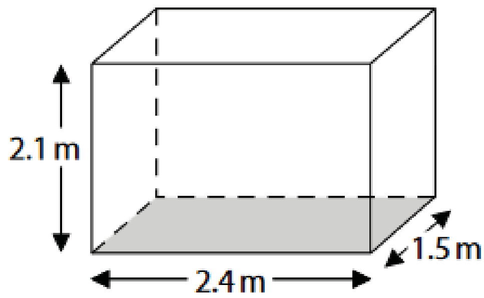


Figure 2

The tank has sides of 2.4 m, 2.1 m and 1.5 m.

The pressure at the bottom of the tank is 12 kPa.

(i) State the equation relating pressure, force and area.

(1)

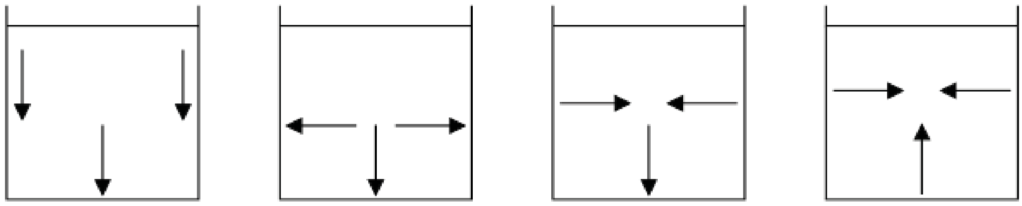
(ii) Calculate the weight of water in the tank.

(4)

weight = ... N

(iii) Which diagram shows the direction of the forces from the water on the inside of the tank?

(1)



☒ **A** ☒ **B** ☒ **C** ☒ **D**

(b) Figure 3 shows three containers A, B, and C.

Each container contains a liquid, as shown.

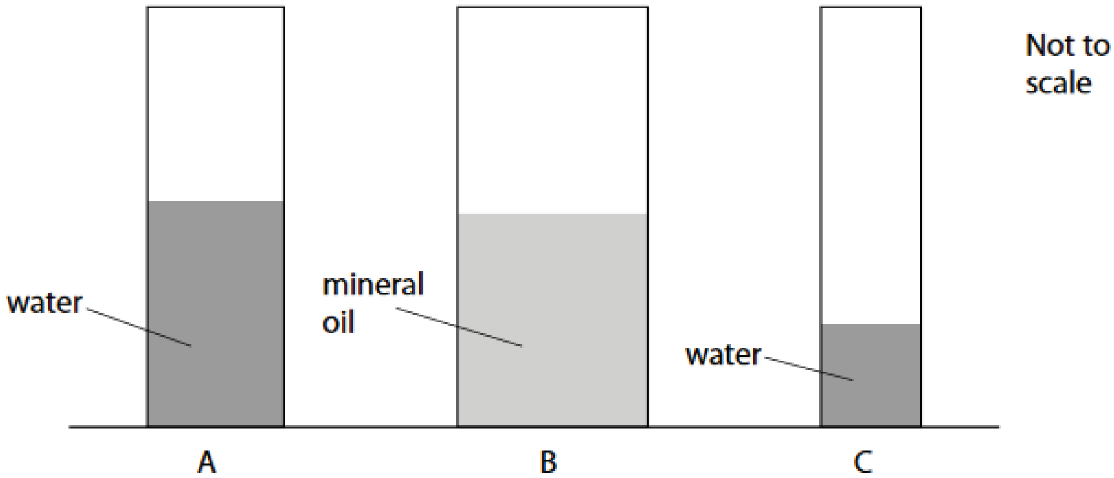


Figure 3

Figure 4 gives some data about the liquids and containers.

container	area of base (cm^2)	name of liquid	density of liquid (g/cm^3)	depth of liquid in container (cm)
A	16	water	1.00	50.00
B	32	mineral oil	0.91	50.00
C	12	water	1.00	25.00

Figure 4

Explain which container has the highest pressure at the bottom, and which container has the lowest.

Use information from Figure 3 and Figure 4.

(3)

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