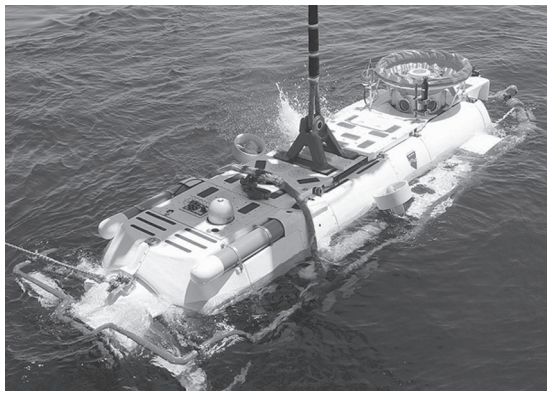
1 The LR5 is a specialist submarine for underwater rescues.



The average density of sea water is 1028 kg/m^3.

(a) (i) State the equation linking pressure difference, depth, density and *g*.

(1)

p = rho * g * h

(ii) Calculate the increase in pressure as the LR5 descends from the surface to a depth of 700 m.

(2)

p = 1028 * 9.8 * 700 =

increase in pressure = **7,200,000** Pa

(iii) Atmospheric pressure is 1.0×10^5 Pa.

Calculate the total pressure on the LR5 when it is at a depth of 700 m.

(1)

1 * 10^5 + 7050000 = 7,150,000 Pa

total pressure = ... Pa

(b) On another descent, the LR5 experiences a total pressure of 41×10^5 Pa.

The entrance to the LR5 is through an access door which has an area of 3.1 m^2.

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

(1)

p = f/a

(ii) Calculate the force on the outside of the door.

(3)

f = p*a = 41*10^5 * 3.1 = 12,700,000 N

force = ... N

(c) The LR5 is tested in fresh water.

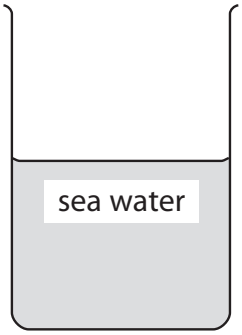
The density of fresh water is 1000 kg/m^3.

Explain why the pressure on the submarine in the fresh water is less than the pressure in sea at the same depth.

(1)

fresh water has a lower density than sea water and so at the same depth the weight of water above the submarine is higher in sea water and so the pressure supporting it is higher.

(d) A student is given a sample of liquid labelled sea water.



Describe an experiment that the student could carry out to find the density of the sample.

(5)

Measure the mass of the sea water in grammes by using a set of digital scales, be sure too subtract the mass of the container by zeroing the scales before pouring in the water. Next measure the volume of the sea water in cm3 by pouring it into a measuring cylinder and observing the bottom of the meniscus. Finally use the equation density = mass / volume to find the density.

(Total for Question 1 = 14 marks)

2 A student places a pile of coins on a table, as shown in photograph **A**.

Photograph **A**

There are 8 coins in the pile.

The weight of each coin is 0.036 N.

The area of each coin is 0.0013 m^2.

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

(1)

p = f/a

(ii) Calculate the pressure on the table caused by the pile of coins.

(2)

p = f/a = (8 * 0.036) / 0.0013 = 221Pa

Pressure = ... Pa

(b) The student then spreads the 8 coins out on the table as shown in photograph **B**.

Photograph **B**

(i) Describe how this affects the total force from the coins on the table.

(2)

the total force is unchanged because there are the sem number of coins as before and their weights have not changed.

(ii) Explain how this affects the pressure on the table caused by the coins.

(2)

The pressure is reduced because the same force as before is now spread over a larger area, (8 * 0.0013)m^2 instead of 0.0013m^2. so the pressure is 8 times less, or 27.7Pa.

(Total for Question 2 = 7 marks)

2 This question is about temperature and pressure in gases.

(a) A gas is heated in a container which has a constant volume.

The particles in the gas

(1)

- ☒ **A** expand
- ☑ **B** hit the walls of the container harder
- ☒ **C** move closer together
- ☒ **D** have a lower average speed

(b) Describe what happens to the average kinetic energy of particles as the temperature decreases from 10 K towards 0 K.

(2)

The average kinetic energy decreases and approaches 0J

(c) (i) Convert a temperature of 27 °C into kelvin (K).

(1)

27 + 273 = 300K

temperature = ... K

(ii) The gas in a cylinder has a pressure of 210 kPa at a temperature of 27 °C.

Calculate the new pressure when the temperature of the gas rises to 81 °C.

(3)

P1/T1 = P2/T2

210/300 = P2 / 354

P2 = 354 * 210/300 = 247.8 kP

pressure = ... kPa

(Total for Question 2 = 7 marks)