O Level Combined Physics Structured

Pressure Test 1.0

Q1

Fig. 4 shows the dimensions of a metal block whose mass is 100 g. Take g = 10 ms^{-2}.
Calculate the maximum pressure the metal block can exert on a table.

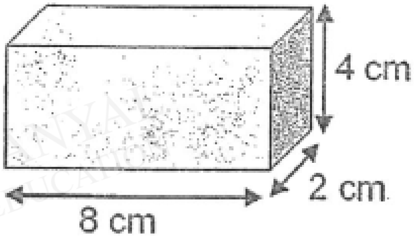

Fig. 4

maximum pressure = ______________________ N/cm^2 [3]

Q2

Fig 10.1 shows a solar oven that is used to heat a pot of water .

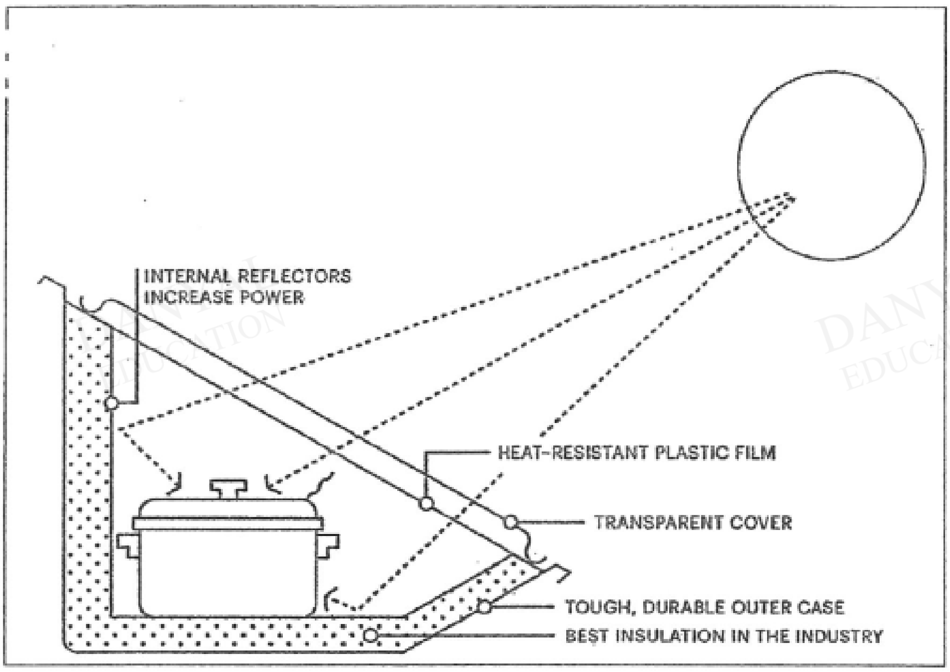

Fig 10.1

(d) The pot and the water has a total mass of 1.5 kg. The pot has a circular base of radius 20 cm.

Calculate the pressure in Pascals that the pot of water exerts on the floor.

pressure = ... Pa [2]

Q3

Fig. 3 shows part of a non-uniform tube filled with an incompressible liquid. The wider end is fitted with a large piston of cross-sectional area 10 cm^2 and the narrower end is fitted with a small piston of cross-sectional area 2.0 cm^2.

A force F = 40 N is exerted on the large piston. The pressure created by the large piston is equal to the pressure acting on the small piston.

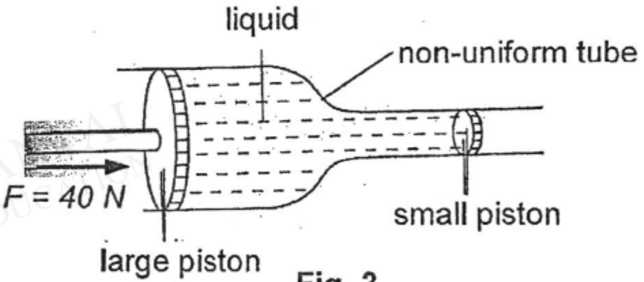

Fig. 3

(a) Calculate the pressure produced by the 40 N force.

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

(b) What is the force acting on the small piston?

force = ... N [1]

(c) If the large piston is moved through a distance of 3.0 cm, calculate the distance moved by the small piston?

distance = ... cm [2]

Q4

Fig. 6.1 shows a cylinder filled with air. It is fitted with a freely moving piston.

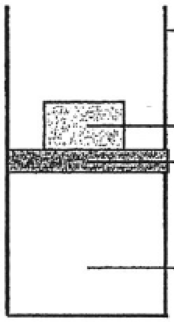

Fig. 6.1

(a) Explain, in terms of the motion of air molecules, how the air in the cylinder exerts a pressure on the piston.

....

....

....[1]

(b) Explain why the piston is pushed upwards when the cylinder is placed in hot water.

....

....

....[2]

(c) In Fig.6.1, the piston is held stationary due to the force exerted by the air pressure in the cylinder and the weight of the load.
Calculate the mass of the load needed to balance the piston when the pressure exerted by the air is 15 Pa and the area of the piston is 0.10 m^2.

mass = ...kg [2]

Q5

A vertical uniform cylinder contains a volume of liquid, as shown in Fig 3.1.

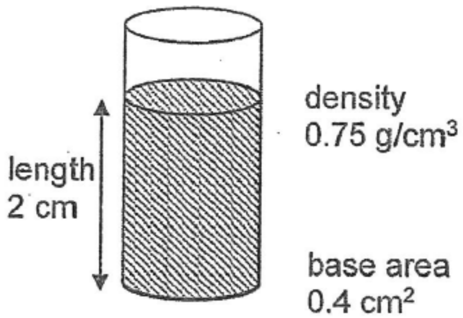

Fig 3.1

The cross-sectional area of the cylinder is 0.4 cm^2.
The vertical length of the liquid is 2 cm.
The density of the liquid is 0.75 g/cm^3.

a) What is the mass of the liquid in the cylinder?

mass = ... g [2]

b) What is the weight of the liquid in the cylinder? (Assume g = 10 N/kg)

weight = ... N [2]

c) What is the pressure which the liquid exerts on the base of the cylinder?

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

Answers

Pressure Test 1.0

Q1

Fig. 4 shows the dimensions of a metal block whose mass is 100 g. Take g = 10 ms^{-2}.
Calculate the maximum pressure the metal block can exert on a table.

Weight = mg = 0.1 x 10 Convert mass to kg, 100 g = 0.1 kg
= **1 N** [M1]

Maximum Pressure
= Force / Minimum Area
= 1 / (2 x 4) [M1: use the correct minimum area]
= **0.125 N/cm²** [ECF1: weight from top is used]

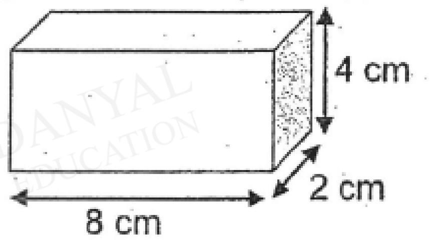

Fig. 4

maximum pressure = ______________ N/cm² [3]

Q2

d)	$A = \pi r^2 = \pi(20 \times 10^{-2})^2 = 0.126\ m^2$	1
	P = F/A = (1.5)(10) / 0.126 = 119 Pa	1

Q3

(a)	$P = \frac{F}{A} = \frac{40}{10}$ $= 4.0\ N/cm^2$	[1] [1]
(b)	$P = \frac{F}{A}$ $4.0 = \frac{F}{2.0}$ $F = 8.0$ N	[1]
(c)	Liquid volume is incompressible: 2 x d = 10 x 3 d = 15 cm	[1] [1]

Q4

(a)	As the air molecules move randomly, the air molecules hit the piston and exert a force upon the impact. This force over the surface of piston will then give rise to pressure.	[B1]
(b)	The air molecules gain energy and move faster so that the frequency of the molecules hitting the piston increases. As a result, the increase in force over the same surface area gives rise to greater upward pressure and the piston moves upwards.	[B1] [B1]
(c)	P = F/A 15 = F/0.10 F = 1.5 N mass = 1.5/10 = 0.15 kg	[M1] [A1]

Q5

5a	Mass = density x volume = 0.75 x 0.4 x 2 = 0.6 g	M1 A1
5b	Weight = mass x g = 0.6/1000 x 10 = 0.006 N	Allows ecf M1 A1
5c	Pressure = force/ area = 0.006 / 0.4 = 0.015 N/ cm^2	Allows ecf M1 A1