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

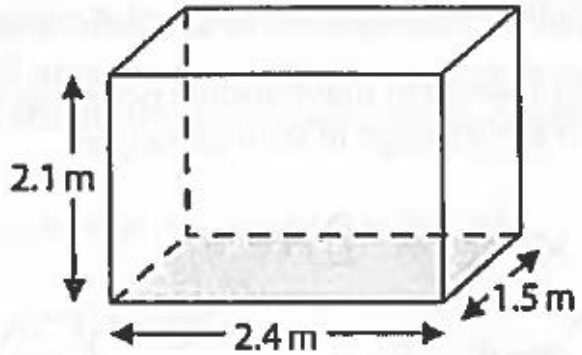


Figure 2

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.

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

F ← force (N)

A ↖ area (m)

p → pressure (Pa)

Why is this a good way to write out the equation?

What does the 12 kPa mean? To help you later you could write out this number ready to go into the equation

What is included that will help the student later in the question? What does Pa stand for?

How else could the question be written which would still require you to write an equation for the answer?

Cover up the equation and check that you can still remember it.

It has the symbol, the word and the unit.

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

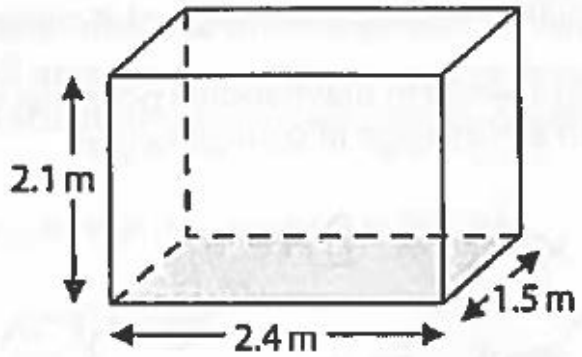


Figure 2

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.

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

F ← force (N)

p → pressure (Pa)

A ← area (m)

12 kPa = 12,000 Pa

What is the relationship between the variables…..

The units will be needed later on in questions after you have worked out a numerical answer.
Pa =Pascals, the unit for pressure

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

$2.4 \times 2.1 \times 1.5 = 7.56\ cm^3 = volume.$

$12 = \frac{F}{7.56}$

$12 \times 7.56 = 90.72N = force$

mass force = mass × gravity

.72

weight = ... N

(Total for Question 2 = 5 marks)

What have they done here? Is it correct?

What has this student done wrong? What should they have worked out? Do this now.

Have they rearranged this equation correctly? What should they have written?

When they had worked out the force, how is that related to the weight?

Their numbers are substituted in correctly, BUT the area number is incorrect and they haven't converted the 12 kPa into 12,000 Pa

They written a divide sign instead of multiple. The should have multiplied the pressure by the area.

The force is the weight, both are measured in Newtons?

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

$2.4 \times 2.1 \times 1.5 = 7.56\ cm^3 = volume.$

The students has worked out the volume, not the area, they should have written 2.4 x1.5 = 3.6

$12 = \frac{F}{7.56}$

$12 \div 7.56 = 90.72N = force$

mass force = mass × g

weight = ... N

(Total for Question 2 = 5 marks)

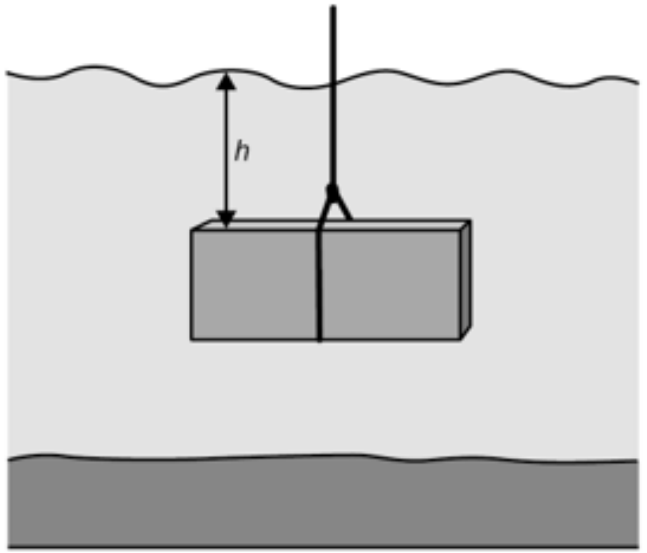
Answers!

Question number	Answer	Mark
2(a)(i)	pressure = force ÷ area	**(1)**

2(a)(ii)	rearrangement (1) $(F =)\ P \times A$ calculation of area (1) $2.4 \times 1.5 = 3.6$ substitution (1) $(F =)\ 12\,000 \times 3.6$ answer (1) 43 200 (N)	award full marks for correct numerical answer without working maximum 3 marks if kPa not converted to Pa	**(4)**

Now try this!

4 This diagram shows a box being lifted from the bottom of a lake. The box is 2.5 metres long, 1.2 metre wide and 1.5 metres high.



a The force on the rope is less than the weight of the box, because the water is providing upthrust.

Explain how upthrust occurs.

_____

_____

_____

_____

(2)

b The pressure on the top of the box due to the water is 50k Pa. Calculate the force on the box.

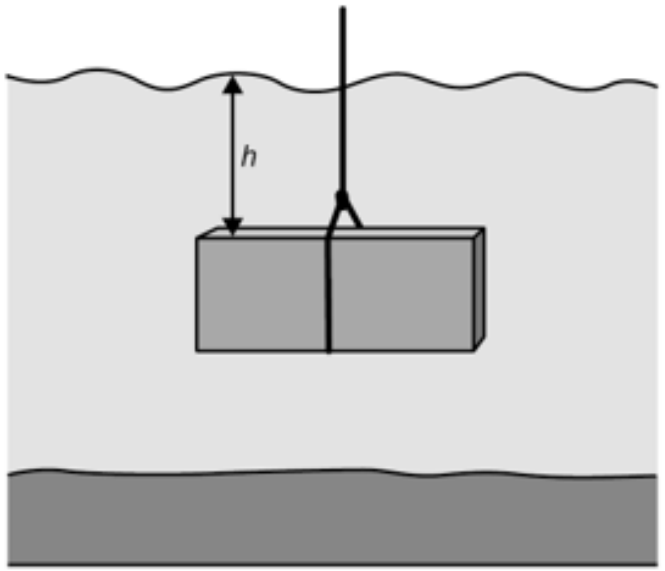
F= _____

(5)

(Total for Question 4 = 7 marks)

N

4 This diagram shows a box being lifted from the bottom of a lake. The box is 2.5 metres long, 1.2 metre wide and 1.5 metres high.



a The force on the rope is less than the weight of the box, because the water is providing upthrust.

Explain how upthrust occurs.

The pressure on the top of the box is less than on the bottom of the box.

So there is an overall upwards force from the water.

(2)

b The pressure on the top of the box due to the water is 50k Pa. Calculate the force on the box.

P = F/A F= PxA

Area = 2.5 x 1.2 = 3 m2

Pressure = 50kPa = 50, 000Pa

Force = 50,000x3 = 150,000 N

F= _____

(5)

(Total for Question 4 = 7 marks)