Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Pressure

Time allowed: 1 hour 10 minutes

Subject code **0625**

Physics

Questions from Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 70

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 70 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 A flask contains gas with a pressure lower than atmospheric pressure.

Fig. 3.1 shows equipment being used to measure the pressure of the gas in the flask.

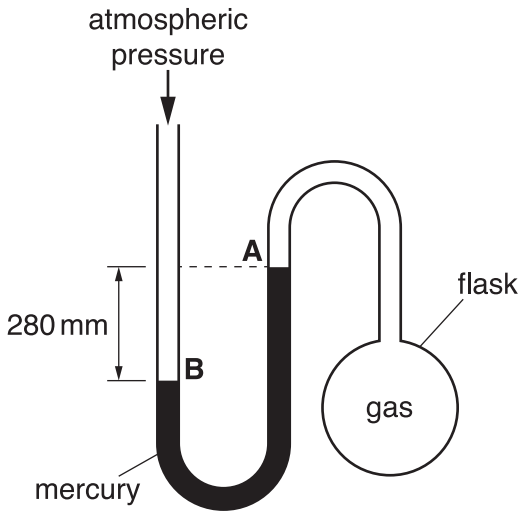


Fig. 3.1

(a) State the name of the equipment shown in Fig. 3.1 that is used to measure the pressure of the gas.

..... [1]

(b) The atmospheric pressure is equal to 760 mm Hg.

The distance between mercury level A and mercury level B is 280 mm.

Determine the pressure of the gas inside the flask.

pressure = ... mm Hg [2]

(c) The flask is cooled. Describe the effect, if any, the cooling has on

mercury level A .....

mercury level B .....

[1]

[Total: 4]

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1(a)	manometer	**B1**
1(b)	760–280	**C1**
	480 (mm Hg)	**A1**
1(c)	(level A) up (level B) down	**B1**

2 A young boy, skating on a frozen pond, has fallen through some thin ice about 10 m from the shore of the pond. Fig. 4.1 shows the situation.



Fig. 4.1

A man, standing near the pond, hears the boy's shouts for help.

The man weighs more than the boy.

(a) Why would it be unsafe for the man to walk on the ice to rescue the boy?

.....

.....[1]

(b) Suggest and explain what the man could do to cross the ice to reach the boy safely.

.....

.....

.....

.....

.....[4]

[Total: 5]

Pressure Click for more variations

2 **(a)** greater pressure from man **OR** man will fall through ice **OR** ice will break / crack B1

(b) idea of increasing area **OR** spreading load M1

any three from: A3
larger (surface) area
load / weight / force more spread out
less pressure
use of $P = F / A$

[Total: 5]

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3 Fig. 4.1 shows a student standing on soft sand. The student does not sink into the sand.



Fig. 4.1

The student has a mass of 40 kg.

(a) Calculate the force of her body acting on the sand.

force = ... N [2]

(b) The total area of both her shoes in contact with the sand is 0.02 m^2.

Calculate the pressure the student exerts on the sand, when standing as shown in Fig. 4.1.

pressure = ... N/m^2 [3]

(c) The student lifts one foot off the sand. The other foot sinks into the sand.

Explain why this happens. A calculation is **not** required.

.....

.....

.....[2]

[Total: 7]

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3(a)	$W = m \times g$ in any form	**C1**
	400 (N)	**A1**
3(b)	pressure = force ÷ area in any form	**C1**
	400 **OR** candidates (a) ÷ 0.02	**C1**
	20 000 (N/m^2)	**A1**
3(c)	greater pressure **OR** wtte	**B1**
	(same force/weight acts on a) smaller area	**B1**
	Total:	**7**

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4 Fig. 4.1 shows a pin. Fig. 4.2 shows a person pushing the pin into a wall.

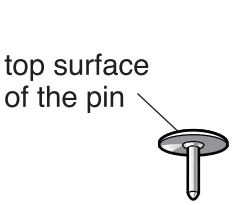


Fig. 4.1

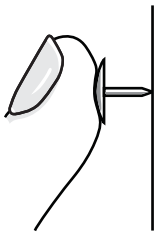


Fig. 4.2

(a) **(i)** The area of the top surface of the pin is 1.8 cm^2. The person applies a force of 50 N.

Calculate the pressure exerted on the top surface of the pin.

pressure = ... N/cm^2 [3]

(ii) The area of the top surface of the pin is 500 times larger than the area of the point. Calculate the value of the pressure exerted by the point on the wall.

pressure = ... N/cm^2 [1]

(b) Fig. 4.3 shows a simple device for measuring atmospheric pressure.

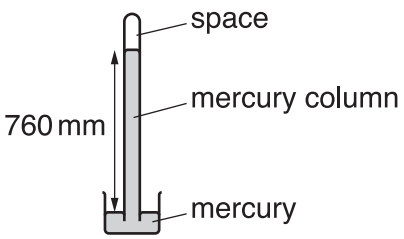


Fig. 4.3

(i) State the name given to the device shown in Fig. 4.3.

..... [1]

(ii) State what, if anything, is in the space at the top of the tube, above the mercury column.

..... [1]

(iii) Fig. 4.3 shows normal atmospheric pressure. Suggest a possible value for the height of the mercury column when atmospheric pressure decreases. Include the unit.

reading = ... [1]

[Total: 7]

Pressure Click for more variations

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4(a)(i)	Pressure = force ÷ area in any form	C1
	50 ÷ 1.8	C1
	28 (N / cm^2)	A1
4(a)(ii)	In range 13 500 to 15 000 (N / cm^2)	B1
4(b)(i)	(mercury) barometer	B1
4(b)(ii)	vacuum **OR** nothing	B1
4(b)(iii)	a value less than 760 mm (Hg) and > 0 mm (Hg)	B1

5 **(a)** Some vehicles have wide tyres so that they can drive over soft mud.

Explain why the wide tyres enable these vehicles to drive over soft mud.

.....

.....

.....

..... [3]

(b) Fig. 4.1 shows a mercury barometer.

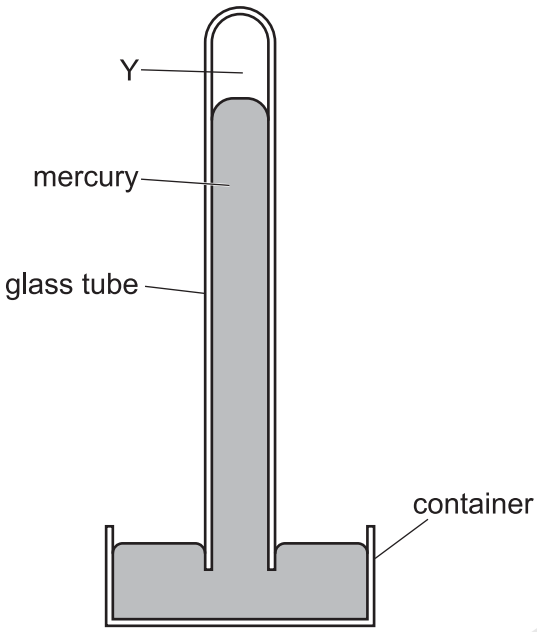


Fig. 4.1

(i) State what is in the space at Y above the mercury.

..... [1]

(ii) Complete the following statement to describe the use of a mercury barometer.

A mercury barometer measures .....

..... [2]

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(c) The diagram in Fig. 4.2 shows a tall can containing water.

The can has three identical holes 1, 2 and 3 on one side, one above the other in a vertical line, as shown in Fig. 4.2.

Water is shown flowing out of hole 2 and hole 3.

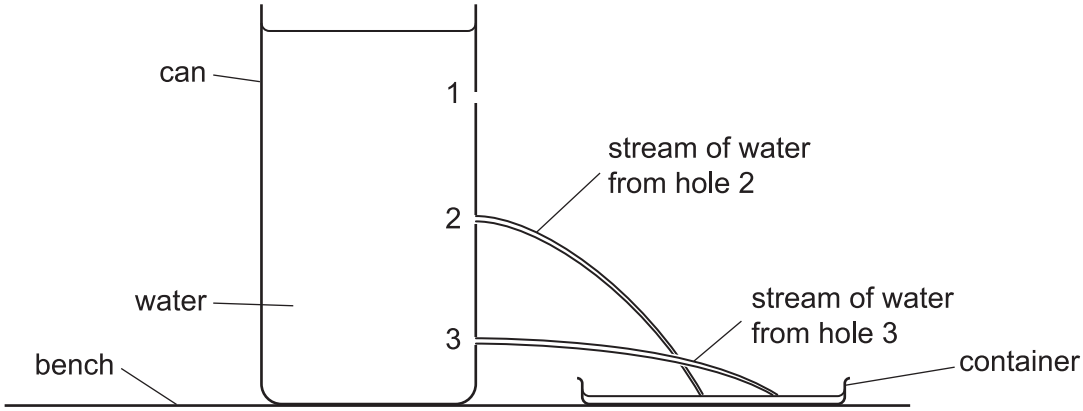


Fig. 4.2

(i) State how the pressure of the water at hole 2 compares with the pressure of the water at hole 3.

..... [1]

(ii) Draw on Fig. 4.2 to show the stream of water flowing from hole 1. [1]

[Total: 8]

Pressure Click for more variations

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5(a)	any **three** from: pressure = force ÷ area weight or force distributed / spread or wtte (over) larger area (so) lower pressure (on the ground) (vehicle) doesn't sink into the mud owtte	**B3**
5(b)(i)	vacuum	**B1**
5(b)(ii)	atmospheric / air	**B1**
	pressure	**B1**
5(c)(i)	(pressure at hole 2 is) less (than that at hole 3) ora	**B1**
5(c)(ii)	water from top hole not travelling further than from middle hole	**B1**

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6 Fig. 4.1 represents part of the hydraulic braking system of a car.

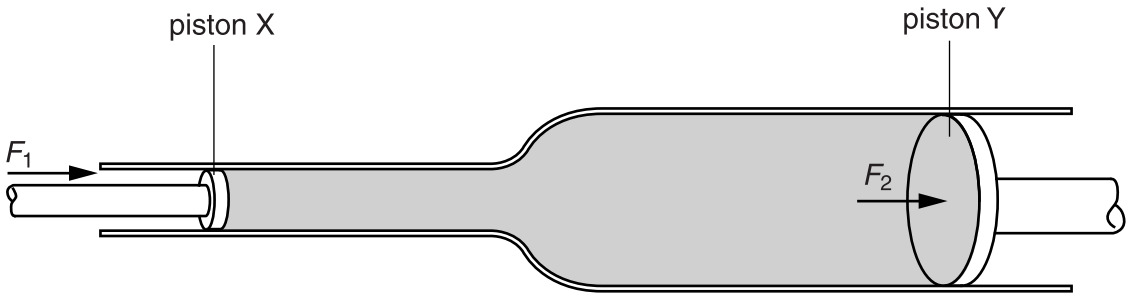


Fig. 4.1

The force F_1 of the driver's foot on the brake pedal moves piston X. The space between pistons X and Y is filled with oil which cannot be compressed. The force F_2 exerted by the oil moves piston Y. This force is applied to the brake mechanism in the wheels of the car.

The area of cross-section of piston X is 4.8 cm^2.

(a) The force F_1 is 90 N. Calculate the pressure exerted on the oil by piston X.

pressure = ... [2]

(b) The pressure on piston Y is the same as the pressure applied by piston X. Explain why the force F_2 is greater than the force F_1.

.....

..... [1]

(c) Piston Y moves a smaller distance than piston X. Explain why.

.....

.....

..... [2]

(d) Suggest why the braking system does not work properly if the oil contains bubbles of air.

.....

.....

..... [2]

[Total: 7]

Pressure Click for more variations

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6 **(a)** (p =) F/A OR in words OR 90/4.8 OR 90 / 0.00048 C1
= 18.75 N/cm^2 OR 1.875×10^5 Pa OR 187500 Pa
OR 187.5 kPa OR 0.1875 MPa at least 2 s.f. A1

(b) Area of Y bigger (than area of X so force greater) B1

(c) Volume of oil moved at Y = volume of oil moved at X B1
Area of Y × distance moved by Y = Area of X × distance moved by X (so distance move by Y smaller) B1
OR
Work done by piston X = work done on piston Y (B1)
Work = force × distance and F_2 is greater than F_1 so distance moved by Y smaller (than distance moved by X) (B1)

(d) Air bubbles compress when pressure applied M1
More movement of piston X required for same movement of piston Y
OR Y moves less (for same movement of X)
OR Driver must push the brake pedal further / do more work
OR Pressure reduced / force on Y reduced
OR System is less efficient A1

[Total: 7]

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7 **(a)** A water tank has a rectangular base of dimensions 1.5 m by 1.2 m and contains 1440 kg of water.

Calculate

(i) the weight of the water,

weight = ... [1]

(ii) the pressure exerted by the water on the base of the tank.

pressure = ... [2]

(b) Fig. 5.1 shows two water tanks **P** and **Q** of different shape. Both tanks are circular when viewed from above. The tanks each contain the same volume of water. The depth of water in both tanks is 1.4 m.

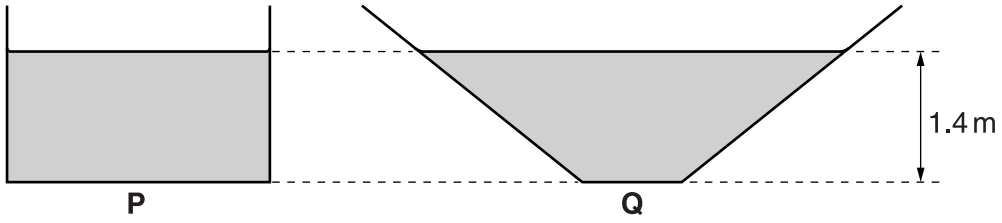


Fig. 5.1

(i) The density of water is 1000 kg/m^3. The pressures exerted by the water on the base of the two tanks are equal.

Calculate this pressure.

pressure = ... [2]

(ii) Equal small volumes of water are removed from each tank.

State which tank, **P** or **Q**, now has the greater water pressure on its base. Explain your answer.

.....

.....

..... [2]

[Total: 7]

Pressure Click for more variations

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7	**(a)**	**(i)**	($W = mg$ =1440 × 10 =) 14 400 N	B1
		(ii)	(P =) F/A OR 14 400 / (1.5 × 1.2)	C1
			8000 Pa OR N / m^2	A1
	(b)	**(i)**	(P =) $h\rho g$ OR 1.4 × 1000 × 10	C1
			14 000 Pa OR N / m^2	A1
	(b)	**(ii)**	pressure on base of **P** smaller / **Q** greater	M1
			(with same volume removed) smaller decrease in depth in Q OR height in **Q** is greater	A1

[Total: 7]

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8 A manometer containing a liquid X, is used to measure the pressure of a gas supply. Fig. 4.1 shows the manometer.

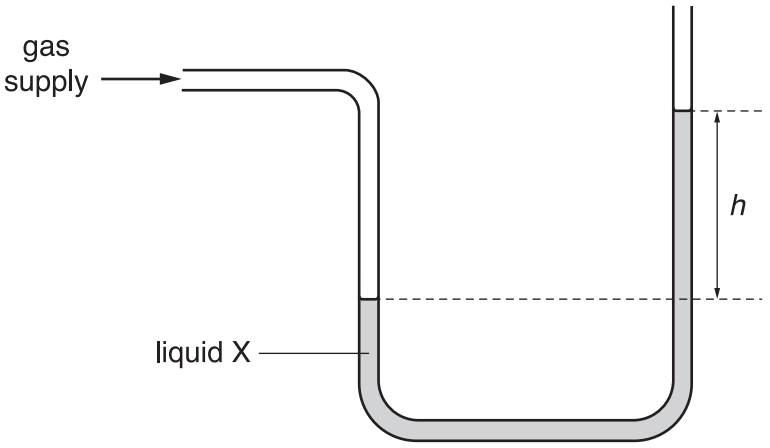


Fig. 4.1

Atmospheric pressure is 9.9×10^4 Pa.

(a) The height h is 0.36 m. The density of liquid X is 840 kg / m^3.

Calculate

(i) the pressure due to a column of liquid X of height 0.36 m,

pressure = ... [2]

(ii) the pressure of the gas supply.

pressure = ... [1]

(b) The pressure of the gas supply stays constant.

Describe what happens to the liquid levels when

(i) the liquid X is replaced by the same volume of a liquid of greater density,

.....

..... [2]

(ii) a manometer tube with a slightly smaller area of cross-section, containing an identical volume of liquid X, is used.

.....

..... [2]

[Total: 7]

Pressure Click for more variations

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8(a)(i)	(p =)*hρg* **or** 0.36 × 840 × 10 3.0(24) × 10^3 Pa	**C1** **A1**
8(a)(ii)	1.0(2024) × 10^5 Pa (**allow** 1.0 × 10^5 Pa **with evidence of addition**)	**B1**
8(b)(i)	left level not as low right level not as high **or** one level higher **and** one level lower smaller *h* / height (difference)	**B1** **B1**
8(b)(ii)	both / liquid levels higher same / 0.36 m *h* / height (difference)	**B1** **B1**
	Total	**5**

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9 **(a)** Fig. 3.1 shows an oil can containing only air at atmospheric pressure.

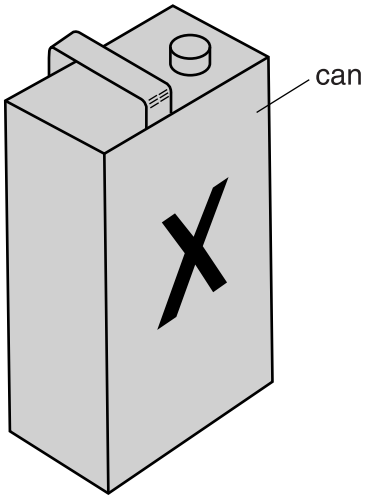


Fig. 3.1

Atmospheric pressure is 1.0×10^5 Pa.

The pressure of the air in the can is reduced by means of a pump. The can collapses when the pressure of the air in the can falls to 6000 Pa.

(i) Explain why the can collapses.

.....

.....[1]

(ii) The surface area of face X of the can is 0.12 m^2.

Calculate the resultant force on face X when the can collapses.

force = ...[3]

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(b) Mercury is poured into a U-shaped glass tube. Water is then poured into one of the limbs of the tube. Oil is poured into the other limb until the surfaces of the mercury are at the same level in both limbs.

Fig. 3.2 shows the result.

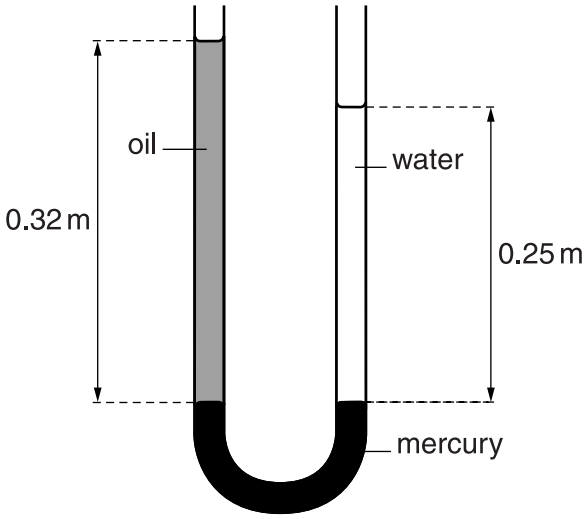


Fig. 3.2

(i) State a condition that must be true in order for the mercury surfaces to be at the same level in both limbs of the tube.

.....[1]

(ii) The height of the water column is 0.25 m. The height of the oil column is 0.32 m. The density of water is 1000 kg/m^3.

Calculate

1. the pressure exerted by the water on the surface of the mercury,

pressure = ...[2]

2. the density of the oil.

density = ...[2]

[Total: 9]

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9	**(a)**	**(i)**	force / pressure greater on outside surface owtte	B1
		(ii)	$p = F/A$ in any form **OR** $(F =) pA$	C1
			$= (1.0 \times 10^5 - 6000) \times 0.12$	C1
			11280 N to at least 2 sig. figs.	A1
	(b)	**(i)**	pressure of oil = pressure of water	B1
		(ii)	**1.** $(p =) h\rho g$	C1
			$(= 0.25 \times 1000 \times 10 =) 2500$ Pa	A1
			2. $h\rho g = 2500$	C1
			$(\rho = 2500 / (0.32 \times 10) =) 781\,kg/m^3$ to at least 2 sig. figs.	A1

[Total: 9]

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10 **(a)** Fig. 2.1 shows a bookshelf with two groups of books A and B on it. There are six books in each group of books. All the books are identical. The mass of each book is 0.52 kg.

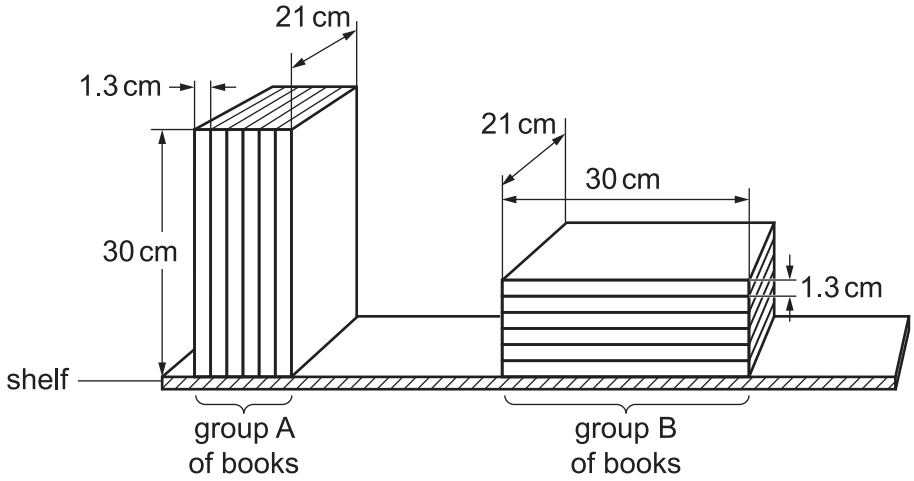


Fig. 2.1

(i) Explain why the pressure exerted on the shelf by the books in group B is less than the pressure exerted on the shelf by the books in group A.

.....

.....

..... [3]

(ii) Calculate the pressure exerted on the shelf by the books in group A.

pressure = ... [3]

(b) A diver dives to a depth below the surface of the sea where the total pressure is 3.0×10^5 Pa. The atmospheric pressure is 1.0×10^5 Pa. The density of the sea water is 1030 kg / m^3.

Calculate the depth of the diver below the surface of the sea.

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depth = ... [3]

[Total: 9]

Pressure Click for more variations

10(a)(i)	pressure = force/area accept P <u>inversely</u> proportional to area	**B1**
	same force exerted by each group of books	**B1**
	area (in contact with bookshelf) in group B is greater OR area (in contact with bookshelf) in group A is smaller	**B1**
10(a)(ii)	(pressure =) 1900 Pa	**A3**
	force = $6 \times 0.52 \times 10$ OR 31(.2) seen	**C1**
	area = $6 \times 0.013 \times 0.21$ OR 0.016(38) seen OR 163.8 (cm^2)	**C1**

10(b)	(depth =) 19 m	**A3**
	$p = \rho gh$ OR $(3.0 - 1.0) \times 10^5 = 1030 \times 10 \times h$ in any form	**C1**
	$h = (3.0 - 1.0) \times 10^5 / 1030 \times 10$ OR $h = 2.0 \times 10^5 / 1030 \times 10$	**C1**

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