

## Pressure & Density

### May 02

1. A cylindrical block of wood has a cross-sectional area  $A$  and weight  $W$ . It is totally immersed in water with its axis vertical. The block experiences pressures  $p_t$  and  $p_b$  at its top and bottom surfaces respectively. Which of the following expressions is equal to the upthrust on the block?

- A  $(p_b - p_t)A + W$       C  $(p_b - p_t)A$   
 B  $(p_b - p_t)$       D  $(p_b - p_t)A - W$

2. A mass of a liquid of density  $\rho$  is thoroughly mixed with an equal mass of another liquid of density  $2\rho$ . No change of the total volume occurs. What is the density of the liquid mixture?

- A  $\frac{4}{3}\rho$       B  $\frac{3}{2}\rho$       C  $\frac{5}{3}\rho$       D  $3\rho$

### Nov 02

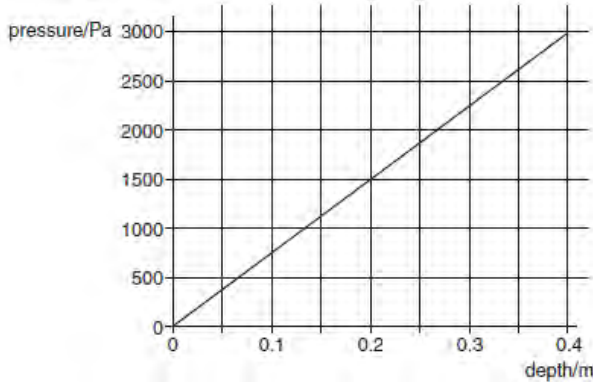
3. At a depth of 20 cm in a liquid of density  $1800 \text{ kg m}^{-3}$ , the pressure due to the liquid is  $p$ . Another liquid has a density of  $1200 \text{ kg m}^{-3}$ .

What is the pressure due to this liquid at a depth of 60 cm?

- A  $\frac{p}{2}$       B  $\frac{3p}{2}$       C  $2p$       D  $3p$

### Nov 03

4. The graph shows how the pressure exerted by a liquid varies with depth below the surface.



What is the density of the liquid?

- A  $600 \text{ kg m}^{-3}$       B  $760 \text{ kg m}^{-3}$       C  $5900 \text{ kg m}^{-3}$       D  $7500 \text{ kg m}^{-3}$

### June 04

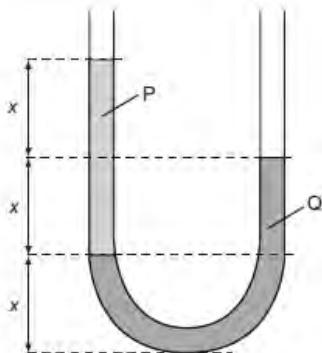
5. An object, immersed in a liquid in a tank, experiences an upthrust.

What is the physical reason for this upthrust?

- A The density of the body differs from that of the liquid.  
 B The density of the liquid increases with depth.  
 C The pressure in the liquid increases with depth.  
 D The value of  $g$  in the liquid increases with depth.

### Nov 04

6. The diagram shows two liquids, labelled P and Q, which do not mix. The liquids are in equilibrium in an open U-tube.



What is the ratio

$$\frac{\text{density of P}}{\text{density of Q}} ?$$

- A  $\frac{1}{2}$       B  $\frac{2}{3}$       C  $\frac{3}{2}$       D 2

### June 05

7. The hydrostatic pressure  $p$  at a depth  $h$  in a liquid of density  $\rho$  is given by the formula  $p = h\rho g$ .

Which equation, or principle of physics, is used in the derivation of this formula?

- A density = mass  $\div$  volume  
 B potential energy =  $mgh$   
 C atmospheric pressure decreases with height  
 D density increases with depth

### Nov 05

8. Why does the pressure increase when a sealed container of gas is heated?

- A The gas molecules collide more often with each other.  
 B The gas molecules expand when they are heated.  
 C The gas molecules travel faster and hit the walls of the container more often.  
 D There are more gas molecules present to collide with the walls of the container.

9. Liquids X and Y are stored in large open tanks. Liquids X and Y have densities of  $800 \text{ kg m}^{-3}$  and  $1200 \text{ kg m}^{-3}$  respectively.

At what depths are the pressures equal?

	depth in liquid X	depth in liquid Y
A	8 m	12 m
B	10 m	10 m
C	15 m	10 m
D	18 m	8 m

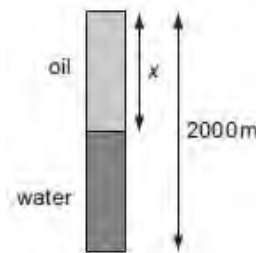
### Nov 06

10. Which force is caused by a pressure difference?

- A friction      B upthrust      C viscous force      D weight

11. A bore hole of depth 2000 m contains both oil and water as shown. The pressure at the bottom is

$17.5 \text{ MPa}$ . The density of the oil is  $830 \text{ kg m}^{-3}$  and the density of the water is  $1000 \text{ kg m}^{-3}$ .



What is the depth  $x$  of the oil?

- A 907 m      B 1000 m      C 1090 m      D 1270 m

### Nov. 07

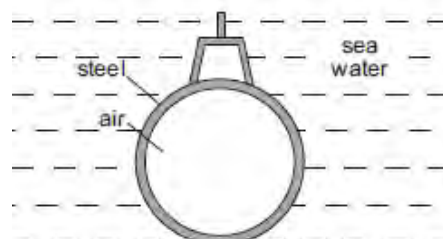
12. A submarine carries a pressure meter so that the crew can work out how far they are below the surface of the sea. At the surface, the meter indicates a pressure of  $100 \text{ kPa}$ . The density of seawater is  $1030 \text{ kg m}^{-3}$ .

What is the depth below the surface when the meter reads  $450 \text{ kPa}$ ?

- A 34.6 m      B 44.5 m      C 340 m      D 437 m

### June 08

13. A submarine is in equilibrium in a fully submerged position.



What causes the upthrust on the submarine?

- A The air in the submarine is less dense than sea water.  
 B The sea water exerts a greater upward force on the submarine than the weight of the steel.  
 C The submarine displaces its own volume of sea water.  
 D There is a difference in water pressure acting on the top and bottom of the submarine

**Nov 08**

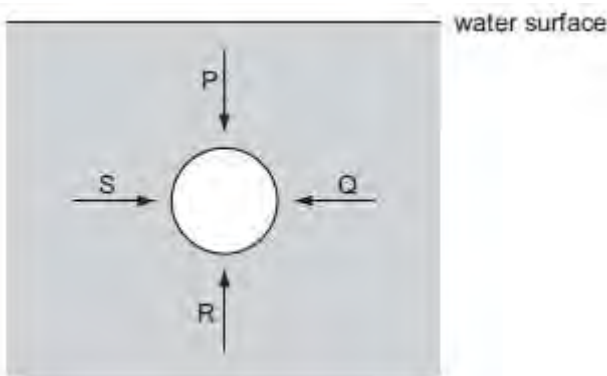
14. Why does an ideal gas exert pressure on its container?  
 A The molecules of the gas collide continually with each other.  
 B The molecules of the gas collide continually with the walls of the container.  
 C The molecules of the gas collide inelastically with the walls of the container.  
 D The weight of the molecules exerts a force on the walls of the container.

**June 07**

15. The density of mercury is  $13.6 \times 10^3 \text{ kg m}^{-3}$ .  
 The pressure difference between the bottom and the top of a column of mercury is 100 kPa.  
 What is the height of the column?  
 A 0.75 m      B 1.3 m      C 7.4 m      D 72 m

**June 09**

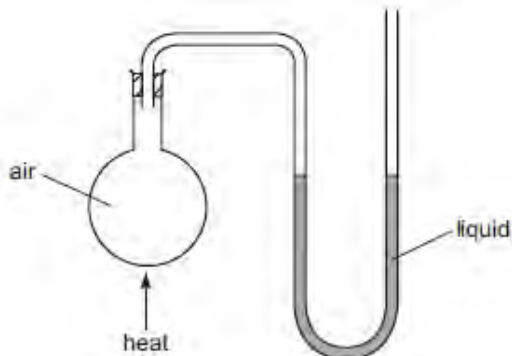
16. The diagram represents a sphere under water. P, Q, R, and S are forces acting on the sphere, due to the pressure of the water.



Each force acts perpendicularly to the sphere's surface. P and R act in opposite directions vertically. Q and S act in opposite directions horizontally.

- Which information about the magnitudes of the forces is correct?  
 A  $P < R$  ;  $S = Q$       B  $P > R$  ;  $S = Q$   
 C  $P = R$  ;  $S = Q$       D  $P = R = S = Q$

17. The diagram shows a flask connected to a U-tube containing liquid. The flask contains air at atmospheric pressure.



The flask is now gently heated and the liquid level in the right-hand side of the U-tube rises through a distance h. The density of the liquid is  $\rho$ .

- What is the increase in pressure of the heated air in the flask?  
 A  $h\rho$       B  $\frac{1}{2} h\rho g$       C  $h\rho g$       D  $2h\rho g$

**Nov 09**

18. In the kinetic model of gases, what is pressure equal to?  
 A the number of atoms hitting and rebounding from a surface of the gas container  
 B the number of atoms hitting and rebounding from a unit area of the gas container surface  
 C the force exerted by the atoms hitting and rebounding from a surface of the gas container  
 D the force exerted by the atoms hitting and rebounding from a unit area of the gas container surface

19. A rectangular metal bar exerts a pressure of 15 200 Pa on the horizontal surface on which it rests.

If the height of the metal bar is 80 cm, what is the density of the metal?

- A  $190 \text{ kg m}^{-3}$       B  $1900 \text{ kg m}^{-3}$   
 C  $19\,000 \text{ kg m}^{-3}$       D  $190\,000 \text{ kg m}^{-3}$

**June 10**

20. An object, immersed in a liquid in a tank, experiences an upthrust.

What is the physical reason for this upthrust?

- A The density of the body differs from that of the liquid.  
 B The density of the liquid increases with depth.  
 C The pressure in the liquid increases with depth.  
 D The value of g in the liquid increases with depth.

21. Atmospheric pressure at sea level has a value of 100 kPa. The density of sea water is  $1020 \text{ kg m}^{-3}$ .

At what depth in the sea would the total pressure be 110 kPa?  
 A 1.0 m      B 9.8 m      C 10 m      D 11 m

Answers

- |    |   |    |   |
|----|---|----|---|
| 1  | c | 16 | a |
| 2  | a | 17 | d |
| 3  | c | 18 | d |
| 4  | b | 19 | b |
| 5  | c | 20 | c |
| 6  | a | 21 | a |
| 7  | a |    |   |
| 8  | c |    |   |
| 9  | c |    |   |
| 10 | b |    |   |
| 11 | d |    |   |
| 12 | a |    |   |
| 13 | d |    |   |
| 14 | b |    |   |
| 15 | a |    |   |