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?

$$\text{Upthrust} = \frac{(\rho_2 - \rho_1)A}{(\rho_2 - \rho_1)A - W}$$

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?

3. At a depth of 20 cm in a liquid of density $1800 \text{ kgm}^{-3}$, the pressure due to the liquid is $p$. Another liquid has a density of $1200 \text{ kgm}^{-3}$. What is the pressure due to this liquid at a depth of 60 cm?

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

5. An object, immersed in a liquid in a tank, experiences an upthrust. What is the physical reason for this upthrust?

6. A bore hole of depth 2000 m contains both oil and water as shown. The pressure at the bottom is 17.5 MPa. The density of the oil is 830 kg m$^{-3}$ and the density of the water is 1000 kg m$^{-3}$. What is the depth $x$ of the oil?

7. The hydrostatic pressure $p$ at a depth $h$ in a liquid of density $\rho$ is given by the formula $p = \rho gh$. Which equation, or principle of physics, is used in the derivation of this formula?

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

9. Liquids X and Y are stored in large open tanks. Liquids X and Y have densities of $800 \text{ kgm}^{-3}$ and $1200 \text{ kgm}^{-3}$ respectively. At what depths are the pressures equal?

10. Which force is caused by a pressure difference?

11. A submarine is in equilibrium in a fully submerged position. What causes the upthrust on the submarine?

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**Pressure & Density**

May 02

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Nov 02

3. At a depth of 20 cm in a liquid of density $1800 \text{ kgm}^{-3}$, the pressure due to the liquid is $p$. Another liquid has a density of $1200 \text{ kgm}^{-3}$. What is the pressure due to this liquid at a depth of 60 cm?

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 $600 \text{ kgm}^{-3}$  B $760 \text{ kgm}^{-3}$  C $5900 \text{ kgm}^{-3}$  D $7500 \text{ kgm}^{-3}$

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 of the density of P to the density of Q?

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

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**May 05**

7. The hydrostatic pressure $p$ at a depth $h$ in a liquid of density $\rho$ is given by the formula $p = \rho gh$. Which equation, or principle of physics, is used in the derivation of this formula?

A density = mass ÷ 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 $800 \text{ kgm}^{-3}$ and $1200 \text{ kgm}^{-3}$ respectively. At what depths are the pressures equal?

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 MPa. The density of the oil is $830 \text{ kgm}^{-3}$ and the density of the water is $1000 \text{ kgm}^{-3}$. What is the depth $x$ of the oil?

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

Nov. 06

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 kPa. The density of seawater is $1030 \text{ kgm}^{-3}$. What is the depth below the surface when the meter reads 450 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.
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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.

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

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 $2h \rho g$

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

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 kg m$^{-3}$  B 1900 kg m$^{-3}$  C 19 000 kg m$^{-3}$  D 190 000 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 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  6 a  11 b
2 a  7 a  12 a
3 c  8 c  13 d
4 b  9 c  14 b
5 c  10 b  15 a
6 a  17 d  18 c
9 c  20 c
10 b

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