Combining equations

PHYSICS EQUATION PRACTICE

USEFUL Equations

PRESSURE DIFFERENCE = DENSITY x g x HEIGHT

DENSITY = MASS / VOLUME

PRESSURE = FORE / AREA

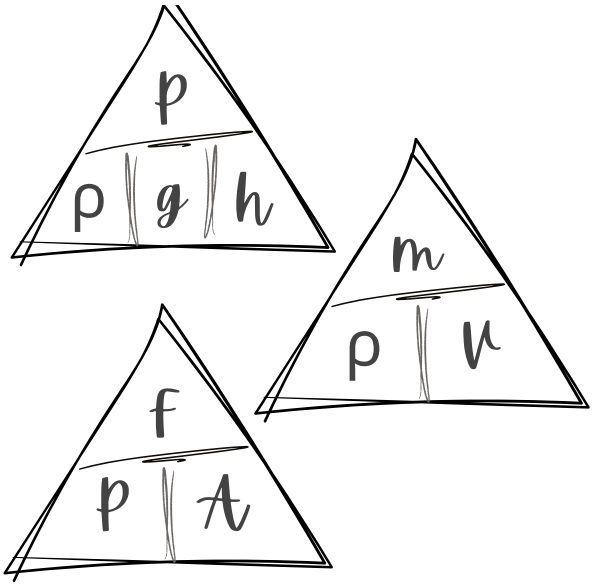
Understand

UNDERSTAND, DON'T MEMORISE

These questions involve two equations. You'll need to identify which are involved to answer the question.

Make a list of variables you have on the left of the answer space, so you can figure out which equations you need.

Equation TRIANGLES



Example QUESTION

QUESTION:

A dolphin dives 5 m below the surface of seawater (density 1,025 kg/m^3). It presses on a hatch with an area of 0.4 m^2. Calculate the force the hatch experiences. (g = 10 m/s^2)

Height — Density — g — Area — Force

ANSWER:

List

$h = 5m$

$\rho = 1{,}025\ kg/m^3$

$g = 10\ m/s^2$

$A = 0.4\ m^2$

$F = ?$

Equations

$\Delta P = \rho \times g \times h$

$1{,}025 \times 10 \times 5$

$= 51{,}250\ Pa$

$F = P \times A$

$51{,}250 \times 0.4$

$= 20{,}500\ N$

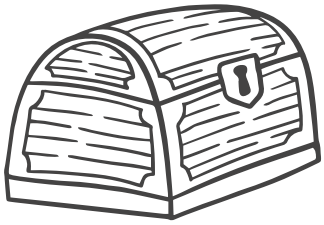
Answer & unit

Challenge QUESTIONS

1. A diver is 15 m below the surface of seawater (ρ = 1,025 kg/m^3). If the diver presses on a hatch with area 0.5 m^2, calculate the force on the hatch. (g = 10 m/s^2)

2. A magical pond has a liquid column 2.5 m deep with a pressure difference of 32,500 Pa. Calculate the density of the liquid. (g = 10 m/s^2)

3. A treasure chest lies 10 m below the surface of freshwater (ρ = 1,000 kg/m^3). The chest's bottom has an area of 1.2 m^2. Calculate the force exerted by the water on the bottom. (g = 10 m/s^2)



4. A liquid column in a flask is 0.8 m high. The pressure difference between top and bottom is 9,600 Pa. Calculate the density of the liquid. (g = 10 m/s^2)

5. A submarine experiences a pressure difference of 340,000 Pa in seawater (density 1,020 kg/m^3). Calculate the depth of the submarine. (g = 10 m/s^2)

Challenge QUESTIONS

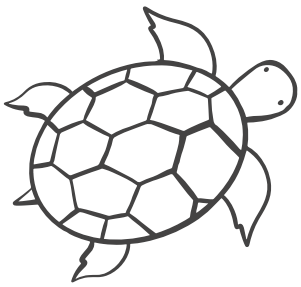
6. A giant turtle stands 6 m below the surface of a lake (ρ = 1,030 kg/m^3). Its shell presses on a platform of area 1.5 m^2. Calculate the force on the platform. (g = 10 m/s^2)

7. A crystal tower is submerged in a liquid with density 1,150 kg/m^3. If the pressure difference between top and bottom is 46,000 Pa, calculate the height of the tower. (g = 10 m/s^2)

8. A potion flask contains a liquid 1.5 m deep with density 1,200 kg/m^3. If the base area is 0.2 m^2, calculate the force the liquid exerts on the base. (g = 10 m/s^2)

9. A diver measures a pressure difference of 50,000 Pa at a certain depth in seawater (ρ = 1,025 kg/m^3). Calculate how deep the diver is. (g = 10 m/s^2)

10. A magical well contains a shimmering fluid. A crystal bottle with a volume of 0.05 m^3 is lowered to a depth of 25 m, where the fluid pressure is 12,500 Pa (ignore surface pressure). Find the mass of the fluid that would fill the bottle at this depth (g = 10 m/s^2)



Working SPACE

Combining Equations - P, P, n

Challenge QUESTIONS — Worked Answers

1. A diver is 15 m below the surtace ot seawater (ρ = 1,025 kg/m³). If the diver presses on a hatch with area 0.5 m², calculate the force on the hatch. (g = 10 m/s²)

h = 15m
ρ = 1,025 kg/m³
g = 10 m/s²
A = 0.5 m²
F = ?

ΔP = ρ × g × h → 1,025 × 10 × 15 = 153,750 Pa

F = P × A → 153,750 × 0.5 = 76,875 N

2. A magical pond has a liquid column 2.5 m deep with a pressure difference of 32,500 Pa. Calculate the density of the liquid. (g = 10 m/s²)

h = 2.5m
P = 32,500 Pa
ρ = ?
g = 10 m/s²

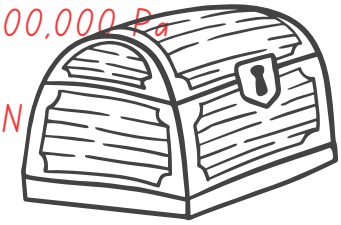
ρ = ΔP ÷ (g × h) → 32,500 ÷ (10 × 2.5) = 1,300 kg/m³
(Density of the magical pond = 1,300 kg/m³)

3. A treasure chest lies 10 m below the surface of freshwater (ρ = 1,000 kg/m³). The chest's bottom has an area of 1.2 m². Calculate the force exerted by the water on the bottom. (g = 10 m/s²)

h = 10 m
ρ = 1000 kg/m³
g = 10 m/s²
A = 1.2 m²
F = ?

ΔP = ρ × g × h → 1,000 × 10 × 10 = 100,000 Pa

F = P × A → 100,000 × 1.2 = 120,000 N



4. A liquid column in a flask is 0.8 m high. The pressure difference between top and bottom is 9,600 Pa. Calculate the density of the liquid. (g = 10 m/s²)

h = 0.8 m
ρ = ?
g = 10 m/s²
P = 9,600 Pa

ρ = ΔP ÷ (g × h) → 9,600 ÷ (10 × 0.8) = 1,200 kg/m³
(Density of the flask liquid = 1,200 kg/m³)

5. A submarine experiences a pressure difference of 340,000 Pa in seawater (density 1,020 kg/m³). Calculate the depth of the submarine. (g = 10 m/s²)

P = 340,000 Pa
ρ = 1,020 kg/m³
g = 10 m/s²
h = ?

h = ΔP ÷ (ρ × g) → 340,000 ÷ (1,020 × 10) ≈ 33.3 m
(Depth of the submarine ≈ 33.3 m)

Challenge QUESTIONS

Worked Answers

6. A giant turtle stands 6 m below the surface of a lake (ρ = 1,030 kg/m^3). Its shell presses on a platform of area 1.5 m^2. Calculate the force on the platform. (g = 10 m/s^2)

$h = 6$ m
$\rho = 1{,}030$ kg/m^3
$g = 10$ m/s^2
$A = 1.5$ m^2
$F = ?$

$\Delta P = \rho \times g \times h \rightarrow 1{,}030 \times 10 \times 6 = 61{,}800$ Pa

$F = P \times A \rightarrow 61{,}800 \times 1.5 = 92{,}700$ N

7. A crystal tower is submerged in a liquid with density 1,150 kg/m^3. If the pressure difference between top and bottom is 46,000 Pa, calculate the height of the tower. (g = 10 m/s^2)

$\rho = 1{,}150$ kg/m^3
$P = 46{,}000$ Pa
$g = 10$ m/s^2
$h = ?$

$h = \Delta P \div (\rho \times g) \rightarrow 46{,}000 \div (1{,}150 \times 10) = 4$ m

(Height of the crystal tower = 4 m)

8. A potion flask contains a liquid 1.5 m deep with density 1,200 kg/m^3. If the base area is 0.2 m^2, calculate the force the liquid exerts on the base. (g = 10 m/s^2)

$h = 1.5$ m
$\rho = 1{,}200$ kg/m^3
$g = 10$ m/s^2
$A = 0.2$ m^2
$F = ?$

$\Delta P = \rho \times g \times h \rightarrow 1{,}200 \times 10 \times 1.5 = 18{,}000$ Pa

$F = P \times A \rightarrow 18{,}000 \times 0.2 = 3{,}600$ N

9. A diver measures a pressure difference of 50,000 Pa at a certain depth in seawater (ρ = 1,025 kg/m^3). Calculate how deep the diver is. (g = 10 m/s^2)

$P = 50{,}000$ Pa
$\rho = 1{,}025$ kg/m^3
$g = 10$ m/s^2
$h = ?$

$h = \Delta P \div (\rho \times g) \rightarrow 50{,}000 \div (1{,}025 \times 10) \approx 4.88$ m

(Depth of the diver $\approx$ 4.88 m)

10. A magical well contains a shimmering fluid. A crystal bottle with a volume of 0.05 m^3 is lowered to a depth of 25 m, where the fluid pressure is 12,500 Pa . Find the mass of the fluid that would fill the bottle at this depth (g = 10 m/s^2)

$V = 0.05$ m^3
$m = ?$
$h = 25$ m
$P = 12{,}500$ Pa
$g = 10$ m/s^2

$\rho = P \div (g \times h) = 12{,}500 \div (10 \times 25) = 50$ kg/m^3;

$m = \rho \times V = 50 \times 0.05 = 2.5$ kg.