Exercise walk-through

Pressure ▪ 8.2

eXercise

You must be able to

- define **pressure** 压强 as force per unit area, $P = \frac{F}{A}$
- calculate the pressure due to a column of fluid, $P = \rho g h$
- explain how pressure increases with **depth** and acts in all directions

Method — Pressure

$P = \dfrac{F}{A}$, measured in pascals ($1\ \text{Pa} = 1\ \text{N m}^{-2}$). The same force over a smaller area gives more pressure.

Method — Pressure in a fluid

$P = \rho g h$ increases with **depth** h and acts equally in **all directions** at a given depth.

Method — Example

At 2.0 m depth in water ($\rho = 1000$, $g = 10$): $P = 1000 \times 10 \times 2.0 = 2.0 \times 10^4$ Pa.

Practice 2.1 ▪ 1 mark

A force of 200 N acts on an area of 0.50 m^2. Find the pressure.

Solution 2.1

Method: Pressure

Worked steps

$$P = \frac{F}{A} = \frac{200}{0.50} = 400 \text{ Pa}$$ B1.

Practice 2.2 ▪ 2 marks

Find the pressure 5.0 m below the surface of a lake ($\rho = 1000$ kg m^{-3}, $g = 10$ m s^{-2}).

Solution 2.2

Method: Pressure

Worked steps

$P = \rho g h = 1000 \times 10 \times 5.0 = 5.0 \times 10^4$ Pa **M1** **A1**.

Practice 2.3 ▪ 1 mark

State how the pressure in a fluid changes with depth.

Solution 2.3

Method: Pressure in a fluid

Worked steps

it increases with depth B1.

Exam-style 3.1 ▪ 1 mark

Pressure is defined as

A force $\times$ area

B force $\div$ area

C mass $\div$ volume

D density $\times$ depth only

Solution 3.1

A force $\times$ area

B force $\div$ area ✓

C mass $\div$ volume

D density $\times$ depth only

Worked steps

B.

Exam-style 3.2 ▪ 1 mark

The pressure due to a column of fluid depends on

A the shape of the container

B the surface area

C the depth and the fluid density

D the total volume

Solution 3.2

Method: Pressure in a fluid

A the shape of the container

B the surface area

C the depth and the fluid density ✓

D the total volume

Worked steps

C.

Exam-style 3.3 ▪ 2 marks

A diver is 12 m below the sea surface ($\rho = 1030$ kg m^{-3}, $g = 10$ m s^{-2}).
(a) Find the pressure due to the water.
(b) Find the total pressure if atmospheric pressure is 1.0×10^5 Pa.

Solution 3.3

Method: Example

Worked steps

(a) $P = \rho g h = 1030 \times 10 \times 12 = 1.24 \times 10^5$ Pa M1 A1. (b) total $= 1.24 \times 10^5 + 1.0 \times 10^5 = 2.24 \times 10^5$ Pa B1.