Year 10 Science: Pressure in liquids and gases, depth and hydraulics

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. A box weighing 240 N rests on a face of area 0.6 m². What pressure does it put on the floor?

2. Find the pressure from the water 5 m down in Lake Taupō. Fresh water has density 1000 kg/m³; use g = 9.8 N/kg.

3. Explain why a dam wall is built thicker at the bottom than at the top.

4. A hydraulic lift has a small piston of 0.0005 m² and a large piston of 0.05 m². A 40 N push is applied to the small piston. Find the output force and the mechanical advantage.

5. A student measures each jet from a holed bottle once, with a ruler held by hand. Suggest two improvements, and say whether each improves accuracy or reliability.

Fix the mistake

6. Correct this statement: "P = 600 ÷ 400 cm² = 1.5 Pa."

7. Correct this statement: "Pressure in water only pushes down."

8. Correct this statement: "The water pressure on a dam is bigger when the lake behind it stretches back further, even at the same depth."

9. Correct this statement: "A hydraulic jack gives you more energy than you put in."

Answer key (for parents and tutors)

1. A box weighing 240 N rests on a face of area 0.6 m². What pressure does it put on the floor?
   P = 240 ÷ 0.6 = 400 Pa.
2. Find the pressure from the water 5 m down in Lake Taupō. Fresh water has density 1000 kg/m³; use g = 9.8 N/kg.
   P = 1000 × 9.8 × 5 = 49 000 Pa = 49 kPa from the water (about 150 kPa in total with the air above).
3. Explain why a dam wall is built thicker at the bottom than at the top.
   Pressure in a liquid increases with depth, so the water pushes hardest on the bottom of the wall, which needs to be strongest there.
4. A hydraulic lift has a small piston of 0.0005 m² and a large piston of 0.05 m². A 40 N push is applied to the small piston. Find the output force and the mechanical advantage.
   Pressure = 40 ÷ 0.0005 = 80 000 Pa; output force = 80 000 × 0.05 = 4000 N; mechanical advantage = 4000 ÷ 40 = 100.
5. A student measures each jet from a holed bottle once, with a ruler held by hand. Suggest two improvements, and say whether each improves accuracy or reliability.
   For example: repeat each measurement three times and average (reliability); clamp the ruler in place and keep the water topped up to the same level (accuracy).
6. Correct this statement: "P = 600 ÷ 400 cm² = 1.5 Pa."
   Area must be in m² for pascals, and 1 cm² is 0.0001 m², so 400 cm² is 0.04 m² and P = 15 000 Pa.
7. Correct this statement: "Pressure in water only pushes down."
   At any point in a fluid the pressure pushes equally in all directions, which is why water squirts sideways out of a hole in a bottle.
8. Correct this statement: "The water pressure on a dam is bigger when the lake behind it stretches back further, even at the same depth."
   Liquid pressure depends only on depth and density (P = ρgh), so how far the lake stretches back makes no difference.
9. Correct this statement: "A hydraulic jack gives you more energy than you put in."
   It multiplies force, but the small piston has to move much further than the large one, so no extra energy is made.