Pressure in a liquid

A liquid cannot be squashed and this property is used in hydraulics. This can be seen in the "Tower of Power" experiment which you hopefully saw last year.

Get a bottle of orange juice and put three holes in it, one at the top, middle and bottom. From which hole will the juice squirt out fastest and furthest? Can you explain why?

The lower the hole is the further the water squirts out. This is because the pressure is higher lower down as all the weight of the water is on.

This is the equation which we use.

Pressure (p, Pa) = height (h, m) x density (ρ, kg/ m^3) x gravity (m/s^2)

The bottle above has a length of 50cm. There are three holes in it; 0.5, 0.25 and 0.45 cm from the top. What is the pressure at these depths?

Method.

For the first hole the height of the water above it is 50 – 0.5 = 49.5 cm = 0.459m. All heights have to be in metres. The density of orange juice is 1.2 kg/m^3 and g is 9.8 m/s^2. Therefore the pressure is 0.495 x 1.2 x 9.8 = 5.8 Pa.

You do the next two in the space below.

Question

A student is holding a bottle of juice over his shoes. It has a height of 40 cm and a cross sectional area of 0.308 m^2. The maximum force it can withstand is 8.0 N. If it is filled up with a liquid of density 6.9 kg/m^3 . Will the bottle break and the liquid go all over the students toes? What are the two equations that you need?

Question

Can you explain using the ideas of pressure why your ears hurt when you swim underwater? Put in a few calculations to justify your answers. The density of water is 1.0 kg/m^3 .

Question

Can you explain what freediving is and why the lungs of those who do it get compressed?