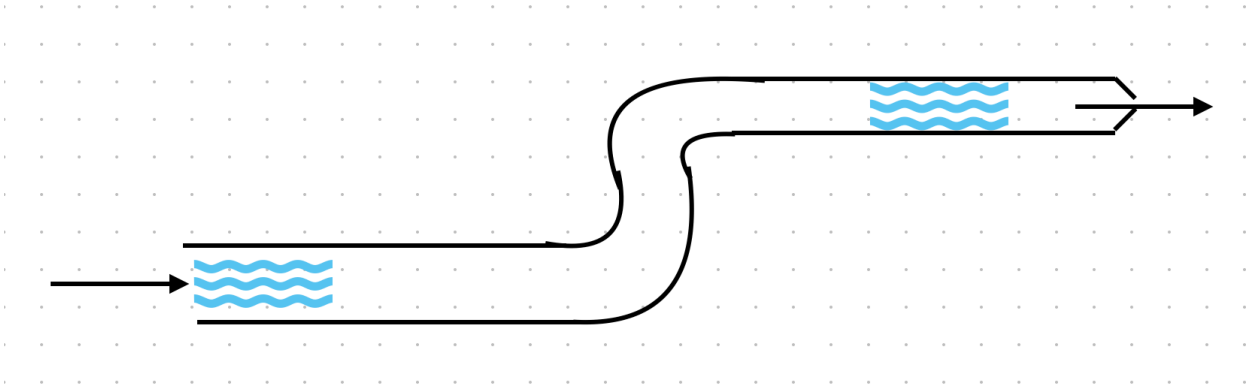
Fluid Dynamics and Statics
PHYS 211

1) Given the following piping system below, find the increase in height y2 of the right tube. Let P1 = 10 kPa, P2 = 5 kPa, V1 = 4 m/s, V2 = 2 m/s, ρ = 997 kg/m^3. Let the height of the left tube, y1, be the ground (y1 = 0).



Using Bernoulli's Equation:

$$P1 + \frac{1}{2}\rho V1^2 + \rho g y1 = P2 + \frac{1}{2}\rho V2^2 + \rho g y2$$

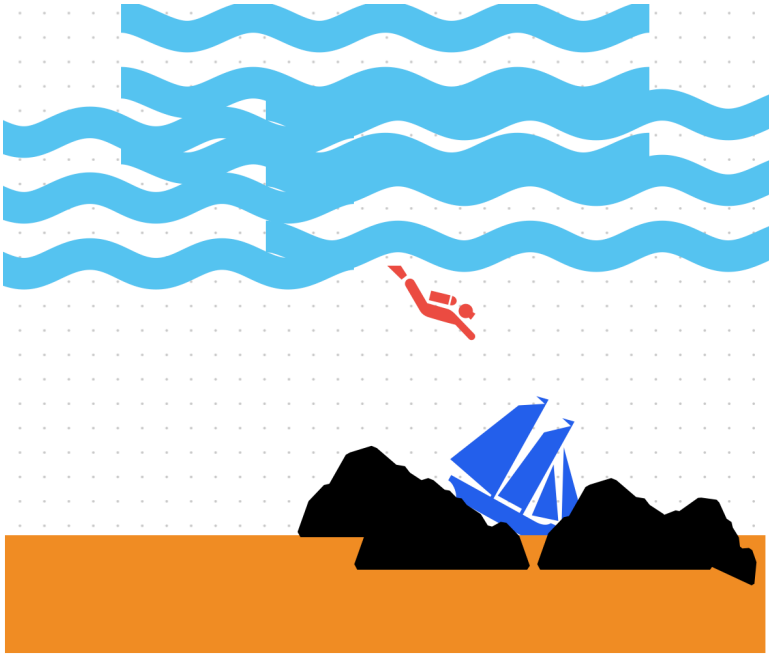
Since y1 is the reference points, it can be assumed to be zero.

$$y2 = \frac{P1 - P2 + \frac{1}{2}\rho(V1^2 - V2^2)}{\rho g}$$

Plugging in the Givens:

y2 = 1.123 m

2) A diver dives deep below the ocean to study a sunken ship as shown.



Suddenly on the way down, they become super interested in hydrostatic pressures and decide to measure the pressure at a height of 25 m below the surface of the ocean.

a) What is the pressure that the diver measures?

Using Hydrostatic Pressure:

$$P = P_o + \rho g h$$

P_o is Atmospheric Pressure: 101.3 kPa = 101,300 Pa

$$P = 101{,}300 + (997)(9.81)(25) = 345{,}814.25 \text{ Pa} = 345.8 \text{ kPa}$$

b) The maximum pressure that the diver's oxygen tank can handle is 350 kPa. Should the diver continue to dive towards the sunken boat? Explain why.

No. The pressure at the height the diver is currently at is very near the maximum pressure the oxygen tank can handle. Any further and the oxygen tank may burst.

3) A wave on a string is described by the equation:

$$y(x,t) = 0.05\cos(3x - 2t)$$

(a) Determine the direction of wave propagation.

Negative Sign Means it propegates to the right.

(b) Find the wavelength and frequency of the wave.

$\lambda = (2\pi)/k = ((2\pi)/3 = 2.09$ m

$f = \omega/(2\pi) = 2/(2\pi) = 0.318$ Hz

4) A string is under a tension of 50 N and has a mass per unit length of 0.02 kg/m.

(a) Calculate the speed of a wave traveling on this string.

$$v = \sqrt{\frac{F}{\mu}} = \sqrt{\frac{50}{0.02}} = 50 \text{ m/s}$$

(b) If the wave frequency is 10 Hz, what is the wavelength?

$\lambda = v/f = 50/10 = 5$ m