SAMPLE

CIVE1400: Fluid Mechanics.
MCQ Test questions: Properties of Fluids and Statics

Name:	**Date:**
Tutor	**Signature:**

These answer assumes the following: Gravitational acceleration, g = 9.81 m/s
Mass density of water, ρ = 1000 kg/m^3

1. If 5.6m^3 of oil weighs 46 800 N, what is the mass density in kg/m^3?

a) 1.2×10^{-4} b) 852.0 c) 8357.1 d) 8.52 e) 8.36

a b c d e

$$\text{Weight of unit volume} = \rho g = \frac{46800}{5.6} = 8360\, N/m^3$$

$$\text{Density} = \rho = \frac{\rho g}{g} = \frac{8360}{9.81} = 852 kg/m^3$$

2. What is the relative density of the oil in question 1?

a) 0.852 b) 83.57 c) 8357.1 d) 8.36 a) 1.2×10^{-4}

a b c d e

$$\text{Relative density} = \sigma = \frac{\rho_{oil}}{\rho_{\text{water}}} = \frac{852}{1000} = 0.852$$

3. A fluid has absolute viscosity, μ, of 0.048 Pa s. If at point A, 75mm from the wall the velocity is measured as 1.125 m/s, calculate the intensity of shear stress at point B 50mm from the wall in N/m^2. Assume a linear (straight line) velocity distribution from the wall.

a) 15 b) 0.048 c) 0.72 d) 0.0032 e) 0.032

a b c d e

For a straight line assumption the velocity gradient is constant for all distances from the wall and given by,

$$\text{Velocity gradient} = \frac{dV}{dy} = \frac{1.125}{0.075} = 15\, s^{-1}$$

From Newton's law of viscosity

$$\text{Shear stess} = \tau = \mu \frac{dV}{d} = 0.048 \times 15 = 0.72\, Pa$$

4. Determine the *absolute* pressure in Pa at a depth of 6m below the free surface of a tank of water when a barometer reads 760mm mercury (relative density 13.57)

a) 101172 b) 58860 c) 160 032 d) 82.42 e) 160.032

a b c d e

Absolute pressure = Atmospheric pressure + Gauge pressure

$$\text{Gauge Pressure} = p_G = \rho g h = 1000 \times 9.81 \times 6 = 58860\, N/m^2$$

$$\text{Atmospheric pressure, } p_A = \text{pressure due to 760mm of mercury}$$
$$= (13.57 \times 1000) \times 0.76 \times 9.81$$
$$= 101172\, N/m^2$$

$$p = p_G + p_A = 58860 + 101172$$
$$= 160\,032\, N/m^2$$

5. Determine the pressure in *bar* at a depth of 10m in oil of relative density 0.750.

a) 735575 b) 0.736 c) 735575×10^5 d) 73.575 e) 98100

a b c d e

$$\text{Pressure} = p = \rho g h = (0.75 \times 1000) \times 9.81 \times 10 = 73575\, N/m^2$$

This must be converted to *bar* where 1 *bar* = 10^5 N/m^2

$$p = \frac{73575}{10^5} = 0.736\, bar$$

6. What depth of oil (in m), relative density 0.75, will give a gauge pressure of 275000 Pa

a) 37.38 b) 367 c) 0.027 d) 20.2×10^4 e) 28.03

a b c d e

$$\text{Gauge pressure} = p = \rho g h$$

$$h = \frac{p}{\rho g}$$

$$h = \frac{275000}{(0.75 \times 1000) \times 9.81}$$
$$= 37.38\, m$$

7. Express the pressure head of 15m of water in metres of oil of relative density 0.75

a) 110.36 b) 11.25 c) 11 250 d) 15.0 e) 20.0

a b c d e

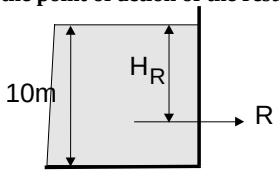
$$p = \rho_{\text{oil}} g h_{oil} = \rho_{water} g h_{water}$$

$$h_{oil} = \frac{\rho_{water} h_{water}}{\rho_{oil}}$$

$$= \frac{\rho_{water} h_{water}}{0.75 \rho_{water}}$$

$$= \frac{15}{0.75} = 20.0m$$

8. A square tank with sides 5m long and vertical walls contains water to depth of 10m, as shown. What is the depth, H_R, in meters to the point of action of the resultant force, R, due to the liquid?



a) 5.0 b) 6.67 c) 3.33 d) 2.0 e) 10.0

a b c d e

$H_R = 2H/3 = 2 \times 10/3 = 6.67m$

9. What is the magnitude of the resultant force, R, in Newton's per metre in the previous question?

a) 654 000 b) 981 000 c) 98 100 d) 49 050 e) 490 500

a b c d e

$$R = pressure\,at\,centroid \times area$$

$$R = \rho g (H/2) \times (H \times 1)$$

$$R = 1000 \times 9.81 \times 5 \times 10$$

$$R = 490500$$