Chapter 14 (Fluids)

1- A column of fluid, is open to the atmosphere at the top, and is 9.5 m high. If the density of the fluid is 1680 kg/m³, what is the total pressure at the bottom of this column? (A: 2.58×10^5 Pa)

2- The velocity of the flow of water in a pipe is 4.5 m/s. If the pipe has a diameter of 8.4 cm, what is the mass of water coming out of the pipe per second? (A: 24.9 kg/s)

3- A pipe carrying water from the ground floor to the fourth floor of a building which is 13 m high. At the fourth floor the pipe has a cross-sectional area of 4.1×10^{-4} m², a pressure of 1.66×10^5 Pa and the velocity of water flow is 8.4 m/s. At the ground floor, the cross-sectional area of the pipe is 9.3×10^{-4} m², what is the pressure in the pipe at the ground floor? (A: 3.22×10^5 Pa)

4- Water flowing at 4 m/s in a non-uniform circular pipe at point A. If the diameter of the pipe at point B is 1/2 its value at A, what is the velocity of water at point B? (A: 16 m/s)

5- A very small hole is made 1.0 m below the top of a large tank full of water. If the tank is open, what is the initial velocity of water coming out of the hole? (A: 4.4 m/s)

6- Find the minimum area of a flat ice slab 1 m thick if it is to support a 2000 kg car above sea water. (Density of ice is 920 kg/m³, density of sea water is 1020kg/m³) (A: 20 m²)

7- Consider an ice cube of 10 cm side and average density of 917 kg/m3. What is the magnitude of the minimum force that one has to exert on its top surface to hold it completely submerged under water? (the density of water 10^3 kg/m³) (A: 0.813 N)

8- A swimming pool of dimensions 30.0 m by 10.0 m has a flat horizontal bottom. When the pool is filled to a depth of 2.0 m with fresh water, what is the total force on the bottom surface of this swimming pool? (Assume the density of water to be 103 kg/m3 and Pa = 1.01×10^5 N/m²) (A: 3.6×10^7 N)

9- A block of wood floats in water with 0.67 of its volume submerged. The density of water is 1000 kg/m³. When the same block floats in oil, 0.90 of its volume is submerged. Find the density of the oil. (A: 744 kg/m³)

10- Water enters the first floor of a house through a pipe 2.0 cm in diameter and at an absolute pressure of 4 x 10^5 Pa. The pipe leads to a second-floor room, 5 m above, where the diameter is 1.0 cm. The flow velocity in the inlet pipe is 4 m/s. What is the flow velocity and pressure in the second room? (A: 16 m/s, 2.31×10^5 Pa)
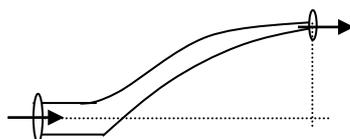
11- A solid sphere has a weight of 10 N. When it is suspended from a spring scale and submerged in water, the scale reads 6.0 N. What is the radius of the solid sphere? (Density of water is 1000 kg/m3). (A: 4.6 cm)

12- Water flows at a rate of 8.00 liter/min from a small hole at the bottom of a tank which is 0.900 m deep. Find the area of the hole. (A: 3.17×10^{-5} m²)

V₀ = 0, P₀
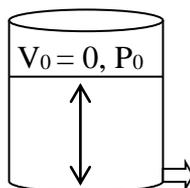
Summary of Chapter 14 topics

1- Understanding the Fluids, Density, and Pressure. Fluids at Rest, Measuring Pressure
2- Understanding the Pascal's Principles, Archimedes Principle
3- Understanding the Continuity Equation, Bernoulli's equation