UCONN Physics 1201Q: **/ 25** **Name: _____**

Unit 10 Fluids – Worksheet II :

Archimedes' Principle:

1. A turtle with volume 0.25 m^3 is floating in the ocean, 80% of the turtle's volume is submerged. Assume the density of the ocean salt water ($\rho_{sea\ water}$) is 1.024×10^3 kg/m^3.

a. What is the buoyant force exerted on the turtle?

b. What is the mass of the turtle?

c. If the fluid were pure water (ρ_{water} = 998 kg/m^3) instead of salt water, how much of the turtle's volume would be submerged in the water?

2. A spherical mass (14.7) kg is attached by a massless string to a force sensor then submerged into a container of water.

a. What is the force sensor reading (i.e. the tension force in the mass-less string) before the mass is submerged in the fluid?

b. When the mass is submerged, the sensor reading is 92.9 N. What is the buoyant force exerted on the mass?

c. What is the density of the hanging mass?

UCONN Physics 1201Q: **/ 25** **Name: _____**

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3. A 60 kg person is attached by a mass-less string to a force sensor then submerged into a container of water. *Assume all of the air is out of her lungs when she is submerged.*

a. What is the force sensor reading (i.e. the tension force in the mass-less string) before the mass is submerged in the fluid?

b. When the mass is submerged, the sensor reading is 37.2 N. What is the density of the person?

c. The density of body fat ($\rho_{body\ fat}$) is 918 kg/m^3 and the density of "lean body mass" ($\rho_{lean\ mass}$) is 1100 kg/m^3. Determine the amount of body fat, in kg, for this person. Assume that the total body mass is the sum of fat mass plus lean mass: $m_{total} = m_{fat} + m_{lean}$.