SOUTHERN ILLINOIS UNIVERSITY
Department of Civil and Environmental Engineering

CE 370- Fluid mechanics
Summer 2009

Assignment-1
Date Assigned: June 17, 2009
Date Due: June 24, 2009

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1. Explain Newton's Second Law of Motion in words and mathematical form.
2. Quantitatively explain the difference between mass and weight. How are these two phenomenon related mathematically? What are the units of each in both US Customary and SI units?
3. In your own words, define a fluid. According to your definition, which of the following would you consider to be fluids? Justify your answer for credits.
    a. Water
    b. Honey
    c. Molten steel
    d. Truckload of fine-grained soil
    e. Toothpaste
    f. Concrete
    g. Mud
    h. Ketchup
4. Consider a 1-gallon bucket of liquid. If the bucket is brim full and its contents weigh 20 lbf, compute the liquid's mass (M), density (ρ), specific weight (γ), and specific gravity (S).
5. Compute the density and specific weight of air at atmospheric pressure (14.7 psia) and a temperature of 12° F. How do these parameters change if the temperature rises to 115° F?
6. A 4-in gap between two large planner surfaces is filled with SAE 30 oil at 100 °F. What force is required to drag a very thin plate of 4 ft^2 between the surfaces at 2.0 ft/s if this plate is equally spaced between the two large planner surfaces, and what power is required?
7. A 1-m long, 7.0-cm, diameter, steel shaft is being pulled upward axially through a bearing sleeve that is 7.03-cm in diameter and 50-cm length. The shaft weighs 80 N, and the clearance between the shaft and sleeve is filled with oil having an absolute viscosity of 0.0264 N-s/m^2. Determine the force required to pull the shaft upward at a velocity of 1 m/s and the power required to maintain this motion.
8. A pressure of 2 MPa is applied to a mass of water that initially filled a 1000 cm^3 volume. What is the volume of water after pressure is applied?
9. Calculate the maximum capillary rise of water between two vertical glass plates spaced 1 mm apart.

10. A clean glass tube of 4 mm diameter is inserted into a container of water as shown below. Calculate the height of the capillary rise, h, in the tube.