PHYS-1800 **Homework 8** **Due: 26 March, 2010**

Name:_____ **(show all your workings)**

1. The operation of a hydraulic jack is based on _____ law (1 point)

2. Suppose you have a helium-filled weather balloon above the house. As a storm approaches the atmospheric pressure drops. Assuming the air temperature is the same, the volume of He in the balloon will _____. (1 point)

3. An airplane wing moving through the air experiences a net upward force or lift. How does velocity of air moving over the top of the wing compare to the velocity of air moving under the wing? (1 point)

   A. velocities are the same
   B. velocity over the wing is greater
   C. velocity of air under the wing is greater

4. A piece of soft wood floats in water with half of its volume submerged. If it is placed in a liquid which has a density of 120% of that of water, it will float _____ (higher, lower, same) compared with floating in water. (1 point)

5. A penny, a quarter and a silver dollar lie at the bottom of a wishing well filled with water. The coin experiencing the largest downward force due to the water pressure is:

   A. penny (1 point)
   B. quarter
   C. silver dollar
   D. all the same

6. Suppose when a mercury barometer was made a little bubble of air got into the top of the tube. If a person uses a barometer in the usual way the reading of atmospheric pressure will be: (1 point)

   A. correct
   B. lower than the actual value
   C. higher than the actual value

7. A steady stream of water flowing down a narrow pipe reaches a point where the pipe widens. Explain what happens, and why, to the speed of the water when the pipe widens? (Use a sketch to help explain your answer.) (2 points)

Name:_____ **(show all your workings)**

8. Three individuals stand with all of their weight on the heel of one foot: a man of weight 600 N and a heel area of 100 cm^2, a child of weight 200 N and a heel area of 25 cm^2 and woman of weight 450 N and a heel area of 2 cm^2. The one exerting the least pressure on the ground is: (2 points)

A. the man
B. the child
C. the woman
D. all exert the same

9. A gas originally occupies a volume of 0.5 m^3 at a pressure of 100 kPa. It is slowly allowed to expand until the volume is 2.5 m^3. Assuming the temperature remains constant, the final pressure will be: (2 points)

A. 10 kPa
B. 20 kPa
C. 50 kPa
D. 100 kPa
E. 500 kPa

10. A piece of aluminum has a mass of 0.25 kg and a density of 2700 kg/m^3. The buoyant force exerted on this body when completely submerged in water of density 1000 kg/m^3 is approximately: (2 points)

A. 2.4 N
B. 1.2 N
C. 0.91 N
D. 0.093 N
E. 2.45×10^{-3} N

11. Two pirates are fighting in a rowboat which is floating on a small pond when a large box of treasure is accidentally tossed over the side and sinks. Use your knowledge og buoyancy to explain what happens and why: (2 points)

a. To the boat:

b. To the water level in the pond:

Name:_____ **(show all your workings)**

12. In a hydraulic system, a force of 900 N is exerted on a piston of cross-sectional area 0.002 m^2. The load bearing piston in the system has an area of 0.3 m^2. (4 points)

a. Make a sketch of the system, and determine
b. The pressure in the hydraulic fluid.
c. The magnitude of the force exerted on the load bearing piston by the fluid.
d. The mechanical advantage of the system.

Two additional (optional) questions worth up to a total of 10 points:

A. A metal block of unknown density is suspended from a string in a beaker of water so that the block is completely submerged but not resting on the bottom. The block is a cube with sides of 0.025 m and has an apparent weight of 0.534 N. Using density of water of 1000 kg/m^3 and g = 9.81 m/s^2 determine: (5 points)

a. The volume of the block in cubic m.
b. The buoyant force acting on the block, and
c. The density of the unknown metal.

Please turn over..

Name:_____ **(show all your workings)**

B. An empty spherical weather balloon has a mass of 5.0 kg has and a radius of 3.0 m when fully inflated. It is suspended to carry a small load of instruments having a mass of 10.0 kg. The balloon is inflated with helium gas. Taking air and helium densities of 1.16 $kg.m^3$ and 0.16 kg/m^3, respectively. Calculate: (5 points)

a. The buoyancy force on the balloon,
b. The net force on the balloon, and
c. Determine if it will get off the ground.

(be careful to include all the weight forces in your final determination)