Physics 2 – Summer Session 2009
Quiz # 4

Question 1

A hydraulic lift is used to raise a car of mass 1800 Kg. The radius of the shaft of the lift is 10 cm, and that of the piston is 2 cm. The force that must be applied to the piston to raise the car is

(a) 706 N
(b) 3.53 kN
(c) 72 N
(d) 360 N
(e) none of the above

Equation 14.7 in the book: $F_1 = (A_1/ A_2) F_2$ where F_2 = Weight = 1800*9.8 = 17640 N.
Since the areas are proportional to the square of the diameters, $A_1/ A_2=(2/10)^2=1/25$
→ $F_1 = (1/25)*17640$ N = 705.6 N → **correct answer is (a)**

Question 2

A large piece of cork weighs 0.358 N in air. When held submerged under water by a spring scale as shown in the figure, the spring scale reads 0.795 N. The density of water is 1000 Kg/m^3. The density of the cork is

(a) 43 Kg/m^3
(b) 310 Kg/m^3
(c) 690 Kg/m^3
(d) 19.4 Kg/m^3
(e) none of the above

Spring scale pulls downward with force 0.795. The buoyant force pulls upward, the weight W pulls downward. The net force is zero.
Thus buyoant force F = 0.795 N + 0.358 N =
$F = \rho_w g V$ where V is the volume of cork and ρ_w is the density of water.
Thus $V = F/ \rho_w g$. Also, $W = \rho_c g V$ where ρ_c is the density of cork.
$W = \rho_c g (F/ \rho_w g) = \rho_c F/ \rho_w$
$\rho_c = (W/F) \rho_w = 0.358/1.153 * 1000$ Kg/m^3 = 310 Kg/m^3.
→ **correct answer is (b)**

Question 3

A horizontal pipe enlarges from a diameter of 2 cm to 6 cm. For a fluid flowing from the small diameter to the larger

(a) the velocity and pressure both increase
(b) the velocity increases and the pressure decreases

(c) the velocity decreases and the pressure increases
(d) the velocity and pressure both decrease
(e) none of the answers is correct

Av = constant tells us that the velocity decreases.
$p + \frac{1}{2} \rho v^2 =$ constant tells us that that if v decreases p must increase
→ **correct answer is (c)**

Question 4
In a building, water flows at 15 m/s through a pipe that has a radius of 4.0×10^{-1} m. The water then rises 3.0 m to the second floor of the building. If the pressure remains unchanged, what is the speed of the water flow on the second floor? (The density of water is 1000 Kg/m^3)
(a) 13 m/sec
(b) 14 m/sec
(c) 15 m/sec
(d) 16 m/sec
(e) 12 m/sec

$p + \frac{1}{2} \rho v^2 + \rho g h =$ constant
p is the same; take h=0 at the bottom and v_0=0 at the bottom. Then
$\frac{1}{2} \rho v^2 + \rho g h = \frac{1}{2} \rho v_0^2$
$v^2 = v_0^2 - 2gh = (225 - 2*9.8*3)$ $m^2/sec^2 = 166.2$ m^2/sec^2 → v = 12.9 m/sec
→ **correct answer is (a)**

Question 5
Two columns are filled with water to the same height. One column has larger diameter than the other. The pressure at the bottom of the two columns will be
(a) larger in the thicker column
(b) larger in the thinner column
(c) the same in each

Pressure only depends on depth → **correct answer is (c)**

Question 6
A metal has a linear coefficient of thermal expansion of 1.5×10^{-5}/K. If a 0.70 m^3 cube of this metal is heated by 60° C, by how much does the volume change?
(a) 6.3 x 10^{-4} m^3
(b) 1.4 x 10^{-4} m^3
(c) 1.1 x 10^{-4} m^3
(d) 1.9 x 10^{-3} m^3
(e) about 0.7 m^3

Equation 17.8 and 17.9: $\Delta V = 3\alpha V \Delta T = 3 * 1.5 \times 10^{-5} * 0.70 * 60$ $m^3 = 1.9$ 10^{-4} m^3.
→ **correct answer is (d)**

Question 7

Two blocks of steel, the first of mass 1 kg and the second of mass 2 kg, are in thermal equilibrium with a third block of aluminum of mass 2 kg that has a temperature of 400 K. What are the respective temperatures of the first and second steel blocks?

(a) 400K and 200K
(b) 800K and 400K
(c) 200K and 400K
(d) 400K and 400K
(e) depends on the relative densities of aluminum and steel

Thermal equilibrium means same temperature → **correct answer is (d)**