Physics 1350 Section 003 Exam #4 Fall 1995

1. The mass of a planet is $4.8 \times 10^{25}\text{kg}$ and its radius is $2.40 \times 10^{7}\text{m}$.

(a.) What is the free-fall acceleration of a 1.00kg object located at a distance of $3.60 \times 10^{7}\text{m}$ from the center of the planet?

(b.) What is the free-fall acceleration of a 5.00kg object at the same location?

2. A cannon shell is fired from the surface of the earth with a speed of 4500m/s at an angle of 45 degrees with respect to the earth's surface. How far above the **surface** of the earth is the shell when its speed is 1000m/s? (Hint: Use energy.)

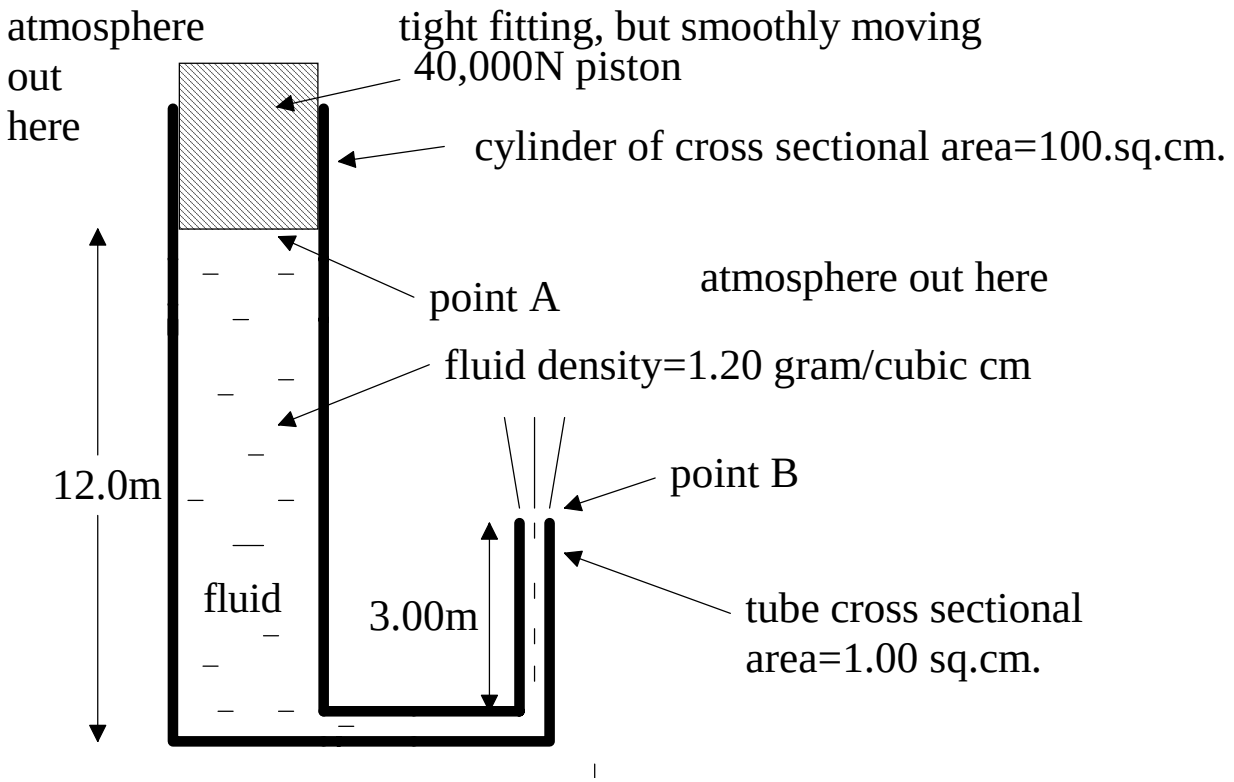
3. A 0.200kg mass attached to a spring of force constant 8.00 N/m vibrates with simple harmonic motion. When the stretch in the spring is 10.0cm, the speed of the mass is 80.0cm/s.
(a.) What is the angular frequency of vibration?

(b.) Use energy concepts to find the amplitude of the vibration?

(c.) What is the minimum time that it takes the mass to move from x=0 to x=10.0 cm?

4. A piece of aluminum is suspended from a string while **half** of its volume is immersed in water. The mass of the aluminum is 2.50 kg, and its density is 2.70×10^3 kg/m^3. Assuming that the aluminum object is in equilibrium while under the influence of the string, the water, and gravity, calculate the tension in the string.

5.



A fluid whose density is $1.20\ \text{gm/cm}^3$, fills a cylindrical chamber whose cross-sectional area is $100.\text{cm}^2$. A tight-fitting, but smoothly moving piston whose weight is $4.00\times10^3\text{N}$ encloses the upper end of the cylinder. As fluid is pushed out of the tube, the piston falls, maintaining contact with the fluid in the chamber. An atmospheric pressure of $1.01\times10^5\ \text{N/m}^2$ surrounds the chamber and tube.

(a.) Determine the pressure in the fluid at point A which is just below the piston.

(b.) What is the ratio of the fluid speed at B to the fluid speed at A?

(c.) Determine the speed of the fluid as it leaves the tube at B.

EQUATION SHEET for EXAM #4

$x = A\cos(\omega t + \delta)$

$T = \frac{1}{f}$

$T = \frac{2\pi}{\omega}$

$\omega = 2\pi f$

$T = 2\pi\sqrt{\frac{I}{mgd}}$

$T = 2\pi\sqrt{\frac{L}{g}}$

$V = \frac{dx}{dt}$ $a = \frac{dv}{dt}$

$U = \frac{1}{2}kx^2$

$K = \frac{1}{2}mv^2$

$\omega = \sqrt{\frac{k}{m}}$

$E = \frac{1}{2}kA^2$

$F = G\frac{m_1 m_2}{R_{12}^2}$

$F = ma$

$a = \frac{v^2}{R}$

$V = \frac{D}{T}$

$U = \frac{-Gm_1 m_2}{R}$

$G = 6.672\times10^{-11}\frac{Nm^2}{kg^2}$

$\rho = \frac{m}{V}$ $P = \frac{F}{A}$

$P = P_a + \rho gh$

$W = mg$

$A_1 v_1 = \text{const}$

$P + \frac{1}{2}\rho v^2 + \rho gy = \text{const}$

mass of earth = 5.98×10^{24} kg

radius of earth = 6.37×10^{6} m

$F = -kx$

$1\ \text{atm} = 1.01\times10^{5}\frac{N}{m^2}$

density of water = $1.00\frac{g}{cm^3}$