

Physics 1350 Section 001 Exam #4 Fall 1993

1. The mass of a planet is $4.8 \times 10^{25} \text{ kg}$ and its radius is $1.20 \times 10^7 \text{ m}$. What is the acceleration due to gravity at a distance of $2.40 \times 10^7 \text{ m}$ from the center of the planet?

2. A cannon shell is fired from the surface of the earth with a speed of 5000 m/s at an angle of 30 degrees with respect to the earth's surface. How far above the surface of the earth is the shell when its speed is 1000 m/s ?

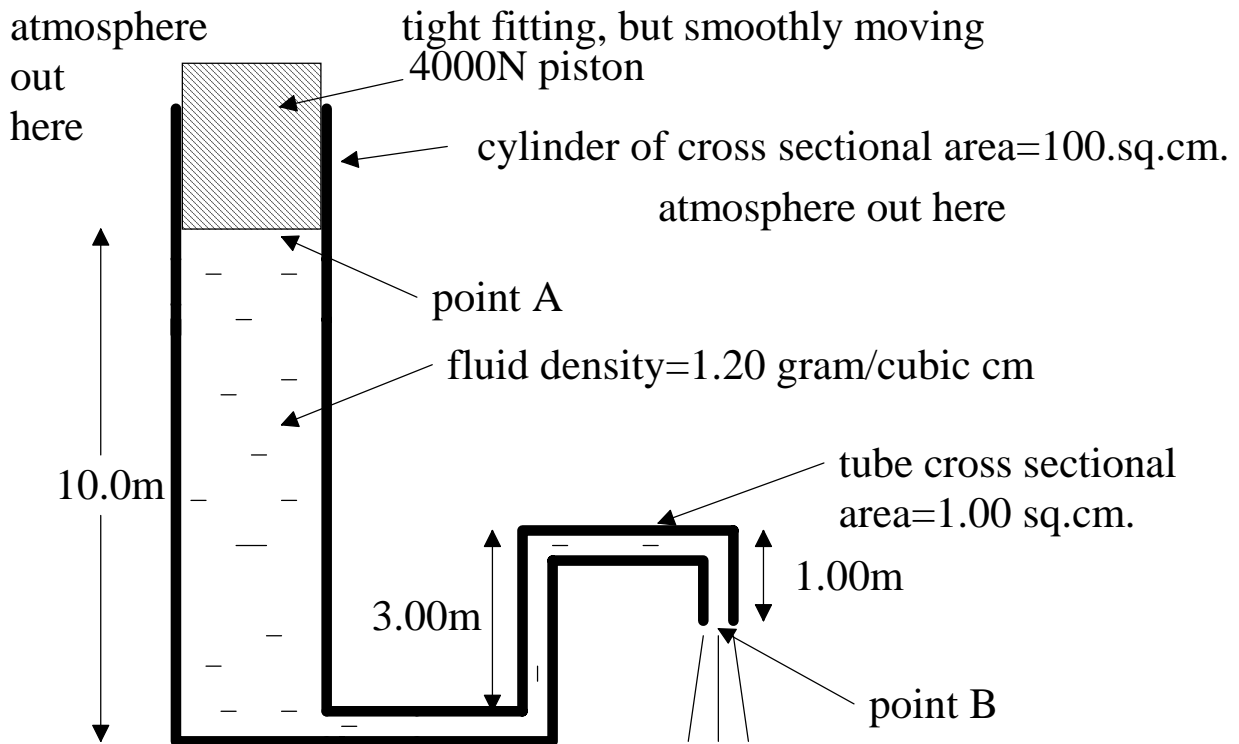
3. A 0.200kg mass attached to a spring of force constant 8.00 N/m vibrates with simple harmonic motion. When the stretch in the spring is 10.0cm, the speed of the mass is 50.0cm/s.
(a.) What is the angular frequency of vibration?

(b.) What is the amplitude of the vibration?

(c.) How long does it take the mass to move from $x=0$ to $x=8$ cm?

4. A piece of aluminum is suspended from a string and then completely immersed in a container of water. The mass of the aluminum is 1.50 kg, and its density is $2.70 \times 10^3 \text{ kg/m}^3$. Calculate the tension in the string after the aluminum is immersed.

5.



A fluid whose density is 1.20 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 $4.00 \times 10^3 \text{ N}$ 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 $1.01 \times 10^5 \text{ N/m}^2$ 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

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

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

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

$$\omega = 2\pi f$$

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

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

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

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

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

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

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

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

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

$$F = ma$$

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

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

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

$$G = 6.672 \times 10^{-11} \frac{\text{Nm}^2}{\text{kg}^2}$$

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

$$P = P_a + \rho gh$$

$$W = mg$$

$$A_1 v_1 = \text{const}$$

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

$$\text{mass of earth} = 5.98 \times 10^{24} \text{ kg}$$

$$\text{radius of earth} = 6.37 \times 10^6 \text{ m}$$

$$F = -kx$$

$$1 \text{ atm} = 1.01 \times 10^5 \frac{\text{N}}{\text{m}^2}$$