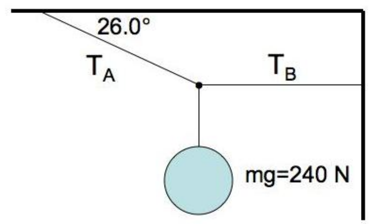
Name:

Make your work clear to the grader. Show formulas used. Give correct units and significant figures. Partial credit is available if your work is clear. Point values are given in parenthesis. Exact conversions: 1 inch = 2.54 cm, 1 ft = 12 in., 1 mile = 5280 ft. Prefixes: f=10^{-15}, p=10^{-12}, n=10^{-9}, $\mu = 10^{-6}$, m=10^{-3}, c=10^{-2}, k=10^{3}, M=10^{6}, G=10^{9}, T=10^{12}, P=10^{15}. Use g=9.80 m/s^2, 1.0 atm=101.3 kPa.

1. (2) **T F** If the net force on an object is zero, it is in static equilibrium.
2. (2) **T F** When the net torque on an object is zero, it is not rotating.
3. (2) **T F** If a single force acts on a mass, it cannot produce any torque.

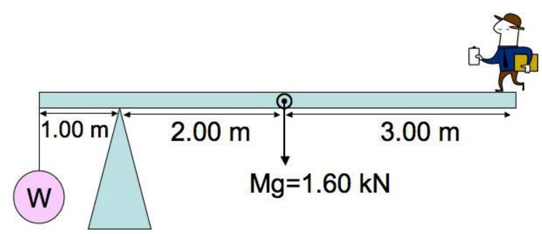
4. (10) A 240-newton mass is hanging from two cords, one connected horizontally to the wall, and one making a 26.0°-angle to the point where it connects to the ceiling.



a) (5) Find the tension T_A in the cord connected to the ceiling.

b) (5) Find the tension T_B in the cord connected to the wall.

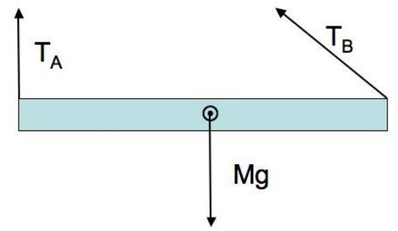
5. (12) Here a worker of mass 80.0 kg stands on the end of a beam weighing 1.60 kN, supported on a pivot. The beam's center of mass is at its center. W is the weight of a counterweight needed to hold the beam in equilibrium.



a) (8) By finding the net torque on the beam, with the pivot point as the axis, determine the counterweight needed, in newtons.

b) (4) What vertical force must the pivot point make on the beam?

6. (6) Explain why this beam of weight Mg cannot be in stable equilibrium.



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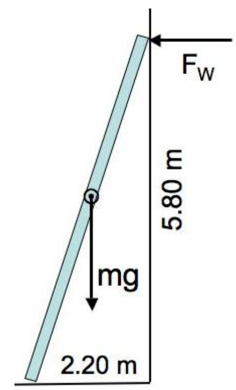
7. (6) A ladder weighing 180 N is set against the wall and does not slip. There is friction between the ladder and floor, but no friction between the ladder and the wall.

What horizontal force due to the wall is needed to hold the ladder stable?



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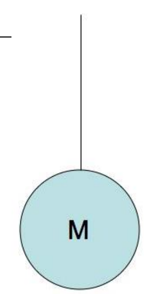
8. (10) Steel has an elastic modulus $E = 200 \times 10^9$ N/m^2. A steel cable is 12.0 m long and 5.00 mm thick. A heavy mass is suspended from it.

a) (5) How large is the stress in the cable when it holds hold up a mass $M = 1.60 \times 10^2$ kg?



b) (5) While supporting the 1.60×10^2 kg mass, by how much is the cable stretched?

Name:

1. (2) The pressure inside a container with fluid at rest

   a. decreases with depth. b. increases with depth. c. does not change with depth.

2. (2) An object submerged underwater has forces due to the water pressure

   a. only on the its lower surface. b. only on its upper surface. c. on all its surfaces.

3. (2) The bouyant force B on an object of mass m floating on water satisfies

   a. $B = 0$. b. $0 < B < mg$. c. $B = mg$. d. $B > mg$.

4. (2) The bouyant force on an object submerged in a fluid

   a. decreases with depth. b. increases with depth. c. does not depend on depth.

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5. (6) The specific gravity of gold is SG=19.3 . Imagine you have a 50.0-kg cube of gold. What would be the length of its edge, in cm? [Hint: Try to get its volume first.]

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6. (6) Healthy blood pressure is quoted as "100 over 60," the numbers being measured in mm-Hg. If the density of blood is 1050 kg/m^3, what height (or depth) of blood corresponds to a pressure change of 100 mm-Hg? [Mercury has SG=13.6]

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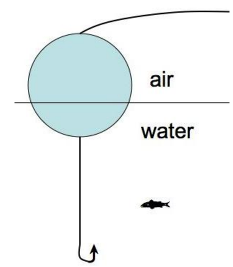
7. (6) What is the force that acts on a surface of area 1.00 cm^2, due to an absolute pressure of 10.0 atm?

8. (12) While fishing, my bobber floats with 1/4 of its volume below the water. The bobber is a sphere of radius 2.0 cm. Initially, the fishing lines are slack, and make no forces on the bobber. The weight of the hook, line, and bait is negligible.



a) (6) How large is the bouyant force on this bobber?

b) (6) A fish bites and pulls the bobber completely under water. What's the minimum downward pulling force applied by the fish to the bobber?

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9. (6) In a streamline of moving fluid,

a) (2) **T F** as the fluid moves uphill against gravity, the pressure has to increase.

b) (2) **T F** points where the fluid is moving faster have higher pressure.

c) (2) **T F** the fluids's kinetic plus potential energy can increase, but at the expense of lower pressure.

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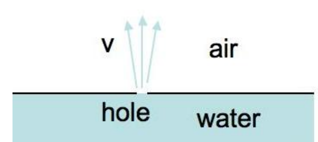
10. (8) Water in a copper pipe in the basement of a house has a gauge pressure of 4.00 atm.



a) (2) How large is the absolute pressure inside this pipe?

b) (6) A worker accidentally drives a nail into the basement pipe, making a small hole in the pipe. When the nail is removed, at what speed does the water emerge through the hole?

Chapter 10 Equations

Density:

$\rho = m/V$, SG=ρ/ρ_{H_2O}, $\rho_{H_2O} = 1000$ kg/m^3 = 1.00 g/cm^3 (at 4°C).

Static Fluids:

$P = F/A$, $P_2 = P_1 + \rho g h$, $\Delta P = \rho g h$, $P = P_{atm.} + P_G$, B or $F_B = \rho g V$.

Pressure Units:

1 Pa = 1 N/m^2, 1 bar = 10^5 Pa = 100 kPa, 1 mm-Hg = 133.3 Pa.

1.00 atm = 101.3 kPa = 1.013 bar = 760 torr = 760 mm-Hg =14.7 lb/in^2.

Moving Fluids:

$A_1 v_1 = A_2 v_2$ = a constant, $P + \frac{1}{2}\rho v^2 + \rho g y$ = a constant.

Chapter 9 Equations

Static Equilibrium:

$\Sigma F_x = \Sigma F_y = \Sigma F_z = 0$, $\Sigma \tau = 0$, $\tau = rFsin\theta$.

Elasticity:

$F = k\Delta L$, stress = F/A, strain = $\Delta L/L_0$, $\frac{\Delta L}{L_0} = \frac{1}{E}\frac{F}{A}$.

Vectors

Written $\vec{V}$ or **V**, described by magnitude=V, direction=θ or by components (V_x, V_y).

$V_x = V\cos\theta$, $V_y = V\sin\theta$,

$V = \sqrt{V_x^2 + V_y^2}$, $\tan\theta = \frac{V_y}{V_x}$. θ is the angle from $\vec{V}$ to $+x$-axis.

Addition: $\mathbf{A} + \mathbf{B}$, head to tail. Subtraction: $\mathbf{A} - \mathbf{B}$ is $\mathbf{A} + (-\mathbf{B})$, $-\mathbf{B}$ is $\mathbf{B}$ reversed.

Trig summary

$\sin\theta = \frac{\text{(opp)}}{\text{(hyp)}}$, $\cos\theta = \frac{\text{(adj)}}{\text{(hyp)}}$, $\tan\theta = \frac{\text{(opp)}}{\text{(adj)}}$, $\text{(hyp)}^2 = \text{(opp)}^2 + \text{(adj)}^2$.