Assignment-1

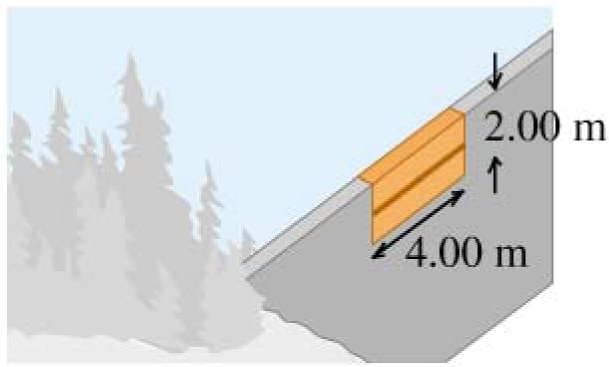
Due: 3:00pm on Tuesday, January 31, 2012

Note: You will receive no credit for late submissions. To learn more, read your instructor's Grading Policy

[Switch to Standard Assignment View]

Problem 14.50

The upper edge of a gate in a dam runs along the water surface. The gate is 2.00 m high and 4.00 m wide and is hinged along a horizontal line through its center (the figure).



Part A

Calculate the torque about the hinge arising from the force due to the water. (*Hint:* Calculate the torque on a thin, horizontal strip at a depth h and integrate this over the gate.)

ANSWER: τ = **2.61×10^4** $\mathrm{N \cdot m}$
Correct

Problem 14.94

A rock with mass m = 2.90 kg is suspended from the roof of an elevator by a light cord. The rock is totally immersed in a bucket of water that sits on the floor of the elevator, but the rock doesn't touch the bottom or sides of the bucket.

Part A

When the elevator is at rest, the tension in the cord is 22.0 N. Calculate the volume of the rock.

ANSWER: V = **6.55×10^{-4}** $\mathrm{m^3}$
Correct

Part B

Derive an expression for the tension in the cord when the elevator is accelerating *upward* with an acceleration of magnitude a .

Essay answers are limited to about 500 words (3800 characters maximum, including spaces).

ANSWER:

My Answer:
T = m g(prime) - b(prime) =(m-pV)g(prime) = Initial value of T (g(prime)/g) therefore: g(prime)=g + a T=(T knot) ((g + a)/(g))

Part C

Calculate the tension when a = 2.30 $\mathrm{m/s^2}$ upward.

ANSWER:

T = **27.2** N
Correct

Part D

Derive an expression for the tension in the cord when the elevator is accelerating *downward* with an acceleration of magnitude a.

Essay answers are limited to about 500 words (3800 characters maximum, including spaces).

ANSWER:

My Answer:
T = m g(prime) - b(prime) =(m-pV)g(prime) = Initial value of T (g(prime)/g) therefore: g(prime)=g + a T=(T knot) ((g - a)/), the only change is -a because its accelerating downward

Part E

Calculate the tension when a = 2.30 $\mathrm{m/s^2}$ downward.

ANSWER:

T = **16.8** N
Correct

Part F

What is the tension when the elevator is in free fall with a downward acceleration equal to g ?

ANSWER:

T = **0** N
Correct

Exercise 14.46

A golf course sprinkler system discharges water from a horizontal pipe at the rate of 7200 $\mathrm{cm^3/s}$. At one point in the pipe, where the radius is 4.00 cm, the water's absolute pressure is $2.40 \times 10^5 \mathrm{Pa}$. At a second point in the pipe, the water passes through a constriction where the radius is 2.00 cm.

Part A

What is the water's absolute pressure as it flows through this constriction?

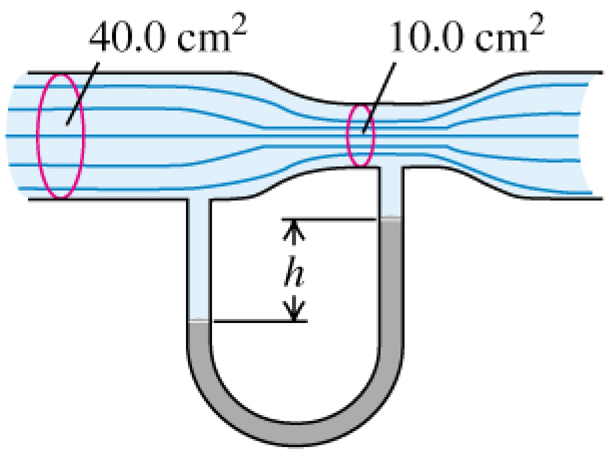
ANSWER: P = **2.25×10^5** Pa
Correct

Problem 14.92

The horizontal pipe, shown in the figure , has a cross-sectional area of $40.0\ \mathrm{cm^2}$ at the wider portions and $10.0\ \mathrm{cm^2}$ at the constriction.

Water is flowing in the pipe, and the discharge from the pipe is $6.00 \times 10^{-3}\ \mathrm{m^3/s}\ (6.00\ \mathrm{L/s})$.

The density of mercury is $\rho_{\mathrm{Hg}} = 13.6 \times 10^3\ \mathrm{kg/m^3}$ and the density of water is $\rho_{\mathrm{w}} = 1.00 \times 10^3\ \mathrm{kg/m^3}$.



Part A

Find the flow speed at the wide portion.

ANSWER: v = **1.50** $\mathrm{m/s}$
Correct

Part B

Find the flow speed at the narrow portion.

ANSWER: v = **6.00** $\mathrm{m/s}$
Correct

Part C

What is the pressure difference between these portions?

ANSWER: ΔP = **1.69×10⁴** Pa
Correct

Part D

What is the difference in height between the mercury columns in the U-shaped tube?

ANSWER: Δh = **13.7** cm
Correct

Exercise 17.28

As a new mechanical engineer for Engines Inc., you have been assigned to design brass pistons to slide inside steel cylinders. The engines in which these pistons will be used will operate between 20.0 $^\circ C$ and 150.0 $^\circ C$. Assume that the coefficients of expansion are constant over this temperature range.

Part A

If the piston just fits inside the chamber at 20.0 $^\circ C$, will the engines be able to run at higher temperatures? Explain.

Essay answers are limited to about 500 words (3800 characters maximum, including spaces).

ANSWER: **My Answer:**
because brass is 2.0*10^-5 (1/Celsius), and steel is 1.2*10^-5 (1/Celsius), therefore if you heat them both the same the brass will expand more, which will not allow the brass to slide into steel cylinders.

Part B

If the cylindrical pistons are 25.000 cm in diameter at 20.0 $^\circ C$, what should be the minimum diameter of the cylinders at that temperature so the pistons will operate at 150.0 $^\circ C$?

Express your answer using five significant figures

ANSWER: d_{min} = **25.026** cm
Correct

Exercise 17.60

A glass vial containing a 16.0-g sample of an enzyme is cooled in an ice bath. The bath contains water and 0.120 kg of ice. The sample has specific heat capacity 2250 $J/(kg \cdot K)$; the glass vial has mass 6.00 g and specific heat capacity 2800 $J/(kg \cdot K)$.

Part A

How much ice melts in cooling the enzyme sample from room temperature ($19.5°C$) to the temperature of the ice bath?

ANSWER: m = **3.08** ***Correct*** g

Problem 17.94

You cool a 130.0 g slug of red-hot iron (temperature 745 $°C$) by dropping it into an insulated cup of negligible mass containing 65.0 g of water at 20.0 $°$.Assume no heat exchange with the surroundings.

Part A

What is the final temperature of the water?

ANSWER: T_{final} = **100** ***Correct*** $°C$

Part B

What is the final mass of the iron and the remaining water?

ANSWER: m_{final} = **187** ***Correct*** g

Problem 17.112

Rods of copper, brass, and steel are welded together to form a Y-shaped figure. The cross-sectional area of each rod is 2.00 cm^2. The free end of the copper rod is maintained at 100.0 $°C$, and the free ends of the brass and steel rods at 0.0 $°C$. Assume there is no heat loss from the surfaces of the rods. The lengths of the rods are: copper, 13.0 cm; brass, 18.0 cm; steel, 24.0 cm.

Part A

What is the temperature of the junction point?

ANSWER: T = **78.4** ***Correct*** $°C$

Part B

What is the heat current in each of the three rods?

Enter your answers numerically separated by commas.

ANSWER: $H_{copper}, H_{brass}, H_{steel}$ = **12.8,9.50,3.28** W
Correct

Exercise 17.76

The emissivity of tungsten is 0.350. A tungsten sphere with a radius of 1.87 cm is suspended within a large evacuated enclosure whose walls are at a temperature of 285.0 K.

Part A

What power input is required to maintain the sphere at a temperature of 2900.0 K if heat conduction along the supports is neglected?

Take the Stefan-Boltzmann constant to be 5.67×10⁻⁸ $\mathrm{W/(m^2 \cdot K^4)}$.

ANSWER: P = **6170** W
Correct

Problem 18.60

A flask with a volume of 1.80 L, provided with a stopcock, contains ethane gas (C_2H_6) at a temperature of 303 K and atmospheric pressure 1.013×10^5 Pa. The molar mass of ethane is 30.1 $\mathrm{g/mol}$. The system is warmed to a temperature of 383 K, with the stopcock open to the atmosphere. The stopcock is then closed, and the flask cooled to its original temperature.

Part A

What is the final pressure of the ethane in the flask?

ANSWER: p_2 = **8.01×10^4** Pa
Correct

Part B

Find the mass of ethane remaining in the flask.

ANSWER: m = **1.72** g
Correct

Score Summary:

Your score on this assignment is 97.6%.
You received 97.63 out of a possible total of 100 points.