Name: _____ Student ID _____
Nickname: _____ Group: _____

Prince of Songkla University
Faculty of Engineering

Exam: Mid-Term, Semester I
Date: August 2, 2010
Subject: 230-301
Basic Chemical Engineering I

Academic Year: 2010 – 2011
Time: 1:30 – 4:30 PM
Room: R201

ทุจริตในการสอบโทษขั้นต่ำคือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

Instructions: There are a total of 5 problems and 10 pages (not including this page). Place your name and the student ID number on every page. Students are allowed to use only a pen or pencil and a calculator. They can also bring in 1 sheet of A4 front side only, a Conversions Table, and a Dictionary. No exams are allowed to leave the room.

Points Distribution (For Grader Only)		
Problem	Points Value	Score
1	25	
2	20	
3	15	
4	20	
5	20	
Total	100	

Exam prepared by
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July 28, 2010

PLEASE CHECK TO MAKE SURE THAT
YOU HAVE ALL 10 PAGES OF THE EXAM BEFORE BEGINNING
(not including the cover sheet).
GOOD LUCK!

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1. Conversions of Units: **(25 Points)**

1.1 Convert

(a) 1.25 g/(s)(in^3) to lb_m/(day)(ft^3) (5 points)

(b) 5.35 Btu/[(hr)(ft^2)(°F/ft)] to kJ/[(min)(m^2)(°C/cm)] (5 points)

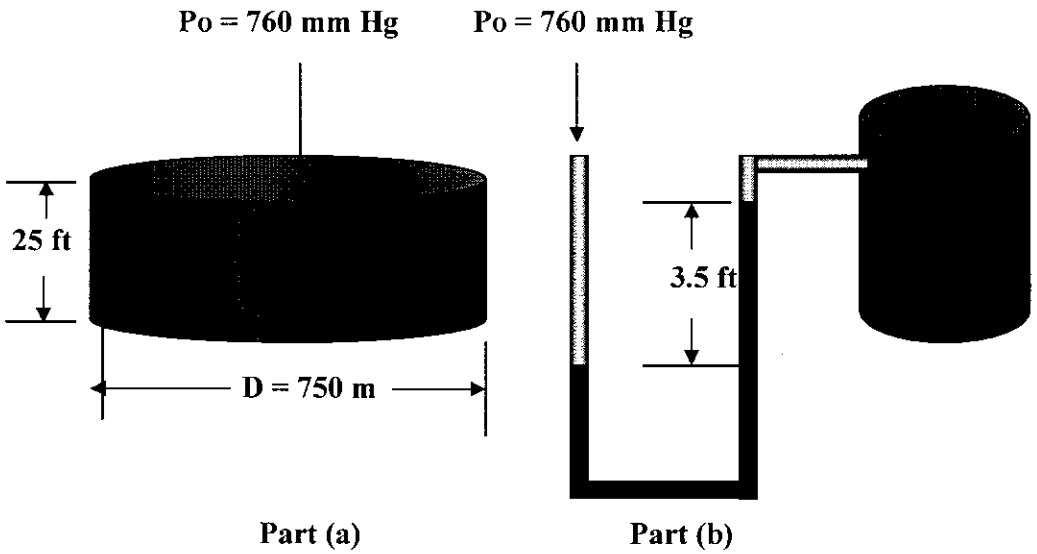
1.2 Water is flowing through a 1.5-inch diameter pipe with a velocity of 5 m/s.

(a) What is the kinetic energy of the water in (ft)(lb_f)/lb? (5 points)

(b) What is the flow rate in gal/min? (10 points)

2. From the figures below, answer the following questions. **(20 Points)**

   (a) What is the total force exerted on the bottom of reservoir in Newton? (10 points) (Hint: Determine the total pressure at the bottom of the reservoir in Pa units.)
   (b) What is the pressure inside the storage tank in psig if water is used as the fluid inside the manometer? (10 points)

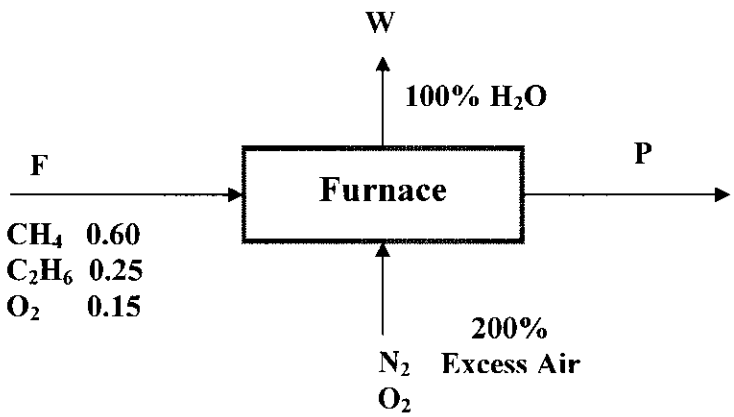


3. To prepare a dilute solution of 60% sulfuric acid, a dilute waste acid containing 35% H_2SO_4 is fortified with a purchased acid containing 95% H_2SO_4. How many kilograms of the purchased acid (95% H_2SO_4) must be bought for each 100 kg of dilute acid? **(15 Points)**

4. Bananas (peeled) contains 80% water when wet and is sold for 20 Baht/kg. The bananas are vacuum fried to produce a product containing 5% water. If the cost of removing the water is 200 Baht/10 kg of water removed. **(20 points)**

   (a) How much water is removed per 100 kg of bananas fried? (10 points)
   (b) What should be the selling price of the vacuum fried bananas to maintain the same profit margin? (10 points)

5. A mixture of 60% CH_4, 25% C_2H_6, 10% CO and 5% O_2 is burned in a furnace with 200% excess air yielding a gas having an Orsat analysis in which the ratio of CO_2 to CO is 2 to 1. If no CH_4 and C_2H_6 leave the furnace, determine the following information: **(20 points)**



(a) The moles of air entering the furnace (10 points)
(b) The moles of water produced (5 points)
(c) The Orsat Analysis of the flue gas (5 points)

BONUS: Where was the picture below of N'Bright taken? (5 points)

CONGRATULATIONS!
END OF EXAM!

N'Bright

Constants:

$g = 32.2\ ft/s^2 = 9.81\ m/s^2$	$1 lb_m = 0.454\ kg$
$g_c = 32.174\ ft\text{-}lb_m/(lb_f\text{-}s^2)$	$1\ ft = 0.3048\ m$
$1\ Btu = 1.055 \times 10^3\ J$	$1\ m^3 = 264.172\ gal$
$1\ psia = 1\ lb_f/in^2 = 6.89476\ kPa$	$1\ Pa = 1\ N/m^2 = 1\ kg/(m\text{-}s^2)$
$1\Delta K = 1.8\Delta°R$	$1\Delta°C = 1.8\Delta°F$
$\rho_{H2O} = 62.4\ lb_m/ft^3 = 1\ g/cm^3$	$1\ J/s = 1\ W\ (Watt)$

Equations:

Pressure = Force/Area

Static Pressure: $P = \rho gh + Po$

Area of Circle = $\pi D^2/4$