

Solutions Manual to Accompany
**Basic Principles and Calculations
in Chemical Engineering**

Seventh Edition

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Professional Technical Reference
Upper Saddle River, New Jersey 07458

TYPICAL EXAMS FOR A ONE SEMESTER COURSE
(Scheduled in the evening to avoid time constraints on students)

Exam No. 1
(Open Book, 1 1/2 hours)

PROBLEM 1 (25%)

Hydrogen can be separated from natural gas by diffusion through a metal tube. The rate of separation is given by

$$N = 2 \pi DpR$$

where
 N = rate of transport of H_2 from the tube, g moles/decade (of length of tube)
 D = diffusion coefficient
 p = molar density of H_2 , g moles/cm³
 R = log mass radius of tube, $r_2 - r_1$ is $\left(\frac{r_2}{r_1}\right)$, with r in cm.

What are the units of D ?

PROBLEM 2 (25%)

A pellet of bones weighing 10 tons is dropped from a lift truck from a height of 10 feet. The maximum velocity that pellet attains before hitting the ground is 8 ft/sec. How much kinetic energy does the pellet have in (Joules) at this velocity?

PROBLEM 3 (25%)

The specific gravity of a fuel oil is 0.82. What is the density of the oil in lb/ft³? Show all units.

PROBLEM 4 (25%)

Sulfur trioxide (SO_3) can be absorbed in sulfuric acid solution to form more concentrated sulfuric acid. If the gas to be absorbed contains 50% SO_3 , 41% N_2 , 7% SO_2 , and 1% O_2 , how many parts per million of O_2 are there in the gas? (a) What is the composition of the gas on a H_2 free basis?

PROBLEM 5 (25%)

You have 100 kilograms of gas of the following composition:

CH_4	30%
H_2	20%
N_2	50%

What is the average molecular weight of this gas?

PROBLEM 6 (25%)

If the heat capacity of a substance is 3.22 J/g(°C) and its molecular weight is 75.4, what is its heat capacity in

(a)	Btu(°F)
(b)	kJ(kg°C)
(c)	kJ(gmol°C)

PROBLEM 7 (25%)

A rock containing 100% $BaSO_4$ is heated with coke (94% C, 6% ash) and the composition of the product is $BaSO_4$ (11.5%), BaS (72.9%), C(13.9%), ash (2.2%). The reaction is



Calculate the percent excess reactant, and the degree of completion of the reaction.

PROBLEM 8 (25%)

A gas cylinder to which is attached an Bourdon gage appears to be at a pressure of 21.38 in. H_2O at 70°F. The barometer reads 141.8 inHg. A student claims that the pressure in the tank is 1.3 psia, but another student points out that this is impossible - the pressure is really 28.2 psia. Can 1.3 psia be correct? Explain and show calculations to back up your explanation.

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Whispering the Secrets of Language: An Mental Quest through **Solution Basic Principles Himmelblau Ed 6**

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