The University of Jordan
Faculty of Engineering & Technology
Chemical Engineering Department

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(0905211) Chemical Engineering Principals — First Semester – 2015/2016

Quiz # 1 (Chapter 2)

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Q1: The volume of microbial culture is observed to increase with time, t, according to the formula:

$$V(cm^3) = 3.0e^{1.5t}, \quad \text{where t is in seconds}$$

a) **What are the units of the constants 3.0 and 1.5?**

The unit for 3.0 $cm^3 \cdot s$ ✓

1.5 → unit less ✓

b) **What is the value of V at t = 30 seconds?**

$V = 3.0\, e^{1.5 * 30}$

$V = 3.0\, e^{45}$

$= 3.0 * 3.49 * 10^{19} = 10.2 * 10^{19}\ cm^3$

c) **Calculate the expression for V'(in^3) in terms of t'(min).**

2.5/

$$V(cm^3) = \frac{1\,cm^3}{28317\,cm^3} \left| \frac{1728\,in^3}{} \right. V' = 0.06102\, V'(in^3)$$

$$t(s) = \frac{15}{60\,s} \left| \frac{1\,min}{} \right. t' = 0.02\, t'(min)$$

0.0402 $V'(in^3) = 3.0\, e^{(1.5(0.02t'))}$ 0.5

$V'(in^3) = 49\, e^{(0.01t')}$ 0.5

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Q2: If experimental data (x, y) are to be correlated by the relation: $y = [ax + b/y]^{-1}$

a) What you plot to get a straight line?

$y = \frac{1}{ax + \frac{b}{y}}$

2.5/ $\frac{1}{y}$ Vs X

$axy + b = 1$

$axy = -b + 1$

$\frac{1}{y} = -\frac{ax}{b}$ O.K

b) What would the slope and intercept be?

the slope $-\frac{a}{b}$ and the intercept = 0

O.K O.K

Quantity	Equivalent Values
Mass	1 kg = 1000 g = 0.001 metric ton = 2.20462 lb_m = 35.27392 oz 1 lb_m = 16 oz = 5×10^{-4} ton = 453.593 g = 0.453593 kg
Length	1 m = 100 cm = 1000 mm = 10^6 microns (μm) = 10^{10} angstroms (Å) = 39.37 in. = 3.2808 ft = 1.0936 yd = 0.0006214 mile 1 ft = 12 in. = 1/3 yd = 0.3048 m = 30.48 cm
Volume	1 m^3 = 1000 L = 10^6 cm^3 = 10^6 mL = 35.3145 ft^3 = 220.83 imperial gallons = 264.17 gal = 1056.68 qt 1 ft^3 = 1728 $in.^3$ = 7.4805 gal = 0.028317 m^3 = 28.317 L = 28,317 cm^3
Force	1 N = 1 kg·m/s^2 = 10^5 dynes = 10^5 g·cm/s^2 = 0.22481 lb_f 1 lb_f = 32.174 lb_m·ft/s^2 = 4.4482 N = 4.4482×10^5 dynes
Pressure	1 atm = 1.01325×10^5 N/m^2 (Pa) = 101.325 kPa = 1.01325 bar = 1.01325×10^6 dynes/cm^2 = 760 mm Hg at 0°C (torr) = 10.333 m H_2O at 4°C = 14.696 $lb_f/in.^2$ (psi) = 33.9 ft H_2O at 4°C = 29.921 in. Hg at 0°C
Energy	1 J = 1 N·m = 10^7 ergs = 10^7 dyne·cm = 2.778×10^{-7} kW·h = 0.23901 cal = 0.7376 ft-lb_f = 9.486×10^{-4} Btu
Power	1 W = 1 J/s = 0.23901 cal/s = 0.7376 ft·lb_f/s = 9.486×10^{-4} Btu/s = 1.341×10^{-3} hp

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Quiz # 3 (Chapter 4)

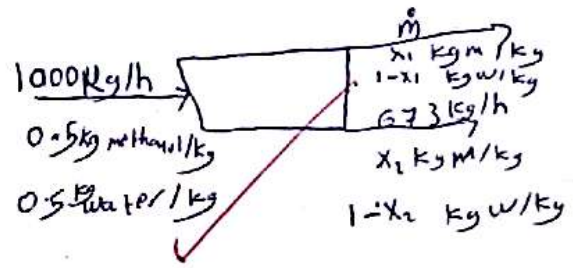
Name: علاء عبدالناصر إسماعيل ID # 0141271

One thousand kilograms per hour of a mixture containing **equal parts by mass** of methanol and water is distilled. Product streams leave the top and bottom of the distillation column. The **flow rate** of the **bottom stream** is measured and found to be **673 kg/h**, and the **overhead stream** is analyzed and found to contain **3% of the water fed to the distillation column.**

(a) Draw and fully label a flowchart of the process.
(b) Do the degree-of-freedom analysis.
(c) Calculate the mass flow rate of methanol in the overhead stream.
(d) Calculate the mass and mole fractions of water in the bottom stream.

Useful Information
M.W (water) = 18 g/mol
M.W (methanol) = 32 g/mol

(a)



$(1-x_1)(\dot{m}) = 0.03 \times (0.5) \times (1000)$

$(1-x_1)(327) = 0.03 \times 0.5 \times 1000$

$1-x_1 = \frac{15}{327} = 0.046 = 0.05$

$x_1 = 0.95$

(b) d.water + methanol

$DoF = 3 - (2 + 1) = 0$

2 ← flow in 3%.

to find x_1

(c) over all Balance ⇒ $1000 = \dot{m} + 673$

$\dot{m} = 327$ Kg/h

methanol Balance ⇒ $(0.5)(1000) = (x_1)(327) + x_2(673)$

water Balance ⇒ $(0.5)(1000) = (1-x_1)(327) + (1-x_2)(673)$

mass flow rate of methanol) $= (0.95)(327) = 310.65$ Kg/h

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d) $X_2 = 0.28$

mass fraction for water in bottom stream $\Longrightarrow$ $(1 - X_2) = 0.72$ kgw/kg

mole fraction for water $\Rightarrow$ $\frac{0.72}{18} = 0.04$ molw/mol

or $\longrightarrow$ $x_M = 0.279/32 = ①$, ①/tot

$1 - x_M = 0.721/18 = ②$, ②/total

نفرض

فرضتها ← Basis 1000 kg

مشان ادرسها

دخل

بار

flow start

	x_i	m_i	n_i	y_i
M	0.279	279	$\frac{279}{32} = 8.7$	$8.7/48.7 = 0.179$
W	0.721	721	$\frac{721}{18} = 40$	$40/48.7 = 0.821$ molw/mol
			$n_{total} = 48.7$	

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