

Lecture 1 Review Problems: 1

$$(a) \quad 4.1031 \cdot 10^{-7} + 1.47 \cdot 10^{-8} = \cancel{4.1031} 4.1031 \cdot 10^{-7} + 0.147 \cdot 10^{-7} \\ \cancel{0.41031 \cdot 10^{-8}} + \cancel{1.47 \cdot 10^{-8}} = \cancel{1.88 \cdot 10^{-8}} \quad 4.250 \cdot 10^{-7}$$

$$(b) \quad 0.44 \cdot 10^{-9} = 4.4 \cdot 10^{-9}$$

Problem 2

(a): $6.1 \text{ mmol} = 6.1 \cdot 10^{-3} \text{ mol} \cdot \frac{6.022 \cdot 10^{23} \text{ molecules}}{\text{mol}} = 3.7 \cdot 10^{21}$

(b): ~~Molecular~~ weight LDA = 107.123 g/mol ;
 $65 \cdot 10^{-3} \text{ mol} \cdot \frac{107.123 \text{ g}}{\text{mol}} = 7 \text{ g}$

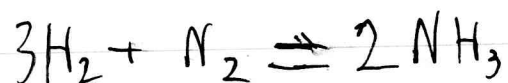
(c): $7 \text{ g} \cdot \frac{1 \text{ ml}}{0.79 \text{ g}} = 8.9 \text{ ml}$

(d): ~~$350 \cdot 10^{-3} \text{ mol} = 2 = \frac{350 \cdot 10^{-3} \text{ mol}}{X}$~~

implies

$X = 0.18 \text{ L}$

Problem 3



(a): For every mole of N_2 we need 3 moles H_2 :

$$35 \cdot 3 = 105 > 75$$

means that H_2 is the limiting reactant. ~~70 mmol of ammonia~~
50 mmol of ammonia are produced.

(b): $1.1 \text{ g H}_2 \cdot \frac{1 \text{ mol}}{2 \text{ g}} = 0.55 \text{ mole H}_2$

Again, H_2 is the limiting reactant, 0.37 mmol ammonia is produced.

Problem 4

(a) Firstly how many moles (2) present:

$$6.85 \text{ g (2)} \cdot \frac{1 \text{ mol}}{152.24 \text{ g}} = 0.045 \text{ mol (2)}$$

Now how many mole (3) present:

$$1 = \frac{x}{0.047} \Rightarrow x = 0.047$$

(2) is the limiting reagent:

(b) we expect 0.045 mol of 4,

$$0.045 \text{ mol} \cdot \frac{284.2 \text{ g}}{\text{mol}} = 12.79 \text{ g expected}$$

$$\frac{12.79}{10.5} = 82.1\% \text{ efficiency,}$$

$$(c) 82.1\% \times 59\% \times 91\% = 44.1\%$$

(d) 0.0145 moles of 1 are generated,

$$0.0145 \cdot \left(\frac{110 \text{ g}}{\text{mol}} \right) = 1.69$$

$$(e) (0.93)^2 = 60\%$$

$$(f) 0.40 \cdot (0.95)^5 = 29\%$$

Problem 5

(a): Molar mass $C_{58}H_{66}N_{10}O_9 = 696.638 + 66.528 + 140.07 + 143.991$
 $= 1047.227 \text{ g/mol}$

% C by mass $= 696.638 / 1047.227 = 66.5\%$

% H by mass $= 66.528 / 1047.227 = 6.4\%$

% N by mass $= 140.07 / 11 = 13.4\%$

% O by mass $= 143.991 / 11 = 13.8\%$

Problem 6

(a): $0.25 = \frac{X}{2} \Rightarrow$ use 0.5 mole NaOH and add to 2L water.

(b): Start with 500 ml stock solution and add to 2L

(c): Start with

$$2 / (12 / 0.5) \approx 83 \text{ ml stock solution}$$

and dilute to 2L.