Midterm Questions Answer Key

1) a. 380 km : 2 d. 1270. s : 4
b. 1.23×10^{-5} M : 3 e. 0.0059 L : 2
c. 3.250 g : 4 0.396

2) $\dfrac{[4.134 + 5.2 + (132 \times 0.003)]}{1.36 \times 400.} \cdot \dfrac{9.13}{544} \cdot 1.8 \times 10^{-2}$

3) ácido cloroso - $HClO_2$
sulfuro de hierro(III) - Fe_2S_3
fosfato de níquel - $Ni_3(PO_4)_2$
As - Arsénico; arsenic
HI - Ácido yodhídrico; hydroiodic acid
N_2O_3 - Trióxido de dinitrógeno; dinitrogen trioxide
Si - Silicio; silicon
HNO_2 - Nitrous acid
Bicarbonato de sodio - $NaHCO_3$
PCl_5 - pentacloruro de fósforo; phosphorous pentachloride
$Sr(CN)_2$ - Cianuro de estroncio; strontium cyanide
bromuro de plomo(IV) - $PbBr_4$

4) Atomic mass $= \sum_n$ (fraction of isotope n) × (mass of isotope n)
$= (0.4245 \times 133.345\ \text{amu}) + (0.5755 \times 136.568)$
$56.605 \quad + \quad 78.595$
$= 135.20\ \text{amu}$

5)

A	Z	Num. de p^+	Num. de n^0	Num. de e^-	carga
214	115	115	99	113	+2
140	70	70	70	74	-4

6) $19.6\,g\,Co + 5.3\,g\,O = 24.9\,g$ **CO**

~~$100\,g\,Co \times \frac{5.3\,g\,O}{19.6\,g\,Co} =$~~

$19.6\,g\,Co : 24.9\,g$ **CoO**

$100\,g\,Co \times \frac{24.9\,g\,CoO}{19.6\,g\,Co} = 127\,g$ **CoO**

7) $86.4\%\ Sn \rightarrow 86.4\,g\,Sn \times \frac{mol}{118.71\,g} = 0.728 / 0.728 = 1 \quad \times 3 = 3$

$13.6\%\ N \rightarrow 13.6\,g\,N \times \frac{mol}{14.01\,g} = 0.971 / 0.728 = 1.3338 \times 3 = 4$

Empirical

$\therefore Sn_3N_4$ ∧ Formula Mass is.

$Sn\ 3 \times 118.71\ \frac{g}{mol} = 356.13\ g/mol$

$N\ 4 \times 14.01\ \frac{g}{mol} = +\ 56.04\ g/mol$

$412.17\ g/mol$

Molecular formula : $(Sn_3N_4) \times \underline{n}$

Molar mass : empirical formula molar mass $\times \underline{n}$

$n = \frac{\text{Molar mass}}{\text{Empirical formula molar mass}} = \frac{824\,g}{412\,g} = 2$

$\therefore 2(Sn_3N_4) = Sn_6N_8$ Molecular formula

8) $A + B \rightarrow AB$

$12.0\,g\ A = 0.232 \times X\ g\ AB$

$51.7\,g\ AB - 12.0\,g\ A = 39.7\,g\ B \rightarrow 76.8\%$ of AB

or

$51.7\,g\ AB \times 0.768 = 39.7\,g\ B$

9) $12.76\ \cancel{kL} \times \frac{1000\ L}{1\ \cancel{kL}} \times \frac{100\ cL}{1\ L} = 1.276 \times 10^6\ cL$

10) $Al(NO_3)_3 \rightarrow 213\ g/mol$

a. $5.00\,g\ Al(NO_3)_3 \times \frac{1\ mol\ Al(NO_3)_3}{213\ g} = \cancel{0.0159}\ \cancel{60}\ 0.0235\ mol\ Al(NO_3)_3$

b. $5.00\,\cancel{g}\ impure \times \frac{78.6\,g\ pure\ Al(NO_3)_3}{100\,g\ impure} \times \frac{1\ mol\ pure}{213\,g\ pure} \times \frac{6.022 \times 10^{23}\ formula\ units}{mol} Al(NO_3)_3$

$= \frac{0.0756 \times 10^{23}}{0.111 \times 10^{23}}$ formula units of $Al(NO_3)_3$

c. $5.00\,g\ impure \times \frac{78.6\,g\ pure\ Al(NO_3)_3}{100\,g\ impure} \times \frac{1\ mol\ Al(NO_3)_3}{213\,g} \times \frac{3\ mol\ NO_3^-}{1\ mol\ Al(NO_3)_3} \times \frac{6.022 \times 10^{23}\ ions\ NO_3^-}{1\ mol\ NO_3^-}$

$= 3.33 \times 10^{22}$ ions of NO_3^-

11. a. $NO + O_2 \rightarrow NO_2$

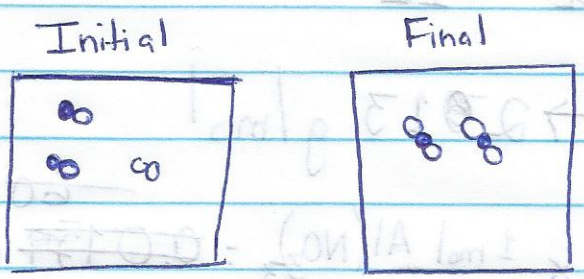
N 1	N 1
O ~~X~~ 2	O 2

$2\left(NO + \frac{1}{2}O_2 \rightarrow NO_2\right)$

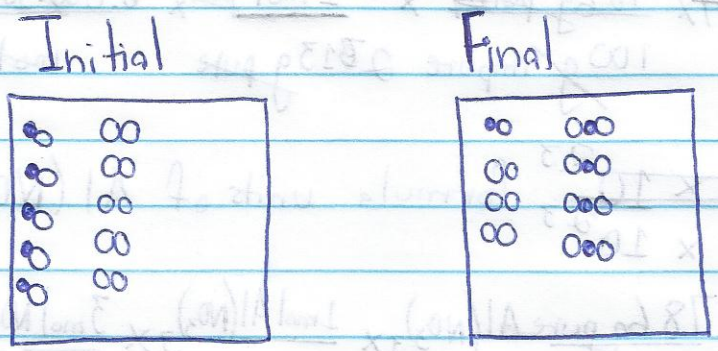
N 1	N 1
O 2	O 2

$2NO + O_2 \rightarrow 2NO_2$

N 2	N 2
O 4	O 4



b.



c. $4.00\text{g NO} \times \frac{\text{mol NO}}{30.01\text{g}} \times \frac{1\text{ mol NO}_2}{1\text{ mol NO}} \times \frac{46.01\text{g NO}_2}{\text{mol}} = 6.13\text{g NO}_2$

d. $4\,C_3H_6 + 6\,NO \rightarrow 4\,C_3H_3N + 6\,H_2O + N_2$

C 12	C 12
H 24	H 24
N 6	N 6
O 6	O 6

~~4.00g C3~~

We know 4 mol C_3H_6 react with 6 mol NO.

$\frac{6\text{ mol NO}}{4\text{ mol } C_3H_6} = \frac{1.5\text{ NO}}{C_3H_6}$

$4.00\text{g } C_3H_6 \times \frac{\text{mol } C_3H_6}{42.078\text{g}} = 0.09506\text{ mol } C_3H_6$

$\frac{0.13329\text{ mol NO}}{0.09506\text{ mol } C_3H_6} = 1.40 < 1.5$

$4.00\text{g NO} \times \frac{\text{mol NO}}{30.01\text{g}} = 0.13329\text{ mol NO}$

∴ NO is the limiting reagent.

$0.13329\text{ mol NO} \times \frac{4\text{ mol } C_3H_3N}{6\text{ mol NO}} \times \frac{53.064\text{g } C_3H_3N}{\text{mol}} = 4.72\text{g } C_3H_3N$

" $\times \frac{6\text{ mol } H_2O}{6\text{ mol NO}} \times \frac{18.016\text{g } H_2O}{\text{mol}} = 2.40\text{g } H_2O$

" $\times \frac{1\text{ mol } N_2}{6\text{ mol NO}} \times \frac{28.02\text{g } N_2}{\text{mol}} = 0.622\text{g } N_2$

e. $0.65 \times X_g = 100_g\ C_3H_3N$

$X_g = 153.8_g\ C_3H_3N$ if 100% yield

$153.8\,g\,C_3H_3N \times \frac{mol\,C_3H_3N}{53.064\,g} \times \frac{4\,mol\,C_3H_6}{4\,mol\,C_3H_3N} \times \frac{42.078\,g\,C_3H_6}{mol} = 121.958_g\ C_3H_6$

$0.808 \times X_g = 121.958_g\ C_3H_6$

$X_g = 150.1_g\ C_3H_6$

I am skipping par #2.

12) E.

13) D.

14) $C_4H_8O_2 + 5O_2 \rightarrow 4CO_2 + 4H_2O$

C 4	C ~~X~~ 4
H 8	H ~~X~~ 8
O ~~X~~ 12	O ~~X X~~ 12

a. 5:4

(7)

15) $3\ BaCl_2 + 2\ Na_3PO_4 \rightarrow Ba_3(PO_4)_2 + 6\ NaCl$

$$0.025\ L\ BaCl_2 \times \frac{0.150\ mol\ BaCl_2}{L} \times \frac{2\ mol\ Na_3PO_4}{3\ mol\ BaCl_2} \times \frac{L\ Na_3PO_4}{0.0500\ mol} \times \frac{1000\ mL}{L} = 50.0\ mL\ Na_3PO_4$$

(C)

16) (D)

17) $$\frac{65.0\ g\ NaOH \times \frac{mol}{39.998\ g}}{5\ L} = 0.325\ M\ NaOH$$

(A)

18) $C_3H_4O_2 + 3\ O_2 \rightarrow 3\ CO_2 + 2\ H_2O$

C 3	C ~~X~~ 3
H 4	H ~~X~~ 4
O ~~X~~ 8	O ~~8~~ X 8

$$3\ molecules\ C_3H_4O_2 \times \frac{3\ molecules\ O_2}{1\ molecule\ C_3H_4O_2} = 9\ molecules\ O_2$$

(E)

19) $N_2 + 3\ H_2 \rightarrow 2\ NH_3$

N 2	N ~~X~~ 2
H ~~X~~ 6	H ~~X~~ 6

$$56.0\ g\ N_2 \times \frac{mol\ N_2}{28.02\ g} \times \frac{2\ mol\ NH_3}{1\ mol\ N_2} \times \frac{17.034\ g\ NH_3}{mol} = 68.1\ g\ NH_3$$

(D)

(8)

20) $0.5\,L\ KNO_3 \times \frac{0.25\ mol\ KNO_3}{L} \times \frac{101.11\ g\ KNO_3}{mol} = 12.639\ g\ KNO_3 \times \frac{100\ g\ impure}{85\ g\ pure\ KNO_3} =$

14.9 g impure substance

- Or -

$X_{g\ impure} \times 0.850 = 12.639\ g\ KNO_3$

$X_g = 14.9\ g$ impure substance

(D)

21) 57.0% por peso

↓

$\frac{57.0\ g\ HI}{100\ g\ solution}$

$57.0\ g\ HI \times \frac{mol\ HI}{127.9\ g} = 0.4457\ mol\ HI$

$100\ g\ solution \times \frac{mL}{1.70\ g} \times \frac{L}{1000\ mL} = 0.05882\ L\ solution$

1.70 g ~ density of Solution

$\frac{0.4457\ mol\ HI}{0.05882\ L} = 7.58\ M$ C is the closest

22) $M_1V_1 = M_2V_2$

$(0.150\,M)V_1 = (0.740\,M)(25.0\,mL)$

$V_1 = 123\ mL$ (D)

23) $5\,H_2C_2O_4 + 6HCl + 2KMnO_4 \rightarrow 2\,MnCl_2 + 8H_2O + 2KCl + 10\,CO_2$

$0.95 \times 0.0570\,g\ H_2C_2O_4 = 0.05415\,g\ H_2C_2O_4$

$0.05415\,g\ H_2C_2O_4 \times \frac{mol\ H_2C_2O_4}{90.036\,g} \times \frac{2\,mol\ KMnO_4}{5\,mol\ H_2C_2O_4} = 2.4057 \times 10^{-4}\,mol\ KMnO_4$

$\frac{2.4057 \times 10^{-4}\,mol\ KMnO_4}{0.024\,L} = 0.0100\,M\ KMnO_4$

(C)

24) $Hg_2(ClO_4)_{2(aq)} + 2KBr_{(aq)} \rightarrow Hg_2Br_{2(s)} + 2\,KClO_{4(aq)}$

$2Hg^{2+}_{(aq)} + 2ClO_4^-{}_{(aq)} + 2K^+_{(aq)} + 2Br^-_{(aq)} \rightarrow Hg_2Br_{2(s)} + 2ClO_4^-{}_{(aq)} + 2K^+_{(aq)}$

$2Hg^{2+}_{(aq)} + 2Br^-_{(aq)} \rightarrow Hg_2Br_{2(s)}$

25) a. $NaCl_{(aq)} + Pb(NO_3)_{2(aq)} \rightarrow NaNO_{3(aq)} + PbCl_{2(s)}$

b. $Ca(C_2H_3O_2)_{2(aq)} + BaCl_{2(aq)} \rightarrow Ba(C_2H_3O_2)_2 + CaCl_{2(aq)}$

No reaction

c. $KHCO_{3(aq)} + HI_{(aq)} \rightarrow CO_{2(g)} + H_2O_{(l)} + KI_{(aq)}$