Name:_____

Nomenclature Quiz #1 – SCH 4C

C^{4-}	carbide	CO_3^{2-}	carbonate
N^{3-}	nitride	NO_3^{1-}	nitrate
O^{2-}	oxide	PO_4^{3-}	phosphate
F^{1-}	fluoride	SO_4^{2-}	sulphate
P^{3-}	phosphide	ClO_3^{1-}	chlorate
S^{2-}	sulphide	OH^{1-}	hydroxide
Cl^{1-}	chloride	CN^{1-}	cyanide
As^{3-}	arsenide		
Se^{2-}	selenide	NH_4^{1+}	ammonium
Br^{1-}	bromide		
Sb^{3-}	antimonide		
Te^{2-}	telluride		
I^{1-}	iodide		

1. Simple monovalent cation (only one oxidation state), elemental anion (ends in ide)

a) NaCl sodium chloride

b) K_2O potassium oxide

c) $MgCl_2$ magnesium chloride

d) Al_2S_3 aluminum sulphide

e) Cs_3N cesium nitride

f) lithium arsenide Li_3As

g) sodium bromide NaBr

h) calcium phosphide Ca_3P_2

i) magnesium carbide Mg_2C

j) aluminum oxide Al_2O_3

2. Polyvalent Cation (more than one possible oxidation state), elemental anion.

1	2	3	4	5	6	7	8	9	10
I	II	III	IV	V	VI	VII	VIII	IX	X

a) iron(II) chloride $FeCl_2$

b) iron(II) sulphide FeS

c) lead(IV) bromide $PbBr_4$

d) lead(IV) oxide PbO_2

e) tin(IV) nitride Sn_3N_4

f) $NiCl_2$ nickel(II) chloride

g) Au_2O_3 gold(III) oxide

h) Hg_2O mercury(I) oxide

i) $CuCl_2$ copper(II) chloride

j) PI_3 phosphorus(III) iodide

3. Simple monovalent cation with polyatomic anions.

a) sodium carbonate Na_2CO_3

b) ammonium nitrate NH_4NO_3

c) silver phosphate Ag_3PO_4

d) zinc hydroxide $Zn(OH)_2$

e) aluminum sulphate $Al_2(SO_4)_3$

f) K_2CO_3 potassium carbonate

g) $Mg(ClO_3)_2$ magnesium chlorate

h) $Sc_2(CO_3)_3$ scandium carbonate

i) $Ca(OH)_2$ calcium hydroxide

j) Na_3PO_4 sodium phosphate

4. Polyvalent cation with polyatomic ion.

a) platinum(IV) chlorate $Pt(ClO_3)_4$

b) gold(I) sulphate Au_2SO_4

c) gold(III) carbonate $Au_2(CO_3)_3$

d) lead(IV) hydroxide $Pb(OH)_4$

e) iridium(VI) phosphate $Ir(PO_4)_2$

f) Au_3PO_4 gold(I) phosphate

g) $Sb_2(SO_4)_5$ antimony(V) sulphate

h) $As(OH)_3$ arsenic(III) hydroxide

i) $Au(CN)_3$ gold(III)cyanide

j) $PbSO_4$ lead(II) sulphate

5. Mixed Problems!!!!!

a) CS_2 carbon(IV) sulphide

b) Na_2SO_4 sodium sulphate

c) $SnCl_4$ tin(IV) chloride

d) $InCl_3$ indium chloride

e) $(NH_4)_2SO_4$ ammonium sulphate

f) $Cu(NO_3)_2$ copper(II) nitrate

g) OsO_3 osmium(VI) oxide

h) $Ni(ClO_3)_3$ nickel(III) chlorate

i) $Zr(SO_4)_2$ zirconium sulphate

j) CrO_3 chromium(VI) oxide

Name:_____

Nomenclature Quiz #2 – SCH 4C

C^{4-}	carbide	CO_3^{2-}	carbonate
N^{3-}	nitride	NO_3^{1-}	nitrate
O^{2-}	oxide	PO_4^{3-}	phosphate
F^{1-}	fluoride	SO_4^{2-}	sulphate
P^{3-}	phosphide	ClO_3^{1-}	chlorate
S^{2-}	sulphide	OH^{1-}	hydroxide
Cl^{1-}	chloride	CN^{1-}	cyanide
As^{3-}	arsenide		
Se^{2-}	selenide	NH_4^{1+}	ammonium
Br^{1-}	bromide		
Sb^{3-}	antimonide		
Te^{2-}	telluride		
I^{1-}	iodide		

1. Simple monovalent cation (only one oxidation state), elemental anion (ends in ide)

a) NaCl sodium chloride

b) Al_2O_3 aluminum oxide

c) Na_2O sodium oxide

d) K_3N potassium nitride

e) Li_2S lithium sulphide

f) calcium sulphide CaS

g) potassium oxide K_2O

h) magnesium chloride $MgCl_2$

i) zirconium sulphide ZrS_2

j) zinc bromide $ZnBr_2$

2. Polyvalent Cation (more than one possible oxidation state), elemental anion.

1	2	3	4	5	6	7	8	9	10
I	II	III	IV	V	VI	VII	VIII	IX	X

a) copper(II) nitride Cu_3N_2

b) copper(I) nitride Cu_3N

c) tin(IV) oxide SnO_2

d) tin(II) oxide SnO

e) lead(IV) nitride Pb_3N_4

f) $AuCl_3$ gold(III) chloride

g) PCl_5 phosphorus(V) chloride

h) CuS copper(II) sulphide

i) CuI copper(I) iodide

j) As_2O_3 arsenic(III) oxide

3. Simple monovalent cation with polyatomic anions.

a) lithium sulphate Li_2SO_4

b) magnesium hydroxide $Mg(OH)_2$

c) zinc carbonate $ZnCO_3$

d) sodium phosphate Na_3PO_4

e) aluminum nitrate $Al(NO_3)_3$

f) Na_2SO_4 sodium sulphate

g) $Ca(NO_3)_2$ calcium nitrate

h) K_2CO_3 potassium carbonate

i) $(NH_4)_3PO_4$ ammonium phosphate

j) KOH potassium hydroxide

4. Polyvalent cation with polyatomic ion.

a) tin(II) carbonate $SnCO_3$

b) gold(III) sulphate $Au_2(SO_4)_3$

c) lead(II) phosphate $Pb_3(PO_4)_2$

d) copper(II) sulphate $CuSO_4$

e) mercury(I) oxide Hg_2O

f) $Au(OH)_3$ gold(III) hydroxide

g) $Cu(ClO_3)_2$ copper(II) chlorate

h) $Pb_3(PO_4)_4$ lead(IV) phosphate

i) $Sn(CO_3)_2$ tin(IV) carbonate

j) $Co(NO_3)_2$ cobalt(II) nitrate

5. Mixed Problems!!!!!

a) CO_2 carbon(IV) oxide

b) MgO magnesium oxide

c) $(NH_4)_3PO_4$ ammonium phosphate

d) Ag_2CO_3 silver carbonate

e) V_2O_5 vanadium(V) oxide

f) $PbSO_4$ lead(II) sulphate

g) NaCl sodium chloride

h) $Mg(NO_3)_2$ magnesium nitrate

i) $IrCl_3$ iridium(III) chloride

j) $Pt_3(PO_4)_4$ platinum(IV) phosphate

Name:_____

Balancing Chemical Equations

Balance each of the following chemical equations:

1. $2Na + Cl_2 \Rightarrow 2NaCl$

2. $Ca + Br_2 \Rightarrow CaBr_2$

3. $4Al + 3O_2 \Rightarrow 2Al_2O_3$

4. $C + O_2 \Rightarrow CO_2$

5. $P_4 + 6Cl_2 \Rightarrow 4PCl_3$

6. $2SO_2 + O_2 \Rightarrow 2SO_3$

7. $2Sn + O_2 \Rightarrow 2SnO$

8. $Al_4C_3 + 12H_2O \Rightarrow 4Al(OH)_3 + 3CH_4$

9. $Fe_3O_4 + 4H_2 \Rightarrow 3Fe + 4H_2O$

10. $2KClO_3 \Rightarrow 2KCl + 3O_2$

11. $2HgO \Rightarrow 2Hg + O_2$

12. $2Al + Fe_2O_3 \Rightarrow Al_2O_3 + 2Fe$

13. $KClO_4 \Rightarrow KCl + 2O_2$

14. $CH_4 + 2O_2 \Rightarrow CO_2 + 2H_2O$

15. $2C_2H_6 + 7O_2 \Rightarrow 4CO_2 + 6H_2O$

16. $SiO_2 + 4HF \Rightarrow SiF_4 + 2H_2O$

17. $2PbO_2 \Rightarrow 2PbO + O_2$

18. $2NaBr + Cl_2 \Rightarrow 2NaCl + Br_2$

19. $Sb_2S_3 + 12HCl \Rightarrow 2H_3SbCl_6 + 3H_2S$

20. $Ca(OH)_2 + 2HNO_3 \Rightarrow Ca(NO_3)_2 + 2H_2O$

21. $Cr_2(SO_4)_3 + 6NaOH \Rightarrow 2Cr(OH)_3 + 3Na_2SO_4$

22. $Cu + 2AgNO_3 \Rightarrow Cu(NO_3)_2 + 2Ag$

23. $3MgO + 2H_3PO_4 \Rightarrow Mg_3(PO_4)_2 + 3H_2O$

24. $3Ba(NO_3)_2 + 2Na_3PO_4 \Rightarrow Ba_3(PO_4)_2 + 6NaNO_3$

Name:_____

SCH 4C Balancing Quiz #1

Balance each equation by adding stoichiometric coefficients before each compound or element. Use pencil!

1. $2Al_2O_3 \rightarrow 4Al + 3O_2$

2. $Ca + Br_2 \rightarrow CaBr_2$

3. $4GaCl_3 + 3O_2 \rightarrow 2Ga_2O_3 + 6Cl_2$

4. $3Na_2SO_4 + 2Al(NO_3)_3 \rightarrow Al_2(SO_4)_3 + 6NaNO_3$

5. $2C_6H_{14} + 19O_2 \rightarrow 12CO_2 + 14H_2O$

Complete each synthesis reaction:

6. $3Ba + N_2 \rightarrow Ba_3N_2$

7. $Na_2O + CO_2 \rightarrow Na_2CO_3$

Complete each decomposition reaction:

8. $Ba(OH)_2 \rightarrow BaO + H_2O$

9. $2Au_2O_3 \rightarrow 4Au + 3O_2$

Complete each single replacement reaction:

10. $3Ca + Au(CN)_6 \rightarrow 3Ca(CN)_2 + Au$

11. $Zn_3N_2 + 3Cl_2 \rightarrow 3ZnCl_2 + N_2$

Complete each double replacement reaction:

12. $CaCl_2 + 2AgNO_3 \rightarrow Ca(NO_3)_2 + 2AgCl$

13. $2Al(ClO_3)_3 + 3Na_2SO_4 \rightarrow Al_2(SO_4)_3 + 6NaClO_3$

Write balanced chemical equations for each word description:

14. the combustion of the hydrocarbon propane with the chemical formula of C_3H_8

    $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

15. the double displacement reaction between gold(III) chloride with hydrogen carbonate

    $2AuCl_3 + 3H_2CO_3 \rightarrow Au_2(CO_3)_3 + 6HCl$

16. the decomposition of scandium sulphide

    $Sc_2S_3 \rightarrow 2Sc + 3S$

17. the single replacement reaction between antimony(V) chloride and oxygen gas

    $4SbCl_5 + 5O_2 \rightarrow 2Sb_2O_5 + 10Cl_2$

18. the synthesis of calcium carbonate from calcium oxide plus a common gas

    $CaO + CO_2 \rightarrow CaCO_3$

Name:_____

SCH 4C Balancing Quiz #2

Balance each equation by adding stoichiometric coefficients before each compound or element. Use pencil!

1. $2Hg_2O \rightarrow 4Hg + O_2$

2. $Mg + Cl_2 \rightarrow MgCl_2$

3. $2Se_2O_5 + 25Cl_2 \rightarrow 10SeCl_5 + 5O_2$

4. $2FeCl_3 + 3Na_2SO_4 \rightarrow Fe_2(SO_4)_3 + 6NaCl$

5. $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

Complete each synthesis reaction:

6. $4Al + 3O_2 \rightarrow 2Al_2O_3$

7. $Ga_2O_3 + 3H_2O \rightarrow 2Ga(OH)_3$

Complete each decomposition reaction:

8. $K_2CO_3 \rightarrow K_2O + CO_2$

9. $2Ag_3N \rightarrow 6Ag + N_2$

Complete each single replacement reaction:

10. $2Sc + Fe_2S_3 \rightarrow Sc_2S_3 + 2Fe$

11. $2Al_2O_3 + 6Br_2 \rightarrow 4AlBr_3 + 3O_2$

Complete each double replacement reaction:

12. $MgO + Ba(ClO_3)_2 \rightarrow Mg(ClO_3)_2 + BaO$

13. $3(NH_4)_2CO_3 + 2AlCl_3 \rightarrow 6NH_4Cl + Al_2(CO_3)_3$

Write balanced chemical equations for each word description:

14. the combustion of the hydrocarbon pentane with the chemical formula of C_5H_{12}

    $C_5H_{12} + 11O_2 \rightarrow 5CO_2 + 12H_2O$

15. the double displacement reaction between copper(II) nitrate with sodium phosphate

    $3Cu(NO_3)_2 + 2Na_3PO_4 \rightarrow Cu_3(PO_4)_2 + 6NaNO_3$

16. the decomposition of calcium nitride

    $Ca_3N_2 \rightarrow 3Ca + N_2$

17. the single replacement reaction between phosphorus(V) oxide and chlorine gas

    $2P_2O_5 + 10Cl_2 \rightarrow 4PCl_5 + 5O_2$

18. the synthesis of barium hydroxide from barium oxide plus a common substance

    $BaO + H_2O \rightarrow Ba(OH)_2$

Name:_____

SCH 4C
Stoichiometry Unit Test

1. Balance the following equations

a) $3Li_2CO_3 + 2FeCl_3 \rightarrow 6LiCl + Fe_2(CO_3)_3$

b) $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

2. Perform each unit conversion. Be sure to use complete and extended units:

a) convert 72.9 g of NH_3 to number of molecules of NH_3

$$72.9 \text{ g } NH_3 \times \frac{1 \text{ mol } NH_3}{17.04 \text{ g } NH_3} \times \frac{6.022 \times 10^{23} \text{ molec } NH_3}{1 \text{ mol } NH_3} = 2.57 \times 10^{24} \text{ molec } NH_3$$

b) convert 8.79×10^{24} H atoms to the equivalent mass of CH_4

$$8.79 \times 10^{24} \text{ atoms H} \times \frac{1 \text{ molec } CH_4}{4 \text{ atoms H}} \times \frac{1 \text{ mol } CH_4}{6.022 \times 10^{23} \text{ molec } CH_4}$$

$$\times \frac{16.04 \text{ g } CH_4}{1 \text{ mol } CH_4} = 58.5 \text{ g } CH_4$$

3. What mass of strontium nitrate is required to form 890.0 g of strontium phosphate?

$3Sr(NO_3)_2 + 2K_3PO_4 \rightarrow Sr_3(PO_4)_2 + 6KNO_3$

$$890.0 \text{ g } Sr_3(PO_4)_2 \times \frac{1 \text{ mol } Sr_3(PO_4)_2}{452.80 \text{ g } Sr_3(PO_4)_2} \times \frac{3 \text{ mol } Sr(NO_3)_2}{1 \text{ mol } Sr_3(PO_4)_2}$$

$$\times \frac{211.64 \text{ g } Sr(NO_3)_2}{1 \text{ mol } Sr(NO_3)_2} = 1248 \text{ g } Sr(NO_3)_2$$

4. What amount of sodium carbonate is require to form 450.0 g of iron(III) carbonate

$3Na_2CO_3 + 2Fe(NO_3)_3 \rightarrow Fe_2(CO_3)_3 + 6NaNO_3$

$$450.0\ g\ Fe_2(CO_3)_3 \times \frac{1\ mol\ Fe_2(CO_3)_3}{291.73\ g\ Fe_2(CO_3)_3} \times \frac{3\ mol\ Na_2CO_3}{1\ mol\ Fe_2(CO_3)_3}$$

$$= 4.63\ mol\ Na_2CO_3$$

5. What is the maximum possible mass of chromium(III) hydroxide that can form from 40.0 g of chromium(III) sulphate and 22.0 g of sodium hydroxide

$Cr_2(SO_4)_3 + 6NaOH \rightarrow 2Cr(OH)_3 + 3Na_2SO_4$
40.0 g 22.0 g ? g

$$40.0\ g\ Cr_2(SO_4)_3 \times \frac{1\ mol\ Cr_2(SO_4)_3}{392.21\ g\ Cr_2(SO_4)_3} \times \frac{2\ mol\ Cr(OH)_3}{1\ mol\ Cr_2(SO_4)_3}$$

$$\times \frac{103.03\ g\ Cr(OH)_3}{1\ mol\ Cr(OH)_3} = 21.0\ g\ Cr(OH)_3$$

$$22.0\ g\ NaOH \times \frac{1\ mol\ NaOH}{40.00\ g\ NaOH} \times \frac{2\ mol\ Cr(OH)_3}{6\ mol\ NaOH}$$

$$\times \frac{103.03\ g\ Cr(OH)_3}{1\ mol\ Cr(OH)_3} = 18.9\ g\ Cr(OH)_3$$

therefore the maximum possible mass of chromium(III) hydroxide that can form is 18.9 g $Cr(OH)_3$

6. Determine the concentration of each of the following solutions:

a) 550 mL of a solution that contains 0.025 mol of HCl

n = 0.025 mol HCl C = ? V = 550 mL ➜ 0.550 L	$C = \frac{n}{V}$ $C = \frac{0.025\ mol}{0.550\ L}$ $C = 0.0455\ mol/L$ $C = 0.0455\ M$

b) 750 mL of a solution that contains 0.025 g of HCl

$n = 0.025\ g\ HCl \times \frac{1\ mol\ HCl}{36.46\ g\ HCl} = 0.000686\ mol\ HCl$ C = ? V = 750 mL ➜ 0.750 L	$C = \frac{n}{V}$ $C = \frac{0.000686\ mol}{0.750\ L}$ $C = 0.000914\ mol/L$ $C = 0.000914\ M$

c) 4.0 L of a solution of sulphuric acid made through the dilution of 25 mL of 12.0 M H_2SO_4

C_S = 12.0 M V_S = 25 mL ➜ 0.025 L C_D = ? V_D = 4.0 L	$C_D = \frac{C_S \times V_S}{V_D}$ $C_D = \frac{12.0\ M \times 0.025\ L}{4.0\ L}$ $C_D = 0.075\ M$

7. Determine the mass of Na_2CO_3 required to make 4.0 L of 0.1 M sodium carbonate solution.

n = ? C = 0.1 M V = 4.0 L	$n = CV$ $n = 0.1\ \frac{mol}{L} \times 4.0\ L$ $n = 0.4\ mol\ Na_2CO_3$ $0.4\ mol\ Na_2CO_3 \times \frac{105.99\ g\ Na_2CO_3}{1\ mol\ Na_2CO_3} = 42.4\ g\ Na_2CO_3$

8. Determine the concentration of solution that would result if 45.0 g of $NaHCO_3$ is dissolved in 1.0 L of water. What will this concentration become if 4.0 L of water is added?

$n = 45.0\ g\ NaHCO_3 \times \frac{1\ mol\ NaHCO_3}{84.01\ g\ NaHCO_3} = 0.536\ mol\ NaHCO_3$ C = ? V = 1.0 L	$C = \frac{n}{V}$ $C = \frac{0.536\ mol}{1.0\ L}$ $C = 0.536\ mol/L$ $C = 0.536\ M$

Adding 4.0 L of water to 1.0 L increases the total volume to 5.0 L. There is no change in amount. Therefore

n = 0.536 mol $NaHCO_3$ (see above) C = ? V = 5.0 L	$C = \frac{n}{V}$ $C = \frac{0.536\ mol}{5.0\ L}$ $C = 0.107\ mol/L$ $C = 0.107\ M$

9. What is the maximum possible amount of lead(II) iodide precipitate that could form from the reaction of 500 mL of 0.25 M lead(II) nitrate mixed with 400 mL of 0.30 M potassium iodide?

$Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$

consider $Pb(NO_3)_2$

n = ? C = 0.25 M V = 500 mL ➜ 0.500 L	$n = CV$ $n = 0.25\ {}^{mol}/_{L} \times 0.500\ L$ $n = 0.125\ mol$
$0.125\ mol\ Pb(NO_3)_2 \times \frac{1\ mol\ PbI_2}{1\ mol\ Pb(NO_3)_2} = 0.125\ mol\ PbI_2$	

consider KI

n = ? C = 0.30 M V = 400 mL ➜ 0.400 L	$n = CV$ $n = 0.30\ {}^{mol}/_{L} \times 0.400\ L$ $n = 0.12\ mol$
$0.12\ mol\ KI \times \frac{1\ mol\ PbI_2}{2\ mol\ KI} = 0.06\ mol\ PbI_2$	

therefore the maximum possible amount of lead(II) iodide is 0.06 mol PbI_2

BONUS: Determine the concentration of potassium ion in p.p.m. for 250 mL of solution that contains a mass of 0.0015 g of K_2CO_3

$$\frac{0.0015\ g\ K_2CO_3}{250\ mL} \times \frac{1\ mol\ K_2CO_3}{138.21\ g\ K_2CO_3} \times \frac{2\ mol\ K^{1+}}{1\ mol\ K_2CO_3} \times \frac{39.10\ g\ K^{1+}}{1\ mol\ K^{1+}}$$

$$\times \frac{1000\ mg}{1\ g} \times \frac{1000\ mL}{1\ L} = \frac{3.395\ mg\ K^{1+}}{1\ L} \rightarrow 3.395\ p.p.m.\ K^{1+}\ ion$$

/95 = %

Name: _____

SCH 4C
Stoichiometry Unit Test

1. Balance the following equations

a) $MgSO_4 + 2HCl \rightarrow MgCl_2 + H_2SO_4$

b) $2C_{10}H_{22} + 31O_2 \rightarrow 20CO_2 + 22H_2O$

/2

2. Perform each unit conversion. Be sure to use complete and extended units:

a) convert 80.4 g of CO_2 to number of molecules of CO_2

$$80.4\,g\,CO_2 \times \frac{1\,mol\,CO_2}{44.01\,g\,CO_2} \times \frac{6.022\times10^{23}\,molec\,CO_2}{1\,mol\,CO_2} = 1.10\times10^{24}\,molec\,CO_2$$

/5

b) convert 3.65×10^{23} Cl atoms to the equivalent mass of $HSiCl_3$

$$3.65\times10^{23}\,Cl\,atoms \times \frac{1\,molec\,HSiCl_3}{3\,atoms\,Cl} \times \frac{1\,mol\,HSiCl_3}{6.022\times10^{23}\,molec\,HSiCl_3} \times \frac{135.45\,g\,HSiCl_3}{1\,mol\,HSiCl_3}$$

$$= 27.4\,g\,HSiCl_3$$

/7

3. What mass of potassium phosphate is required to form 54.0 g of strontium phosphate?

$3Sr(NO_3)_2 + 2K_3PO_4 \rightarrow Sr_3(PO_4)_2 + 6KNO_3$

$?\,g \qquad 54.0\,g$

$$54.0\,g\,Sr_3(PO_4)_2 \times \frac{1\,mol\,Sr_3(PO_4)_2}{452.80\,g\,Sr_3(PO_4)_2} \times \frac{2\,mol\,K_3PO_4}{1\,mol\,Sr_3(PO_4)_2} \times \frac{212.27\,g\,K_3PO_4}{1\,mol\,K_3PO_4}$$

$$= 50.7\,g\,K_3PO_4$$

/8

/22

4. What (amount) of iron (III) nitrate is require to from 250.0 g of iron(III) carbonate ✓

$3\,Na_2CO_3 + 2\,Fe(NO_3)_3 \rightarrow Fe_2(CO_3)_3 + 6\,NaNO_3$

? (mol) ✓ 250.0 g ✓

$$250.0\,g\ Fe_2(CO_3)_3 \times \frac{1\,mol\ Fe_2(CO_3)_3}{291.73\,g\ Fe_2(CO_3)_3} \times \frac{2\,mol\ Fe(NO_3)_3}{1\,mol\ Fe_2(CO_3)_3} = 1.71\,mol\ Fe(NO_3)_3$$ ✓ ✓ ✓

/6

5. What is the maximum possible mass of chromium(III) hydroxide that can form from 42.0 g of chromium(VI) sulphate and 25.0 g of sodium hydroxide

$Cr_2(SO_4)_3 + 6\,NaOH \rightarrow 2\,Cr(OH)_3 + 3\,Na_2SO_4$ ✓

42.0 g 25.0 g ?(g)

Consider $Cr_2(SO_4)_3$

$$42.0\,g\ Cr_2(SO_4)_3 \times \frac{1\,mol\ Cr_2(SO_4)_3}{392.21\,g\ Cr_2(SO_4)_3} \times \frac{2\,mol\ Cr(OH)_3}{1\,mol\ Cr_2(SO_4)_3} \times \frac{103.03\,g\ Cr(OH)_3}{1\,mol\ Cr(OH)_3}$$ ✓ ✓ ✓

$$= 22.1\,g\ Cr(OH)_3$$ ✓

/16

Consider NaOH

$$25.0\,g\ NaOH \times \frac{1\,mol\ NaOH}{40.00\,g\ NaOH} \times \frac{2\,mol\ Cr(OH)_3}{6\,mol\ NaOH} \times \frac{103.03\,g\ Cr(OH)_3}{1\,mol\ Cr(OH)_3}$$ ✓ ✓ ✓

$$= 21.5\,g\ Cr(OH)_3$$ ✓

∴ $21.5\,g\ Cr(OH)_3$ is the maximum possible mass of $Cr(OH)_3$ / NaOH is the limiting reagent ✓

/22

6. Determine the concentration of each of the following solutions:

a) 750 mL of a solution that contains 0.015 mol of HCl

$n = 0.015 \text{ mol HCl}$ ✓

$C = ?\ (M)$ ✓

$V = 750 \text{ mL} \rightarrow 0.750 \text{ L}$ ✓

$C = \frac{n}{V}$ ✓

$C = \frac{0.015 \text{ mol HCl}}{0.750 \text{ L}}$ ✓

$C = 0.02 \text{ M HCl}$ ✓

/5

b) 650 mL of a solution that contains 0.045 g of HCl

$n = 0.045 \text{ g HCl} \times \frac{1 \text{ mol HCl}}{36.46 \text{ g HCl}} = 0.00123 \text{ mol HCl}$ ✓ ✓

$C = ?\ (M)$

$V = 650 \text{ mL} \rightarrow 0.650 \text{ L}$ ✓

$C = \frac{n}{V}$ ✓

$C = \frac{0.00123 \text{ mol HCl}}{0.650 \text{ L}}$ ✓

$C = 0.00190 \text{ M HCl}$ ✓

/7

c) 5.0 L of a solution of sulphuric acid made through the dilution of 55 mL of 12.0 M H_2SO_4

$C_S = 12.0 \text{ M}$

$V_S = 55 \text{ mL} \rightarrow 0.055 \text{ L}$ ✓

$C_D = ?$ ✓

$V_D = 5.0 \text{ L}$

$C_D = \frac{C_S V_S}{V_D}$ ✓

$C_D = \frac{12.0 \text{ M} \times 0.055 \text{ L}}{5.0 \text{ L}}$

$C_D = 0.132 \text{ M}$ ✓

/4

/16

7. Determine the mass of Na_2CO_3 required to make 2.0 L of 0.25 M sodium ~~hydr~~carbonate solution.

$n = ?$

$C = 0.25\,M\ Na_2CO_3$

$V = 2.0\,L$ ✓

$n = CV$ ✓

$n = \frac{0.25\ mol\ Na_2CO_3}{1\,L} \times 2.0\,L$

$n = 0.50\ mol\ Na_2CO_3$ ✓

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$0.50\ mol\ Na_2CO_3 \times \frac{105.99\ g\ Na_2CO_3}{1\ mol\ Na_2CO_3} = 53.0\ g\ Na_2CO_3$ ✓ ✓

8. Determine the concentration of solution that would result if 85.0 g of $NaHCO_3$ is dissolved in 1.5 L of water. What will this concentration become if 8.0 L of water is added?

$n = 85.0\ g\ NaHCO_3 \times \frac{1\ mol\ NaHCO_3}{84.01\ g\ NaHCO_3} = 1.01\ mol\ NaHCO_3$

$C = ?$

$V = 1.5\,L$ ✓

$C = \frac{n}{V} \rightarrow C = \frac{1.01\ mol\ NaHCO_3}{1.5\,L} \rightarrow C = 0.675\,M\ NaHCO_3$ ✓

$C_S = 0.675\,M$ ✓

$V_S = 1.5\,L$ ✓

$C_D = ?$

$V_D = 1.5\,L + 8.0\,L = 9.5\,L$

$C_D = \frac{C_S V_S}{V_D}$ ✓

$C_D = \frac{0.675\,M \times 1.5\,L}{9.5\,L}$

$C_D = 0.107\,M\ NaHCO_3$ ✓

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9. What is the maximum possible mass of lead(II) iodide precipitate that could form from the reaction of 250 mL of 0.25 M lead(II) nitrate mixed with 300 mL of 0.35 M potassium iodide?

$Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$ ✓

250 mL, 0.25M | 300mL, 0.35M | ? g

Consider $Pb(NO_3)_2$

$n = ?$ $\quad c = 0.25M$ ✓ $\quad V = 250mL \rightarrow 0.250L$

$n = CV$ ✓

$n = 0.25 mol/L \times 0.250L$

$n = 0.0625 mol\ Pb(NO_3)_3$ ✓

$$0.0625 mol\ Pb(NO_3)_3 \times \frac{1 mol\ PbI_2}{1 mol\ Pb(NO_3)_2} \times \frac{461.01 g\ PbI_2}{1 mol\ PbI_2} = 28.8 g\ PbI_2$$ ✓

Consider KI

$n = ?$ $\quad c = 0.35M$ ✓ $\quad V = 300mL \rightarrow 0.300L$

$n = CV$

$n = 0.35 mol/L \times 0.300L$

$n = 0.105 mol\ KI$ ✓

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$$0.105 mol\ KI \times \frac{1 mol\ PbI_2}{2 mol\ KI} \times \frac{461.01 g\ PbI_2}{1 mol\ PbI_2} = 24.2 g\ PbI_2$$ ✓

↑ limiting reagent

↑ maximum possible mass ✓

BONUS: Determine the concentration of potassium ion in p.p.m. for 250 mL of solution that contains a mass of 0.0015 g of K_2CO_3

$K_2CO_3 \rightarrow 2K^{1+} + CO_3^{2-}$

$$\frac{0.0015 g\ K_2CO_3}{250 mL} \times \frac{1 mol\ K_2CO_3}{138.21 g\ K_2CO_3} \times \frac{2 mol\ K^{1+}}{1 mol\ K_2CO_3} \times \frac{39.10 g\ K^{1+}}{1 mol\ K^{1+}}$$

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$$\times \frac{1000 mg}{1 g} \times \frac{1000 mL}{1 L} = \frac{3.395 mg}{1 L} \Rightarrow 3.395\ p.p.m.$$

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