Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

A) Na₂X B) Na₃X₂ C) Na₂X₂ D) $\underline{Na_3}X$ E) NaX

2) Of the reactions below, which one is <u>not</u> a combination reaction?

A) $2Mg + O_2 \rightarrow 2MgO$ B) $2CH_4 + 4O_2 \rightarrow 2CO_2 + 4H_2O$ C) $2N_2 + 3H_2 \rightarrow 2NH_3$ D) $CaO + H_2O \rightarrow Ca(OH)_2$ E) $C + O_2 \rightarrow CO_2$

 Which of the following are weak electrolytes? HCl HC2H3O2 NH3

KCl A) <u>HC2H3O2, NH3</u> B) HCl, HC2H3O2, NH3, KCl C) HC2H3O2, KCl D) HCl, KCl E) HCl, HC2H3O2, KCl

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

 A compound was found to contain 90.6% lead (Pb) and 9.4% oxygen. What is the empirical formula for this compound..

 $\frac{1 \text{ molePb}}{90.6 \text{ g Pb x}} = 0.437258 \text{ moles Pb}/0.437258 = 1 \text{ x } 3 = 3$ $\frac{1 \text{ mole 0}}{9.4 \text{ mole O x}} = 0.5875 \text{ moles O } 0.437258 = 1.34 \text{ x } 3 = 4$

<u>Answer: Pb_3O_4 </u>

2. A compound that is composed of only carbon and hydrogen contains 85.7% C and 14.3% H by mass.

3)

2)

What is the empirical formula of the compound?

 $\frac{1 \text{ moleC}}{85.7 \text{ g C x}} = 7.14 \text{ moles C} / 7.14 = 1$

 $\frac{1 \text{ moleH}}{14.3 \text{ g H}} = 14.18 \text{ moles H} / 7.14 = 2$

Answer CH₂

3. A compound that is composed of only carbon and hydrogen contains 80.0% C and 20.0% H by mass. What is the empirical formula of the compound?

 $\frac{1 \text{ moleC}}{12.00 \text{ g C}} = 6.666 \text{ mole C} / 6.666 = 1$ $20 \text{ g H x} \frac{1 \text{ moleH}}{1.008 \text{ g H}} = 19.84 \text{ mole H} / 6.666 = 2.97$

Answer CH₃

4. What is the empirical formula of an oxide of nitrogen whose composition is 25.94% nitrogen and the rest oxygen?

25.94 g N x $\frac{1 \text{ moleN}}{14.01 \text{ g N}} = 1.851 \text{ mol N} / 1.851 = 1 \text{ x2} = 2$

 $\frac{1 \text{ mole } o}{74.06 \text{ g O } x \frac{1 \text{ mole } o}{16.00 \text{ g O}}} = \frac{1}{4.628 \text{ mole O} / 1.851 = 2.5 \text{ x } 2 = 5}$

Answer N₂O₅

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

5) Which one of the following is the formula of hydrochloric acid?					5)
A) HClO ₄	B) HClO ₂	C) HClO ₃	D) HClO	E) <u>HCl</u>	
					(
A) Fe(NO ₃) ₃	B) K2SO4	C) Na2CO3	D) ZnS	E) AgNO3	0)
11/10(1003)3	2) 112004	0) 1 (12 0 0 0)	2) <u>=</u>	2) 19100	
7) The mass % of H i	n methane (CH4) is	·			7)
A) <u>25.13</u>	B) 7.743	C) 92.26	D) 74.87	E) 4.032	
8) Which formula/na	me pair is incorrect?				8)
A) FeSO3	iron(II) sulfite				
b) $FesO_4$	iron(II) suifate				
C) $Fe_2(SO_3)_3$	iron(III) suifite				
D) $\underline{\text{Fe}_2(504)_3}$	iron(III) suifide				
E) FeS	iron(II) suifide				
9) When the followir	ng equation is balanced,	the coefficients are	•		9)
,		_			,
C ₈ H ₁	$_{.8} + O_2 \rightarrow CO_2 + H_2$	0			
A) 2, 3, 4, 4					
B) 1, 4, 8, 9					
C) 2, 12, 8, 9					
D) 4, 4, 32, 36					
E) <u>2, 25, 16, 18</u>					
10) A work electrolyte	a aviete prodominantly	in coluti	ion		10)
A) electrons	B) an isotope	C) ions	D) atoms	E) molecules	10)
	2) an lootope		2) atomo	2) <u>morecures</u>	
11) A sample of CH ₂ F ₂ with a mass of 19 g contains atoms of F.					11)
A) 3.3 × 10 ²⁴	B) 9.5	C) 38	D) <u>4.4 × 10</u> 23	E) 2.2 × 10 ²³	
12) There are	12) There are atoms of oxygen are in 300 molecules of CH ₃ CO ₂ H.				
A) 300					
B) <u>600</u>					
C) 3.61 × 1026					
D) 1.80 × 10 ²⁶					
E) 3.01 × 10 ²⁴					

13) Which species below	ow is the sulfite ion?				13)
A) SO4-2	B) <u>SO3</u> =2	C) SO ₂ -2	D) S ²⁻	E) HS ⁻	-

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

14) Limiting Reagent

Exercise 20

What is the theoretical yield of $Ca_3(PO_4)_2(s)$ by the reaction

$$3 \operatorname{Ca}(OH)_2(s) + 2 \operatorname{H}_3 \operatorname{PO}_4(l) \operatorname{Ca}_3(\operatorname{PO}_4)_2(s) + 6 \operatorname{H}_2O(l)$$

when 10.00 g Ca(OH)₂ and 10.00 g H₃PO₄ are mixed? [F.W. Ca(OH)₂ = 74.10 u; M.W. H₃PO₄ = 97.99 u; F.W. Ca₃(PO₄)₂ = 310.18 u]

Answer:

$$mol \ Ca(OH)_2: 10.00g \ Ca(OH)_2 \times \frac{1 \ mol \ Ca(OH)_2}{74.10g \ Ca(OH)_2} = 0.13495 \ mol \ Ca(OH)_2$$

$$mol H_{3}PO_{4}: 10.00g H_{3}PO_{4} \times \frac{1 \ mol \ H_{3}PO_{4}}{97.99g \ H_{3}PO_{4}} = 0.10205 \ mol \ H_{3}PO_{4}$$

$$Identify limiting reagent by dividing each number of moles by its stoichiometric coefficient in the balanced equation to determine the "sets" for each:
sets Ca(OH)_{2}: 0.13495 mol Ca(OH)_{2} \times \frac{2 \ mol \ of \ Ca(OH)_{2}}{3 \ mol \ of \ Ca(OH)_{2}} \times \frac{2 \ mol \ of \ Ca(OH)_{2}}{3 \ mol \ of \ Ca(OH)_{2}} = 0.0899 \ mol \ H3PO_{4}$$

$$sets \ H_{3}PO_{4} = 0.1020512297173181 \ mol \ H_{3}PO_{4} \times \frac{1 \ set \ H_{3}PO_{4}}{2 \ mol \ H_{3}PO_{4}}$$

$$ca(OH)_{2} \ is the limiting reagent, has few er "sets"$$

 $\label{eq:Calculate} Calculate the mass of Ca_3(PO_4)_2:$

mass $Ca_3(PO_4)_2$

$$= 0.13495 \ mol \ Ca(OH)_2 \times \frac{1 \ mol \ Ca_3(PO_4)_2}{3 \ mol \ Ca(OH)_2} \times \frac{310.18g \ Ca_3(PO_4)_2}{1 \ mol \ Ca_3(PO_4)_2}$$

= $13.95321 = 13.95g Ca_3(PO_4)_2$ What is the theoretical yield of $Ca_3(PO_4)_2(s)$ by the reaction

$$3 \operatorname{Ca}(OH)_2(s) + 2 \operatorname{H}_3 \operatorname{PO}_4(I) \operatorname{Ca}_3(\operatorname{PO}_4)_2(s) + 6 \operatorname{H}_2O(I)$$

when 8.00 g Ca(OH)₂ and 11.00 g H₃PO₄ are mixed?[F.W. Ca(OH)₂ = 74.10 u; M.W. H₃PO₄ = 97.99 u; F.W. Ca₃(PO₄)₂ = 310.18 u]

Answer

$$mol \ Ca(OH)_2: 8.00g \ Ca(OH)_2 \times \frac{1 \ mol \ Ca(OH)_2}{74.10g \ Ca(OH)_2} = 0.107962 \ mol \ Ca(OH)_2$$

 $mol \ H_{3}PO_{4}: 11.00g \ H_{3}PO_{4} \times \frac{1 \ mol \ H_{3}PO_{4}}{97.99g \ H_{3}PO_{4}} = \ 0.112256 mol \ H_{3}PO_{4}$

Identify limiting reagent by dividing each	Or 0.107962 mol of $C_2(OH)_{2,X}$
coefficient in the balanced equation to determine the "sets" for each:	2 mol of H3P04 3 mol of Ca(OH)2
sets $Ca(OH)_2$: 0.107962213 mol $Ca(OH)_2$ = 0.0359874 mol $Ca(OH)_2$	$= \underbrace{074974(OH)_2}_{3 \text{ mol } Ca(OH)_2} \text{mol } H3PO4$ Since we have more than that much of H3PO4 Ca(OH)2 is limiting
sets $H_3PO_4 = 0.11225 \ mol \ H_3PO_4 \times \frac{1 \ set}{2 \ mol}$	$\frac{H_3 PO_4}{H_3 PO_4} = 5.612817 E - 2 mol H_3 PO_4$
Ca(OH) ₂ is the limiting reagent, has few er "sets"	

Calculate the mass of $Ca_3(PO_4)_2$:

 $\begin{aligned} \max S Ca_3(PO_4)_2 \\ &= 0.107962 \ mol \ Ca(OH)_2 \times \frac{1 \ mol \ Ca_3(PO_4)_2}{3 \ mol \ Ca(OH)_2} \times \frac{310.18g \ Ca_3(PO_4)_2}{1 \ mol \ Ca_3(PO_4)_2} \\ &= 11.162573 = 11.2g \ Ca_3(PO_4)_2 \end{aligned}$ What is the theoretical yield of $Ca_2(PO_4)_2$ (c) by the reaction

What is the theoretical yield of $Ca_3(PO_4)_2(s)$ by the reaction

$$3 \operatorname{Ca}(OH)_2(s) + 2 \operatorname{H}_3 \operatorname{PO}_4(l) \operatorname{Ca}_3(\operatorname{PO}_4)_2(s) + 6 \operatorname{H}_2O(l)$$

when 12.00 g Ca(OH)₂ and 12.00 g H₃PO₄ are mixed? [F.W. Ca(OH)₂ = 74.10 u; M.W. H₃PO₄ = 97.99 u; F.W. Ca₃(PO₄)₂ = 310.18 u]

Answer:

$$mol \ Ca(OH)_2: 12.00g \ Ca(OH)_2 \times \frac{1 \ mol \ Ca(OH)_2}{74.10g \ Ca(OH)_2} = 0.161943 \ mol \ Ca(OH)_2$$

$$mol H_3PO_4: 12.00g H_3PO_4 \times \frac{1 \ mol \ H_3PO_4}{97.99g \ H_3PO_4} = 0.122461 \ mol \ H_3PO_4$$

Identify limiting reagent by dividing each number of moles by its stoichiometric coefficient in the balanced equation to determine the "sets" for each:	Or 0.161943mol of Ca(OH)2 x 2 mol of H3P04 3 mol of Ca(OH)2	
sets Ca(OH) ₂ : 0.161943 mol Ca(OH) ₂ × = 5.39811E - 2 mol Ca(OI	$\frac{1}{3} \frac{s_0!}{mol Ca(OH)_2} \mod H3PO4$ $\frac{1}{3} \frac{s_0!}{mol Ca(OH)_2} \mod H3PO4$ $H3PO4 Ca(OH)^2 \ is limiting$	
sets $H_3PO_4 = 0.122461 \text{ mol } H_3PO_4 \times \frac{1}{2\pi}$	$\frac{\sec H_3 PO_4}{\operatorname{nol} H_3 PO_4} = 6.12307 \text{ E} - 2 \operatorname{mol} H_3 PO_4$	
Ca(OH) ₂ is the limiting reagent, has few er "sets"		

Calculate the mass of $Ca_3(PO_4)_2$:

mass $Ca_3(PO_4)_2$ $= 0.161943 \ mol \ Ca(OH)_2 \times \frac{1 \ mol \ Ca_3(PO_4)_2}{3 \ mol \ Ca(OH)_2} \times \frac{310.18g \ Ca_3(PO_4)_2}{1 \ mol \ Ca_3(PO_4)_2}$ $= 16.74385 = 16.74g Ca_3(PO_4)_2$ What is the theoretical yield of $Ca_3(PO_4)_2(s)$ by the reaction

$$3 \text{ Ca}(\text{OH})_2(s) + 2 \text{ H}_3\text{PO}_4(l) \text{ Ca}_3(\text{PO}_4)_2(s) + 6 \text{ H}_2\text{O}(l)$$

when 15.00 g Ca(OH)₂ and 14.00 g H₃PO₄ are mixed? [F.W. Ca(OH)₂ = 74.10 u; M.W. H₃PO₄ = 97.99 u; F.W. Ca₃(PO₄)₂ = 310.18 u]

Answer:

$$mol \ Ca(OH)_2: 15.00 \ g \ Ca(OH)_2 \times \frac{1 \ mol \ Ca(OH)_2}{74.10 \ g \ Ca(OH)_2} = 0.20242 \ mol \ Ca(OH)_2$$

 $mol H_{3}PO_{4}: 14.00 \ g H_{3}PO_{4} \times \frac{1 \ mol H_{3}PO_{4}}{97.99g \ H_{3}PO_{4}} = 0.142871 \ mol \ H_{3}PO_{4}$ $\boxed{\text{Identify limiting reagent by dividing each number of moles by its stoichiometric coefficient in the balanced equation to determine the "sets" for each:
<math display="block">\underbrace{sets \ Ca(OH)_{2}: 0.202429 \ mol \ Ca(OH)_{2} \times \frac{16\pi 3G(9H)_{2}}{3 \ mol \ of \ Ca(OH)_{2}} = 6.74763E - 2 \ mol \ Ca(OH)_{2} \text{ resc} = 6.74763E - 2 \ mol \ Ca(OH)_{2} \text{ resc} = 7.14358 \ E - 2 \ mol \ H_{3}PO_{4}$ $\boxed{\text{Ca}(OH)_{2} \ is the limiting reagent, has fewer "sets"}$

Calculate the mass of $Ca_3(PO_4)_2$:

 $\begin{array}{l} mass \ Ca_3(PO_4)_2 \\ = \ 0.20242 \ mol \ Ca(OH)_2 \times \frac{1 \ mol \ Ca_3(PO_4)_2}{3 \ mol \ Ca(OH)_2} \times \frac{310.18g \ Ca_3(PO_4)_2}{1 \ mol \ Ca_3(PO_4)_2} \\ = 20.9298 = \ 20.93 \ g \ Ca_3(PO_4)_2 \end{array}$

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

15) Which of the following are combustion reactions? 15) 1) CH₄ (g) + O₂ (g) \rightarrow CO₂ (g) + H₂O (l) 2) CaO (s) + CO₂ (g) \rightarrow CaCO₃ (s) 3) $PbCO_3(s) \rightarrow PbO(s) + CO_2(g)$ 4) CH₃OH (l) + O₂ (g) \rightarrow CO₂ (g) + H₂O (l) A) 1, 3, and 4 B) 3 and 4 C) 1 and 4 D) 2, 3, and 4 E) 1, 2, 3, and 4 16) Which hydroxides are strong bases? 16) Sr(OH)₂ KOH NaOH Ba(OH)₂ A) Sr(OH)2, KOH, NaOH, Ba(OH)2 B) KOH, Ba(OH)₂ C) KOH, NaOH D) KOH, NaOH, Ba(OH)₂ E) None of these is a strong base. 17) The correct name for MgF₂ is _____. 17) A) manganese difluoride B) manganese bifluoride C) magnesium difluoride D) monomagnesium difluoride E) magnesium fluoride 18) Which combination will produce a precipitate? 18) A) NaOH (aq) and HCl (aq) B) NaCl (aq) and HC₂H₃O₂ (aq) C) NaOH (aq) and Fe(NO₃)₂ (aq) D) NH₄OH (aq) and HCl (aq) E) AgNO₃ (aq) and Ca(C₂H₃O₂)₂ (aq) 19) Which of the following is soluble in water at 25°C? 19) D) <u>Fe(NO3)</u>2 A) FeS B) FeCO₃ C) Fe(OH)₂ E) Fe₃(PO₄)₂

20) Which one of the following is a weak acid?				20)	
A) HI	B) HNO3	C) HCl	D) HClO4	E) <u>HF</u>	
21) Which metal does no A) Cu	t form cations of diff B) <u>Na</u>	ering charges? C) Sn	D) Fe	E) Co	21)
22) Of the choices below, A) RbCl	which one is <u>not</u> an B) NaCl	ionic compound? C) <u>PCl5</u>	D) MoCl ₆	E) PbCl ₂	22)
23) Which of the following are strong acids? HI HNO ₃ HF HBr A) HNO ₃ , HF, HBr B) HI, HF, HBr C) HF, HBr D) HI, HNO ₃ , HF, HBr E) <u>HI, HNO₃, HBr</u>				23)	