

KEY

Name _____

Date _____

Due Date _____

Mark 28 / 28

Correct and Hand in Again by _____

Chemistry 11

Hand In Assignment # 6 - Percent Composition, Empirical and Molecular Formulas, Molarity Calculations and Dilution

This Assignment will be marked and you are allowed to do one set of corrections.

1. Find the percent composition (% by mass of each element) in the following compound:

$\text{Ba}_3(\text{PO}_4)_2$. Show your work. (3 marks)

3

$$\text{Ba}_3(\text{PO}_4)_2$$

$$3(137.3) + 2(31.0) + 8(16.0)$$

$$411.9 + 62.0 + 128.0 = 601.9$$

$$\% \text{Ba} = \frac{411.9}{601.9} \times 100 = 68.4\%$$

$$\% \text{P} = \frac{62.0}{601.9} \times 100 = 10.3\%$$

$$\% \text{O} = \frac{128}{601.9} \times 100 = 21.3\%$$

Answer 68.4% Ba, 10.3% P, 21.3% O

2. Calculate the percent by mass of water (H_2O) in strontium hydroxide octahydrate, $\text{Sr}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$. (2 marks)

2

$$87.6 + 2(16.0) + 2(1.0) + 8(18.0) = 265.6$$

$$\% \text{H}_2\text{O} = \frac{8(18.0)}{265.6} \times 100 = \frac{144}{265.6} \times 100 = 54.2\%$$

Answer 54.2% H_2O

5

 5

KEY

3. A compound was analyzed and the following results were obtained:

Molar mass: 162.0 g/mol

Mass of sample: 0.8821 g

• Mass of hydrogen: 0.0220 g

• Mass of phosphorus: 0.3374 g

Mass of oxygen: the remainder of the sample is oxygen

1

a. Determine the mass of oxygen in the sample. (1 mark)

$$0.8821 - (0.0220 + 0.3374) =$$

$$0.8821 - 0.3594 = 0.5227 \text{ g}$$

Answer 0.5227 g

b. Determine the empirical formula for this compound. (4 marks)

4

Element	Mass	$\frac{M}{\text{Mass}}$	Moles	$\frac{\text{moles}}{\text{Sm. moles}}$	S.R.
H	0.0220	1.0	0.0220	2.02	2
P	0.3374	31.0	0.0108839	1	1
O	0.5227	16.0	0.03266875	3.00	3

Answer: Empirical Formula:

H₂PO₃

c. Determine the molecular formula for this compound. (2 marks)

2

Empirical
Molecular

Mass	Formula
81.0	H ₂ PO ₃
162.0	H ₄ P ₂ O ₆

Answer: Molecular Formula:

H₄P₂O₆

4. 89.523 g of sodium sulphate Na₂SO₄ are dissolved in enough water to form 850.0 mL of solution. Calculate the molar concentration of Na₂SO₄ ([Na₂SO₄]) Include proper units in your work and in your answers. (2 marks)

2

$$89.523 \text{ g Na}_2\text{SO}_4 \times \frac{1 \text{ mol}}{142.1 \text{ g}} = 0.630 \text{ moles}$$

$\uparrow \quad \uparrow \quad \uparrow$
 $2(23.0) + 32.1 + 4(16.0)$
 $= 142.1$

$$M = \frac{\text{mol}}{L} = \frac{0.630 \text{ mol}}{0.850 \text{ L}} = 0.741 \text{ M}$$

Answer [Na₂SO₄] = 0.741 M

9
9

5. Calculate the mass of potassium carbonate (K_2CO_3) needed to make 400.0 mL of a 0.200 M solution of K_2CO_3 . Include proper units in your work and in your answers. (2 marks)

$\frac{\text{mol}}{\text{ML}}$

$$\text{mol} = M \times L$$

$$= 0.200 M \times 0.4000 L$$

$$= \underline{0.0800 \text{ mol}}$$

$$0.0800 \text{ mol } K_2CO_3 \times \frac{138.2 \text{ g}}{1 \text{ mol}} = \underline{11.056 \text{ g}}$$

$$\begin{matrix} \uparrow & \uparrow & \uparrow \\ 2(39.1) & + & 12.0 & + & 3(16.0) \\ & & & & = & 138.2 \text{ g/mol} \end{matrix}$$

Answer 11.1 g

6. What volume of 2.50 M Li_2SO_3 would need to be evaporated in order to obtain 422.55 g of solid Li_2SO_3 ? Include proper units in your work and in your answers. (2 marks)

$\frac{\text{mol}}{\text{ML}}$

$$422.55 \text{ g } Li_2SO_3 \times \frac{1 \text{ mol}}{93.9 \text{ g}} = \underline{4.50 \text{ mol}}$$

$$L = \frac{\text{mol}}{M} = \frac{4.50 \text{ mol}}{2.50 M} = \underline{1.8 L}$$

$2(6.9) + 32.1 + 3(16.0) = 93.9 \text{ g/mol}$

Answer 1.80 L (1800 mL)

7. 150.0 mL of water are added to 200.0 mL of 0.60 M HNO_3 . Calculate the final $[HNO_3]$. Include proper units in your work and in your answers. (2 marks)

$$FC = IC \times \frac{IV}{FV} = 0.60 M \times \frac{200.0 \text{ mL}}{350.0 \text{ mL}} = \underline{0.342857 M}$$

Answer 0.34 M

8. What volume of water needs to be added to 50.0 mL of 6.00 M H_2SO_4 in order to bring the concentration down to 2.50 M? Include proper units in your work and in your answers. (2 marks)

$$FV \times FC = IV \times IC$$

$$FV = \frac{IV \times IC}{FC} = \frac{50.0 \text{ mL} \times 6.00 M}{2.50 M} = \underline{120.0 \text{ mL}}$$

Water added = $FV - IV$

$$= 120.0 - 50.0 \text{ mL} = \underline{70.0 \text{ mL}}$$

8
8

$$FV = IV + WA$$

Answer 70.0 mL

9. What volume of 12.0 M HCl must be used in order to produce 500.0 mL of 0.250 M HCl? Include proper units in your work and in your answers. (2 marks)

$IV \times IC = FV \times FC$
 $IV \times 12.0M = 500.0 \text{ mL} \times 0.250M$

(2) $IV = 500.0 \text{ mL} \times \frac{0.250M}{12.0M} = \underline{10.416 \text{ mL}}$

Answer 10.4 mL

10. 200.0 mL of 0.450 M NaOH is diluted to a total volume of 1.00 L. Calculate the final concentration of NaOH. Include proper units in your work and in your answers. (2 marks)

$FC = IC \times \frac{IV}{FV} = 0.450M \times \frac{200.0 \text{ mL}}{1000.0 \text{ mL}} = \underline{0.0900M}$

(2)

Answer 0.0900 M

11. Give directions on how to make 400.0 mL of 0.020 M KMnO₄ using solid KMnO₄ and water. Include proper units in your work and in your answers. (2 marks)

(2) $\text{mol} = M \times L$
 $= 0.020M \times 0.4000L = \underline{0.00800 \text{ mol}}$

$0.00800 \text{ mol KMnO}_4 \times \frac{158.0g}{1 \text{ mol}} = \underline{1.264g}$
 $\uparrow \quad \uparrow \quad \leftarrow$
 $39.1 + 54.9 + 4(16.0)$
 $= 158.0g/mol$

Add 1.26g KMnO₄ to less than 400.0 mL of water. Dissolve and add water to dilute to 400.0 mL

$\frac{6}{6}$