## Empirical Formula:

5. 0.0950 g sample containing **C** (FM=12), **H** (FM=1) and **O** (FM=16) only was burned in air and produced 0.2383 g of $CO_2$ and 0.1172 g of $H_2O$. What is the **empirical formula** of the compound?

a) $C_3H_8O$ b) $C_2H_6O$ c) $C_4H_{10}O$ d) $C_5H_{12}O$

6. In the empirical formula experiment, which of the following is **correct**?

a) During heating the crucible, if rapid oxidation occurs and some Mg is lost, the reported value of (Mg to O) ratio will decrease.
b) If the magnesium oxide is not dried completely, the reported value of (Mg to O) ratio will decrease.
c) (Mg to O) ratio will decrease, if air is not sufficient to react with all the magnesium.
d) If the side product $Mg_3N_2$ is not decomposed, the reported value of (Mg to O) ratio will decrease.

## Molar Mass of Volatile Liquid:

7. A conical flask weighs 40.1305g when clean, dry, evacuated, 138.2410g when filled with water at 25°C (d = 0.9970 g/ml) and 40.2487g when filled with a gaseous substance at 922 torr and 96°C. What is the **molar mass** (g/mol) of the gas?

a) 60.20 b) 49.34 c) 37.37 d) 30.00

8. Experimentally when determining the molar mass of a volatile liquid, if the mass of the flask is measured after the liquid has been vaporized but before the outside of the flask is dried. Will the molar mass of the unknown liquid be too high or too low?

a) Too high, because the volume of the flask will be measured as more than it should be when it is filled with water to determine its volume.
b) Too low, because the volume of the flask will be measured as less than it should be when it is filled with water to determine its volume.
c) Too high, because the water would be measured as part of the mass of the volatile liquid.
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## Limiting Reactant:

9. In the limiting reactant of a salt mixture experiment, to test for limiting $PO_4^{-3}$ ion :

a) Add few drops of Barium ion (0.5 M) to the supernatant and precipitate will appear.
b) Heat the mixture solution in the water bath for 30 minutes.
c) Wash the precipitate by hot distilled water.
d) Add few drops of Phosphate ion (0.5 M) to the supernatant and precipitate will appear.

10. For the following reaction:

$$2Na_3PO_4.12H_2O + 3BaCl_2.2H_2O \longrightarrow Ba_3(PO_4)_{2(s)} + 6NaCl + 30H_2O$$

The following data was obtained:

Mass of $Ba_3(PO_4)_2$= 0.2 g

Mass of mixture ( $Na_3PO_4.12H_2O + BaCl_2.2H_2O$) = 1.00 g

L.R is $BaCl_2$

(Molar mass: $Na_3PO_4.12H_2O$ = 380.2g/mole, $BaCl_2.2H_2O$ = 244.2 g/mole, $Ba_3(PO_4)_2$ = 602.2g/mole)

The % composition of salt mixture ($Na_3PO_4.12H_2O$ , $BaCl_2.2H_2O$), **respectively** is:

a) 42.6 %, 57.4%
b) 75.7 %, 24.3%
c) 57.4%, 42.6 %
d) 24.3%,75.7 %

Good Luck

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Faculty of Science
Chemistry Department

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| Chem.108 | Mid-Term | | /4/2010 | |
|---|---|---|---|---|
| [illegible] | | | | |

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**Useful Constant:**

$R = 0.0821\ L\ atm\ mole^{-1} K^{-1}$ 1 atm = 760 torr = 760 mmHg $T(K) = T(C^{\circ}) + 273$ (4)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| a | a | a | a | a | a | a | a | a | a |
| b | b | b | b | b | b | b | b | b | b |
| c | c | c | c | c | c | c | c | c | c |
| d | d | d | d | d | d | d | d | d | d |

## Safety Rules:

1. The **not correct** statement concerning handling of chemicals in lab is:

   a) Direct contact with chemicals is **not allowed.**
   b) Smelling and tasting chemicals are **not allowed.**
   c) **Always** read the label on reagent bottles
   d) Toxic chemicals **can be** used outside the fume hood.

2. One of the following is a **safety rule** in the chemistry laboratory:

   a) **Don't pointing** the mouth of the test tube towards your partner while you make a test.
   b) If during the lab, you get thirsty you are **allowed** to keep a can of ***PEPSI*** ® at your locker.
   c) It's **not necessary** to ask the technician for advice if you are doubt in anything.
   d) Open sandals, short skirts and shorts are **allowed** in the lab.

## Colligative Properties:

3. Which one of the following statements is **correct**? (Assume the solutions are ideal in each case.) The freezing point of a solution containing 0.201 mole of sucrose (a nonelectrolyte) in 1 kg of water is:

   a) The same as that of a solution containing 0.156 mole of $Na_2SO_4$ in 1 kg of water.
   b) The same as that of a solution containing 0.053 mole of $BaCl_2$ in 1 kg of water.
   c) The same as that of a solution containing 0.067 mole of $Na_2SO_4$ in 1 kg of water.
   d) The same as that of pure water.

4. How much $C_2H_5OH$ must be added to 1.00 kg of $H_2O$ so that the solution will freeze at (-35°C)? ($K_f$ = 1.86 °C /m, Molar mass of $C_2H_5OH$ = 46 g/mol)

   a) 495g b) 742g c) 989g d) 866g

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**a)495g b)742g c)989g d)866g**

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**6. In the empirical formula experiment ,which of the following is correct?**
**a)During heating the crucible , if rapid oxidation occurs and some Mg is lost, the reported value of (Mg to O) ratio will decrease.**
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# *Limiting Reactant:*

**9. In the limiting reactant of a salt mixture experiment. To test for limiting (PO4)^-3 ion:**

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**10. For the following reaction :**

**2Na3PO4.12H2O + 3BaCl2.H2O ---------->Ba3(PO4)2 + 6NaCl + 30H2O**

**The following data was obtained :**

**Mass of Ba3(PO4)2 =0.2g**

**Mass of mixture(Na3PO4.12H2O + BaCl2.H2O)=1g**

**L.R is BaCl2 .**

**(Molar mass:Na3PO4.12H2O=380.2g/mol , BaCl2.2H2O=244.2 g/mol , Ba2(PO4)2= 602.2 g/mol)**

**The % composition of salt mixture(Na3PO4.12H2O . BaCl2.H2O) , respectively is:**

**a)42.6% , 57.4%**

**b)75.7% , 24.3%**

**c)57.4% , 42.6%**

**d)24.3% , 75.7%**

1. How many grams of potassium are in 12.5 g of $K_2Cr_2O_7$?
   a) 2.02 g
   b) 1.66 g
   c) 6.64 g
   d) 3.32 g
   e) 25.0 g

2. Aspirin (a compound consisting only of carbon, hydrogen, and oxygen) with a mass of 1.00 g, burn it in air, and collect 2.20 g of carbon dioxide ($CO_2$)and 0.400 g water ($H_2O$). The molar mass of aspirin is between 170 and 190 g/mol. The molecular form of aspirin is
   a) $C_6H_8O_5$
   b) $C_8H_{10}O_5$
   c) $C_9H_8O_4$
   d) $C_{10}H_6O_4$
   e) none of these

Aspirin + $O_2$ ⟶ $CO_2$ + $H_2O$
2.20 + .400
.05 .02
2.25 1
$C_9$ $O_4$

3. How much heat is required to raise the temperature of a 6.21-g sample of iron (specific heat = 0.450 J/(g°C) from 25.0°C to 79.8°C?
   a) 70.0 J
   b) 101 J
   c) 386 J
   d) 227 J
   e) 153 J

4. Adipic acid contains 49.32% C, 43.84% O, and 6.85% H by mass. What is the empirical formula?
   a) $C_2H_5O_4$
   b) $C_3H_3O_4$
   c) $C_2HO_3$
   d) $C_3H_5O_2$
   e) $C_3HO_3$

C O H
49.32 43.84 6.85
4.1/2.74 2.74/2.74 6.79/2.74
1.50 1 2.48
3 2 5
X 2

5. $SO_2$ reacts with $H_2S$ as follows:

$$2H_2S + SO_2 \rightarrow 3S + 2H_2O$$

When 7.50 g of $H_2S$ reacts with 12.75 g of $SO_2$, which statement applies?
   a) 10.6 g of sulfur are formed.
   b) 6.38 g of sulfur are formed.
   c) 0.0216 moles of $H_2S$ remain.
   d) 1.13 g of $H_2S$ remain.
   e) $SO_2$ is the limiting reagent.

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6. Consider the following reaction:

$$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$$

A 1.00-mole sample of $C_6H_{12}O_6$ was treated with yeast. If 46 grams of $C_2H_5OH$ was obtained, what was the percent yield of $C_2H_5OH$?

a) 50.%
b) 56%
c) 100%
d) 53%
e) none of these

7. Calculate the work for the expansion of $CO_2$ from 1.5 to 2.5 liters against a pressure of 1.0 atm at constant temperature.

a) 1.5 liter × atm
b) 2.5 liter × atm
c) -1 liter × atm
d) −1.5 liter × atm
e) −2.5 liter × atm

8. A sample of helium gas occupies 12.4 L at 23°C and 0.956 atm. What volume will it occupy at 40°C and 1.50 atm?

$\frac{RnT}{PV} = \frac{RnT}{PV}$

a) 8.36 L
b) 6.28 L
c) 12.4 L
d) 10.4 L
e) 17.2 L

9. You are holding two balloons, an orange balloon and a blue balloon. The orange balloon is filled with neon (Ne) gas and the blue balloon is filled with argon (Ar) gas. The orange balloon has twice the volume of the blue balloon. Which of the following best represents the mass ratio of Ne:Ar in the balloons?

a) 3:1
b) 1:2
c) 2:1
d) 1:3
e) 1:1

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10. A gas with a molar mass of 71.0 g/mol, its density at 1.00 atm and 30.°C is

a) 29.0 g/L
b) 40.0 g/mL
c) 1.16 g/L
d) 1.29 g/L
e) 2.85 g/L

11. For a particular process q = + 20 kJ and w = + 15 kJ. Which of the following statements is true?

a) Heat flows from the system to the surroundings.
b) The system does work on the surroundings.
c) ΔEsystem = + 35 kJ.
d) All of the above are true.
e) None of the above is true.

2. A gas sample is heated from −20.0°C to 57.0°C and the volume is increased from 2.00 L to 4.50 L. If the initial pressure is 0.125 atm, what is the final pressure?

a) 0.189 atm
b) 0.555 atm
c) 0.0605 atm
d) 0.247 atm
e) none of these

A sample of oxygen gas has a volume of 5.50 L at 27°C and 800.0 torr. How many oxygen molecules does it contain?

a) $1.16\times10^{23}$
b) $5.8\times10^{22}$
c) $1.41\times10^{23}$
d) $1.16\times10^{22}$
e) none of these

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