Make-up Exam 3

There is only one best answer to each question.

1) Carbon tetrachloride has a chlorine-to-carbon mass ratio of 11.8:1. If a sample of carbon tetrachloride contains 10 g of chloride, what mass of carbon does it contain?
   a. 7.38 g
   b. 0.85 g *(circled)*
   c. 2.35 g
   d. 1.18 g

Handwritten annotations:

CCl_4

first solution (1th way)

$\frac{Cl}{C} = \frac{11.8}{1} = \frac{10}{C}$ $C = \frac{10}{11.8} = 0.85$ gc

$10 \, g \, Cl \times \frac{1 \, mol \, Cl}{35.45 \, g \, Cl} \times \frac{1 \, mol \, C}{4 \, mol \, Cl} \times \frac{12.01}{1 \, mol \, C} = 0.85 \, g^C$

Second Solution (2nd way)

2) Write a chemical formula for a compound that contains two oxygen atoms to every two hydrogen atoms.

Handwritten: H ... 20 ... 2

   a. H_2O
   b. $H(O_2)_2$
   c. H_2O_2 *(circled)*
   d. HO_2

3) How many oxygen atoms are in the chemical formula $Fe_3(PO_4)_2$?

Handwritten: O

   a. 8 *(circled)*
   b. 4
   c. 2
   d. 3

Handwritten: $4 \times 2 = 8$

Handwritten: Cation $\binom{NH_4^+ \text{ or } metals}{}$ + non-metal anion

4) Which compound is ionic?
   a. $Fe(OH)_2$ *(circled)*
   b. HNO_3 → Acid
   c. H_2O → Molecular
   d. NI_3 → Molecular

5) Write a formula for the compound that forms between potassium and chlorite ions.

Handwritten: K^+ ... ClO_2^-

   a. $NaClO_3$
   b. $KClO_3$
   c. $NaClO_2$
   d. $KClO_2$ *(circled)*
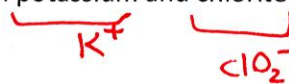
6) Name the compound $MgSO_4$
   a. Magnesium sulfate *(circled)*
   b. Magnesium sulfite
   c. Magnesium (II) sulfate
   d. Magnesium (II) sulfite

7) What is the formula for hydrochloric acid?
   a. HClO
   b. $HClO_2$
   c. $HClO_3$
   d. **HCl** ✓

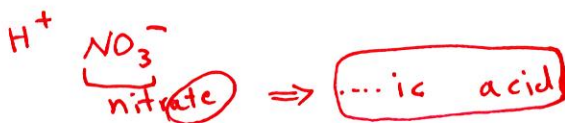*Binary acid ⇒ 2 elements*

8) Determine the formula mass of BCl_3
   a. 115.36
   b. **117.16** ✓
   c. 186.25
   d. 67.88

$BCl_3 = (B \times 1) + (Cl \times 3) = 117.16$

10.81   35.45

B	Cl
10.81	35.45

9) Name the acid HNO_3
   a. **Nitric acid** ✓
   b. Nitrous acid
   c. Hydrogen nitrate
   d. Hydronitrous acid

H^+ NO_3^-

nitrate ⇒ ...ic acid

10) Name the compound SF_6
   a. Monosulfur hexafluoride ✗
   b. Sulfur fluoride
   c. Monosulfur fluoride ✗
   d. **Sulfur hexafluoride** ✓

We never write mono at the beginning.

SF_6: Molecular compound.

11) How many atoms are there in 10 mol helium?
   a. 6.022×10^{22}
   b. 6.022×10^{23}
   c. **6.022×10^{24}** ✓
   d. 1.66×10^{-23}

? atoms $= 10$ mol He $\times \dfrac{6.022 \times 10^{23} \text{ atoms He}}{1 \text{ mol He}} = 6.022 \times 10^{24}$ atoms

12) A sample of pure gold has a mass of 100 g. How many moles of gold are in the sample?
   a. **0.51** ✓
   b. 0.93
   c. 1.08
   d. 1.97

100 g Au $\times \dfrac{1 \text{ mol Au}}{196.97 \text{ g Au}} = 0.507 \cong 0.51$ mol Au

13) Which sample contains the largest number of atoms?
   a. 20 g Na
   b. **20 g H** ✓
   c. 20 g He
   d. 20 g Ne

? atoms $= 20$ g Na $\times \dfrac{1 \text{ mol Na}}{22.99 \text{ g Na}} \times \dfrac{6.022 \times 10^{23} \text{ # atoms Na}}{1 \text{ mol Na}}$

for all 4 options, 20 and 6.022×10^{23} are the same. We can only compare the following numbers: (Molar masses)

a: $\dfrac{1}{22.99}$

b: $\dfrac{1}{1.01}$ → Largest

c: $\dfrac{1}{4.00}$

d: $\dfrac{1}{20.18}$

* To compare fractions with the same numerator, Just compare the denominator. The fraction with the smallest denominator is the biggest (largest).

$$O: 3 \times 2 = 6$$

14) How many moles of O are in 1.5 mol of Mg $(NO_3)_2$?

   a. 6.0

   b. 4.5

   (c.) 9.0

   d. 3.0

$$? \text{ mol } O = 1.5 \text{ mol } Mg\,(NO_3)_2 \times \dfrac{6 \quad \text{mol } O}{1 \quad \text{mol } Mg(NO_3)_2}$$

$$= 9.0 \text{ mol } O$$

15) A compound is decomposed in the laboratory and produces 1.40 g N and 0.20 g H. What is the empirical formula of the compound?

   (a.) NH_2

   b. N_2H

   c. NH

   d. N_7H

$$N_{\frac{0.0999}{0.0999}} \quad H_{\frac{0.1980}{0.0999}}$$

$$N H_{1.98}$$

$$NH_2$$

$$? \text{ mol } N = 1.40 \text{ g } N \times \dfrac{1 \quad \text{mol } N}{14.01 \quad \text{g } N} = 0.0999 \ \#/\text{g}$$

$$? \text{ mol } H = 0.2 \text{ g } H \times \dfrac{1 \quad \text{mol } H}{1.01 \quad \text{g } H} = 0.1980$$

16) Acetylene, a gas used in welding torches, has the empirical formula CH and a molar mass of 26.04 g/mol. What is its molecular formula?

   a. CH

   (b.) C_2H_2

   c. C_3H_3

   d. CH_2

$$n = \dfrac{26.04 \ \frac{g}{mol}}{C + H} = \dfrac{26.04 \ \frac{g}{mol}}{12.01 + 1.01} = 2$$

$$(CH)_2 = C_2H_2$$

17) Complete the following sentence: : " The numerical value of the ------- is defined as being equal to the number of atoms in exactly 12 g of pure carbon-12."

   (a.) Mole

   b. Gram

   c. Kilogram

   d. Density

18) Which statement is NOT correct?

   a. Atomic elements have single atoms as their basic units.

   b. Molecular elements do not normally exist in nature with single atoms as their basic units.

   (c.) All ionic compounds are composed of one or more metals paired with one or more nonmetals

   d. Molecular compounds are composed of two or more nonmetals

19) What are polyatomic ions?

   (a.) Ions that are themselves composed of a group of atoms with an overall charge

   b. Two or more cations paired with two or more anions

   c. Ions that are themselves composed of a group of atoms with total charge of zero

   d. A metal and one or more nonmetals together in a chemical formula

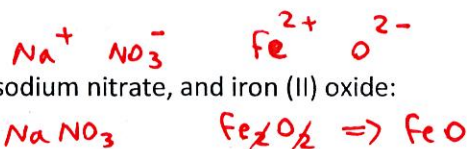20) Which acid has the higher mass percent composition of O?

   a. $HClO_2$

   (b.) $HClO_3$

$$HClO_2: \quad \text{Mass percent } O = \dfrac{2 \times 16.00 \quad \times 100\%}{H + Cl + (O \times 2)} \cong 0.47 \times 100\%$$
$$\underset{1.01 \quad 35.45 \quad 16}{} \cong 47\%$$

$$HClO_3: \quad \text{Mass percent } O = \dfrac{3 \times 16.00 \quad \times 100\%}{1.01 + 35.45 + (16 \times 3)} \cong 0.57 \times 100\% \cong 57\%$$

Na^+ NO_3^- Fe^{2+} O^{2-}

21) What is the correct chemical formula for sodium nitrate, and iron (II) oxide:

   a. $Na\,NO_2$, Fe_2O_3
   b. $Na\,NO_3$, FeO ✓
   c. $Na\,NO_2$, FeO
   d. $Na\,NO_3$, Fe_2O_3

$Na\,NO_3$ $Fe_2O_2 \Rightarrow FeO$

22) What is the mass of S in 100 g of H_2SO_4?

   a. 98.08 g
   b. 0.03 g
   c. 32.69 g   ✓
   d. 3.12 g

1.01 32.06 16.00

$H_2SO_4 = (H\times2) + (1\times S) + (O\times4) = 98.08$

$? \; gS = 100\,g\,H_2SO_4 \times \dfrac{1 \; mol \; H_2SO_4}{98.08 \; gH_2SO_4} \times \dfrac{1 \; mol \; S}{1 \; mol \; H_2SO_4}$

$\times \dfrac{32.06 \; g\,S}{1 \; mol\,S}$

$= 32.69 \; gS$

23) Which of the following is NOT an empirical formula?

   a. $C_6H_{12}O_6$ ✓ $\Rightarrow$ can be simplified
   b. C_5H_4
   c. H_2O
   d. TiO_2

$CH_2O \; (CH_2O)$

24) Which of the following is an ionic compound?

   a. $Mg \rightarrow$ Not a compound
   b. $NH_3 \rightarrow$ Molecular compound
   c. $NaCl$ ✓
   d. $CO_2 \rightarrow$ Molecular compound

25) What is the name of H_2SO_3?

   a. Dihydrogen monosulfite
   b. Sulfurous acid   ✓
   c. Dihydrogen monosulfate
   d. Hydrosulfuric acid

H^+ SO_3^{2-}

Sulfite ----- + ous acid