Chemistry - Mid Term Exam Review Sheet #1

The midterm exam covers chapters 1 - 4 & 9 - 11. You should read through each chapter, look over old tests you still have, answer the following questions and do the calculations in order prepare yourself for the mid-term.

1. Define the following terms and describe where each is located.

proton - *Positive subatomic particle (inside nucleus)*

neutron - *neutral subatomic particle (inside nucleus)*

electron – *negative subatomic particle (outside nucleus)*

2. Complete the following table:

Element name	Atomic #	Mass #	# of protons	# of Neutrons	# of Electrons	Symbol
Hydrogen	1	1	1	0	1	H
Carbon	6	12	6	6	6	C
Sodium	11	23	11	12	11	Na
Calcium	20	40	20	20	20	Ca
Fe	26	56	26	30	26	Iron

3. Define the following and give an example of each using chemical symbols.

atomic number *Whole # on periodic table (# of protons)* / $_1^1H$

atomic mass *decimal # on periodic table (# of p^+ + n)* / $_1^1H$

isotope *Same # of p different # of neutrons* / $_1^1H$ and $_1^2H$

4. Which of the following are isotopes of the same element? $\boxed{_9^{19}Y \quad _9^{20}Y}$ $_{10}^{19}Y$

5. Describe Rutherford's experiment: *Gold Foil experiment. He shot alpha (+ charged) particles at gold foil. He expected the particles to go right through, but some were deflected... He discovered the positively charged nucleus.*

6. Explain all the major parts of Dalton's Atomic Theory.

a. *Law of constant composition. Compounds are formed in whole # ratios*

b. *All atoms of the same element are identicle (* False b/c of isotopes)*

c. *Atoms are indivisible (false b/c of subatomic particles)*

d. *All elements are composed of atoms*

7. Balance the following chemical equations:

$$3\,CO + \underline{\quad} Fe_2O_3 \rightarrow 2\ Fe + 3CO_2$$

$$3\,Zn(OH)_2 + 2\,H_3PO_4 \rightarrow \underline{\quad} Zn_3(PO_4)_2 + 6\,H_2O$$
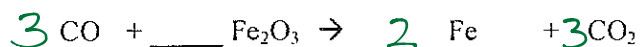
8. Define Ionic and Molecular compounds, and tell how each is formed.

Ionic ⇒ metal bonded to 1 or more non metals

Molecular ⇒ two or more non metals bonded together

9. Name the following compounds and state if it is ionic or molecular in nature:

Ionic   a. $Al(OH)_3$ *Aluminium hydroxide*

Molecular   b. N_2O_5 *dinitrogen pentoxide*

Ionic   c. MgI_2 *Magnesium Iodide*

Molecular   d. Cl_2O_7 *dichlorine heptoxide*

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10. Write a chemical formula for each name given and tell whether it is an ionic (i) or molecular (m) compound:

Ionic	a.	Ammonium Phosphate	$(NH_4)_3PO_4$
Ionic	b.	Magnesium Nitride	Mg_3N_2
Molecular	c.	Oxygen Difluoride	OF_2
Molecular	d.	Carbon Dioxide	CO_2
Molecular	e.	Sulfur Dioxide	SO_2

11. Name and describe the 5 types of chemical reactions. Give an example of each.

Honors Chem

a. Combustion $CH_4 + O_2 \Rightarrow CO_2 + H_2O$

b. Synthesis (combination) $Na + Cl_2 \rightarrow NaCl$

c. Decomposition $H_2O \Rightarrow H_2 + O_2$

d. Single Displacement $Na + HCl \rightarrow NaCl + H_2$

e. Double Displacement $NaCl + MgO \rightarrow Na_2O + MgCl_2$

Oxidation-reduction $Na + Cl_2 \Rightarrow NaCl$

Acid-Base $HCl + NaOH \Rightarrow H_2O + NaCl$

Precipitation $AgNO_3^{(aq)} + NaCl^{(aq)} \rightarrow NaNO_3^{(aq)} + AgCl (s)$

12. Define and give an example of each:

Element	substances that contain only only one type of atom	Gold
Mixture	a physical blend of two or more components	salt water
Compound	two or more elements chemically combined	salt
homogeneous substance	a mixture with uniform composition throughout	salt water
heterogeneous substance	a mixture that does not have uniform composition	soil + water
physical property	Property that can be observed	melting point
chemical property	ability to undergo a change in chemical composition of material	ability to rust
physical change	some properties change, but not the composition	boiling
chemical change	change that produces matter w/ a different composition	rusting
qualitative measurements	measurements made by observations	Observing color change
quantitative measurement	numerical observations	measuring temperature

13. Which of the following is a homogeneous mixture?

    a. oil in water   b. soot in water   (c. alcohol in water)

14. Which of the following could be considered a physical change?

    a. cooking a pancake   b. burning a tree   (c. melting an ice cube)

15. Which of the following is considered a heterogeneous mixture?

* not clear answer

    a. salt and sugar   b. flour and baking powder   (c. salt and pepper)

16. Classify each as a physical or chemical change.

    P   a. instant coffee is combined with hot water to produce a brown liquid mixture

    C   b. from exposure to air and moisture, iron turns reddish and cannot conduct electricity rust

    P   c. iron is heated, turns red and then melts

    C   d. sugar is heated to produce steam and a black solid

1. Classify each as an element, mixture, ionic compound or molecular compound.

   a. sodium **E**

   b. water **MC**

   c. table salt **IC**

   d. sugar **MC**

   e. oxygen **E**

   f. air **M**

   g. soil **M**

   h. lemon soda **M**

2. Classify each as a qualitative or quantitative observation:

   a. the liquid solution was blue **Qual**

   b. the reaction gave off smoke **Qual**

   c. 5 grams of the chemical was used **Quant.**

   d. the temperature was 87 degrees **Quant.**

   e. the metal was smooth **Qual.**

3. List the diatomic molecules:

   a. __**H**__   d. __**F**__   g. __**Cl**__

   b. __**O**__   e. __**I**__

   c. __**Br**__   f. __**N**__

4. List the names & formulas of the six common acids: **(Honors Chem only)**

   a. H_2SO_4 - **Sulfuric acid**

   b. **HCl** - hydrochloric

   c. **HNO_3** - nitric

   d. H_2CO_3 - **Carbonic acid**

   e. $HC_2H_3O_2$ - **acetic acid**

   f. **H_3PO_4** - phosphoric

5. Define:

   Metal   1 – 3 valence e's, become cations in ionic compounds, lose e's, luster, malleable, conductios **(left of staircase)**

   Non-metal   opposites of above... ⬆ **(right of staircase)**

   Metalloid   **has properties of both metals + nonmetals**

6. Classify each element as a metal, non-metal, or metalloid.

   a. aluminum **Metal**

   b. gold **Metal**

   c. silicon **metalloid (non)**

   d. hydrogen **Non**

   e. argon **Non**

7. Define groups **columns** and periods **rows**
Describe how elements arranged on the periodic table:
   by atomic mass and/or atomic #

8. What are the main groups of elements on the periodic table and where are they located?
   alkali metals / 1st column   alkaline earth metals / 2nd column
   halogens / 17th column
   noble gases / 18th column

9 What is special about the elements in a particular group on the periodic table?
   Same chemical properties b/c form same ions

10. What is the ~~oxidation (nuclear)~~ charge of each substance (ion) given? **Answers Given**

   a. Al   3+
   b. S   2-
   c. Cl   1-
   d. phosphorus 3-
   e, nitrate   1-
   f. carbonate   2-
   g. lithium   1-
   h. Ag   1-

11. What is the total positive charge on the Aluminum ion in the following compounds?

a. $Al(ClO_4)_3$ __3__   b. $Al_2(SO_2)_3$ __3__   c. $AlPO_4$ __3__

12. For each compound in question # 25 give the following information:

	$Al(ClO_4)_3$	$Al_2(SO_2)_3$	$AlPO_4$
# of moles of atoms for each element	Al 1 mole / Cl 3 mole / O 12 mole	Al 2 moles / S 3 / O 6	Al 1 / P 1 / O 4
the total number of atoms in the entire compound	16 atoms	11 atoms	6 atoms
Find molar mass gram molecular mass of compound	325 g Al(1×27) Cl(3×35.5) O(12×16)	246.1 g	121.8 g

13. What is Avogadro's number? 6.02×10^{23} (answer given)

14. Define the following: (2 or more)

Molecule — group of bonded atoms

Atom — smallest particle of matter that retains individual properties

Ion — atom w/ a charge

Cation — ion w/ positive charge

Anion — ion w/ negative charge

15. From what type of elements are cations and anions formed and explain how each is formed.

Cations: metal - loss of electron(s) (-)   Answers given

Anions: nonmetal – gain electron(s)

16. Calculate the % composition by mass of the compounds formed from these reactions.

a. 8.2 g of Mg combine with 5.4 g of oxygen   Mg = 60.3% - O = 39.7%

Example: $\%Mg = \frac{8.2g}{(8.2+5.4)} \times 100 = 60.3\%$

b. 29 g of Ag combine with 4.3 g of sulfur   Ag = 87.1% - S = 12.9%

17. Calculate the % composition by mass of: Answers Given

Find molar mass

Propane C_3H_8 C = 81.2%   H = 18.9%

Ex. C (3 × 12.01) H (8 × 1.008) +

$\%C = \frac{(3 \times 12.01)}{\text{molar mass}} \times 100$

Water H_2O H = 11.1%   O = 88.9%

18. Element X has two isotopes. The first isotope has a mass of 10.012 amu with a relative abundance of 19.91%. The second has a mass of 11.009 and has a relative abundance of 80.09%. Calculate the -atomic mass of this element, and name it.

$(10.012 \times .1991) + (11.009 \times .8009) = 10.81$ Boron

19. The four isotopes of lead are given below, each with its percent by mass abundance and the composition of its nucleus. Using this data, calculate the atomic mass of lead.

Pb	Pb	Pb	Pb
p+ =82	p+ =82	p+=82	p+=82
n= 122	n = 124	n= 125	n= 126
1.37%	26.26%	20.82%	51.55%

Mass> 82+122=204   206   207   208

$(204 \times .0137) + (206 \times .2626) + (207 \times .2082) + (208 \times .5155) = 207.2$

Hint: for #17, and 18 use the formula: % mass (of each element) $= \frac{\text{grams of element}}{\text{grams of compound}} \times 100\%$

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$D = \dfrac{m}{V}$

Name _____

Per. _____

1. A copper penny has a mass of 3.1 g and a volume of 0.35cm³. What is the density of copper? $8.9\ g/cm^3$

2. A liquid has a density of 4.8 g/ml. What is the mass of a 2 liter sample? $9.6\ g$

3. What is the volume of a substance that has a mass of 80 g and a density of 10 g/cm³? $8\ cm^3$

4. Indicate the meaning (as a power of 10) for each of the following metric prefix:

a. kilo 10^3 b. centi 10^{-2} c. milli 10^{-3}

d. deci 10^{-1} e. nano 10^{-9} f. Micro 10^{-6}

5. Calculate the following quantities:

a. 1,100 cm = 11.00 m   b. 1 m = 1000 mm   c. 10 m = 1000 cm

d. 2.5 km = 2500 m.   e. 4.05 kg = 4050 g   f. 0.5g = 500 mg

g. 1 nm = 1×10^{-9} m   h. 3.0 g = 3.0×10^9 ng

6. Indicate the number of significant figures in each of the following:

a. 12600 3 b. 0.09 1 c. 2001 4 d. 0.00500100 6 e. 1000 1

7. Define:

accuracy how close you are to the true value

precision consistanly getting near the same value

8. The accepted value or true value for the density of lead (Pb) is 11.35 g/ml. Your experimental value or observed value found during a class lab is 9.65 g/mL

What is the error of your measurement?

What is the percent error of your measurement? $\dfrac{|11.35 - 9.65|}{11.35} \times 100 = 14.98\%$

9. Define:

Meter SI unit for length

Liter SI unit for volume

Volume Space an object occupies

Mass amount of matter

Gram base unit for mass

Temperature °C or K measures movement of atoms

10. Name the two temperature scales used in science? Give the freezing pt., and boiling pt. of water for each of them.

°C   0°C / 100°C

Kelvin   273K / 373K

11. Which type of particle (atom, ion, or molecule) goes with each of the following substances?

a. Na atom   b. Ca²⁺ ion   c. N₂ molecule

d. Cl₂ molecule   e. H₂O molecule   f. CO molecule

12. Define:

empirical formula Simplified version of molecular formula

molecular formula exact count of the atoms in a compound

13. Which of the following are empirical formulas and which are molecular formulas?

a. CH₄N E.   b. NaO E.   c. C₆H3O₃ M

d. H_2O_2 ___M___   e. Na_2SO_3 ___E___   f. $C_6H_{10}O_4$ ___M___

14. Find the empirical formula of each compound from its % composition.

   a. 72.4 % Fe and 27.6% O   b. 94.1% O and 5.9% H

   FeO$_4$ OH

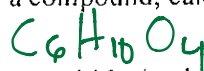$$\frac{94.1g}{16g} = \frac{X}{1mol} \quad \frac{5.88 \, mol \, O}{5.85}$$

$$\frac{5.9}{1.01} = \frac{X}{1mol} \quad \frac{5.85 \, mol \, H}{5.85}$$

15. If given the empirical formula and gram formula mass for a compound, calculate the compound's molecular formula?

   $C_6H_{10}O_4$

   a. CH_2O , mass = 90 g/mol   b. $C_3H_5O_2$ mass = 146 g/mol

   $C_3H_6O_3$

16. Find the missing density, mass of volume of the following:

a. The mass of a substance is 45.6 g and the volume is 15 cm3:   Density = __3.04 g/cm³__

b. The volume of a substance is 2.9 ml its density is 6 g/ml: Mass = __17.4 g__

c. The density of a substance is 7.8 g/cm3 and the mass is 125 g: Volume = __16.03 cm³__

   (Hint: D/1 = M/V (Given any two of the numbers; D, M or V, you can cross multiply and divide to find what's missing)

17. If you have 6.7 L of O_2 at STP, how many moles do you have __X = 0.30 mol__

$$\frac{6.7L}{22.4L} = \frac{X \, mol}{1 \, mol}$$

18. What is the molar mass of $Sn_3(PO_4)_2$? __546.08 g/mol__

19. How many moles are in 137.5 g of Mn? __2.5 moles__

20. What is the mass of 3 moles of Sc? __134.8 g__

21. What is the mass of 2 moles of C_2H_6? __60.136 g__

22. What are the correct formulas for the following compounds?

a. potassium sulfate __K_2SO_4__   b. calcium phosphate __$Ca_3(PO_4)_2$__

23. How many moles of $CaCl_2$ are in 12 g of $CaCl_2$?

$$\frac{12g}{110.98} = \frac{X \, mole}{1 \, mole} \qquad 0.108 \, mol$$

❖ Finding % composition from Mass of elements in a compound:
   What is the percent mass of each element in K_2O if the mass of the compound is 188 g and the mass of oxygen is 32 g? *(Hint: Mass of K must be 188 – 32 = 156 g)*

   Answers Given
   K = 156/188 = 83%
   O = 32 / 188 = 17%

❖ Finding % composition from the chemical formula of elements in a compound:
   What is the percent mass of the elements in C_3H_8? *(Hint: Find molar mass of each element and divide by molar mass of compound).*

   Answers Given
   Molar Mass of C_3H_8 = 44 g
   Mass of 3 moles C = 36 g   36/44 = 82%
   Mass of 8 moles H = 8 g 8/44   = 18%

❖ Finding empirical formulas by % mass of a compound:
   A compound consists of 80% carbon and 20% Hydrogen. What is its empirical formula?
   (Hint divide each % by the molar mass of the element)

   Answers Given
   C = 80/12 = 6.7
   H = 20/1 = 20
   The ratio of 20 to 6.7 is 3 to 1 (20/6.7 = 2.99) so there are 3 times as many H as C atoms.
   The empirical formula is CH_3