Exam II Test Review: Chemistry 1302

Chapter Four Review:

Important Scientists:

Scientist #1: Who Am I?

atomic theory

1. I lived in the early 1900 s and proposed a theory that matter is made of tiny, indestructable particles.
2. I believed that atoms of the same element have the same mass and properties.
3. I said atoms combine in simple, whole-number ratios to form compounds.
4. My theory helped revive ancient ideas from democritus.
   My name is: John Dalton

Scientist #2: Who Am I?

1. I was a Russian professor who loved organizing things.
2. I noticed that when elements are arranged by increasing mass, certain properties repeat.
3. I created a table that predicted the existence of elements not yet discovered.
4. My law summarized observations but didn't explain the reason behind them.
   My name is: Dmitri Mendeleev

Scientist #3: Who Am I?

1. I discovered a particle smaller than the atom.
2. I found that this particle had a negative charge and was present in many substances.
3. I proposed the "plum pudding" model of the atom.
4. My discovery showed that atoms are not indivisable after all.
   My name is: JJ Thomson

Scientist #4: Who Am I?

1. I conducted an experiment using gold foil and alpha particles.
2. I expected particles to pass through, but some bounced back.
3. I concluded that atoms have a dense, positively charged center.

4. I proposed the nuclear model of the atom.
   My name is: Ernest Rutherford

Subatomic Particles

Particle #1: Who Am I?

1. I have a negative charge.
2. I am located in the outer cloud of the atom.
3. My mass is almost negligible compared to the other particles.
4. When I am gained or lost, I form an ion.
   My name is: Electron

Particle #2: Who Am I?

1. I have a positive charge.
2. I am located in the nucleus of the atom.
3. My mass is about 1 amu.
4. The number of me in the nucleus determines the atomic number of the element.
   My name is: proton

Particle #3: Who Am I?

1. I have no charge—I am neutral.
2. I am located in the nucleus of the atom.
3. My mass is about 1 amu, similar to another particle.
4. When my number changes, I form an isotope.
   My name is: neutron

Periodic Families

Families share similar properties.

Group 1A: alkali metals

Group 2A: alkaline earth metals

Group 7A: halogens

Group 8A: noble gases

Group 3-12: transition metals

Left of PT: metals

Stairsteps of PT: metalloids

Right of PT: nonmetals

mass
atomic # X charge

Elements

Symbol	Atomic Number	Mass Number	# of Protons	# of Electrons	# of Neutrons	Charge
$^{24}_{12}Mg$	12	24	12	12	12	Neutral
$^{35}_{17}Cl^{-1}$	17	35	17	18	18	-1
$^{40}_{20}Ca^{+2}$	20	40	20	18	20	+2
Phosphorus $^{31}_{15}P$	15	31	15	15	16	Neutral
$^{11}_{6}C^{+2}$	6	11	6	4	5	+2
$^{14}_{7}N^{-1}$	7	14	7	8	7	-1
Argon $^{40}_{18}Ar^{-2}$	18	40	18	20	22	Neutral -2

Gallium has two naturally occurring isotopes: Ga-69 with mass 68.9256 amu and a natural abundance of 60.11%, and Ga-71 with mass 70.9247 amu and a natural abundance of 39.89%. Calculate the atomic mass of gallium

Ga-69 68.9256 * 60.11% = 41.43 amu

Ga-71 70.9247 * 39.89% = 28.29 amu

69.72 amu

Magnesium has three naturally occurring isotopes with masses of 23.99, 24.99 and 25.98 amu and natural abundances of 78.99%, 10.00%, and 11.01% respectively. Calculate the atomic mass of magnesium.

23.99 * 78.99% = 18.95

24.99 * 10.00% = 2.499

25.98 * 11.01% = 2.860

24.309099

24.31 amu

Chapter 5 Review:

1. Make a T-Chart comparing molecular and ionic compounds and how to name them:

molecular/covalent	ionic
- 2 non metals	- metal + nonmetal
- (-) + (-)	- (+) + (-)
- anions	- cations & anions
- ex) CO_2, H_2O	- ex) NaCl
- prefixes, -ide	- -ide

2. Make a T-Chart comparing how to name acids. => H

Elements (Binary Acids) H_2S	Polyatomic ions ending in -ate (Oxyacid)	Polyatomic ions ending in -ite (Oxyacid)
hydro ___ ic acid	___ -ic acid	___ -ous acid
	Nitrate => Nitric Acid	Nitrite => Nitrous Acid

3. What is a polyatomic ion?

poly = many, multiple atoms

$H_4(PO_4)$

4. How many atoms are in $Al_2(SO_4)_2$?

Al = 2

S = 2

O = 8

5. Name each substance as a molecular compound, ionic compound, or polyatomic ion and name each accordingly.

Calcium Chloride - ionic

$CaCl_2$ Ca^{+2} Cl^{-1}

+2 = -1(2)

2 ← (Di)nitrogen Trisulfide molecular

N_2S_3

Tin (II) Chloride

Sn^{+2} Cl^{-1}

$SnCl_2$

SO_4^{-2} → SO_3^{-2}

polyatomic sulfate sulfite

P_2O_3 - molecular

Diphosphorus Trioxide

KBr - ionic

Potassium Bromide

NiS - ionic $Ni^{+2}S^{-2}$

Nickle (II) sulfide

$B_2(CrO_4)_3$ - ionic

Boron chromate

6. Name the following acids:

HNO_2

Nitrous Acid

HF

Hydrofluric Acid

H_2CO_3

Carbonic acid

H_2S Hydrosulfuric acid

7. Calculate the formula mass of carbon tetrachloride. CCl_4

C: 12.011 * 1 = 12.011

+

Cl: 35.45 * 4 = 141.8

153.811 → 153.8

153.8 amu

N_2O

8. Calculate the formula mass of dinitrogen monoxide.

N: 14.007 * 2 = 28.014
O: 15.999 * 1 = + 15.999
44.013 amu

Chapter 6 Review:

1. What is Avogadro's Number?

6.022×10^{23}

2. How do you convert between grams and moles?

Periodic table

N^{-3} O^{-2}

3. Calculate the mass percent composition of Nitrogen in Nitrogen oxide.

part / whole * 100

N = 14.007 * 2 = 28.014
O = 15.999 * 3 = + 47.997
76.011 ⇐ whole

$\frac{28.014}{76.011} = 36.855\%$ N_2O_3

4. Determine the mass of hydrogen in 3.75 g of glucose, $C_6H_{23}O_6$.

$3.75\ g\ C_6H_{23}O_6 \left| \frac{1\ mol\ C_6H_{23}O_6}{191.243\ g\ C_6H_{23}O_6} \right| \frac{6.022 \times 10^{23}\ atoms}{mol\ C_6H_{23}O_6} \left| \frac{37}{100} \right| \frac{23\ molecules\ H}{1\ FU\ C_6H_{23}O_6}$

$\frac{1.00794\ g\ H}{1\ molecule\ H} = 12.74 \times 10^{23}\ g\ H$ 0.2517 g H

5. A compound contains only carbon, hydrogen, and oxygen. When a sample of the compound is analyzed, it produces 40.00% of carbon, 6.71% of hydrogen, and 53.29% oxygen by mass. What is the empirical formula of this compound?

$40.00\ g\ C \left| \frac{1\ mol\ C}{12.011\ g\ C} \right. = \frac{3.33}{3.33} = 1$

$6.71\ g\ H \left| \frac{1\ mol\ H}{1.00794\ g\ H} \right. = \frac{6.66}{3.33} = 2$

$53.29\ g\ O \left| \frac{1\ mol\ O}{15.999\ g\ O} \right. = \frac{3.33}{3.33} = 1$

CH_2O

$n = \frac{\text{molar mass}}{\text{empirical mass}} \Rightarrow$ given

6. What is the molecular formula the previous compound? molar mass 180 g/mol

$C = 12.011 * 1 = 12.011$

$H = 1.00794 * 2 = 2.01588$ +

$O = 15.999 * 1 = 15.999$

$30.026\ g$

$\frac{180\ g/mol}{30.026\ g} = 6$

$C_1H_2O_1 = C_6H_{12}O_6$

Use the following space for extra practice: 0.450 g

How many atoms of O are in $MgCO_3$

$$0.450\ g\ MgCO_3 \left| \frac{1\ mol\ MgCO_3}{84.286\ g\ MgCO_3} \right| \frac{6.022 \times 10^{23}\ \text{atoms}\ MgCO_3}{1\ mol\ MgCO_3}$$

$$\frac{3\ \text{atoms O}}{1\ \text{FU}\ MgCO_3} = 9.45 \times 10^{21}\ \text{atoms O}$$