Chemistry Exam 2: Unit 6 Cheat Sheet

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Atomic Mass (atomic weight)

weighted average mass of atoms of a given element

unit = amu

amu = 1.66×10^{-27}

Formula Mass (formula weight)

relative mass of an individual compound

sum of the atomic weights of all the atoms in a compound

unit = amu

Mole (mol)

1 mole = 6.022×10^{23} (atoms, molecules, or ions)

Moles used most often to convert to **atoms** or **compounds**

1 mol / 6.02×10^{23}

OR

OR 6.02×10^{23} / 1 mol

Limiting Reactant

Chemistry questions that ask about theoretical yield (amount of product) or percent yield

Limiting reactant - the reactant that is completely used up in a reaction

- the amount of product produced is dependent on the amount of starting materials or reactants

Limiting Reactant (cont)

- often one reactant will limit the reaction by getting completely used up and thus ending the reaction

- thus, the number of moles of limiting reactant determines the number of moles of product that can form

All chemistry questions that use molar ratios from a chemical reaction equation to convert from one side of the reaction to the other, must include the following steps:

1. Write the complete balanced chemical reaction equation

a. write the correct molecular formulas for each reactant and each product

b. balance the reaction equation using coefficients

2. Determine the limiting reactant

a. calculations may or may not be necessary based on the information provided in the problem

3. Determine the theoretical yield = amount of product

a. based on the limiting reactant

4. Determine the percent yield of the product

a. based on the theoretical yield

b. based on the information provided in the problem

Avogadro's

of atoms contained in exactly 12g of the C^{-12} isotope

Used to convert *particles to moles (and vice versa)

*could also be ions, molecules, ionic compound, atoms, etc.

6.02×10^{23} / 1 mol

OR

1 mol / 6.02×10^{23}

Molar Ratio

used to convert moles of one particle to moles of another particle

(mol A / mol B)

(mol B / mol A)

Molar Mass

used to convert mass to moles (and vice versa)

g / mol

OR

mol / g

Element: molar mass = atomic mass

Compound: molar mass = formula mass

Types of Chemistry Problems

Problem type #1

the provided information includes the amount (such as mass or moles) of one reactant and no information about the second reactant

Types of Chemistry Problems (cont)

the limiting reactant is assumed to be the reactant whose amount was provided. Any assumption made should be stated in the answer to the problem

no calculations are necessary

Problem type #2

the provided information includes the amount (such as mass or moles) of one reactant and the second reactant is in excess

the limiting reactant is automatically the reactant whose amount was provided, as "in excess" means there is an unlimited amount present of that reactant

no calculations are necessary

Problem type #3

the provided information includes the amount (such as mass or moles) of both reactants

the limiting reactant could be either reactant

calculations must be performed to determine which one

Ionic Compounds

since inoic compounds are held together through electrostatic interactions, only **physical** means are needed to separate them

Atoms are balance in ionic compounds and molecules

Potassium oxide

Cation:	$K+$
Anion:	O^{-2}
Goal:	no overall charge
Formula:	K_2O

Covalent Compounds

Breaking a covalent bond requires a chemical reaction. For atoms of a molecule to be separated, bonds must be broken and new bonds must be formed

Methane

Elements:	C & H
Atoms:	1C & 4H
Goal:	octet rule as possible
Formula	CH_4

Percent Yield

Percent yield (%) =

actual yield (g) / theoretical yield (g) x 100%

Theoretical yield or expected yield

Percent Yield (cont)

amount of product expected from a given amount of reactant based on the coefficients in the **balanced** chemical equation

Actual yield or experimental yield

amount of product isolated from a reaction

Percent Yield (%)

indicates the quantity of product produced

Step 1.	determine the limiting reactant (LR) (method 1 or 2)
Step 2.	determine the theoretical yield of each product separately using the mass of the LR
Step 3.	Determine the percent yield of each product separately using the theoretical yields calculated in step 2 and the actual yields provided

Polyatomic Ions

Calcium Acetate

Cation:	Ca^{2+}
Anion:	CH_3CO_2-
Goal:	no overall charge
Formula:	$Ca(CH_3CO_2)_2$

Balancing Chemical Reaction Equations

Stoichiometry - used to balance chemical equations

- matter can neither be created nor destroyed

- the same number of atoms of every element must be on both sides of the equation

Steps to balance a chemical reaction:

1. write the equation with the correct chemical formulas for the reactants and products

1. determine if the equation is balanced by counting the number of atoms of each element on both sides of the equation

3. balance the equation using coefficients one element at a time

4. check to ensure that the smallest whole numbers have been used as coefficients

5. double check that the equation is now balanced by counting the number of atoms of each element on both sides of the equation

Balancing chemical reactions with **Polyatomic ions**:

Balancing Chemical Reaction Equations (cont)

1. if the bonds in polyatomic ions are **NOT** broken during the reaction (same on both sides of the equation), then treat the polyatomic ion as a unit

2. if the bonds in polyatomic ions **ARE** broken during the reaction (not the same on both sides of the equation), then separate out all of the elements for balancing

Percent Error

indicates the quality of the data produced

Percent error (%)

[theoretical value (g/mol) - experimental value (g/mol)] / [theoretical value (g/mol)] x 100%

Accepted value or theoretical value

value determined from other scientists doing the same experiement with multiple replicates or the actual value of an unknown made for you

Actual value or experimental value

value determined from your own experimentation