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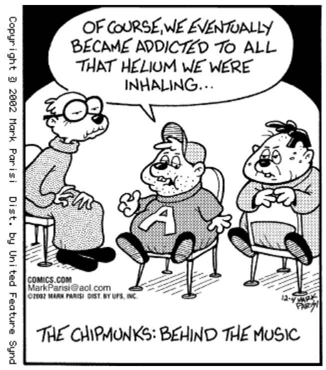
Stoichiometry

Math of Chemistry



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Atomic and Formula Mass

- Atomic Mass: a relative mass for ______ atom based on a standard of __________ at 12.00amu (atomic mass units)
- Formula Mass: sum of atomic masses in a __________
- Ex#1. H_20 = 18.0amu
  - H = 1.0amu * 2 atoms H = ____amu
  - +O= 16.0amu * 1 atom O = ____amu
- =____amu

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Formula and Molar Mass

- Ex. #2 $HC_2H_3O_2$ (acetic acid) = 60.0amu
- H= 1.0amu * __ atoms H = ___amu
- C=12.0amu* __ atoms C =___amu
- +O= 16.0amu * __ atoms O = ___amu
- =___amu
- Molar Mass (gram formula mass/gfm): gram(g) _______________ to formula mass that represents a _____ of particles. **Unit is _____**

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Percent Composition

- (Mass of Part/Mass of Whole)*100
- What is the % composition of Glucose $C_6H_{12}O_6$
  - Find Molar Mass/Gram formula mass 1st
  - Determine percentages separately (totaling 100% for all parts)
    - C=12.0amu *___ atoms ____amu
    - H= 1.0amu *___atoms ____amu
    - O= 16.0amu *___atoms ____amu
- ____amu
- %C = (____amu/_____amu)* 100 = 40.0%
- %H = (___amu/_____amu)* 100 = 6.7%
- %O = (___amu/_____amu)* 100 = 53.3%
- 100%

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The Mole and Avogadro's Number $6.02*10^{23}$

- Avogadro's number→ $6.02*10^{23}$ particles (atoms, molecules, formula units) equals _____ mole
  - One mole of Lead(Pb) would have a molar mass of _______g/mol, while a mole of Carbon(C) would be _____g/mol
  - Both 1 mole of Pb and C would have $6.02*10^{23}$ atoms each (or any other element as well)

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Molecules and Random Facts

- Molecules: are considered to be a whole unit
- Ex. $6.02*10^{23}$ __________ of H_20 in a mole of water
- $6.02*10^{23}$ molecules of H_2 in a ______ of hydrogen gas
- Random Avogadro facts:
  - If you had a mole of pennies, you could give out a million dollars a day for 3000 years
  - a mole of paper would be stacked beyond our solar system

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Formula Units (ionic Compounds)

- Formula Unit: lowest ____________ of an Ionic compound
- 6.02* 10^{23} formula units in a mole of NaCl
  - broken down into __________ of ions
    - 1 mole _____ ion   1 mole ____ ion
- 6.02* 10^{23} formula units in a mole of $CaCl_2$
  - broken down into __________ of ions
    - __ mole ____ ion   __ moles ____ ion

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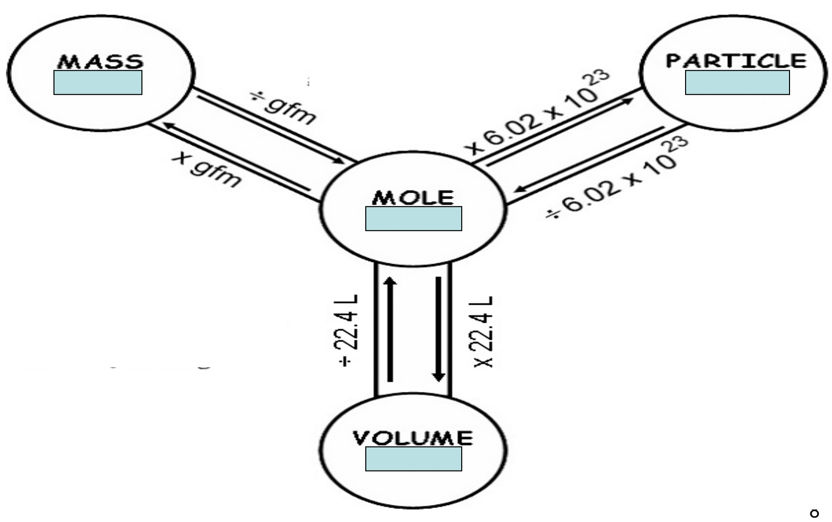
Molar Conversions



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Mole Ratio's: ratio of moles within an equation

- Ex. $2Al_2O_3$ (l) → $4Al(s) + 3O_2(g)$
- __moles →__moles + __moles
- 2:4:3 ratio exists here
- This is used to find moles/mass/volume/particles needed for, or produced in, a completed reaction with the factor label method

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Mole Ratio's continued

- Ex. Ethane + oxygen → Carbon dioxide + water
- $2C_2H_6$ + $7O_2$ → $4CO_2$ + $6H_2O$
- ↑#mol C_2H_6 ↑#mol O_2 ↑#mol CO_2 ↑#mol H_2O
- 2: 7: 4: 2 ratio exists

- Burning 2 moles of C_2H_6 results in __ mol of CO_2
- Burning 2 moles of C_2H_6 results in __ mol of H_2O

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Mole Ratio's continued

- $2C_2H_6$ + $7O_2$ → $4CO_2$ + $6H_2O$
- Ex#1 How many moles of water are produced from the combustion of 3 mol of ethane gas?
- Ex #2 If 5 moles of ethane are burned, how much carbon dioxide is produced?

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Empirical Formula

- ________________ whole number ratio of elements in a compound or molecule.
- Ex. Glucose $C_6H_{12}O_6$→ _____
- Ex. $C_{54}H_{110}$ would be what?

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Molecular Formula

- ________ number of atoms in a compound or molecule
- Whole number __________ of empirical formula
  - – Empirical formula glucose (CH_2O)
  - – Actual formula → $6(CH_2O)$ → $C_6H_{12}O_6$
- Ex.What is the molecular formula for β-carotene if its empirical formula is C_5H_7 and molar mass is 536g/mol?
  - – C_5H_7 →_____g/mol
  - – 536g/_____g is a multiple of _→ __(C_5H_7) = _____

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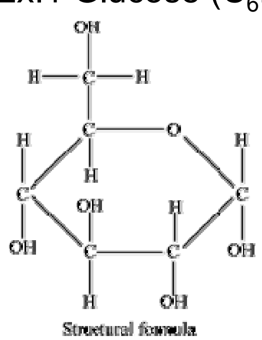
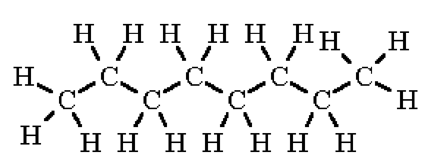
Other types of Formulas

- Structural Formulas: shows the ______, ________, ___________ and ___________ in a molecule (does not need to show lone pair ___________)
- Ex.1 Glucose ($C_6H_{12}O_6$) Ex.2 Octane (C_8H_{18})



Structural formula for glucose



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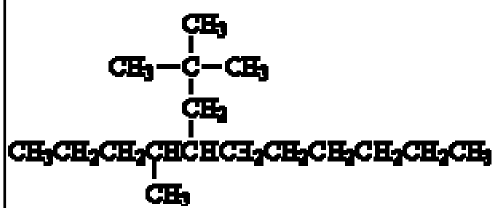
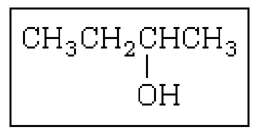
Other types of Formulas

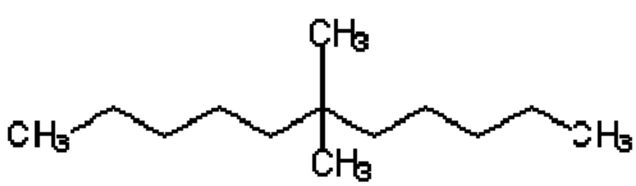
- Condensed Structural Formulas: show ______, _________ and __________of atoms, *but do not show all* ______
- Ex. #1 Ex. #2





Other types of Formulas

- Skeletal Structures: show general ______ of molecule and ________ present, *but not all* ______
- Each bend represents a point where a ___ atom would exist



Types of Chemical Reactions and Equations

- Word equation
  - ____________ of Methane and __________ of oxygen yield ______ of carbon dioxide and ___________ of water
- Formula equation
  - _____+ _____ → _____ and _____
- Reversible reaction
  - Represented by a double arrow
    - ____ or ___________

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