TOC/Index/Labs

C11 - 0.0 - Methods 11

Attach Prefix Exponent to the Base Unit!

Giga $= 10^{9} = 1000000000$
Mega $= 10^{6} = 1000000$
Kilo $= 10^{3} = 1000$
Base $= 10^{0} = 1$
deci $= 10^{-1} = \frac{1}{10}$
centi $= 10^{-2} = \frac{1}{100} = 0.01$
milli $= 10^{-3} = \frac{1}{1000} = 0.001$
micro $= 10^{-6} = \frac{1}{1,000,000}$ (μ)
nano $= 10^{-9} = \frac{1}{1,000,000,000}$
pico $= 10^{-12} = \frac{1}{1,000,000,000,000}$

$\frac{1L}{1kg}$ Water

$\frac{1mL}{1cm^3}$ Fluid

Proportions (=Fractions) Unit Conversions!

$$\frac{?}{400m} = \frac{100cm}{1m} \quad 400\cancel{m} \times \frac{100cm}{1\cancel{m}} = 40000cm$$

$$Given\ units \times \frac{desired\ units}{given\ units}$$

Sig Figs
123 3 *Sig Figs*
0.4 1 *Sig Fig*
505 3 *Sig Figs*
0.40 2 *Sig Figs*
10 1 *Sig Fig*
10. 2 *Sig Figs*
1.0E2 2 *SigFigs*
Add: Round to least # of decimal places.
Multiply: Round to least # of sig figs.

Calculator Scientific Notation

$\frac{(2+3)}{(4+6)}$ Brackets

$5 \times 10^3 = 5E3 =$ 5000

5 | 2nd | EE | 3 Above 7

Periodic Table Key
Families/Metal/Nonmetal
States (s),(l),(g),(aq)
Atomic #/Mass/Charge
$\#e^- = \#p^+ - charge$
$\#n = GMM - \#p$
Bohr/Lewis/Vespr/Polarity

Combining Capacity!

$Na^{1+}\ O^{2-}$

Na_2O_1

$\frac{atoms}{molecule}$ $\frac{molecule(s)}{molecule(s)}$

Naming
Compounds
Acids/Bases

Balancing/Predicting Equations
Types: S/D/SR/DR/C/N
Radioactivity/Fus/Fission

Metals Trade
Non-Metals

Radioactive Decay , α, β, γ
Fission/Fusion

Read Scale
Round to half small increment*
(Bottom Meniscus)

Accuracy vs Precision

Mono	1	Meth
Di	2	Eth
Tri	3	Prop
Tetra	4	But
Penta	5	Pent
Hexa	6	Hex
Hepta	7	Hept
Octa	8	Oct
Nona	9	Non
Deca	10	Dec

Nucleus (p&n)
Atoms vs Ions
Charge: $p^+/e^-/n^0$
Compound/Molecule

Valence Shells
2,8,8,18,18 …

Noble gases
No valence electrons
Hence, Not reactive

Phases
$(s) = solid \quad (l) = liquid$
$(g) = gas \quad (aq) = aqueous$

$H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(l)}$

Diatomic
N_2 O_2 F_2 H_2 Cl_2 Br_2 I_2
Only (g)
"HOF-BrINC-I"

Bonding

Ionic
Metals/Non-metals
Transfer Electrons
Combining Capacity (Switch!)
Multivalent $Fe^{+2}\ (II)\ Fe^{+3}\ (III)$
Polyatomic $(NH_4)^+$ (Brackets)

Covalent
Non-metals/non-metals
Share Electrons
Prefixes

$\alpha, \beta, \gamma, n, e^+$

Energy Δ:Change
$\Delta H > 0, Endothermic\ (Gives\ Heat)$
$\Delta H < 0, Endothermic\ (Takes\ Heat)$

Rutherford - Father of nuclear physics (atom).
Thompson - Plum pudding model

Isotope: Element with a different number of neutrons → different atomic mass.

$\%\ Yield$
$\%\ Purity$

Percent Composition (by mass) CH_4 75%C, 25%H

$Assume\ 1\ mole$
$Assume\ 100g$

$$\% = \frac{Part}{Total} \times 100\%$$

Molecular Formula C_2H_8
Empirical Formula CH_4
Molar Ratio 1 : 2 : 1

$$N = \frac{Molecular\ Mass}{Empirical\ Mass}$$

Conservation Laws :
Mass/Matter cannot be created or destroyed.
Energy cannot be created or destroyed.

$Q = mc\Delta T$
$\Delta Q = -\Delta \boldsymbol{Q}$
$Q = mH_{f/v}$

Labs Steps
Title/Intro
Procedure
Results
Discussion
Conclusion

C11 - 0.0 - Methods 11

Equal moles of different elements contains the same number of particles.

Avagadro's # : 6.02×10^{23}
Dozen Pairs* $= 24$

mass<->moles<->particles/atoms/molecules
<->Volume<->Density
<->Molarity<->

mol

Molar Mass $GMM: \frac{g}{mol}$

Mole Ratio $\frac{mol\ (s)}{mol\ (s)}$

$STP: \frac{22.4L}{mol}$ $1\ atm$ 0^oC

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

$1AMU = 1.67 \times 10^{-27} kg$ (Atomic Mass Unit)
Mass p/n=1AMU, Mass e $= \frac{1AMU}{1850}$

$\frac{6.02E23\ particles/atoms/molecules}{mol}$

$\frac{12\ eggs}{dozen}$

Concentration $c = \frac{n}{V}$ $c_1v_1 = c_2v_2$ $c_1v_1 + c_2v_2 = c_2v_3$

Stoichiometry: Relationship between amount of reactants/products of a chemical reaction.

Reactions
Dissociation
Dissolution
Precipitation
Titration
Crystallization

Limiting/Excess!!!
Theoretical/Actual Mole Ratio

Excess is smaller ratio of moles to coefficients

Solution Types
"Like dissolves like"
Solubility Chart

Net Ionic Equation*
$Pb^{2+}_{(aq)} + 2Cl^{-}_{aq} \rightarrow PbCl_{2(s)}$

Periodic Trends
Properties
Notation/Core
Hund/Aufbau/Pauli
Energy Levels/Orbitals
Electronegativity
Ionization Energy
Electron Affinity
Size Atoms/Ions
Hybridization

Opposite charges attract.
Like charges repel.
-proportional to charge.
-inversely proportional to distant.

Electrostatic Force: the force between two charged particles.

$F = \frac{kqq}{r^2}$ Double distance Quarter Force

Electron Configurations (Full/Core)

Organic Chemistry:
Condensed/Full/Line Structure
Naming
1) *Alphabetical*
2) *Smallest #*
1) *Longest Alkane Chain*
2) *Attached Alkyl*
2) *# − Location of attached Alykl/@*

Count from before the double/triple bond
Double/Triple Bond Overrides Alphabetical!
Group (last) Overrides Ethyl
Count Away from Group
Right to Left*

Avagadro's Hypothesis:
= V's of gas @STP
= # particles

Gas Laws (R*)
$K = C^o + 273.15$
Atm/torr/kPa/mmHg

Gas Laws

$\frac{P_{pA}}{n_A} = \frac{P_{pB}}{n_B} = \frac{P_T}{n_T}$

$P_{Total} = P_{pA} + P_{pB} + \cdots$

P_p : Partial Pressure

$1atm = 101.3\ kPa$
$= 760\ mmHg$

$1\ bar = 100kPa$
$1\ psi = 51.7mmHg$
$1\ Torr = 1mmHg$
$760\ Torr = 1atm$

Combined Gas Laws

$\frac{PV}{T} = k$ $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Ideal Gas Law* (*K*)

$PV = nRT$

$\frac{V_1}{n_1} = \frac{V_2}{n_2}$ Lassuc/Boyle/Charles/Dalton/Ideal/Comb

$R = 8.314 \frac{kPaL}{molK} = \frac{101.3\ kPa\ \times 22.4\ L}{1\ mol \times 273\ K}$

$R = 0.0821 \frac{atmL}{molK} = \frac{1atm \times 22.4\ L}{1\ mol \times 273\ K}$

Organic Chemistry: CH_4
Alkanes/Ethyls $R - CH_3$
(Linear/Branched/cyclo)
alkene: = (diene) alkyne: ≡
Isomers (Structural/cis/trans)
akyl halides - Halogens
alcohol (di,triol)
aldehyde = O at end
Keytones = O Not at end
carboxylic acid $R - COOH$
amine $R - NH_2$
amide $R - CONH_2$
ester oxy $R - O - R$
ether oate $R - COO - R$
Aromatics (Benzenes)
@, < #, < 2,3, > 1 > @
$Group < yl, R \rightarrow L$
Away From Group
Sec 1/Iso 2/Tert 3