

Midterm Review Notes -

Unit 1 – Intro

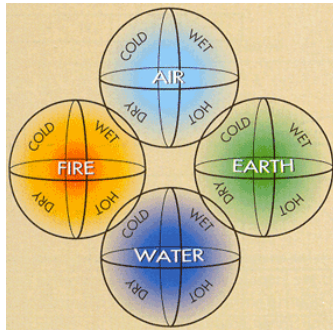
- 3 States of Matter
 - Solid – definite shape, definite volume, very little molecular movement
 - Liquid – definite volume, takes shape of container, molecules move faster
 - Gas – does not have a definite volume or shape, molecules are moving very fast
- Properties
 - Physical – anything that can be observed without changing the identity of the substance
 - Chemical - characteristics which are exhibited as one substance is chemically transformed into another
- Changes
 - Physical - change in which the matter's physical appearance is altered, but composition remains unchanged; can be reversed
 - Chemical – change that alters the composition of the original matter; can't be reversed
- Classification of Matter
 - Pure Substance – uniform properties throughout the substance
 - Element – composed of only 1 type of atom
 - Compound – composed of multiple atoms, but cannot be separated
 - Mixture
 - Heterogeneous – composition with a non-uniform composition, components can separate and vary in composition
 - Homogenous – composition is mixed uniformly throughout, doesn't separate out
 - Solvent – liquid that does the dissolving
 - Solute – solid that is being dissolved

Unit 2 - The Atom

- Protons - positive charge, inside the nucleus, 1 amu; tell the identity of the atom
- Electrons - negative charge, orbits the nucleus (outside), 1/2000 amu; give atoms their chemical properties
- Neutrons - neutral charge, inside the nucleus, 1 amu
- Ions - atoms with either extra electrons or missing electrons
- Isotopes - atoms with the same # of protons, but differing numbers of neutrons, which leads to different atomic masses
- Neutral atoms - atoms that contain the same number of protons and electrons
- Lewis structure - shows the bonding of valence electrons & lone pairs
- Valence electrons - number of electrons in the outer shell, can only be 8
- Orbital diagram - show individual orbitals in each energy level
 - s - holds 2
 - p - holds 6
 - d - holds 10
 - f - holds 14
- Electron Configuration Rules
 - Aufbau – must start at the lowest energy level & fill orbitals in the correct order

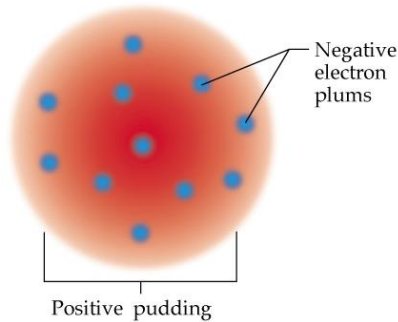
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- Hund – (pizza rule) every orbital has to have 1 electron first before second electrons can be given
- Pauli – electrons have to go in opposing directions
- Energy Levels
 - E level 1 - holds 2
 - All other E levels - holds 8
- Models of the atoms
 - Democritus - atomos
 - Dalton - first atomic theory
 - JJ Thomson - discovered electrons; Plum Pudding Model
 - Rutherford - discovered protons & nucleus; Gold Foil Experiment
 - Bohr - Bohr model; electrons move around nucleus in shells
 - Chadwick - discovered neutrons & had no charge
- Atomic Models

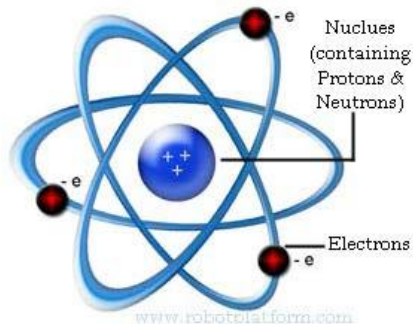


- Greek

Thompson plum pudding model of the atom

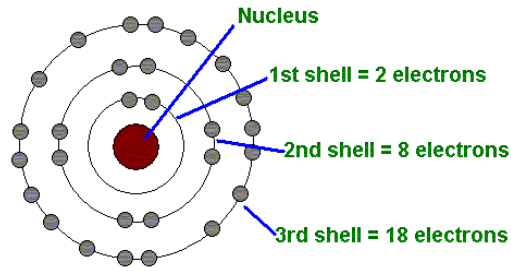


- JJ Thomson



- Rutherford

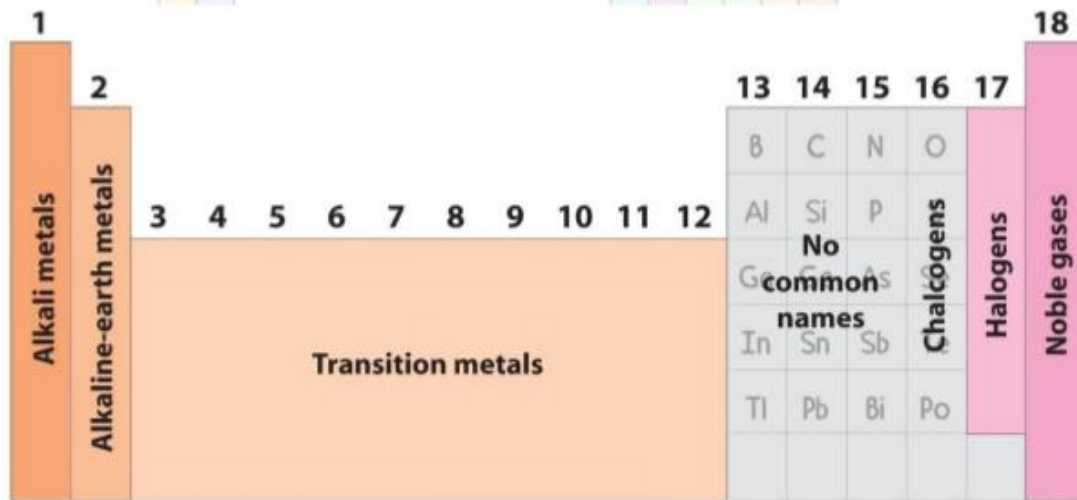
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- Bohr

Unit 3 - The Periodic Table

- Periodic Table locations



Group # = Valence Electron #

- PT Valence Electrons & Energy Levels

Row # = Energy Level

	1A	2A	3A	4A	5A	6A	7A	8A
Row 1	1 H 1.01							2 He 4.00
Row 2	3 Li 6.94	4 Be 9.01	5 B 10.8	6 C 12.0	7 N 14.0	8 O 16.0	9 F 19.0	10 Ne 20.2
Row 3	11 Na 23.0	12 Mg 24.3	13 Al 27.0	14 Si 28.1	15 P 30.1	16 S 32.1	17 Cl 35.5	18 Ar 39.9
Row 4	19 K 39.1	20 Ca 40.1	31 Ga 69.7	32 Ge 72.6	33 As 74.9	34 Se 79.0	35 Br 79.9	36 Kr 83.8
Row 5	37 Rb 85.5	38 Sr 87.6	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 133
Row 6	55 Cs 133	56 Ba 137	81 Tl 204	82 Pb 207	83 Bi 209	84 Po (209)	85 At (210)	86 Rn (222)
Row 7	87 Fr (223)	88 Ra (226)						

Unit 4 - Nomenclature & Bonding

- Naming Rules

Type I Ionics-

1. Cation named, then anion
2. Cation gets name from element
3. Anion gets name from element & add suffix **-ide**
4. Combine 2 & 3 for name

Ex: LiCl Lithium chloride

Type II Ionics Multiple Cations
* Transitions

1. Cation 1st, then anion
2. Cation gets element name & **Roman numeral** for charge
3. Anion name from element & **-ide**
4. Combine 2 & 3

Ex. CuCl_2 Copper(II) chloride

Type III Binary Covalents-

1. 1st element named for element
2. 2nd element named as if it were an anion \bar{c} **-ide** suffix
3. Prefixes are used to denote # of atoms

Mono-1	Tri-3	Penta-5	Hepta-7	Nona-9
Di-2	Tetra-4	Hexa-6	Octa-8	Deca-10

* Mono never used in 1st element!

Ex. PCl_3 Phosphorous trichloride

Polyatomics- 2 or more atoms bound together

- * Given special names [memorize]
- * OXYanions ~ anions \bar{c} different #s of O
- ↓ # = -ite ↑ # = -ate

Ex. NO_2^- Nitrite NO_3^- Nitrate

Acids -

1. If anion doesn't contain O name \bar{c} prefix hydro- & suffix **-ic** [Ex. HCl Hydrochloric Acid]
2. If anion contains O name is from root of central element in anion \bar{c} suffix of **-ic** or **-ous**

-ate uses -ic -ite uses -ous
 * See polyatomics

**** O - No Hydro**

Ate ic

Ite OUS **

Ex. H_2SO_4 → Sulfate Sulfuric Acid

Ex. H_2SO_3 → Sulfite Sulfurous Acid

- Polar vs Covalent ID Rules
 - Lone pair on central atom = POLAR
 - Charge on molecule = POLAR
 - If neither of the above are true & the lewis structure is symmetrical, symmetry trumps polarity = NONPOLAR

Midterm Review Notes -

- Intermolecular vs Intramolecular
 - INTER - attractions between molecules (van der Waals)
 - Ionic
 - H-Bonds (H & F, O, or N)
 - Dipole
 - London Forces
 - INTRA - attractions within the molecule (electronegativity)
 - Ionic 1.7+
 - Polar 0.5 to 1.69
 - Nonpolar 0.49 & below
- Electrolyte vs Nonelectrolyte
 - Electrolyte - any substance that separates (ionizes or dissociates) into ions in water; conducts electricity
 - Nonelectrolyte - does not conduct electricity nor does it break down in water

Unit 5 – Chemical Reactions

- 5 Rxn Types (Written as Reactants \rightarrow Products)
 - Synthesis – 2 elements become 1 molecule
 - $A + B \rightarrow AB$
 - Decomposition – 1 molecule breaks down into 2 atoms
 - $AB \rightarrow A + B$
 - Single Replacement – 1 element takes the place of the like element in a molecule)
 - $AB + C \rightarrow A + CB$
 - If C is + then it replaces the + atom in AB; if C is – then it replaces the – atom in AB)
 - Double Replacement – cations and anions switch “partners” to form new compounds
 - $AB + CD \rightarrow AD + CB$
 - Combustion – hydrocarbon reacts with oxygen to form carbon dioxide and water
 - $C_xH_y + O_2 \rightarrow CO_2 + H_2O$
- Signs a Rxn has occurred
 - Formation of a precipitate (solid or liquid)
 - Formation of a gas
 - Heat or light is given off (change in temperature)
 - Change in color
 - Change in odor
- Driving Forces of a Rxn
 - Double Replacement
 - Formation of a solid (*most common)
 - Formation of water (H₂O in products)
 - All others
 - Formation of gas (H₂, N₂, O₂, F₂, Cl₂)
 - Transfer of electrons (*most common)