L-1 / 04.12.2023 /

Quiz - 30% (2 out of 3)

Midterm - 30%

Final - 30%

Attendance - 5%

Chapter-1

⊛ Quantitative Data: Which we can measure ~~and~~ in terms of unit such as mass (g), length (cm), volume (mL), temperature.

⊛ Qualitative Data: Categorical data, that can't be measure in terms of number or unit.

⇒ The sky is $\boxed{\text{blue.}}$

⊛ Matter: Anything that occupies space and has mass is Matter.

- Matter
  - Pure substance (only one component)
    - Elements
      - atoms
    - Compounds (Diff. elements)
      - Molecules (Single type of elements)
  - Mixtures
    - Homogeneous
    - Heterogeneous

State of Matter:

i. Solid

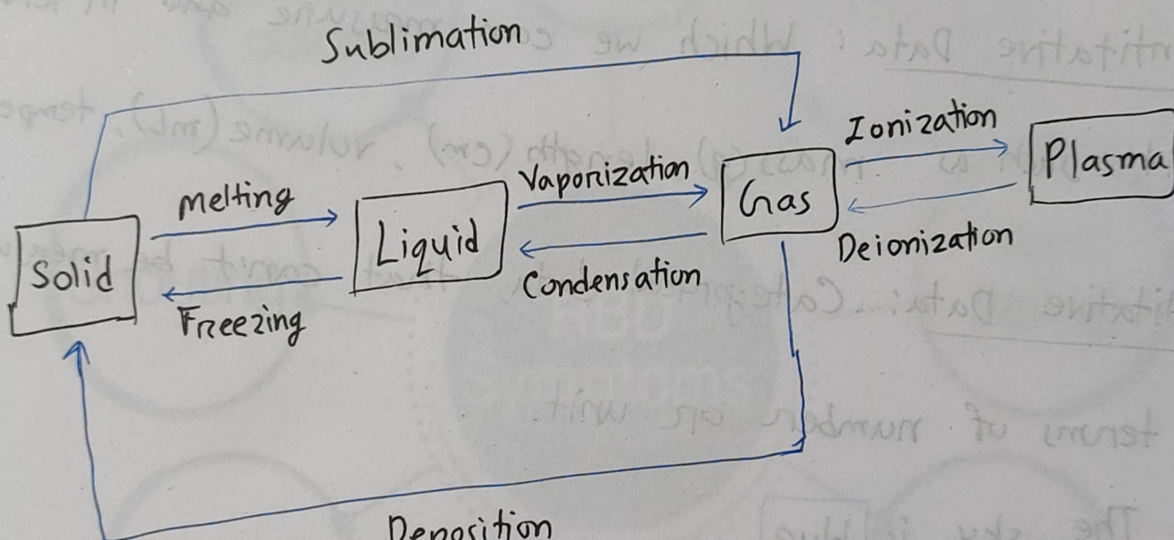
ii. Liquid

iii. Gas

Difference between the tree state of matter.

⇒ Slide Page - 20

Transformation: Enthapy of the System.



- The smallest bits of any matter are called atoms.

- Symbol of gold ⇒ Au ⇒ aurum

  iron ⇒ Fe ⇒ ferrum

  copper ⇒ Cu ⇒ cuprum

  Mercury ⇒ Hg ⇒ hydrargyrum

  Lead ⇒ Pb ⇒ plumbum

  Sodium ⇒ Na ⇒ natrium

  Silver ⇒ Ag ⇒ argentum

Three types of Atoms (118)

i. Metals ⇒ 94 → good conductor of heat and electricity

ii. Nonmetals ⇒ 18 → poor conductor

iii. Metaloids ⇒ 6 → intermediate between metals and non-metals

Metals :

⇒ shiny

⇒ conduct heat & electricity

⇒ malleability

⇒ solid except mercury

Nonmetals :

⇒ Don't have the properties of metals

⇒ Solid, Liquid or Gas

Metalloids :

⇒ Semi-conductor

⇒ Some shiny, some dull

⇒ Somewhat malleable and some conduct heat & electricity.

⇒ Solids

⇒ B, Si, Ge, As, Sb, Te..

Difference between Metal & Nonmetal

$\boxed{\Rightarrow \text{Slide page 33}}$

⊛ Natural abundance:

Oxygen = 45.5%

Silicon = 27.2%

Aluminum = 8.3%

Iron = 6.2%

Calcium = 4.7%

Magnesium = 2.8%

All others = 5.3%

⊛ Human Body abundance:

Oxygen = 65%

Carbon = 18%

Hydrogen = 10%

Nitrogen = 3%

Calcium = 1.6%

Phosphorus = 1.2%

All others = 1.2%

⊛ Molecule: A molecule is formed when two or more atoms join together in fixed proportions.

⊛ Compounds: A compound is a molecule that contains at least two different elements.

* All compounds are molecules ~~bun~~ but not all molecules are compounds.

H ⟹ H_2 ⟹ H_2O

↓ atom ↓ molecule ↓ compound

* Mixture:

Combination of two or more substance, in which substance will retain their distinct identities.

⟹ Air, Soft drinks, Milk, Cement.

(i) Homogeneous:

⟹ Solution are homogenous mixture

⟹ composition of mixture same throughout.

⟹ Cannot see individual components

⟹ Components cannot be separated easily.

⟹ One phase or state

(ii) Heterogeneous:

⟹ composition of the mixture is not same.

⟹ components are visible.

⟹ can see individual components.

⟹ components can be separated easily.

⊛ Mixtures can be separated by physical method.

Compounds can be separated only by chemical method.

⊛ Properties of Matter:

(i) Physical Properties

(ii) Chemical Properties

⊛ Physical Properties:

⇒ can be measured and observed without changing the composition or identity of a substance.

⇒ Physical changes is a reversible process.

$$\begin{tikzcd}[column sep=large]
\text{Ice} \arrow[r, shift left, "\text{heat}"] \arrow[rd, phantom, ""] & \text{Water} \arrow[l, shift left, "\text{freezing}"] \arrow[r, shift left, "\text{heat}"] & \text{Vapor} \arrow[l, shift left, "\text{freezing}"] \\
\text{MP} & & \text{BP}
\end{tikzcd}$$

⇒ Properties: Melting Point, Boiling Point, Density, Freezing Point, Mass.

⇒ change in shape, size, phase

⊛ Chemical Property:

⇒ can be observed only when matter undergoes a chemical change.

⇒ after changes, matters loose their identities and new substance is formed.

⇒ chemical change is a irreversible process.

⊛ In a physical change, matter changes form but not chemical identity.

⊛ In a chemical change, a chemical reaction occurs and new products occur.

⊛ Exothermic Reaction: Release energy

the reactants have greater energy than the products and energy is released as the reaction occurs.

⊛ Endothermic Reaction: absorbed energy

the products have more energy than the reactants, and energy is absorbed as the reaction occurs.

⊛ wood burning ⇒ Exothermic

ice melting ⇒ Endothermic

Extensive Property:

⇒ depends on how much matter is being consider.

⇒ mass, length, volume.

Intensive Property:

⇒ Doesn't depends upon how much matter is being consider.

⇒ density, temperature, color.

Macroscopic Property:

⇒ anything seen with the naked eye and they can be determined directly.

⇒ Length, Volume, Mass, Temperature.

(Like, extensive property)

Microscopic Property:

⇒ includes atoms and molecules.

⇒ things not seen with the naked eye and they can be determined indirectly.

⇒ Atomic radius etc.

SI Units:

⇒ in 1960

⇒ has seven SI base units.

⇒ larger or smaller unit for a physical quantity is indicated by an SI Prefix.

⇒ Length ⇒ meter ⇒ m

Mass ⇒ Kilogram ⇒ kg

Time ⇒ second ⇒ s

Temperature ⇒ kelvin ⇒ k

Amount of substance ⇒ mole ⇒ mol

Electric current ⇒ ampere ⇒ A

Luminous intensity ⇒ candela ⇒ cd

Metric Prefix Scale:

⇒ Slide page 54.

Practice Slide Page – 41, 48

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- Mass ⇒ Symbol "m" ⇒ unit "kg"
- Weight ⇒ force "f" ⇒ Newton "N"
- Volume ⇒ V

$1 mL = 1 cm^3$

$1 L = 1 dm^3$

- Density, $d = \frac{m}{V} = \frac{mass}{volume}$

$= g/cm^3$ or g/mL

- Length:

1 km = 0.6214 mi

1 m = 39.37 in = 1.094 yd

1 ft = 30.48 cm

1 in = 2.54 cm

- Mass:

1 kg = 2.205 lb

1 lb = 453.59 g

1 oz = 28.35 g

- Volume

1 L = 1000 mL
= 1000 cm^3

1 L = 1.057 qt

1 U.S. gal = 3.785 L

Temperature Conversation:

$\boxed{K = C + 273}$

$C = K - 273$

$\boxed{F = 1.80C + 32}$

~~C = (F-32)~~

$C = (F-32)/1.80$

Significant Figures:

⇒ any digit that is not zero is significant

⇒ Remove the decimal point. then remove all zero in left side. Then count the digit. Multiplyer is no countable

For multiplication or division, the limiting term is the one with the smallest number of significant figures.

⇒ $4.51 \times 3.6666 = 16.536366 = 16.5$

4.51 ↑ 3 sig figs ↑ Limiting sig figs

3.6666 ↑ 5 sig figs

16.536366 ↑ 8 sig figs ↑ Need to round & use ceil & floor

16.5 ↑ round to 3 sig figs

$\frac{8.315}{298} = 0.0279027 = \underbrace{0.0279 = 2.79 \times 10^{-2}}_{\text{Both Connect}}$

298 ↓ Limiting

* For addition or subtraction, the limiting term is the one with the smallest number of decimal places.

$$\begin{array}{r} 12.11 \\ 18.0 \\ + \quad 1.013 \\ \hline 31.123 \end{array}$$

18.0 → Limiting term, only one decimal

31.123 → 31.2

→ need to round up to one decimal.

* Do some exercise from Slide

Chapter-2

* Dalton Model:
  - ⇒ 1803
  - ⇒ Tiny, Solid sphere

* Thomson Model
  - ⇒ 1897
  - ⇒ Discover electron, embeded in sphere

* Hantaro Nagaoka
  - ⇒ 1904
  - ⇒ atom has ~~ne~~ nucleus. electron moves around saturn

* Rutherford Model
  - ⇒ 1911
  - ⇒ finds small, dense, positively charged nucleus.
  - ⇒ electron moves around the nucleus.

* Bohr Model
  - ⇒ 1913
  - ⇒ electron moves in a circular orbit at fixed distance from nucleus.

* Louis de Broglie
  - ⇒ 1923
  - ⇒ electrons have some properties of waves.

* Erwin Schrodinger
  - ⇒ 1926
  - ⇒ developed mathematical equation to describe the motion of electrons in atoms.
  - ⇒ electron cloud model

* James Chadwick
  - ⇒ 1932
  - ⇒ existence of ~~nut neo~~ neutrons. & protons.

* Dalton Atomic Theory :

  (i) Elements are composed of extremely small particles called atoms.

  (ii) All atoms of a given element are identical, having the same size, mass and chemical properties. The atoms of one element are different from atoms of all other elements.

(iii) Compounds are composed of atoms of more than one element. In any compound, the ratio of the numbers of atoms of any two of the elements present is either an integer or a simple fraction.

(iv) A chemical reaction involves only the separation, combination, or rearrangement of atoms. it does not result in their creation or destruction.

* Niels Bohr, student of Rutherford's.

* Bohr proposed that an electron is found only in specific circular paths or orbits around the nucleus.

* Each electron has a fixed energy = an energy level

* Electrons can jump from one energy level to another and can not be or exist between energy levels.

* A Quantum of energy:

  ⇒ is the amount of energy needed to move an electron from one energy level to another energy level.

* To move from one level to another, the electron must gain or lose ~~energy~~ the right amount of energy.

* The higher the energy level, the farther it is from the nucleus.

* Gain energy to move to higher level.

Lose energy to move to lower energy level.

* Atomic Spectra

⇒ When atoms absorb energy, electron move into higher energy levels. These electrons then lose energy by emitting light, when they return to lower energy.

⇒ the closer the orbits are in energy, the lower the energy of the ~~photton~~ photon emitted.

⇒ Lower energy photon = longer wavelength.

* How many seniese given in the Bohr Model of hydrogen?

⇒ Three.

(i) Lyman

(ii) Balmer

(iii) Paschen

Range of Light:

Violet Light ⇒ 380-450 nm

Blue Light ⇒ 475 nm

Green Light ⇒ 495-570 nm

Yellow Light ⇒ 570 nm

Orange Light ⇒ 590 nm

Red Light ⇒ 620-750 nm

important for MCQ

- There are many forms of radiant energy, called as Electromagnetic radiation.

- All light is part of the EM specturm:

  Invisible ⇒ Gamma, X-rays, UV, IR, microwaves, radio waves

  Visible ⇒ Wavelength from 380 to 740 nm.

⇒ Radiant energy can be described in terms of wave.

⇒ A wave is characterized by its length, amplitude & frequency.

- Longer wavelength ⇒ Lower frequency

  Shorter wavelength ⇒ Higher Frequency

- Schrodinger Equation

$$\hat{H}\psi = E\psi$$

Heisenberg Uncertainty Principle

⇒ We can not know both the position and momentum of a particle at a given time.

$$\Delta x \cdot \Delta (mv) \geq \frac{h}{4\pi}$$

x = position

mv = momentum

h = Planck's constant

Broglie Wave:

$$\lambda = \frac{h}{p}$$ $p \rightarrow$ momentum

There are two region of an atom.

⇒ Centre of atom ⇒ Protons and neutrons

⇒ Electron "Cloud" ⇒ Area surrounding nucleus containing electrons.

The center of an atom is called the nucleus.

⇒ Nucleus contains 2 types of subatomic particles.

⇒ Protons = positive (+)

⇒ Neutrons = no charge, neutral

⇒ Nucleus is always positive.

(*) Cloud of electron:

⇒ electrons spin quickly

⇒ are negatively (-) charged

⇒ are very small

⇒ Have a mass of 0 AMU.

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(*) A system of one or more electrons bound to a nucleus is called an atom.

(*) Nuclear model of the Atom: Rutherford's Experiment

⇒ Atom has a tiny dense central core or the nucleus which contains practically the entire mass of the atom, leaving the rest of the atom almost empty.

(*) Proton:

⇒ Proton is positively charged particle and remains in the nucleus of the atom.

(*) 1932, Sir James Chadwick discovered neutron.

⇒ He found that a new particle were ejected which had a property like γ-ray. It had almost the same mass as the proton and has no charge.

⇒ third item of sub atomic particle

⇒ ellectronically neutral

⇒ mass slightly higher than proton.

⇒ remains with proton in the nucleus.

⊛ Atom is made of 3 types of particles

(i) Protons (+)

(ii) Neutrons (0)

(iii) Electrons (-)

in Nucleus (+ charge) = electrons (- charge)

⊛

atomic number

A → # of proton

6

C

12.011

Z

⊛

Mass Number (proton + neutron)

A

C

Z

Atomic number = proton number

⊛ electron number on a shell ⇒ $2n^2$

⊛ Isotopes ⇒ Atoms that have same atomic number but different mass number.

Isobars :

iso = same

barys = heavy

⇒ the atoms which have the same mass number but different atomic numbers are called isobars.

⇒ $^{40}_{18}Ar$, $^{40}_{19}K$, $^{40}_{20}Ca$

Isotones :

⇒ Atoms which have different atomic number and different atomic masses but the same number of neutrons are called Isotones.

⇒ $^{14}_{6}C$, $^{15}_{7}N$, $^{16}_{8}O$

⇒ different elements having entirely different atomic structure.

⇒ They have different physical and chemical properties.

Relative Atomic Mass (RAM)

$$(A_r) \Rightarrow \frac{\Sigma(\text{Isotopic mass} \times \%\ \text{abundance})}{100}$$

⇒ Do some math, finds some Average mass of given Isotopes.

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⊛ Compound Formation:

$Na(11) = 1s^2\ 2s^2 2p^6\ 3s^1 \xrightarrow{-e} Na^+ (10)$

→ behave like Ne (10)

structure:	s	sp	sp	sdp	sdp	sfdp	sfdp
	1	22	33	434	545	6456	7567

$Cl(17) = 1s^2\ 2s^2 2p^6\ 3s^2 3p^5 \xrightarrow{+e} Cl^- (18)$

→ behave like Ar (18)

$Al^{3+} + O^{2-} = Al_2O_3$

$Na^+ O^{2-} = Na_2O$

$Al^{3+} + N^{3-} = AlN$

$NO_3 \Rightarrow$ Nitrate

$NO_2 \Rightarrow$ Nitrite

$N \Rightarrow$ Nitride

⊛ Outer shell → valence electron

⊛ Inner shell ⇒ Core shell

⊛ What is stability? ⇒ stable number of electrons = 8 e^-

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* Periodic table arranged by increasing atomic number.

⇒ rows called periods

⇒ Columns called families or groups

⇒ same group have similar chemical properties.

⇒ Same number of valence electron

* Column 1

⇒ alkali metals

Column 17 ⇒ Halogens

Column 18 ⇒ Noble gases ⇒ monatomic gases

⇒ very stable

* diatomic molecule ⇒ only two atoms

⇒ H_2, N_2, HCl, CO

* polyatomic molecule ⇒ more than two atoms

⇒ O_3, NH_3

* Empirical formula: smallest whole-number ratio of atoms present in a compound.

* Molecular formula: Actual number of each type of atom present in a given compound.

Molecular formula	Empirical formula
C_6H_6	CH
$C_6H_{12}O_6$	CH_2O
N_2H_4	NH_2

Percent Composition :

H_2O

Molar mass of water $= 2\times H + 1\times O$

$= 2\times 1 + 1\times 16$

$= 2+16$

$= 18$ gm/mol $\Rightarrow$ amu

% of H in water $= \dfrac{\text{Atomic mass of H} \times \text{number of H}}{\text{Total Molar mass}}$

$= \dfrac{1\times 2}{18}\times 100\%$

$= \dfrac{1}{9}\times 100\% = 11.11\%$

% of O in water $= \dfrac{16\times 1}{18}\times 100\%$

$= 88.89\%$

Na_2O (Na → 23, O → 16)

molar mass $= 23\times 2+16$

$= 62$ gm/mol

$$\left.\begin{aligned} Na &= \frac{2\times 23}{62}\times 100\% = 74.19\% \\ O &= \frac{1\times 16}{62}\times 100\% = 25.81\% \end{aligned}\right\} 100\%$$

(*)

$$\frac{C}{74.03\ gm} : \frac{H}{8.70\ gm} : \frac{N}{17.27\ gm}$$

$$\frac{74.03\ gm}{12\ gm/mol} \quad \frac{8.70\ gm}{1} \quad \frac{17.27\ gm}{14}$$

$$= \frac{6.16\ mol}{1.238} : \frac{8.70\ mol}{1.238} : \frac{1.238\ mol}{1.238}$$ → dividable br smallest

$$= 5.008 : 7.07 : 1$$

$$= 5:7:1$$

→ E.F ⇒ C_5H_7N

(*)

$$\frac{\overset{12}{C}}{10.06\%} : \frac{\overset{1}{H}}{0.84\%} : \frac{\overset{35.5}{Cl}}{89.10\%}$$

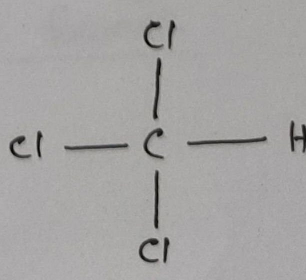
$$\Rightarrow \frac{10.06\ gm}{12\ gm/mol} : \frac{0.84\ gm}{1\ amu} : \frac{89.10\ gm}{35.5\ amu}$$

$$\Rightarrow \frac{0.883}{0.84} : \frac{0.84}{0.84} : \frac{2.5098}{0.84}$$

$$\Rightarrow 1.05 \approx 1 : 1 : 2.976 \approx 3$$

$$\Rightarrow 1:1:3$$

→ E.F = $CHCl_3$



⇒ Tri cloromethile/Cloroform

* $M.F = E.F \times n$

Given,

$MW = 90\ gm = CH_2O$

$\therefore n = \frac{90}{CH_2O} = \frac{90}{12 + 2\times 1 + 16} = 3$

$\therefore M.F = E.F \times n$

$= CH_2O \times 3$

$= C_3H_6O_3$

* Ions
  - → (+) cation
  - → (−) anion

*

$Na^+ \quad O^{2-} \Rightarrow Na_2O$

$Na^+ \quad SO_4^{2-} \Rightarrow Na_2SO_4$

$Al^{3+} \quad SO_4^{2-} \Rightarrow Al_2(SO_4)_3$

$Ca^{2+} \quad N^{3-} \Rightarrow Ca_3N_2 \Rightarrow$ Calcium nitride

$Ca^{2+} \quad NO_3^- \Rightarrow Ca(NO_3)_2$

$H_2^{2+} \quad SO_4^{2-} \Rightarrow H_2SO_4 \Rightarrow$ Sulfate

$H^+ \quad NO_3^- \Rightarrow HNO_3$

↳ ~~Nitrate~~ Nitric Acid

Chapter 7 & 8

General Chemistry

Niels Bohr

⇒ Danish physicist

⇒ student of Rutherfords

⇒ proposed that an electron is found only in specific circular paths, or orbits, around the nucleus.

⇒ The higher the energy level, the farther it is from the nucleus.

⇒ The wavelengths of emitted light depend on the element.

Define Wave Formula. (de Broglie)

⇒ For light ⇒ $E = h\nu = hc/\lambda$

⇒ For particles ⇒ $E = mc^2$

⇒ $mc = h/\lambda$

⇒ (mass) × (velocity) = h/λ

⇒ λ for particles is called the de Broglie wavelength

Schrodinger Equation:

$$\hat{H}\psi = E\psi$$

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⊛ Heisenberg Equation :

$$h = \Delta x \cdot \Delta p$$

⊛ Atomic orbital :

- a region of space in which there is a high probability of finding an electron.

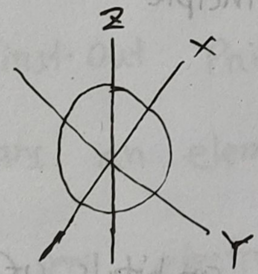
⊛ Orbital :

- Region in space where there is 90% probability of finding an e^-.

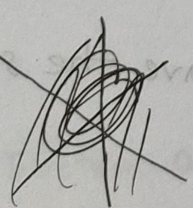
⊛ Different atomic orbitals :

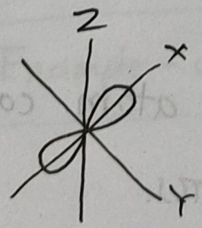
- s orbitals are spherical
- p orbitals are dumbbell-shaped. there are three p orbitals.
- d orbitals are dumbbell-shaped. there are five d orbitals.

⊛ Shape :

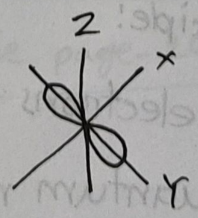


s - orbitals

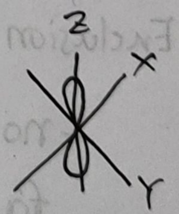




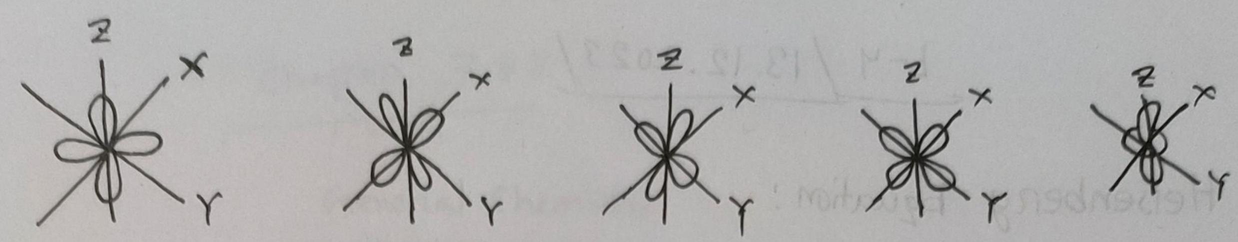
P_x - orbital



P_y - orbital



P_z - orbital



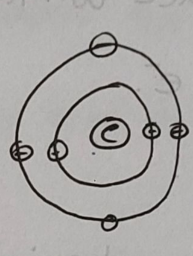
d_{xy} d_{yz} d_{xz} $d_{x^2-y^2}$ d_{z^2}

* missing will be overlap
  other will be middle

*

$2n^2$ → energy level / shell

$C(6) = 1s^2 \quad 2s^2 2p^2$



* Electron configurations:
  - There are three rules
  - aufbau principle
  - the Pauli exclusion principle
  - Hund's rule

* Aufbau principle:
  - electrons occupy the orbitals of lowest energy first.

* Pauli Exclusion Principle:
  - no two electrons in an atom can have the same four quantum numbers.

  • → n, l, m_l, m_s

Hund's Rule:

- every orbital in a sublevel is singly occupied before any orbital is doubly occupied.
- singly occupied orbitals have the same ~~level~~ up spin.

Magnetic Properties of elements:

⇒ Paramagnetic:

- A species with any unpaired electrons is paramagnetic.
- attracted by a magnetic field.

⇒ Diamagnetic:

- A species with all its electrons paired is diamagnetic.
- not attracted by a magnetic field.

⇒ First-In First-Out Principle.

- that means, an element can turn into diamagnetic by loss ~~one~~ electron. (Some cases)

$\boxed{\text{Example - on slide page-20}}$

Electron Order:

s	s p	s p	s d p	s d p	s f d p	s f d p
1	2 2	3 3	4 3 4	5 4 5	6 4 5 6	7 5 6 7

* Anomalies of $_{24}Cr$ and $_{29}Cu$

⇒ Half-filled and fulfilled d-orbitals tend to be more stable than partially filled ones.

$$_{24}Cr = [Ar]\ 4s^1\ 3d^5$$

$$_{29}Cu = [Ar]\ 4s^1\ 3d^{10}$$

* Elements in the same group (collumn) have the same outer electron configuration, and thus they exhibit similar chemical behavior.

* $_{46}Pd \Rightarrow 1s^2\ 2s^2 2p^6\ 3s^2 3p^6\ 4s^2 3d^{10} 4p^6\ 4d^{10}$

↪ diamagnetic $(5s^0)$

* Quantum Numbers:

⇒ There four quantum numbers.

(i) The principal quantum number (n)

(ii) The angular momentum quantum number (l)

(iii) The magnetic quantum number (m_l)

(iv) The magnetic spin quantum number (m_s)

* atomic orbital is defined by 4 quantum numbers: n, l, m_l, m_s

⇒ Electrons are arranged in shell and subshells of ORBITALS.

* $n \rightarrow$ shell

$l \rightarrow$ subshell

$m_l \rightarrow$ designates an orbital within a subshell

$m_s \rightarrow$ orientation of rotation of electron around itself.

*

$n \Rightarrow$ principal $\Rightarrow$ distance from nucleus

$l \Rightarrow$ angular $\Rightarrow$ shape of orbital

$m \Rightarrow$ magnetic $\Rightarrow$ orientation in shape

$s \Rightarrow$ spin $\Rightarrow$ electron spin

*

$n \Rightarrow$ main energy level.

- shell number
- 1, 2, 3, 4, ...

$l \Rightarrow$ sub-level

- $s \Rightarrow 0$ | $d \Rightarrow 2$ | $g \Rightarrow 4$
- $p \Rightarrow 1$ | $f \Rightarrow 3$

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$m_l \Rightarrow$

if, $l = 2$, $m_l = 0, \pm 1, \pm 2$

Example - page - 46

* Three p orbital : $p = 1\ (l)$

$m_l = -1, 0, +1$

$\downarrow$ P_x P_z P_y

* Five d orbitals : $d = 2\ (l)$

$m_l = -2, -1, 0, +1, +2$

$\downarrow$ d_{xy} d_{xz} d_{z^2} d_{yz} $d_{x^2-y^2}$

For any n, # of orbitals is n^2

For any n, # of electrons is $2n^2$

$\boxed{\text{Page - 48,49}}$

Factors Affecting Atomic Size

- affected by two factor.
  - (i) Positive change in the Nucleus (z)
  - (ii) Number of shell (n value) around the Nucleus.

⇒ Higher positive change pulls the electron closer.

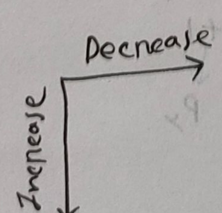
⇒ The more the number of shells, the greater the shielding effect from the inner electrons. and increase the atomic size.

Atomic size decrease if we move left to right.

- The positive nuclear change increases as we move to the right but number of shell remains the same.

If we move to down ⇒ atomic size increase.

Atomic Size



Ionization energy:

- energy required to remove an electron from gaseous atom or ion in the ground state.

- Metals have a low IE and they form +ve ion or cations.

- Non metal have a high IE and they form -ve ions or anions.

increase →

decrease ↓

Ionic Size:

- Cations are smaller than their parent atoms while anions are larger.

- Cation size decreases as the net positive charge increase.

- Calculate proton and electron number. Then compare.

Metalic:

- metal lose electron in chemical reaction

- non metal gain electron in chemical reaction

decrease →

increase ↓

metallic character

Isoelectronic:

- Ions with the same electronic configuration as a noble gas are said to be isoelectronic with a noble gas.

- same electron configuration as a noble gas

- $K^+ \Rightarrow Ar$ (same electron)

- $Ca^{2+} \Rightarrow Ar$

Effective nuclear charge (Z_{eff}):

$Z_{eff} = Z -$ # of core electron

$Na(11) = 11 - 10 = \underbrace{1}_{Z_{eff}}$

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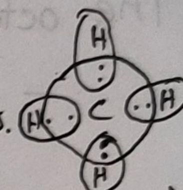
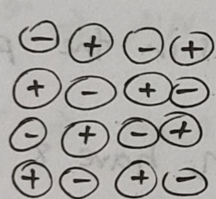
Chapter - ~~9~~ 10

Chemical Bonding & Molecular Shape

- Chemical bond: an attractive force that allow atoms to be closely associated.
- IONIC bond: Attractive between oppositely charged ions. → solid
- Covalent bond: Sharing of electrons between two atoms. → separate molecules



- Metallic bond: A regular array of metal atoms with freely moving valence electrons.



⇒ Positive ions surrounded by a sea of delocalised electrons.

⇒ Strong attraction between ions and delocalised electrons

⇒ High melting points, almost all are solid at room temp.

⇒ Conduct electricity.

- The valence electrons of atoms are the ones that are involved in bonding.

⇒ Lewis symbols are simple representations of the valence electrons in atom.

⇒ The symbol for the element surrounded by a dot for each valence electron.

·Ċ· ⇒ 4 valence electron