Padasalai's Telegram Groups!

(தலைப்பிற்கு கீழே உள்ள லிங்கை கிளிக் செய்து குழுவில் இணையவும்!)

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- Padasalai's Channel - Group
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- Lesson Plan - Group
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- 12th Standard - Group
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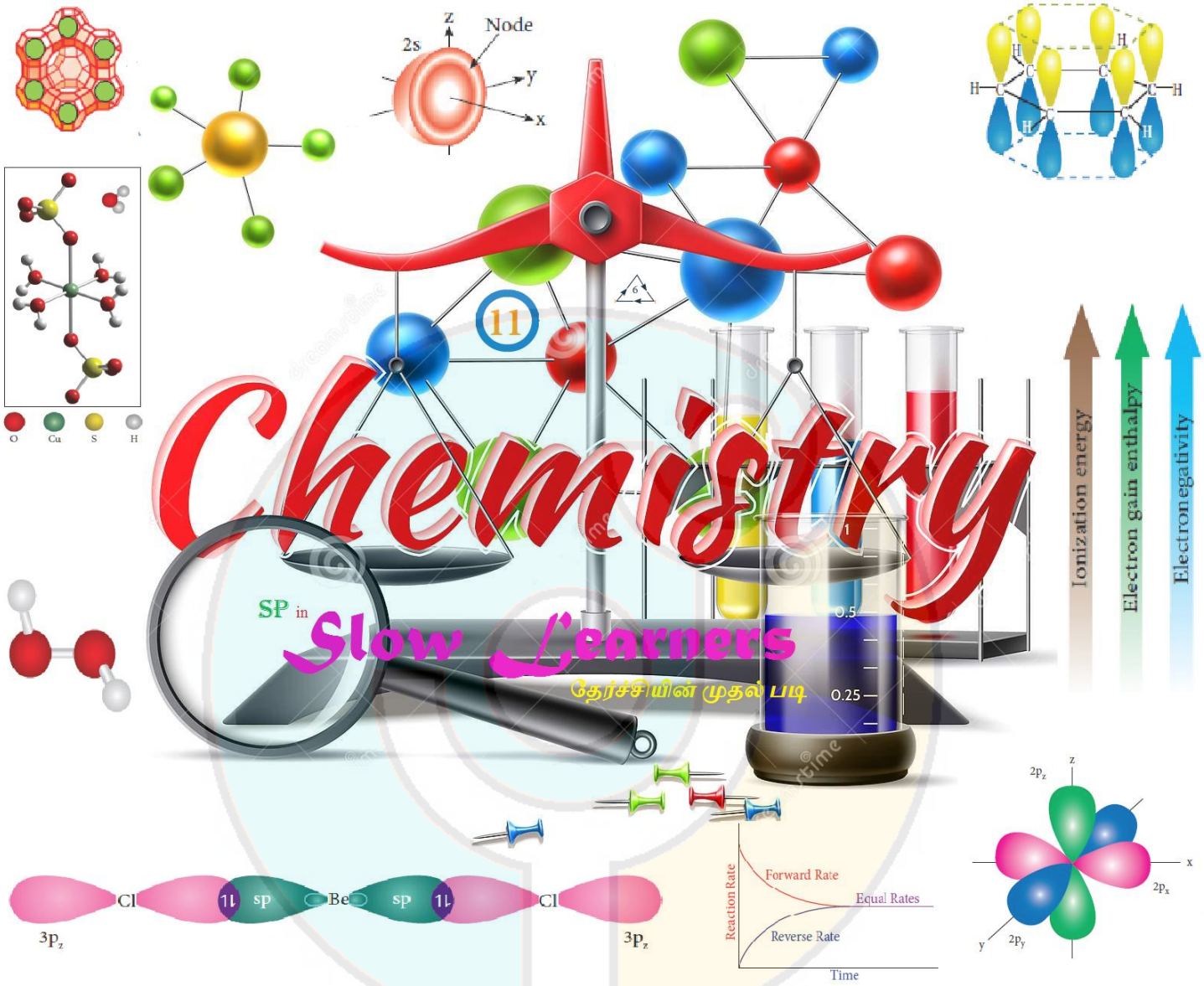


SHORT ANSWERS:

1. **Define relative atomic mass.**
   - ✓ The relative atomic mass is defined as the ratio of the average atomic mass factor to the unified atomic mass unit.
   - ✓ Relative atomic mass (Ar)= Average mass of an atom / Unified atomic mass
2. **Define mole**
   - ✓ The mole may be defined as the amount of the substance that contains as many specified elementary particles as the number of atoms in 12g of carbon - 12 isotope.
   - ✓ **1 Mole = 6.023×10^{23} entities**
   - ✓ **Mole = Mass / Molar mass**
3. **Define equivalent mass.**
   - ✓ Gram equivalent mass of an element, compound or ion is the mass that combines or displaces 1.008 g hydrogen or 8 g oxygen or 35.5 g chlorine.
   - ✓ Equivalent mass has no unit but gram equivalent mass has the unit g eq^{-1}

4. Define Avogadro's number.

- ✓ The total number of entities present in one mole of any substance is equal to 6.023×10^{23}.

5. Define Empirical formula

- ✓ Empirical formula of a compound is the formula written with the simplest ratio of the number of different atoms present in one molecule of the compound as subscript to the atomic symbol.
- ✓ The empirical formula of C_6H_6 is CH.

6. Define Molecular formula

- ✓ Molecular formula of a compound is the formula written with the actual number of different atoms present in one molecule as a subscript to the atomic symbol.
- ✓ The molecular formula of acetic acid(CH_3COOH) is $C_2H_4O_2$

7. How many moles of hydrogen is required to produce 10 moles of ammonia ?

- ✓ The balanced stoichiometric equation for the formation of ammonia is

$$N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$$

As per the stoichiometric equation, to produce 2 moles of ammonia, 3 moles of hydrogen are required

$\therefore$ to produce 10 moles of ammonia,

$= \frac{3\ moles\ of\ H2}{2\ moles\ of\ NH3} \times 10$ moles of NH_3 = 15 moles of hydrogen are required.

8. What is Limiting Reagents , Excess reagents ?

- ✓ The reactant that is is completely consumed. The reactant limits the further reaction from taking place and is called as the limiting reagent.
- ✓ The other reagents which are in excess are called the excess reagents.

9. Distinguish between oxidation and reduction.

Oxidation	Reduction
Addition of oxygen	Addition of Hydrogen
Removal of Hydrogen	Removal of Oxygen
Loss of electron	Gain of electron
Increasing of oxidation number	Decreasing of oxidation number

10. What are the Combination reactions ? Give an example

- ✓ Redox reactions in which two substances combine to form a single compoundare called combination reaction.
- ✓ e.g $C + O_2 \rightarrow CO_2$

11. What are the Decomposition reaction? Give an example

- ✓ Redox reactions in which a compound breaks down into two or more components are called decomposition reactions.
- ✓ e.g $2KClO_3 \rightarrow 2KCl + 3O_2$

12. what are the Disproportionation reaction (Auto redox reactions) .

- ✓ In some redox reactions, the same compound can undergo both oxidation and reduction.
- ✓ $2H_2O_2 \rightarrow 2H_2O + O_2$

13. Calculate the molar mass of the following compounds.

i) urea $[CO(NH_2)_2]$	**ii) acetone $[CH_3COCH_3]$**
C = 12 x 1 = 12 O = 16 x 1 = 16 N = 14 x 2 = 28 H = 1 x 4 = 4 **60 g / mol**	C = 12x 3 = 36 H = 1 x 6 = 6 O = 16 x 1 = 16 **58 g / mol**
iii) boric acid $[H_3BO_3]$	**iv) sulphuric acid $[H_2SO_4]$**
H = 1 x 3 = 3 B = 11 x1 = 11 O = 16 x 3 = 48 **62 g / mol**	H = 1 x 2 = 2 S = 32 x 1= 32 O = 16 x 4 = 64 **98 g / mol**

14. Which contains the greatest number of moles of oxygen atoms?

i) 1 mol of ethanol ii) 1 mol of formic acid iii) 1 mol of H_2O

- ✓ 1 mol of ethanol = C_2H_5OH = 1 x 6.023 x 10^{23} = 6.023 x 10^{23} oxygen atoms.
- ✓ 1 mol of formic acid = HCOOH = 2 x 6.023 x 10^{23} = 12.046 x 10^{23} oxygen atoms.
- ✓ 1 mol of H_2O = H_2O = 1 x 6.023 x 10^{23} = 6.023 x 10^{23} oxygen atoms.
- ✓ Hence **Formic acid** contains the greatest number of moles of oxygen atoms.

15. What is the difference between molecular mass and molar mass?

Calculate the molecular mass and molar mass for carbon monoxide.

Molecular Mass	**Molar Mass**
Ratio of mass of molecule to the unified mass	Mass of 1 mole of substance
Relative Molecular Mass of any compound is Calculated by adding the relative atomic of its constituent atoms.	Molar Mass of a compound is equal to the sum of the relative atomic masses of its Masses constituent atoms.
Its Unit is u or amu	Its Unit is g / mol
Molecular Mass of CO : (1 x at.mass of C) + (1x at.mass of O) (1 x 12) + (1x 16) = 28 amu	**Molar Mass of CO:** (1 x at.mass of C) + (1x at.mass of O) (1 x 12) + (1x 16) = 28 g / mol

16. What is the empirical formula of the following ?

i) Fructose ($C_6H_{12}O_6$) found in honey

ii) Caffeine ($C_8H_{10}N_4O_2$) a substance found in tea and coffee.

- ✓ CH_2O
- ✓ $C_4H_5N_2O$

17. Postulates of Bohr atom modal.

- ✓ The energies of electrons are quantized.
- ✓ The electron is revolving around the nucleus in a circular path called stationary orbit.
- ✓ Electron revolve only in those orbits in which the angular momentum (mvr) of the electron must be equal to an integral multiple of $h/2\pi$.

  i.e. $mvr = nh/2\pi$ --------1 , where n = 1,2,3,...etc.,
- ✓ As long as an electron revolves in the fixed stationary orbit, it doesn't lose its energy. However, when an electron jumps from higher energy state

(E_2) to a lower energy state (E1), the excess energy is emitted as radiation.The frequency of the emitted radiation is,

$E_2 - E_1 = h\nu$

$\nu = (E_2 - E_1) / h$

✓ Conversely, when suitable energy is supplied to an electron, it will jump from lower energy orbit to a higher energy orbit.

18. Derive De-Broglie's relation.

✓ Planck's quantum hypothesis:

$E = h\nu$ -------- 1

ν - frequency of the wave, h - Plank's constant

✓ Einsteins mass-energy relationship

$E = mc^2$ -------- 2

m – mass of photon, c – velocity of light

From 1 and 2

$h\nu = mc^2$

$h c/\lambda = mc^2$

$\lambda = h / mc$ ------ 3

$\lambda = h / mv$

19. Heisenberg's uncertainty principle

✓ It is impossible to accurately determine both the position as well as the momentum of a microscopic particle simultaneously'.

✓ $\Delta x.\Delta p \geq h/4\pi$

Δx uncertainties in the position

Δp uncertainties in the momentum.

20. Explain briefly the time independent schrodinger wave equation?

$H\Psi = E\Psi$

$$\hat{H} = \left[\frac{-h^2}{8\pi^2 m}\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}+\frac{\partial^2}{\partial z^2}\right)+V\right]$$

$$\left[\frac{-h^2}{8\pi^2 m}\left(\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}\right)+V\psi\right] = E\psi$$

Multiply by $-\frac{8\pi^2 m}{h^2}$ and rearranging

$$\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}+\frac{\partial^2\psi}{\partial z^2}+\frac{8\pi^2 m}{h^2}(E-V)\psi = 0$$

21. State Aufbau principle:

✓ The orbitals are filled in the order of their increasing energies.

22. State Pauli Exclusion Principle :

✓ No two electrons in an atom can have the same set of values of all four quantum numbers.

23.State Hund's rule

✓ Electron pairing in the degenerate orbitals does not take place until all the available orbitals contains one electron each.

24. Which quantum number reveal information about the shape, energy, orientation and

size of orbitals?

- ✓ Principal Quantum number - Size and energy of orbitals.
- ✓ Magnetic Quantum number – Orientation of orbitals.
- ✓ Angular Quantum number – Shape of orbitals

25. Define orbital? what are the n and l values for 3px and $4dx^2-y^2$ electron?

- ✓ An orbital is the region of space around the nucleus within which the probability of finding an electron of given energy is maximum.

Orbital	n	l
3px	3	1
$4dx^2-y^2$	4	2

26. How many orbitals are possible for n =4?

- ✓ n = 4 , l = 0, 1, 2, 3

Where l = 0, s – orbital (4s) 1

l = 1, p- orbital ($4p_x$,$4p_y$,$4p_z$) 3

l = 2 , d – orbital (4dxy ,4dyz, 4dzx,$4dx^2-y^2$,$4dz^2$) 5

l = 3 , f- orbital [$4fz^3$, $4fxz^2$, $4fyz^2$,4fxyz, $4fz(x^2-y^2)$, $4fx(x^2-3y^2)$, $4fy(3x^2-y^2)$] 7

16

- ✓ Totally there are 16 orbitals are possible .

27. How many radial nodes for 2s, 4p, 5d and 4f orbitals exhibit? How many angular nodes?

Orbitals	n	l	Radial nodes (n-l-1)	Angular nodes (l value)
2s	2	0	1	0
4p	4	1	2	1
5d	5	2	2	2
4f	4	3	0	3

28. For each of the following, give the sub level designation, the allowable m values and the number of orbitals

i) n = 4, l =2, ii) n =5, l = 3 iii) n=7, l=0

S.NO	n	l	Sub-shell designation	m	Total
I	4	2	4 d	-2,-1,0,1,2	5 orbitals
II	5	3	5f	-3,-2,-1,0,1,2,3	7 orbitals
III	7	0	7s	0	1 orbital

29. Give the electronic configuration of Mn^{2+} and Cr^{3+}

- ✓ $_{25}$**Mn** $=1s^2\ 2s^2\ 2p^6\ 3s^2\ 3s^2\ 3p^6\ 4s^2\ 3d^5$, **Mn^{2+}**$=1s^2\ 2s^2\ 2p^6\ 3s^2\ 3s^2\ 3p^6\ 3d^5$ **(loss 2 e-)**
- ✓ $_{24}$**Cr** $= 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3s^2\ 3p^6\ 4s^1\ 3d^5$, **Cr^{3+}**$=1s^2\ 2s^2\ 2p^6\ 3s^2\ 3s^2\ 3p^6\ 3d^3$ **(loss 3 e-)**

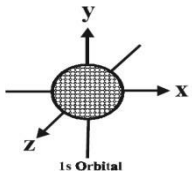
30. Give the electronic configuration of chromium and copper..

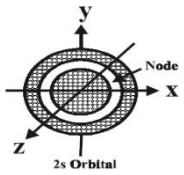
- ✓ **Cr :** $1s^2,2s^2,2p^6,3s^2,3p^6,3d^5,4s^1$
- ✓ **Cu :** $1s^2,2s^2,2p^6,3s^2,3p^6,3d^{10},4s^1$

31. Explain the shape of orbital:

✓ **s - orbital :**

l=0, m=0, one orientation. Diagram:



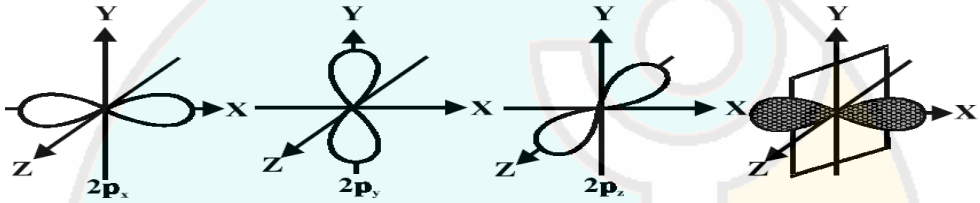


Symmetrically spherical shape.
Number of node is found by (n-1).
The number of radial nodes are equal to (n-l-1).
Shape of orbital depends on principal quantum number (n).

✓ **p - orbital:**

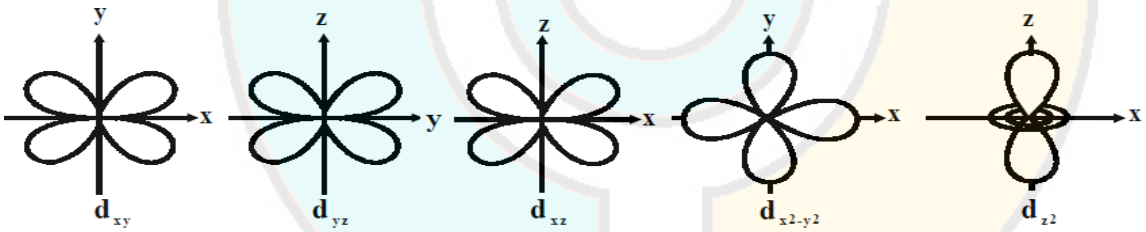
l=1, m=-1,0,+1, three orientations. p_x,p_y,p_x.
Dumb-bell spherical shape.
Each d-orbital contain one node at the centre of the two lobes.

Diagram:



✓ **d - orbital:**

l=2, m=-2,-1, 0,+1,+2. 5 orientations. d_{xy}, d_{yz}, d_{xz}, d_{x2-y2}, d_z^2
clover leaf shape. (dz^2 is dumb-bell shape with a doughnut)



32. Define modern periodic law.

✓ The physical and chemical properties of the elements are periodic functions of their atomic numbers.

33. What are isoelectronic ions? Give examples.

✓ Ions having the same number of electrons but different nuclear charge.

Ex: Li^+: $1s^2$, Be^{2+} : $1s^2$ **&** Na^+ : $1s^2\ 2s^2\ 2p^6$,F^- : $1s^2\ 2s^2\ 2p^6$

34. What is effective nuclear charge ?

✓ The net nuclear charge experienced by valence electrons in the outermost shell is called the effective nuclear charge.

✓ $Z_{eff} = Z - S$ Z = Atomic number , S = Screening constant

35. Give the general electronic configuration of lanthanides and actinides?

✓ The lanthanides ($4f^{1-14}$, $5d^{0-1}$, $6s^2$) and the actinides ($5f^{0-14}$, $6d^{0-2}$, $7s^2$)

36.Define Ionisation energy.

✓ The amount of energy is required to remove electron from an Isolated gaseous atom.

✓ $M_{(g)}$ + energy $\rightarrow M^+ + e^-$

37.Define electron affinity.

- ✓ The amount of energy released when adding electron to gaseous atom.
- ✓ $M_{(g)} + e^- \rightarrow M^-$ + energy

38.Define electronegativity.

- ✓ It is defined as the relative tendency of an element present in a covalently bonded molecule, to attract the shared pair of electrons towards itself.

39.Why halogens act as oxidising agents?

- ✓ Halogens have high electron negativity and electron affinity values.
- ✓ Halogens have a unstable np^5 electronic configuration. So they easily gaining one electron it becomes a Stable Fully filled np^6 electronic Configuration. Hence it act as a strong oxidising agents.

40. Explain the following, give appropriate reasons.

(i) Ionisation potential of N is greater than that of O

- ✓ $N_7 = 1s^2\ 2s^2\ 2p^3$ $O_8 = 1s^2\ 2s^2\ 2p^4$
- ✓ Nitrogen has high Nuclear Charge
- ✓ Nitrogen has Stable Half filled np^3 electronic configuration.
- ✓ Hence Ionisation energy of N > O

(ii)First ionisation potential of C-atom is greater than that of B atom, where as the reverse is true is for second ionisation potential.

- ✓ $B_5 = 1s^2\ 2s^2\ 2p^1$ $C_6 = 1s^2\ 2s^2\ 2p^2$
- ✓ First IE value of C >B . Because Carbon is smaller in size and has high nuclear charge. So Carbon has more Ionisation energy Boron.
- ✓ second IE value C < B .Because Boron has fully filled Stable ns^2 electronic configuration. And has high nuclear charge.

41. Explain the pauling method for the determination of ionic radius.

- ✓ d = rC+ + rA-
- ✓ rC+ α 1 / (Zeff) C+
- ✓ rA- α 1 / (Zeff) A-
- ✓ $\frac{r_C^+}{r_A^-} = \frac{Z(eff)_{A^-}}{Z(eff)C^+}$

42. Explain the diagonal relationship.

- ✓ The similarity in properties existing between the diagonally placed elements
- ✓ Li Be B C
  Na Mg Al Si
- ✓ On moving diagonally across the periodic table, the second and third period elements show certain similarities.

43. Define isotopes and explain the types of isotopes of Hydrogen.

- ✓ Elements having same atomic number but different mass number .
- ✓ Hydrogen has 3 isotopes.

  Protium = $_1H^1$, Deuterium = $_1H^2$,Tritium = $_1H^3$

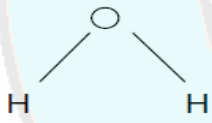
44. Give the difference between Ortho and para hydrogen

S.No	Ortho Hydrogen	Para Hydrogen
1.	Both the nuclei rotates in the same direction	Both the nuclei rotates in the opposite direction
2.	75% at room temperature	25% at room temperature
3.	It is more stable	It is less stable
4.	Its melting point is 13.95K	Its melting point is 13.83K
5.	Its boiling point is 20.39K	Its boiling point is 20.26K
6.	It has a net magnetic moment	It has Zero magnetic moment

45. How will you convert Para hydrogen to Ortho hydrogen

- ✓ By treatment with catalysts like platinum or iron
- ✓ By passing an electric discharge
- ✓ By heating to 800oC or more.
- ✓ By mixing with paramagnetic molecules like O2 , NO, NO2.
- ✓ By mixing with nascent hydrogen or atomic hydrogen.

46. Compare the structure of water and peroxide.

S.Nm	H_2O	H_2O_2
1	It is bent structure	It is Open book structure
2	The bond angle is 104.5^0	The bond angle is 90.2^0
3		

47. What is Syngas or Water gas or synthetic gas and give its use

- ✓ When Carbon reacts with steam at 1000^0 C, it gives a mixture of Carbon monoxide and hydrogen. This mixture is called as Water gas or Syngas.
- ✓ $C + H_2O \xrightarrow{1000^0 C} H_2 + CO$

48. Explain the water gas shift reaction.

- ✓ When carbon monoxide is reacts with steam at 400^0C in the presence of iron catalyst it gives hydrogen.
- ✓ $CO + H_2O \xrightarrow{400^0 C} H_2 + CO_2$

49. List the uses of Heavy water

- ✓ It is used as Moderators in Nuclear reactor.
- ✓ It is used as tracer element to study the mechanisms of organic reactions.
- ✓ It is used as coolant in nuclear reactors to absorb the heat.

50. Mention the uses of deuterium.

- ✓ It is used as tracers in the study of mechanism of chemical reactions.
- ✓ High speed deuterons are used in artificial radioactivity.
- ✓ Its oxide known as heavy water (D_2O) which is employed as moderator in nuclear reactor to slow down the speed of fast moving neutrons.

51. How is tritium prepared?

- ✓ By bombarding lithium with slow neutrons

$$_3Li^6 + _0n^1 \longrightarrow _1T^3 + _2He^4$$

- ✓ By bombarding beryllium with deuterons

$$_4Be^9 + _1D^2 \longrightarrow _1T^3 + _4Be^8$$

$$_4Be^9 + _1D^2 \longrightarrow _1T^3 + 2\,_2He^4$$

52. List the uses of Hydrogen

- ✓ Liquid hydrogen is used as Rocket Fuel
- ✓ Atomic hydrogen is used for cutting and welding metals.
- ✓ Hydrogen is used for preparing Fertilizer and explosives.
- ✓ Hydrogen is used in Fuel cells for generating electricity.
- ✓ It is used as catalyst for the preparation of Vanaspathi.
- ✓ It is used for the preparation of Methanol and industrial solvent

53. List the uses of Hydrogen peroxide

- ✓ It is used as Antiseptic
- ✓ It is used to bleach paper and textile
- ✓ It is used in water treatment to oxidize pollutant in water.

54. What is hydrogen bonding? What are Types of hydrogen bonding?

- ✓ When hydrogen is covalently bonded to a highly electronegative atom such as fluorine, oxygen and nitrogen, the bond is polarized.
- ✓ Intra molecular hydrogen bonding :

  The hydrogen bonding which occur within the molecule.

  Eg. Ortho Nitro Phenol.
- ✓ Inter molecular hydrogen bonding:

  The hydrogen bonding which occur between two or more molecules

  Eg. Water.

55. What are the importance of Hydrogen bonding?

- ✓ It plays an important role in bio molecules like proteins. It plays a important role in the structure of DNA,
- ✓ It holds the two helical Nucleic acid chains of the DNA together.

56. What are the uses of alkali metals:

- ✓ Lithium metal is used to make useful alloys. E.g White metal" [Pb + Li]
- ✓ Lithium is also used to make electrochemical cells
- ✓ Lithium carbonate is used in medicines
- ✓ Na is used to make Na / Pb alloy needed to make Pb (Et_4) and Pb $(Me)_4$
- ✓ These organolead compounds were earlier used as anti – knock additives to petrol, but nowdays lead – free petrol.
- ✓ Liquid Na metal – coolant in fast breed on nuclear reactor
- ✓ K has a vital role in biological system.
- ✓ KCl is used as fertilizer.
- ✓ KOH is used for manufacture of soft soap.
- ✓ It is also used as excellent absorbent of CO_2.
- ✓ Cs is used in devising photoelectric cell.

57. Write the uses of Sodium Carbonate.

- ✓ Sodium carbonate known as washing soda is used heavily for laundering
- ✓ It is an important laboratory reagent used in the qualitative analysis and in volumetric analysis.
- ✓ It is also used in water treatment to convert the hard water to soft water
- ✓ It is used in the manufacturing of glass, paper, paint etc...

58. Write the electrode reactions involved in the electrolytic method of preparation of sodium Hydroxide.

- ✓ At cathode : $Na^+ + e- \rightarrow Na(amalgam)$
- ✓ At anode : $Cl- \rightarrow ½ Cl_2 \uparrow + e^-$
- ✓ $2Na(amalgam)+2H_2O \rightarrow 2NaOH+2Hg+H_2\uparrow$

59. Write the uses of beryllium.

- ✓ Because of its low atomic number and very low absorption for X-rays, it is used as radiation windows for X-ray tubes and X-ray detectors.
- ✓ The sample holder in X-ray emission studies usually made of beryllium
- ✓ Because of its low density and diamagnetic nature, it is used in various detectors.

60. Write the uses of magnesium

- ✓ Removal of sulphur from iron and steel
- ✓ Refining of titanium in the "Kroll" process.
- ✓ Used as photoengrave plates in printing industry.
- ✓ Magnesium alloys are used in aeroplane and missile construction.
- ✓ Mg ribbon is used in synthesis of Grignard reagent in organic synthesis.
- ✓ It alloys with aluminium to improve its mechanical, fabrication and welding property.
- ✓ As a desiccant .
- ✓ As sacrificial anode in controlling galvanic corrosion.

61. Write the uses of calcium

- ✓ As a reducing agent in the metallurgy of uranium, zirconium and thorium.
- ✓ As a deoxidiser, desulphuriser or decarboniser for various ferrous and non-ferrous alloys.
- ✓ In making cement and mortar to be used in construction.
- ✓ As a getter in vacuum tubes.
- ✓ In dehydrating oils
- ✓ In fertilisers, concrete and plaster of paris.

62. What the uses of Calcium hydroxide

- ✓ In the preparation of mortar, a building material.
- ✓ In white wash due to its disinfectant nature.
- ✓ In glass making, in tanning industry, in the preparation of bleaching powder and for the purification of sugar.

63. Mention the uses of Plaster of Paris.

- ✓ The largest use of Plaster of Paris is in the building industry as well as plasters.
- ✓ It is used for immobilising the affected part of organ where there is a bone fracture.
- ✓ It is also employed in dentistry, in ornamental work and for making casts of statues and busts.

64. Give the uses of gypsum

- ✓ Gypsum is used in making drywalls or plaster boards.
- ✓ Another important use of gypsum is the production of plaster of Paris.
- ✓ Gypsum is used in making surgical and orthopedic casts, such as surgical splints and casting moulds.
- ✓ Gypsum is used in toothpastes, shampoos, and hair products, mainly due to its binding and thickening properties.
- ✓ Gypsum is a component of Portland cement, where it acts as a hardening retarder to control the speed at which concrete sets.

65. Write the mathematical expression for Boyle's law.

- ✓ Boyle's law, for given mass of a gas at constant temperature, the pressure (P) is inversely proportional to its volume (V).

✓ $P \alpha 1 / V$ (at constant temperature)

66. Define Charle's law.

- ✓ For a fixed mass of a gas at constant pressure, the volume is directly proportional to its temperature (K).

✓ $V \alpha T$

67. State Avagadros law.

- ✓ Equal volumes of all gases under the same condition of T&P contain equal number of molecule.

✓ $V \alpha n.$

68. State Dalton law of partial pressure

- ✓ The total pressure of non – reacting gas is sum of partial pressure of gases present in the mixture.

✓ $P_{total} = P_1 + P_2 + P_3 \ldots.$

69. Define Gay – lussac's law

- ✓ At constant volume,the pressure of fixed mass of gas is directly proportional to temperature.

✓ $P \propto T.$

70. Write the significance of Vanderwaal's constants.

- ✓ The term a/V2 is the measure of the attractive forces of the molecules. It is also called as the cohesion pressure (or) internal pressure.
- ✓ The inversion temperature of a gas can be expressed in terms of `a' and `b' Ti = 2a / Rb
- ✓ The vanderwaal constants `a' and `b' enable the calculation of critical constants of a gas.

71. Define Joule-Thomson effect.

- ✓ The phenomenon of producing lowering of temperature when a gas is made to expand adiabatically from a region of high pressure into a region of low pressure.

72. What is meant by inversion temperature ?

- ✓ The characteristic temperature below which a gas expands adiabatically into a region of low pressure through a porous plug with a fall in temperature is called as inversion temperature (Ti).

✓ $Ti = 2a / Rb$

73. What is Critical temperature (Tc)?

- ✓ It is defined as the characteristic temperature of a gas at which increase in pressure brings in liquefaction of gas above which no liquefaction occurs although the pressure may be increased many fold.
- ✓ $Tc = 8a / 27Rb$

74. What is Critical pressure (Pc)?

- ✓ It is defined as the minimum pressure required to liquefy 1 mole of a gas present at its critical temperature.
- ✓ $Pc = a / 27b^2$

75. What is Critical volume (Vc)?

- ✓ The volume occupied by 1 mole of a gas at its critical pressure and at,critical temperature is the critical volume (Vc) of the gas.
- ✓ $Vc = 3b$

76. What are the methods used to liquefaction of gases

- ✓ Linde's method
- ✓ Claudes process
- ✓ Adiabatic process

77. What are Homogeneous system and Heterogeneous system.

- ✓ Homogeneous system :

  If the physical states of all the matter is uniform throughout the system, it is known as homogeneous system.
- ✓ Heterogeneous system :

  If the physical state of all the matter is not uniform throughout the system, it is known as heterogeneous system.

78. Define the following terms:

a. isothermal process:

The temperature of the system remains constant, during the change from its initial to final state.

b. adiabatic process:

There is no exchange of heat (q) between the system and surrounding during the process.

c. isobaric process:

The pressure of the system remains constant during its change from the initial to final state.

d. isochoric process:

The volume of system remains constant during its change from initial to final state.

79. What is Intensive properties :

- ✓ The properties that are independent of the mass or size of the system are known as intensive properties.
- ✓ Eg. refractive index, surface tension, density, temperature, boiling point, freezing point etc.

80. What is Extensive properties :

- ✓ The properties that depend on the mass or size of the system are known as extensive properties.
- ✓ eg.,Volume, number of moles, mass, energy, internal energy etc.

81. Define zeroth law of thermodynamics.

- ✓ If two systems at different temperatures are separately in thermal equilibrium with a third one, then they tend to be in thermal equilibrium with themselves.

82. Define first law of thermodynamics.

- ✓ Energy may be converted from one form to another, but cannot be created or be destroyed
- ✓ $\Delta U = q + w$

83. Define specific heat capacity.

- ✓ The heat is absorbed by one kilogram of substance to raise its temperature by one Kelvin at specified temperature

84. Define Hess's Law.

- ✓ The enthalpy change of reaction either at constant volume (or) constant pressure is same whether it takes place in a single (or) multiple step.
- ✓ $\Delta H_r = \Delta H_1 + \Delta H_2 + \Delta H_3$

85. Define lattice energy. (or) Lattica enthalpy

- ✓ The amount of energy required to completely remove the constituents ions from its crystal lattice to an infinite distance.

86. What is Entropy.Mension the unit.

- ✓ It is a measure of molecular disorder (randomness) of system.
- ✓ unit of entropy Jk^{-1}.

87. Define Kelvin planck statement.

- ✓ It is impossible to construct a machine that absorbs heat from a hot source and converts it completely into work by cyclic process without transferring a part of heat to a cold sink.

88. Define – Clausius statement.

- ✓ It is impossible to transfer heat from a cold reservoir without doing some work.

89. Third law of thermodynamics.

- ✓ The entropy of pure crystalline substance at absolute zero is zero.
- ✓ S = 0 (for perfect crystalline substance)

90. Application of Bomb calorimeter.

- ✓ Used to determine the amount of heat released in combustion reaction.
- ✓ Used to determine the calorific value of food.
- ✓ Used in many industries (food processing, explosive testing etc)

91. List the characteristics of internal energy.

- ✓ It is an extensive property.
- ✓ It is a state function
- ✓ Change in internal energy is . $U = U_f - U_i$
- ✓ In cyclic process , U = 0.
- ✓ $U = U_f - U_i$ = -ve ($U_f < U_I$)
- ✓ $U = U_f - U_i$ = +ve ($U_f > U_I$).

92.Write the characteristics of entropy?

- ✓ Entropy 'S' is state function.
- ✓ $\Delta S_{rev} = \Delta q_{rev} / T_{(k)}$
- ✓ Entropy is a measure of randomness of the molecule of a system. Entropy increases in all spontaneous process.
- ✓ $\Delta S>0$ - spontaneous process,
  $\Delta S = 0$ - equillibrium process
  $\Delta S<0$ - non spontaneous process .
- ✓ Units of entropy
  Cgs unit $CalK^{-1}$ SI unit JK^{-1}

93.List the characteristics of Gibbs free energy.

- ✓ Free energy is defined as G = (H-TS). „G" is a state function.
- ✓ G-Extensive property. ΔG- become intensive property , when the system is closed.
- ✓ G has a single value for the thermodynamic state of the system.
- ✓ $\Delta G <0$ - spontaneous ,
  $\Delta G = 0$ – equilibrium,
  $\Delta G > 0$ - non- spontaneous
- ✓ $\Delta G = \Delta H – T\Delta S$. $\Delta H = \Delta E + P\Delta V$ and $\Delta E = q – w$. But $T\Delta S = q$ $\Delta G = q - w + P\Delta V – q$.
- ✓ **$\Delta G = - w + P\Delta V$ = network**

94.Why the chemical equilibrium is called dynamic equilibrium?

- ✓ At equilibrium the forward and backward reaction proceeding at the same rate.
- ✓ There is no macroscopic change is occurs.

95.Law of mass action.

- ✓ At any instant the rate of a chemical reaction at given temperature is directly proportional to the product of active masses of the reactants at that instant".
- ✓ Rate $\propto [Reactant]^x$

96.Define equilibrium constant.

- ✓ At a given temperature the ratio of the product of active mass of reactions products raised to the respective stoichiometric coefficient in the balanced chemical equation to that of reactants is constant.

97.Write application of equilibrium constant.

- ✓ Predict the direction in which the net reaction will takes place.
- ✓ Predict the extents of reaction.
- ✓ Calculate the equilibrium concentration of reactants and products

98.Define (Q) reaction quotient.

✓ The ratio of the products of active mass of reaction products raised to respective stichiometric coefficients in the balanced chemical equation to that of reactants.

$$Q = \frac{[C]^l[D]^m}{[A]^x[B]^y}$$

99.Sate Le – chatelier principle.

- ✓ If the system at equilibrium is distributed then the system shift itself in a direction that nullifies the effect of that disturbance.

100. Derive the relation between Kp and Kc.

$$xA + yB \rightleftharpoons lC + mD$$

$$k_c = \frac{[C]^l[D]^m}{[A]^x[B]^y} \qquad k_p = \frac{p_C^l \times p_D^m}{p_A^x \times p_B^y}$$

$$k_p = \frac{[C]^l[RT]^l[D]^m[RT]^m}{[A]^x[RT]^x[B]^y[RT]^y}$$

$$k_p = \frac{[C]^l[D]^m}{[A]^x[B]^y}[RT]^{(l+m)-(x+y)}$$

$$k_p = K_c(RT)^{(\Delta n_g)}$$

101. Derive the value of Kc and Kp for the synthesis of HI

$$H_2(g) + I_{2(g)} \rightleftharpoons 2HI_2(g)$$

	H_2	I_2	HI
Initial number of moles	a	b	0
number of moles reacted	x	x	0
Number of moles at equilibrium	a-x	b-x	2x
Active mass or molar concentration at equilibrium	$\frac{a-x}{V}$	$\frac{b-x}{V}$	$\frac{2x}{V}$

$$K_C = \frac{[HI]^2}{[H_2][I_2]} = \frac{4x^2}{(a-x)(b-x)}$$

$$\Delta n(g) = n_p - n_r = 2 - 2 = 0$$

$$Kp = Kc \qquad K_p = \frac{4x^2}{(a-x)(b-x)}$$

102. Arrive at the expression of Kc and Kp for the dissociation of PCl_5

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

	PCl_5	PCl_3	Cl_2
Initial number of moles	a	0	0
number of moles dissociated	x	0	0
Number of moles at equilibrium	a-x	x	x
Active mass or molar concentration at equilibrium	$\frac{a-x}{V}$	$\frac{x}{V}$	$\frac{x}{V}$

$$K_C = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{x^2}{(a-x)V}$$

$$\Delta ng = n_p - n_r = 2 - 1 = 1 \qquad RT = \frac{PV}{n}$$

$$K_p = \frac{x^2P}{(a-x)(a+x)}$$

103. Derive a general expression for the equilibrium constant Kp and Kc for the reaction $3H_{2(g)} + N_{2(g)} \rightleftharpoons 2NH_{3(g)}$

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

	N_2	H_2	NH_3
Initial number of moles	a	b	0
number of moles reacted	x	3x	0
Number of moles at equilibrium	a-x	b-3x	2x
Active mass or molar concentration at equilibrium	$\frac{a-x}{V}$	$\frac{b-3x}{V}$	$\frac{2x}{V}$

$$K_C = \frac{[NH_3]^2}{[N_2][H_2]^3} \qquad K_C = \frac{4x^2V^2}{(a-x)(b-3x)^2}$$

$$\Delta n_g = n_p - n_r = 2 - 4 = -2$$

$$K_p = \frac{4x^2V^2}{(a-x)(b-3x)^3}(RT)^{-2}$$

$$K_p = \frac{4x^2(a+b-2x)^2}{P^2(a-x)(b-3x)^3}$$

104. Deduce the Vant Hoff equation.

$$\Delta G^\circ = -RT\ln K$$

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$

$$\ln K = \frac{-\Delta H^\circ}{RT} + \frac{\Delta S^\circ}{R}$$

$$\frac{d(\ln K)}{dT} = \frac{\Delta H^\circ}{RT^2}$$

$$\ln \frac{K_2}{K_1} = \frac{\Delta H^\circ}{R}\left[\frac{T_2 - T_1}{T_2T_1}\right]$$

$$\log \frac{K_2}{K_1} = \frac{\Delta H^\circ}{2.303\,R}\left[\frac{T_2 - T_1}{T_2T_1}\right]$$

105. Define molarity .

- ✓ Molarity of a solution is defined as the number of gram-moles of solute dissolved in 1litre of a solution
- ✓ Molarity = No. of moles of solute / Volume of Solution in litres

106. Define molality.

- ✓ Molality of a solution is defined as the number of gram-moles of solute dissolved in 1000 grams (or 1 kg) of a Solvent.
- ✓ Molality = Number of moles of solute / Mass of solvent in kilograms

107. Define normality.

- ✓ Normality of a solution is defined as the number of gram equivalents of the solute dissolved per litre of the given solution.
- ✓ Normality = Number of gram-equivalents of solute / Volume of Solution in litre

108. Define mole fraction.

- ✓ Mole fraction is the ratio of number of moles of one component (Solute or Solvent) to the total number of moles of all the components (Solute and Solvent) present in the Solution.

109. What are the factors influencing solubility?

- ✓ Nature of solute and solvent
- ✓ Effect of temperature
- ✓ Effect of pressure of solution

110. State Henry's law.

- ✓ The partial pressure of gas in vapour phase (vapour pressure of solute) is directly proportional to the mole fraction (x) of the gaseous solute in the solution at low concentration.
- ✓ P solute $\propto$ X solute in solution

111. What are the limitations of Henry's law?

- ✓ Applicable at moderate temperature and pressure only.
- ✓ Obey only less soluble gases.
- ✓ The gases reacting with solvent do not obey henry's law.

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

- ✓ The gases obeying Henry's law should not associate or dissociate while dissolving in the solvent.

112. Define Raoult's law.

- ✓ The solution of volatile liquids, the partial vapour pressure of each components $(A \propto B)$ of solution is directly proportional to its mole fraction.

$$\checkmark \quad P_A \propto X_A$$

113. What are colligative properties

- ✓ The properties only doesnot depends upon the chemical nature of solute particle depends on the number of the solute particles

114. Define osmosis.

- ✓ Spontaneous process by which solvent molecules pass through a semi permeable membrane from a solution of lower concentration to a solution of higher concentration.

115. Define Osmotic pressure:

- ✓ The pressure must be applied to the solution to stop the influx of the solvent through the semipermeable membrane

116. What is Isotonic solution:

- ✓ Two solution having same osmotic pressure at given temperature are called isotonic solutions.

117. Define Reverse osmosis:

- ✓ A process in which a solvent passes through a semipremeable membrane in the opposite direction of osmosis. (before you write definition of osmosis)

118. Define van't Hoff factor.

- ✓ i = $Normal\ (actual) molar\ mass\ /\ Observed\ (abnormal) molar\ mass$

119. State Octet rule.

- ✓ The atoms transfer or share electrons so that all atoms involved in chemical bonding obtain 8 electrons in their outer shell (valance shell).

120. Define Hybridisation.

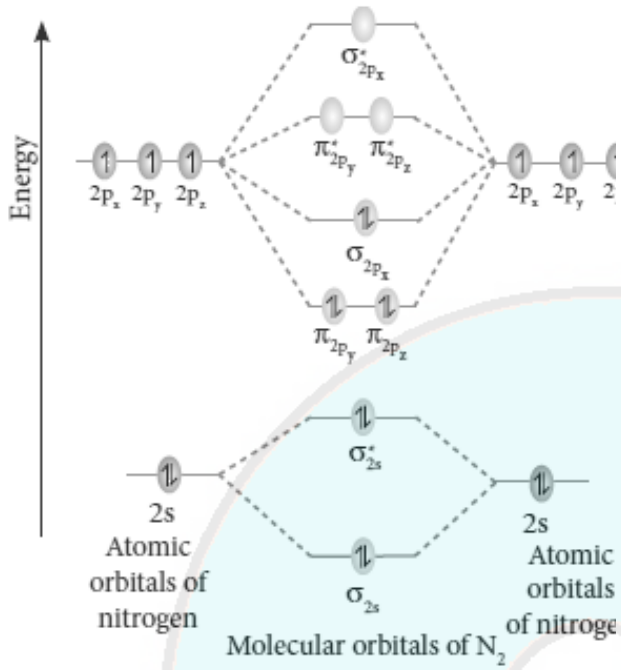
- ✓ The process of mixing of atomic orbitals of the same atom with comparable energy to form equal number of new equivalent orbitals with same energy.

121. What are the salient features of MO theory.

- ✓ When atoms combines to form molecules, their individual atomic orbitals lose their identity and forms new orbitals called molecular orbitals.
- ✓ The shapes of molecular orbitals depend upon the shapes of combining atomic orbitals.
- ✓ The number of molecular orbitals formed is the same as the number of combining atomic orbitals.
- ✓ Half the number of molecular orbitals formed will have lower energy than the corresponding atomic orbital, while the remaining molecular orbitals will have higher energy.
- ✓ The molecular orbital with lower energy is called bonding molecular orbital and the one with higher energy is called anti-bonding molecular orbital.
- ✓ The bonding molecular orbitals are represented as σ (Sigma), π (pi), δ (delta) and the corresponding antibonding orbitals are denoted as σ*, π* and δ*.
- ✓ The electrons in a molecule are accommodated in the newly formed molecular orbitals. The filling of electrons in these orbitals follows Aufbau's principle, Pauli's exclusion principle and Hund's rule as in the case of filling of electrons in atomic orbitals.
- ✓ Bond order gives the number of covalent bonds between the two combining atoms.

  Bond order = Nb – Na / 2

122. Discuss the formation of N_2 molecule using MO Theory



Molecular orbital diagram of nitrogen molecule (N_2)

Electronic configuration of N atom $1s^2\ 2s^2\ 2p^3$

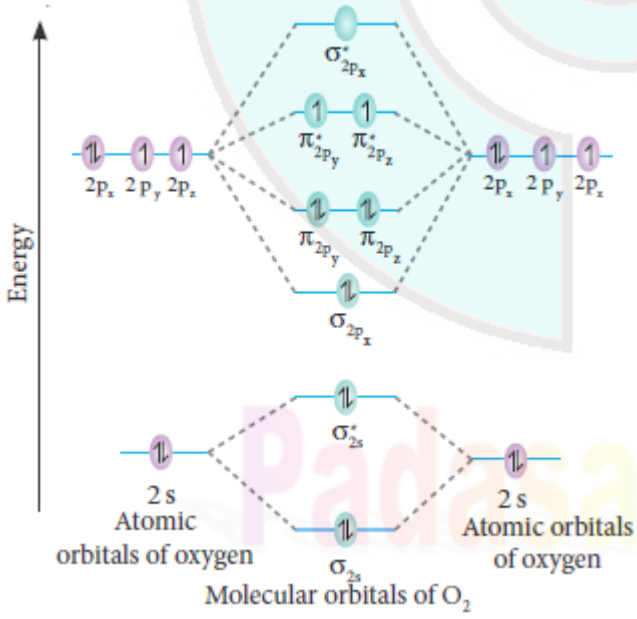
Electronic configuration of N_2 molecule

$\sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \pi^2_{2p_y}, \pi^2_{2p_z} \sigma_2^2 px$

$$\text{Bond order} = \frac{N_b - N_a}{2} = \frac{10-4}{2} = 3$$

Molecule has no unpaired electrons hence it is diamagnetic.

123. Discuss the formation of O_2 molecule using MO Theory



Molecular orbital diagram of oxygen molecule (O_2)

Electronic configuration of O atom $1s^2\ 2s^2\ 2p^4$

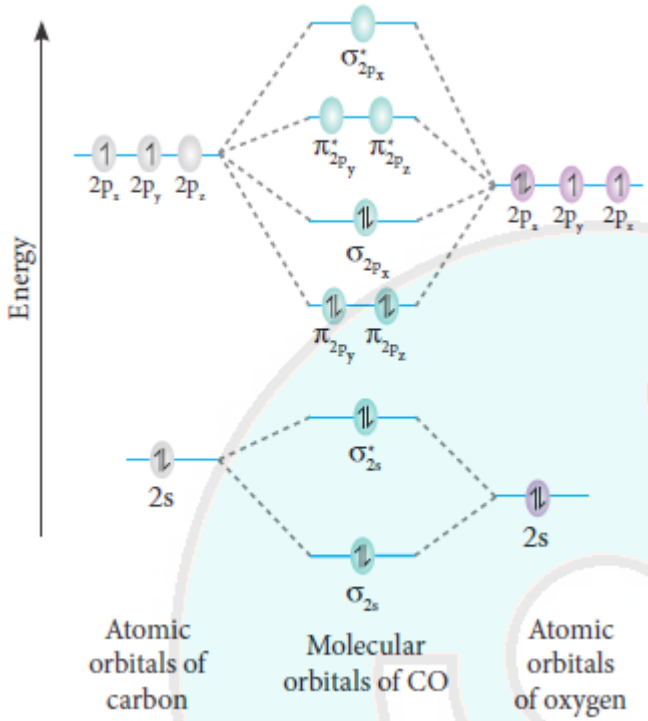
Electronic configuration of O_2 molecule

$\sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \sigma_{2p_x}^2\ \pi^2_{2p_y}, \pi^2_{2p_z}, \pi^{*1}_{2p_y}, \pi^{*1}_{2p_z},$

$$\text{Bond order} = \frac{N_b - N_a}{2} = \frac{10-6}{2} = 2$$

Molecule has two unpaired electrons hence it is paramagnetic.

124. Discuss the formation of CO molecule using MO Theory



Bonding in some heteronuclear di-atomic molecules

Molecular orbital diagram of Carbon monoxide molecule (CO)

Electronic configuration of C atom $1s^2\ 2s^2\ 2p^2$

Electronic configuration of O atom $1s^2\ 2s^2\ 2p^4$

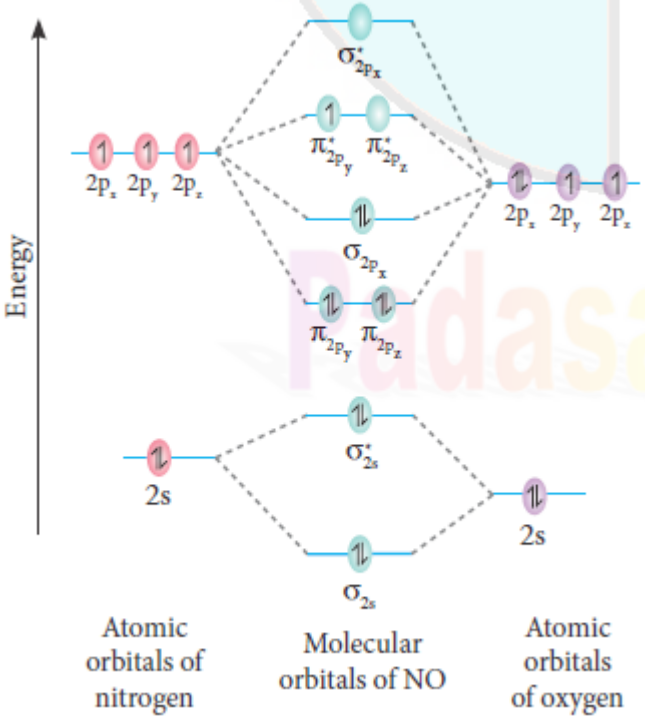
Electronic configuration of CO molecule

$\sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \pi^2_{2p_y}, \pi^2_{2p_z}, \sigma^2_{2p_x}$

$$\text{Bond order} = \frac{N_b - N_a}{2} = \frac{10-4}{2} = 3$$

Molecule has no unpaired electrons hence it is diamagnetic.

125. Discuss the formation of NO molecule using MO Theory



Molecular orbital diagram of Nitric oxide molecule (NO)

Electronic configuration of N atom $1s^2\ 2s^2\ 2p^3$

Electronic configuration of O atom $1s^2\ 2s^2\ 2p^4$

Electronic configuration of NO molecule

$\sigma_{1s}^2, \sigma_{1s}^{*2}, \sigma_{2s}^2, \sigma_{2s}^{*2}, \pi^2_{2p_y}, \pi^2_{2p_z}, \sigma_2 p^2_x\ \pi^{*1}_{2p_y}$

$$\text{Bond order} = \frac{N_b - N_a}{2} = \frac{10-5}{2} = 2.5$$

Molecule has one unpaired electron hence it is paramagnetic.

126. What is isomerism.

- ✓ Compounds that have the same molecular formula but different structural formulae are called isomers

127. What is Simple distillation?

- ✓ Simple distillation involves conversion of a liquid into its vapour by heating in a distilling flask and then condensation of the vapour into a liquid in the receiver.

128. Define chromatography

- ✓ The technique for the separation of a mixture of compounds where the separation is brought about by the differential movement of the individual compounds through a porous medium under the influence of a moving solvent.

129. What is Rf value?

- ✓ The relative adsorption of each component of the mixture is expressed in terms of its retention factor.
- ✓ Rf = Distance moved by the substance from base line (x) / Distance moved by the solvent from base line (y)

130. Differentiate paper and thin layer chromatography

Paper Chromatography	Thin Layer Chromatography
(i) Separation based on partition	Separation is based on partition, adsorption and ion exchange.
(ii) Stationary phase is the water molecules bound on the paper.	Stationary phase is a layer of silica gel or alumina on glass plate.

131. Define resonance

- ✓ Organic compounds can be represented by more than one structure and they differ only in the position of bonding and lone pair of electrons.

132. Define hyper conjugation.

- ✓ The delocalisation of electrons of **σ** bond is called as hyper conjugation.

133. How will you distinguish between electrophiles and nucleophiles

Electrophiles	Nucleophiles
They are electron deficient	They are electron rich
They are cations	They are anions
They are lewis acids	They are lewis bases
Accept an electron pair	Donate an electron pair
Attack on electron rich sites	Attack on electron deficient sites

134. State Markovnikoff's rule :

- ✓ When an unsymmetrical alkene reacts with hydrogen halide, the hydrogen adds to the carbon that has more number of hydrogen and halogen add to the car- bon having fewer hydrogen.

135. What are the condition of aromaticity?

- ✓ The molecule must be co-planar
- ✓ Complete delocalization of π electron in the ring
- ✓ Presence of (4n+2) π electrons in the ring where n is an integer (n=0,1,2….)

136. State Saytzeff 's Rule.

- ✓ In a dehydrohalogenation reaction, the preferred product is that alkene which has more number of alkyl groups attached to the doubly bonded carbon (more substituted double bond is formed)

137. What are Freons? Discuss their uses and environmental effects

- ✓ The chloro fluoro derivatives of methane and ethane are called freons
- ✓ **Uses:**

(i) Freons are a used as refrigerants in refrigerators and air conditioners.
(ii) It is used as a propellant for aerosols and foams
(iii) It is used as propellant for foams to spray out deodorants, shaving creams, and insecticides.

138. Write the uses of DDT

- ✓ DDT is used to control certain insects which carries diseases like malaria and yellow fever
- ✓ It is used in farms to control some agricultural pests
- ✓ It is used in building construction as pest control
- ✓ It is used to kill various insects like housefly and mosquitoes due to its high and specific toxicity.

139. Compare SN_1 and SN_2 reaction mechanisms.

SN_1 reaction	SN_2 reaction
It is unimolecular reaction	It is a bimolecular reaction
Its mechanishm occurs in two steps	It is a one step process
It involves the formation of an intermediate (Carbocation)	It involves the formation of transition sate.
Rate = k[Alkyl halide]	Rate = k[Alkyl halide] [Nuclophile]
It leads to racemisation	It leads to invertion of configuration

140. Define environmental pollution:

- ✓ Any undesirable change in our environment that has harmful effects on plant, animals and human beings is called environmental pollution.

141. What are biodegradable and non – biodegradable pollutants with example?

- ✓ Pollutants are easily decomposed by Natural Biological process.
  Eg: Animal wastes and plant wastes.
- ✓ Pollutants are not easily decomposed by Natural biological process.
  Eg: DDT, plastics.

142. What is Green chemistry?

- ✓ Green chemistry means Science of environmentally favorable chemical synthesis.
- ✓ It is a chemical philosophy encouraging the design of products and processes that reduce or eliminate the use and generation of hazardous substances.

143. How acid rain is formed? Explain its effect.

- ✓ The SO_2 react with O_2 form SO_3 as like N_2 combine with O_2 form NO_2 it react with rain to form acid rain.

$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$

$4NO_2 + O_2 + 2H_2O \rightarrow 4HNO_3$

- ✓ **Effect**

Acid rain affects plants and animal life in aquatic ecosystem.

It is harmful for agriculture, trees and plants as it dissolves and removes the nutrients needed for their growth.

It causes respiratory ailment in humans and animals.

144. What is green house effect?

- ✓ Heating up of earth surface due to infrared radiation reflected by CO_2 layer in atmosphere.
- ✓ The radiation reflected by earths surface by CO_2 layer in the atmosphere.

145. What is meant by global warming

- ✓ The heating up of earth through the green house effect is called global warming.

146. Why ozone layer is called earth projective umberlla?

- ✓ Ozone layer shield the harmful UV radiation from sunlight.
- ✓ It behave like a umbrella.
- ✓ It prevent skin cancer.

147. What are the point source and non point source:

- ✓ Easily identified source of place of pollution – Municipal - point source.
- ✓ Can't easily identified source of place of pollution, acid rain, mining waste non – point source.

148. Define Smog

- ✓ Smog is a combination of smoke and fog which forms droplets that remain suspended in the air.

149. How does classical smog differ from photochemical smog?

Classical smog	Photo chemical smog
It consists of coal smoke and fog.	It occurs in warm, dry and sunny climate
It generally occurs in the morning and becomes worse when the sun rises.	It forms when the sun shines and becomes worse in the afternoon.
It occurs in cool humid climate.	smoke, dust and fog with air pollutants like oxides of nitrogen and hydrocarbons in the presence of sunlight.
It also causes bronchial irritation	It causes corrosion of metals stones, building materials and painted surfaces.
It is also known as London smog.	It is also called as oxidizing smog.

150. Differentiate the following

(i) BOD and COD

(ii) Viable and non-viable particulate pollutants

BOD	COD
The total amount of oxygen in milligrams consumed by microorganisms in decomposing the waste in one litre of water at $20^{o}C$ for a period of 5 days	The amount of oxygen required by the organic matter in a sample of water for its oxidation by a strong oxidising agent like $K_2Cr_2O_7$ in acid medium for a period of 2 hrs.
Expressed in ppm.	Expressed in mg /l.
Measure og degree of water pollution	Measure of amount of organic compounds in a water sample.

viable particulate	non-viable particulate
The viable particulates are the small size living organisms such as bacteria, fungi, moulds, algae, etc. which are dispersed in air	The non- viable particulates are small solid particles and liquid droplets suspended in air
Some of the fungi cause allergy in human beings and diseases in plants	They help in the transportation of viable particles.
They contain living organisms	They contain non-living organisms

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