11	a)	Describe the instrumentation of UV-Visible spectroscopy.	L3	CO3	5 M
	b)	Explain the electronic transitions in UV-Visible spectroscopy.	L4	CO5	5 M

PVP 23

Code: 23BS1202

I B.Tech - II Semester – Regular / Supplementary Examinations
MAY 2025

CHEMISTRY
(Common for IT, AIML, DS)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	State the Heisenberg's uncertainty principle.	L1	CO2
1.b)	Explain O_2 molecule is paramagnetic in nature based on MOT.	L2	CO2
1.c)	What is a superconductor? Give an example.	L1	CO2
1.d)	Define super capacitor. Give an example.	L1	CO2
1.e)	Differentiate between anode and cathode.	L2	CO2
1.f)	Define the principle of Potentiometric titration.	L1	CO2
1.g)	Express the functionality of monomer with an example.	L2	CO1
1.h)	Name the monomer of Nylon-6,6.	L1	CO1
1.i)	State the Beer-Lambert's law.	L1	CO1
1.j)	Write the principle of High-Performance Liquid Chromatography.	L1	CO3

PART – B

			BL	CO	Max. Marks
		UNIT-I			
2	a)	Illustrate the molecular orbital diagram of O_2 and calculate the bond order.	L3	CO2	5 M
	b)	Draw the π-molecular orbital diagram of 1, 3-butadiene.	L4	CO4	5 M
		OR			
3	a)	Derive the Schrodinger wave equation. State the significance of ψ and ψ^2.	L3	CO2	5 M
	b)	Draw the π-molecular orbital diagram of Benzene.	L4	CO4	5 M
		UNIT-II			
4	a)	Construct the band diagrams of conductors, insulators and semiconductors.	L3	CO2	5 M
	b)	Classify super capacitors based on their characteristics and explain them in detail.	L4	CO4	5 M
		OR			
5	a)	Explain the applications of semiconductors.	L4	CO4	5 M
	b)	What are the types of carbon nanotubes? Give their applications.	L3	CO2	5 M

		UNIT-III			
6	a)	Describe the construction and working of Lithium-ion battery.	L3	CO2	5 M
	b)	Discuss the conductometric titration of strong acid and strong base.	L4	CO4	5 M
		OR			
7	a)	Explain construction and working of H_2-O_2 fuel cell.	L4	CO4	5 M
	b)	Derive the Nernst equation of a single electrode potential.	L3	CO2	5 M
		UNIT-IV			
8	a)	Differentiate between thermoplastics and thermosetting plastics.	L4	CO5	5 M
	b)	Interpret the synthesis and applications of buna-N rubber.	L3	CO3	5 M
		OR			
9	a)	What are biodegradable polymers? Write the synthesis and applications of PGA.	L3	CO3	5 M
	b)	Explain the preparation and applications of Bakelite.	L4	CO5	5 M
		UNIT-V			
10	a)	Explain the classification of chromatography.	L3	CO3	5 M
	b)	Make use of neat diagrams to explain modes of vibrations.	L4	CO5	5 M
		OR			

Code:23BS1202 PVP-23

PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

I B.Tech – 11-Semester –Regular/Supplementary Examinations

May- 2025

Scheme of Valuation

Name of the Subject : CHEMISTRY(Common for IT,AIML,DS)

Duration:3 hours **Max. Marks:70**

PART-A

1.a) States the Heisenberg's uncertainty principle --2M

1. b) Explain O_2 molecule is paramagnetic in nature based on MOT. --------------- 2M

1.c) What is superconductor ? Give an example.-- 2M

1.d)Define super capacitor.Give an example.-- 2M

1.e)Differentiate between anode and cathode.--- 2M

1.f)Define the principle of Potentiometric titration.--2M

1.g)Express the functionality of monomer with an example. ----------------------------2M

1.h) Name the monomer of Nylon-6,6. --2M

1.i) State the Beer-Lambert's law.--2M

1.j) Write the principle of High-Performance Liquid Chromatography.---------------2M

PART-B

UNIT-1

2.a) Molecular orbital diagram of O_2 Molecule --- 3M

Bond order --- -2M

b) Draw the π-molecular orbital diagram of 1,3-butadiene.----------------------------- 5M

OR

3.a) Derive the Schodinger wave equation --3M

State the significance of ψ and ψ.2 ---2M

b) Draw the π-molecular orbital diagram of Benzene -------------------------------- 5M

UNIT-2

4.a)Construct the band diagram of conductors, insulators and semiconductors. --- 5M

b) Classification of super capacitors based on their characteristics and explain them in details -- --------- 5 M

OR

5. a) Explain any five applications of semiconductors.--5M

b) Types of carbon nanotubes --3M

Any two applications of carbon nano tubes ---2M

UNIT-3

6. a) Construction of Li-ion battery --3M

Working of Li-ion battery .---2M

b) Discuss the conductometric titration of strong acid and strong base .------------------5M

OR

7. a) Construction of H2-O2 Fuel cell . --3M
Working of H2-O2 Fuel cell .--- 2 M
b) Derive the Nernst equation of a single electrode potential.-----------------------------------5M
UNIT-4
8. a) Write any five differentiates between thermo plastics and thermosetting plastics.---------5M
b) Synthesis of buna –N rubber---3M
Write any three applications of buna-N-rubber.---2M
OR
9. a) Define Biodegrade polymer---1M
Synthesis and applications.---(2+2)
b) Bakelite – preparation. --- 3M
Applications .--- ---2M
UNIT-5
10.a)Explain the classification of Chromatography.--5M
b) Modes of vibrations diagrams ---2M
Explanation – modes of vibrations.--3M
OR
11 .a) Instrumentation UV-Visible diagram ---2M
Explanation of UV-Visible --- 3M
b) Explain the electronic transitions in UV-Visible spectroscopy------------------------------5M

ANSWERS

PART-

1.a) States the Heisenberg's uncertainty principle.

Heisenberg uncertainty principle: In consequence to the dual nature of matter, it is not possible to measure simultaneously both velocity and position with accuracy. According to Heisenberg, "it is not possible to determine accurately the position and velocity (or momentum) of smaller moving particles".

1. b) Explain O2 molecule is paramagnetic in nature based on MOT

O2 molecule is paramagnetic in nature ,because as for MO Diagram the orbitals consisting of un pair of electrons . Due to unpair of electrons it exbhits paramagnetic natur

1.c) What is superconductor ? Give an example.

Superconductivity is a remarkable physical phenomenon where certain materials can conduct electric current with zero electrical resistance. This means that when a material becomes superconducting .Ex: Hg , Cuprates etc.

1.d)Define super capacitor.Give an example.

Super capacitors are energy storage devices.
they have a much higher energy density, making them excellent for a variety ofapplications EX: lithium-ion capacitor etc.

1.e)Differentiate between anode and cathode.
Anode: At anode always oxidation reaction takes place. That means the loosing of electrons.
Cthod : : At cathod always reduction reaction takes place. That means the gaining of electrons

1.f)Define the principle of Potentiometric titration.

It involves measuring the electrical potential of an electrochemical cell during a titration reaction by potentio metrically.(Based on Redox titrations)

1.g)Express the functionality of monomer with an example.

Functionality The number of active bonding sites of a monomer is referred to as its functionality. So, the monomer should have two reactive sites (or) bonding sites to form a polymer. Ex. Ethylene molecule has a double bond and it is bifunctional.

1.h) Name the monomer of Nylon-6,6.

Monomers: 1. Hexa methylene di amine . 2) adipic acid.

1.i) State the Beer-Lambert's law.

The Beer-Lambert law is a linear relationship between the absorbance and the concentration, molar absorption coefficient and optical path length of a solution.

1.j) Write the principle of High-Performance Liquid Chromatography.

- HPLC is a technique for disjointing, determining, and quantifying each component in a mixture.
- Spectroscopy is used to identify and quantify the mixture, which is separated using the fundamental concept of column chromatography.

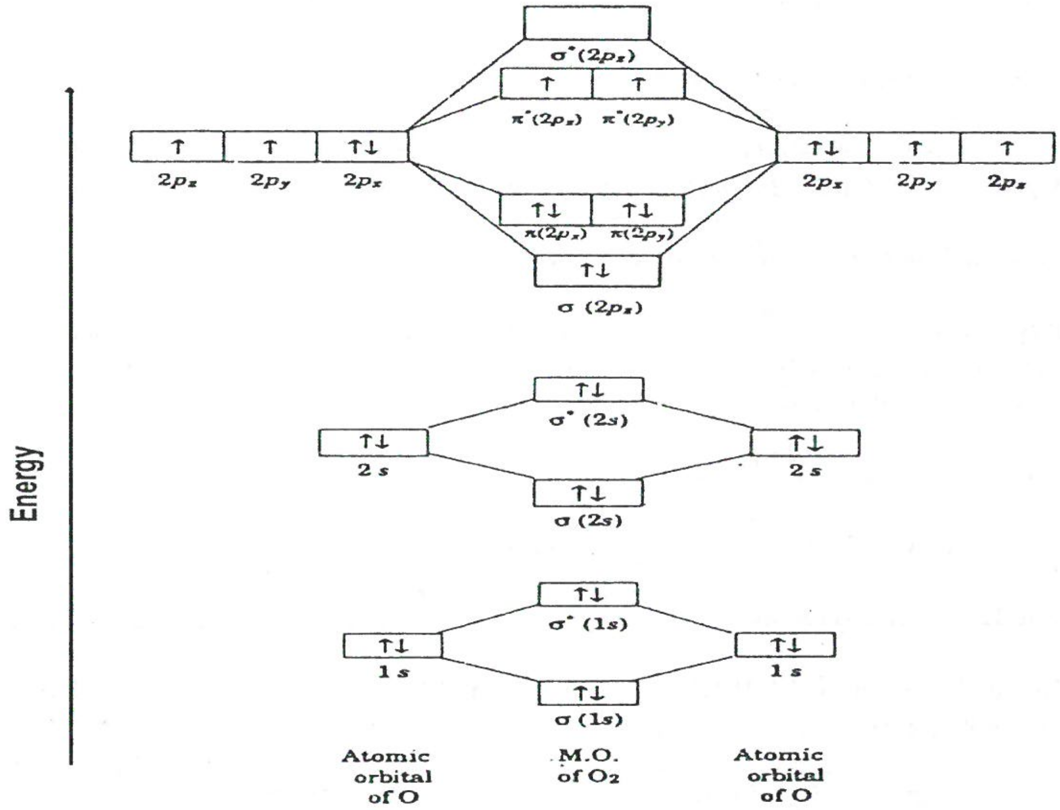
PART-B:

UNIT-1:

2.a) Molecular orbital diagram of O2 Molecule and bond order.

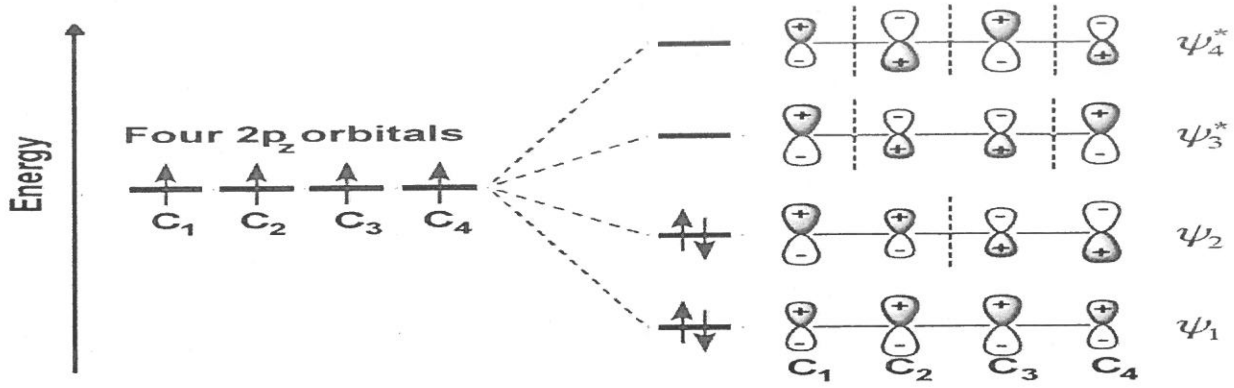
$$\text{Bond order} = \frac{N_b - N_a}{2} = \frac{8 - 4}{2} = 2.0$$

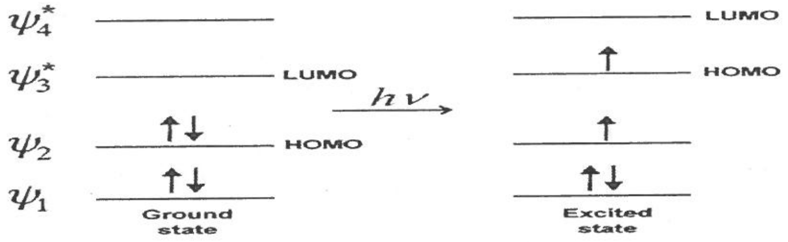
Hence, oxygen molecule contains a double bond and it is highly stable. It is a paramagnetic molecule, since there are two unpaired electrons in its antibonding molecular orbitals.



b) Draw the π-molecular orbital diagram of 1,3-butadiene Reference Electrodes:

π-Molecular orbitals of 1,3-butadiene: 1,3-butadiene is an organic molecule that contains four carbon atoms with two double bonds in conjugation. Each carbon is involved in sp2 hybridisation and contains one pz orbital unhybridised. Each pz orbital contains one unpaired electron. These orbitals overlap to form four π-molecular orbitals denoted as Ψ1, Ψ2, Ψ * 3 and Ψ * 4. Here Ψ1 and Ψ2 are bonding MO while Ψ * 3 and Ψ * 4 are antibonding





(OR)

3.a) Derive the Schodinger wave equation. State the significance of ψ and ψ 2.

Schrodinger wave equation: The fundamental equation describing the behaviour of a small particle in terms of wave motion is

$$\frac{d^2\psi}{dx^2}+\frac{4\pi^2\psi}{\lambda^2}=0$$

$$\Rightarrow \frac{1}{\lambda^2}=-\frac{d^2\psi}{dx^2}\times\frac{1}{4\pi^2\psi} \qquad \text{-----(1)}$$

where ψ =amplitude of the wave, x =displacement in a given direction and λ =wavelength.
According to de Broglie equation,

$$\lambda=\frac{h}{mc}$$

$$\Rightarrow \frac{1}{\lambda^2} = \frac{m^2c^2}{h^2} \qquad \text{-----(2)}$$

where m=mass of the particle, c=velocity of the particle and h=Planck's constant.
From eqs.(1) and (2),

$$\frac{m^2c^2}{h^2} = -\frac{d^2\psi}{dx^2} \times \frac{1}{4\pi^2\psi}$$

$$\Rightarrow m^2c^2 = -\frac{h^2}{4\pi^2\psi} \times \frac{d^2\psi}{dx^2} \qquad \text{-----(3)}$$

For a particle of mass m moving with velocity c, the kinetic energy is given by,

$$K = \frac{1}{2}mc^2 \quad \text{or,} \quad K = \frac{m^2c^2}{2m}$$

$$\Rightarrow m^2c^2 = K \times 2m \qquad \text{-----(4)}$$

From eqs.(3) and (4),

$$K \times 2m = -\frac{h^2}{4\pi^2\psi} \times \frac{d^2\psi}{dx^2}$$

$$\Rightarrow K = -\frac{h^2}{8\pi^2 m\psi} \times \frac{d^2\psi}{dx^2}$$

As the total energy E is the sum of kinetic energy K and potential energy V,

$$\mathrm{E = K + V}$$

$$\therefore\ E = -\frac{h^2}{8\pi^2 m\psi} \times \frac{d^2\psi}{dx^2} + V$$

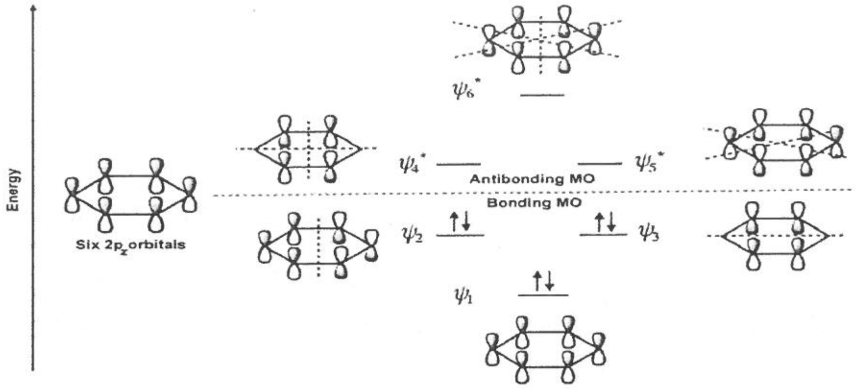
$$\Rightarrow \frac{d^2\psi}{dx^2} + \frac{8\pi^2 m}{h^2}(E - V)\psi = 0$$

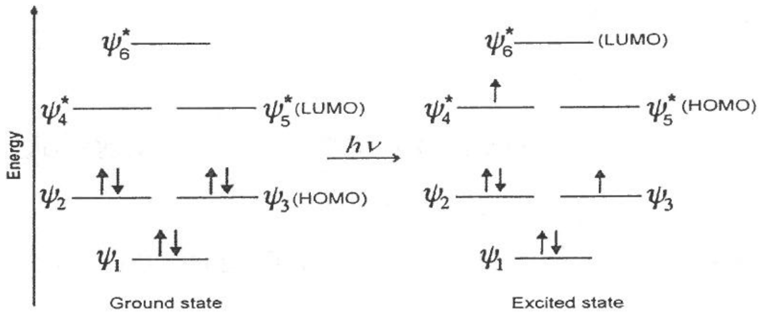
This is the Schrodinger wave equation in one dimension, X. If the motion of the particle is in three coordinates, X, Y and Z, then the equation becomes

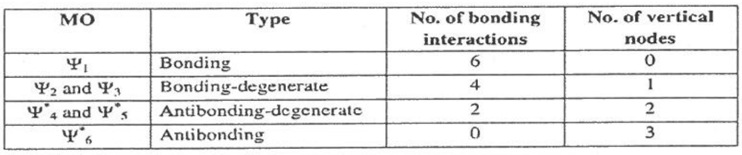
$$\frac{d^2\psi}{dx^2} + \frac{d^2\psi}{dy^2} + \frac{d^2\psi}{dz^2} + \frac{8\pi^2 m}{h^2}(E - V)\psi = 0$$

Significance of ψ and ψ^2: In Schrodinger wave equation, ψ is the amplitude of wave, called wave function. $\frac{d^2\psi}{dx^2}$ represents the second derivative of ψ w.r.t. x and so on. Being a second order differential equation, Schrodinger wave equation has several possible solutions. However, only a few values of ψ have physical significance. Each permitted solution of ψ is called Eigen function and it corresponds to a definite energy state of electron. The Eigen function for an electron is called an atomic orbital. The wave function (ψ) has no physical significance except that it represents the amplitude of the wave. It may be positive, negative or imaginary. However, ψ^2 has a physical meaning and it is related to the probability of finding of electron (particle) with definite energy within a certain domain in space. ψ^2 provides the measure of electronic charge density at a point.

b) Draw the π-molecular orbital diagram of Benzene







MO	Type	No. of bonding interactions	No. of vertical nodes
Ψ_1	Bonding	6	0
Ψ_2 and Ψ_3	Bonding-degenerate	4	1
Ψ^*_4 and Ψ^*_5	Antibonding-degenerate	2	2
Ψ^*_6	Antibonding	0	3

UNIT-2:

4.a)Construct the band diagram of conductors, insulators and semiconductors.

BAND THEORY :- M.O Theory was extended to the solids to explain the conductivity of metals and semiconductors. atomic orbitals combine to form bonding and anti bonding molecular orbitals.

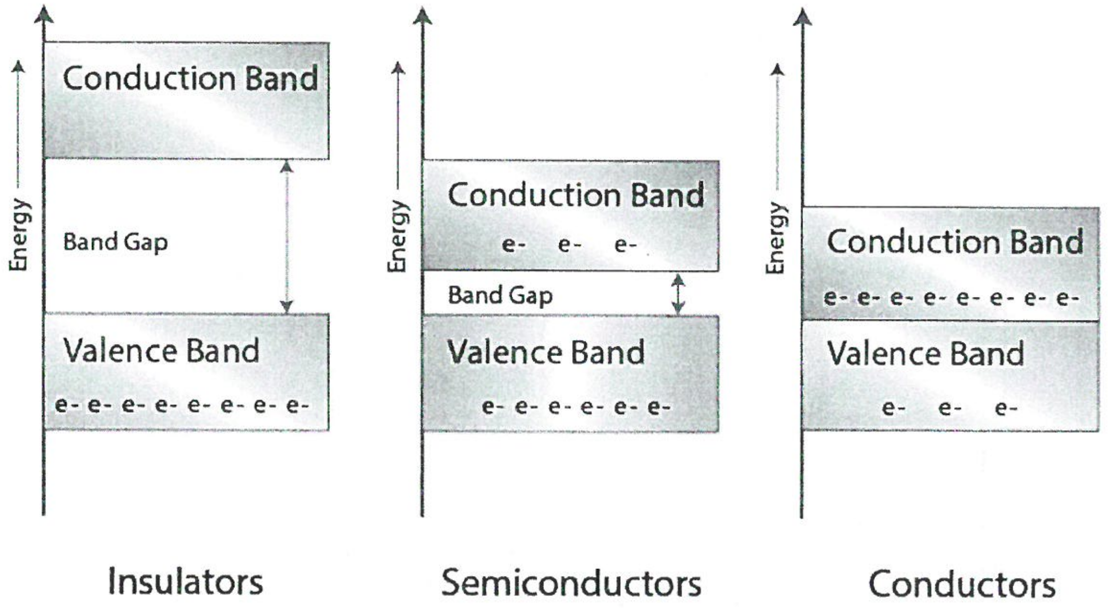
In solids these are called as valence band and conduction band.

Valence Band

The energy band involving the energy levels of valence electrons is known as the valence band. It is the highest occupied energy band. When compared with insulators, the band gap in semiconductors is smaller. It allows the electrons in the valence band to jump into the conduction band on receiving any external energy.

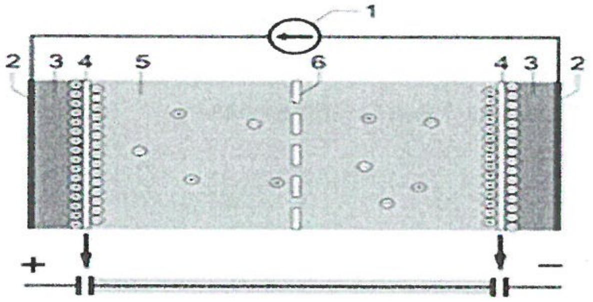
Conduction Band

It has conducting electrons resulting in the flow of current. The conduction band possess a high energy level and is generally empty. The conduction band in semiconductors accepts the electrons from the valence band



b).**Classify super capacitors based on their characterstics and explain them in detail.**

- ➢ Double-layer capacitors
  - o (Store charge electrostatically)
- ➢ Pseudo-capacitors
  (Store charge electrochemically)
- ➢ Hybrid capacitors(store charge electrostatically & electrochemically)



Typical construction of a supercapacitor:

(1)power source,
(2) collector,
(3) polarized electrode,
(4) Helmholtz double layer,
(5) electrolyte having positive and negative ions,
(6) separator

Electrical double-layer capacitance

- Electrostatic Double Layer Capacitors comprises two electrodes, a separator, and an electrolyte.
- Electrolyte is a mixture comprising positive and negative ions dissolved in water.
- The two electrodes are separated from each other through a separator.
- The supercapacitors use carbon electrodes with much higher electrostatic double-layer capacitance.
- The separation of charge in electrostatic double-layer capacitors is much less than in a conventional capacitor which ranges from 0.3–0.8 nm.

Electrochemical pseudo capacitance

- Pseudo Capacitors are also referred to as electrochemical pseudo-capacitors.
- They make use of metal oxide or conducting polymer electrodes that have a high amount of electrochemical pseudocapacitance.
- They store electrical energy by electron charge transfer between electrode and electrolyte.
- It is done through the oxidation and reduction reaction commonly known as a redox reaction.

Hybrid supercapacitor

- Hybrid Capacitors are made by using the techniques of double-layer capacitors and pseudo-capacitors.
- In these capacitors, electrodes with different characteristics are used.
- One electrode has the capacity to display electrostatic capacitance and the other electrode showcases electrochemical capacitance.

An example of a hybrid capacitor is the lithium-ion capacitor

(OR)

5.a)Explain any five applications of semiconductors.

- Temperature sensors are made with semiconductor devices.
- They are used in 3D printing machines
- Used in microchips and self-driving cars
- Used in calculators, solar plates, computers and other electronic devices.
- The physical and chemical properties of semiconductors make them capable of designing technological wonders like microchips, transistors, LEDs, solar cells, etc.
- The microprocessor used for controlling the operation of space vehicles, trains, robots, etc., is made up of transistors and other controlling devices, which are manufactured by semiconductor materials.

b) Types of carbon nanotubes and applications of nanotubes.

Carbon Nanotubes (CNTs):- Carbon nanotubes are allotropes of carbon with a nanostructurehaving length to diameter ratio greater than 1, 00,000. They can be considered as a sheet of graphite rolled in the form of a tube, with the ends of the sheet closed by bonds. Each carbon atom in carbon nano tube is covalently bonded to 3 other carbon atoms. Depending upon the way in which they are arranged, there are two types of CNTs.

1. Single walled nanotube (SWNTs)
2. Multiwalled Nanotubes.(MWNTs)

Single Walled Nanotubes:-Most of the single walled nanotubes have a diameter of nearlyone nanometer and a length that can be many millions of times greater than the diameter. The structure of SWNT can be obtained by wrapping one atom thick layer of graphite called graphene into a seamless cylinder. There are 3 types of single walled nanotubes based on the way the graphene sheet is wrapped. The graphene sheet is represented by a pair of indices (n,m)

called the chiral vector. The integers n and m denote the number of unit vectors along two directions in a crystal lattice of graphene.
If m=0 the nanotube is called zig-zag.

If n=m the nanotubes are called armchair. The lines of hexagons are parallel to the axis of the nanotube.

Engineering applications of carbon nanotubes:

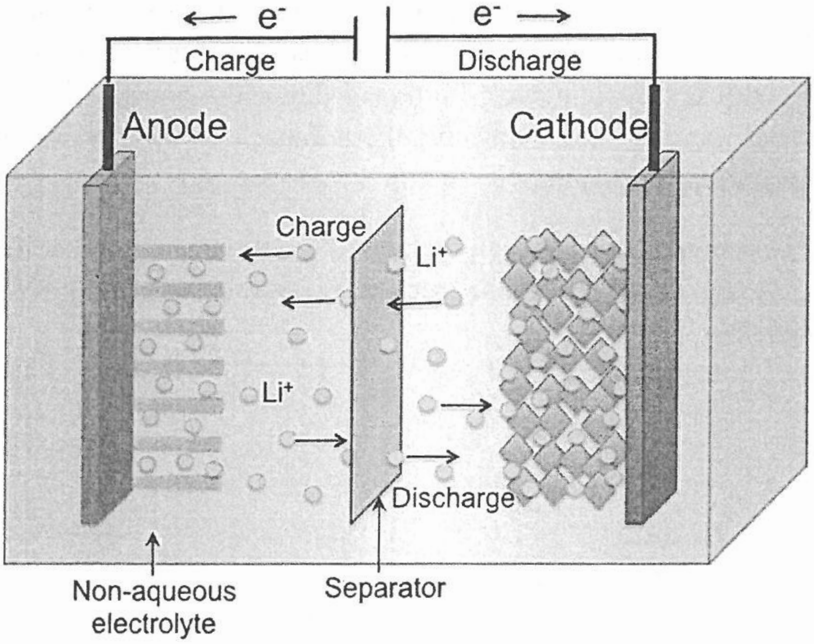
1. They find application in conductive composites, high strength composites, energy storage devices energy conversion devices, energy storage media, sensors, nanometer sized semi conductor devices etc. They are used as nanoprobes in biological and chemical investigations.
2. CNT can be functionalized with bio active peptides, proteins, nucleic acids, and drugs and can be used to deliver them to cells and organs.

UNIT-3:

6. a) Construction and working of Li-ion battery.

Lithium ion battery:-

The Li batteries are a rechargeable battery best suited to mobile devices that requires small size, light weight and high performance. In lithium –ion batteries, lithium compounds are used as anode. These batteries are known as rechargeable batteries. Therefore, lithium batteries are considered as best than pure lithium based batteries. It works on the principal of **Intercalation mechanism.**



Li- ion has four –layer structure.

- **Anode:-** lithium interacted graphite/carbon, metal matrix or polymer.
  A negative electrode made with specialty carbon.

- **Anode current collector** :- copper foil
- **Cathode**:- partially lithiated oxides of Ni, Co and manganese: Li_yNiO_2,Li_yCoO_2 and, Li_yMnO_2
- **Cathode current collector:** - aluminium foil.
- A **Separator** is a fine porous polymer film.
- An electrolyte made with lithium salt [$LiPF_6$] in an organic solvent [propylene carbonate or 1,2- dimethoxyethane]

  Lithium ion secondary battery depends on an "intercalation" mechanism.

  Reactions:-

  At anode: $Li_xC_6 \rightleftharpoons XLI^{+} + Xe^{-} + 6C$

  At Cathode :-$Li_{1-x}CoO_2 + XLI^{+} + Xe^{-} \rightleftharpoons LiCoO_2$

  Overall reaction :-$Li_xC_6 + Li_{1-x}CoO_2 \rightleftharpoons LiCoO_2 + 6C$

b) Discuss the conductometric titration of strong acid and strong base.

Ex1:Titrationofstrongacid vs. strongbase:

According to Kohlrausch's law, the electrical conductance of a solution depends upon thenumber and mobility of ions. For the titration of a strong acid like HCl against a strong baselike NaOH, before the NaOH solution is added, the acid solution has a high conductance duetothehighlymobilehydrogenions.Asalkalisolutionisaddedthehydrogenionsareremoved due to combination with the hydroxyl ions forming feebly ionized water (H_2O)moleculesandtheirplaceistakenbythemuchslowermoving Na+ions.

$$H^{+}Cl^{-}+Na^{+}OH^{-} \rightarrow Na^{+}Cl^{-}+H2O(feeblyionized)$$

Consequently the conductance of the solution decreases and continues to decrease on addingsodium hydroxide solution until equivalence point is reached. Any further addition of alkalimeans increase of Na+ and fast moving hydroxyl ions and thus the conductance begins toincrease. If we plot the conductance measured against the volume of NaOH added, the pointofintersectionwillgivetheneutralizationpoint

Graph: The values of observed conductance are plotted along Y axis against the volume ofNaOH added along the X axis. The point of intersection gives the amount of NaOH requiredforneutralizationoftheHCl.

(OR)

7. a)Explain Construction and working of H2-O2 Fuel cell.

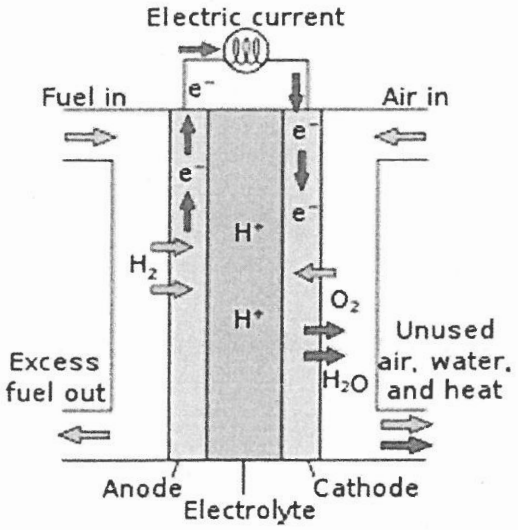
Construction and working ofH_2-O_2 fuel cell

Anode electrode–Porous carbon electrode containing Ni.

Cathode electrode-- Porous carbon electrode containing CoO or Ni and NiO

Electrolyte -- NaOH or KOH

1. It has two electrodes where the reactions take place and an electrolyte i.e., molten KOH which carries the charged particles from one electrode to the other.
2. $E^O{}_{cell}$Is positive, the cell reaction is spontaneous. The fuel cell produces power through redox reaction between hydrogen and oxygen.
3. At anode the hydrogen is oxidized through reaction with producing water and releasing two electrons.
4. The electrons flow through external circuit and returns to the cathode, reducing oxygen which consequently reacts with water to produce .
5. The fuel cell electrodes contain catalysts to speed up electrode reactions and the process is known electro catalysis. In the a mixture of Ni and NiO embedded in porous carbon electrodes which serves electro catalysts in the cell.



The corresponding reactions at anode cathode are;

At anode - $H_2 \longrightarrow 2H + 2e^-$ $E^0 = 0V$

At cathode - $\frac{1}{2} O_2 + 2H^+ + 2e^- \longrightarrow H_2O$ $E^0 = 1.2291\ V$

The overall reaction $H_2 + \frac{1}{2} O_2 \longrightarrow H_2O$ $E^0 = 1.2291\ V$

b) Derive the Nernst equation of a single electrode potential.

Consider any electrode half cell whose redox reaction is

$M^{n+} + ne^- = M$

The relation between the actual cell potential E and the standard potential E° is developed in the following way. We begin with the equation which relates the standard free energy change (for the complete conversion of products into reactants) to the standard potential

$\Delta G^\circ = -nFE^\circ \qquad (1)$

By analogy we can write the more general equation

$\Delta G = -nFE \qquad (2)$

We now substitute these into the expression that relates ΔG and ΔG° which has been given by Vant Hoff's equation(3)

$$\Delta G = \Delta G^\circ + RT \ \ln \frac{[\text{Products}]}{[\text{Reactants}]} \qquad (3)$$

substituting Therefore (1) and (2) in eq (3)

$$-nFE = -nFE^0 + RT\ \ln[\frac{\text{Product}}{\text{Reactent}}]$$

which can be rearranged to

$$E = E^\circ - (RT/nF)\ \ln \frac{[\text{Products}]}{[\text{Reactants}]}$$

This is the Nernst equation that relates the cell potential to the standard potential and to

We now substitute these into the expression that relates ΔG and ΔG° which has been given by Vant Hoff's equation(3)

$$\Delta G = \Delta G^\circ + RT \ \ln \frac{[\text{Products}]}{[\text{Reactants}]} \qquad (3)$$

substituting Therefore (1) and (2) in eq (3)

$$-nFE = -nFE^0 + RT\ \ln[\frac{\text{Product}}{\text{Reactent}}]$$

which can be rearranged to

$$E = E^\circ - (RT/nF)\ \ln \underline{[\text{Products}]}$$

[Reactants]

:

$E = E° - (2.303RT/nF) \log \underline{[M]}/[M^{n+}]$

$$E = E^0 - \frac{2.303RT}{nF}\log[\frac{\mathrm{M}}{\mathrm{M}^{n+}}]$$

$$E = E^0 + \frac{0.059}{n}\log[\frac{1}{\mathrm{M}^{n+}}\} \text{ (at 25 0c)}$$

UNIT-4:

8. a) Differentiates between thermo plastics and thermosetting plastics.

Thermoplastics	Thermosetting plastics
1. On heating, they become soft.	1. They do not soften on heating and become hard. On prolonged heating, these start burning.
2. These can be remoulded or reshaped.	2. They cannot be remoulded.
3. These have linear structures.	3. They have three dimensional crosslinked structures.
4. They are formed by addition polymerisation.	4. They are formed by condensation polymerisation.
5. They are less brittle and are soluble in organic solvents, e.g. PVC, teflon and nylon.	5. They are more brittle and are insolu- ble in organic solvents, e.g. bakelite and terylene.
6. soluble in organic solvents.	6. Insoluble in organic solvents.

8 (b). **b) Synthesis and applications of buna –N rubber.**

Buna –N (or) Nitrile butadiene rubber (NBR):

Preparation: It is prepared by free radical polymerization in the presence of free radical initiator✣ cumene hydrogen peroxide. It is a copolymer of 75% butadiene and 25% acrylonitrile.

Properties: It is oil resistance. If the content of acrylonitrile more than 40% then it is• extremely oil resistance. Resistant to heat, light and acids.• High load bearing capacity.• It has good tensile strength• It has good abrasion resistance.• It is less resilient than natural rubber.

• Applications: Used for the manufacture of• Hoses• Conveyer belts• Printing rollers• Tank lining• High altitude air craft components•

(OR)

9.a) What are the biodegradable polymers ? Write the synthesis and applications of PGA.

Biodegradation is the chemical breakdown of materials by physiological environment.

Preparation It can be prepared starting from glycolic acid by ring-opening polymerization. The most common synthesis used to produce a high molecular weight form of the PGA polymer is ring-opening polymerization of "glycolide", the cyclic diester of glycolic acid. Ring-opening polymerization of glycolide can be catalyzed using different catalyst

♦ Some polymers undergo degradation when exposed to moisture, heat, oxygen, ozone and micro organisms.

After solidification the resulting high MW polymer is collected.

Properties 1. Polyglycolic acid (PGA) has a high melting point in the range of 225 to 230 °C.

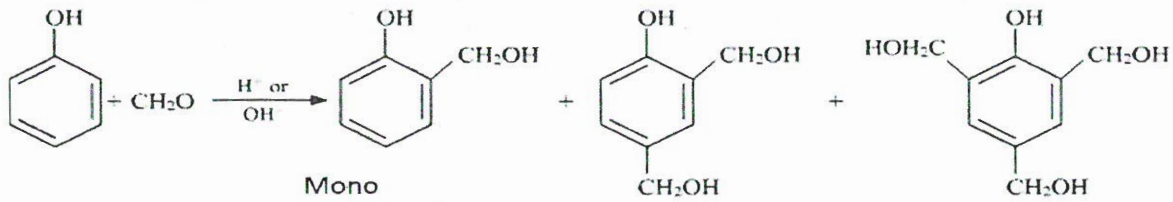
2. PGA also exhibits high crystallinity, and is insoluble in water.

3. The solubility of this polyester due to its high molecular weight form is insoluble in almost all common organic solvents (acetone, dichloromethane, chloroform, ethyl acetate, tetrahydrofuran

b) Explain the preparation and applications of Bakelite.

Step-1

Thefirststepisreactionbetweenphenolandformaldehydetoformmono,diandtri- methylol phenols.



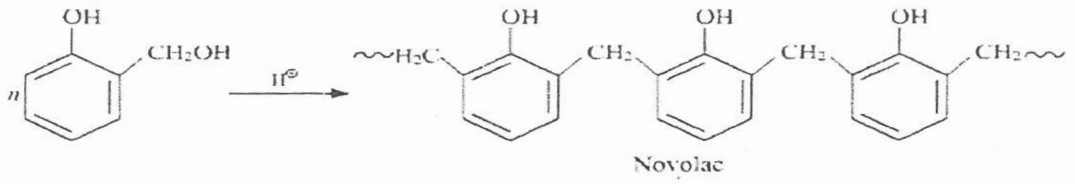
Mono methylol phenol

diMethylol phenol

TriiMethylol phenol

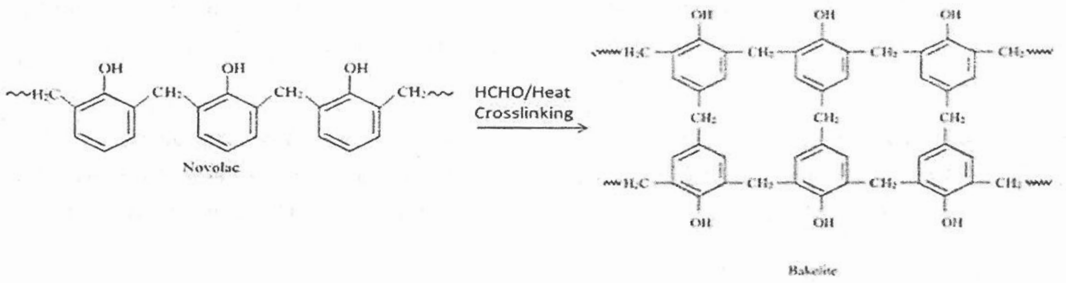
Step-II

When methylol phenols are heated with excess of phenol in presence of acid catalyst, the methylol phenols condense with phenol through methylenelinkagesto**fromlinearproductnovolac**withtheeliminationofwatermolecule.



Step-III

Further heating novolac and phenol in the presence of a catalyst(hexamethylenetetramine) leads to formation of hard, rigid, infusible crosslinked polymer called bakelite.



Properties: Theseare

Rigid
Hard, resistantto heat
With stand to high temperature
Good insulator
Applications : Usedforthepreparationof Electrical insulator parts likeSwitches, Plugs&Handles

UNIT-5:

10.a)Explain the classification of Chromatography.

1. Gas chromatography

2. HPLC

3.Adsorbtion chromatography

4. Thin layer chromatography.

5. paper chromate graphy.

Give explanation of above methods.

10.b) Make use of neat diagram to explain modes of vibrations.

Stretching vibrations:

• This involves the alternating compression and elongation of bond lengths. • Here distance between two atoms increases or decreases but the atoms remain in same bond axis.

• Symmetrical molecules like O=C=O are not IR active because no change in dipole moment is observed upon stretching vibrations. Stretching vibrations are of two types: • a. Symmetrical stretching: When two bonds increase or decrease in length.

• b. Asymmetrical stretching: When one bond length increased, the other decreases. Bending vibrations: • This type results in a change of bond angles.

• However, not all molecular vibrations induce an absorption of IR radiation. • For a vibration to be IR-active, it must cause a change in the molecule's dipole moment. • Hence, symmetrical molecules like O2 show no IR absorption. • Involve movement of atoms which are attached to a common central atom, such that there is change in bond axis & bond angle of each individual atom without change in their bond lengths. • Bending vibrations requires less energy & occur at longer wavelength than stretching vibrations. • Also called deformation vibrations.

Types of bending vibrations • A. In plane vibrations a) Scissoringb) Rocking • B. Out plane vibrations a) Waggingb) Twisting A. In-plane vibration: a) Rocking: In plane bending of atoms occurs wherein they swing back & froth with respect to the central atom. b) Scissoring: 2 atoms connected to central atom move towards and away from each other

B. Out plane vibrations: a) Wagging: two atoms oscillate up and below the plane with respect to the central atom. b) Twisting: one of atom moved up the plane while other down the plane with respect to central ato

(OR)

11.a) Describe the measurement of UV-Visible spectroscopy.

• U.V-Visible spectroscopy is absorption spectroscopy that deals with the recording of the absorption of electromagnetic radiation of the U.V and Visible regions of the electromagnetic spectrum.

• The U.V-region ranges from 200-400 nm whereas the visible region ranges from 400 to 800 nm. • So, we can say that U.V-Visible spectroscopy utilises a 200-800 nm range for working.

• This technique is widely used for detecting the presence and elucidating the nature of the conjugated multiple bonds and aromatic rings. Instrumentation of UV-Visible Spectroscopy 1. Radiation source

• Hydrogen-discharge lamp is the most commonly used source of radiation in the U.V region (200-400 nm) whereas a deuterium-discharge lamp is used when more intensity (3-5 times) is desired.

• A tungsten-filament lamp is used when absorption in the Visible region (400-800 nm) is to be determined.

2. Monochromator • It helps to separate the radiations into separate wavelengths that are only allowed to pass a specific wavelength through it.

• Monochromators are generally made up of prism or grating which is made up of quartz. • This is so because quartz does not absorb the radiations thus ensuring no loss of intensity and precise results.

3. Beam separator ● As the name suggests, beam separators help to separate the single radiation into two different paths/chambers : the reference chamber and the sample chamber. ● The former is called the reference beam and the latter is known as the sample beam.

4. Detectors ● Detectors have photocells or photomultiplier tubes that generate a voltage proportional to the radiation energy that strikes them.

5. Amplifier ● The spectrophotometer has a balancing electronic amplifier that subtracts the absorption of the solvent from that of the solution electronically.

6. Recorder ● A recorder automatically records the spectrum as a plot of the wavelengths of absorbed radiations against absorbance (A) or molar absorptivity (e)

11.b) Explain the electronic transitions in UV-Visible spectroscopy.

1)σ-σ*transition:

An electron in a bonding s-orbital is excited to the corresponding anti-bonding orbital and● observed with saturated compounds. The energy required is large.● For example, methane (which has only C-H bonds, and can only undergo σ-σ* transition)● shows an absorbance maximum at 125 nm. Absorption maxima due to σ-σ* transition is not seen in typical UV-VIS spectra (200 – 700● nm) but in UV-region (125-135nm

2)n-σ* transition:

Saturated compounds containing atoms with lone pairs (non- bonding electrons) like O, N, S● and halogens are capable of n-σ*transition. These transitions usually need less energy than n-σ* transition● They can be initiated by light whose wavelength in range 150 – 250 nm.● The number of organic functional groups with n-σ* peaks in the UV region is small.

3)π-π* transition:

π-electron in a bonding orbital is excited to correspondinganti-bonding orbital π* and● observed in conjugated compounds. Compounds containing multiple bonds like alkenes, alkynes, carbonyl, nitriles, aromatic● compounds, etc undergo π-π* transitions. e.g. Alkenes generally absorb in the region 170 to 205 nm.●

4)n- π* transition:

An electron from non-bonding orbital is promoted to anti- bonding π* orbital and required lower energy. Compounds containing double bond involving hetero atoms. (C=O, C=N, N = O) undergo● such transitions. n-π* transitions require minimum energy and show absorption at longer wavelength around 300● nm