Code: 23BS1202

I B.Tech - II Semester – Regular / Supplementary Examinations
JUNE 2026

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)	Define bond order and explain its significance.	L2	CO1
1.b)	State Heisenberg's uncertainty principle.	L2	CO1
1.c)	Explain intrinsic semiconductor with example.	L2	CO2
1.d)	Identify any two applications of nanomaterials.	L3	CO2
1.e)	Describe electrode potential.	L3	CO2
1.f)	Explain the concept of fuel cell. Give an example.	L2	CO2
1.g)	Describe thermoplastics with example.	L3	CO3
1.h)	Identify any two properties of Buna-S.	L3	CO3
1.i)	State Beer-Lambert's law.	L2	CO3
1.j)	Describe mobile phase in chromatography.	L3	CO3

PART – B

			BL	CO	Max. Marks
UNIT-I					
2	a)	Explain molecular orbital theory of O_2 with energy level diagram.	L4	CO4	5 M
	b)	Calculate bond order of CO and comment on stability.	L3	CO2	5 M
OR					
3	a)	Explain particle in one-dimensional box.	L4	CO4	5 M
	b)	Describe π-molecular orbitals of benzene.	L3	CO2	5 M
UNIT-II					
4	a)	Explain classification of nanomaterials.	L4	CO4	5 M
	b)	Discuss properties and applications of graphene and CNTs.	L3	CO2	5 M
OR					
5	a)	Explain band theory of semiconductors.	L4	CO4	5 M
	b)	Describe superconductors and their applications.	L3	CO2	5 M
UNIT-III					
6	a)	Derive Nernst equation.	L3	CO2	5 M
	b)	Calculate EMF of Daniell cell.	L3	CO2	5 M
OR					
7	a)	Explain construction and working of lithium-ion battery.	L4	CO4	5 M

	b)	Construct and working of hydrogen-oxygen fuel cell.	L3	CO2	5 M
UNIT-IV					
8	a)	Explain chain growth and step growth polymerization.	L4	CO5	5 M
	b)	Describe preparation and applications of Nylon-6,6.	L3	CO3	5 M
OR					
9	a)	Explain conducting polymers with mechanism.	L4	CO5	5 M
	b)	Discuss biodegradable polymers (PGA & PLA).	L3	CO3	5 M
UNIT-V					
10	a)	Explain Beer-Lambert's law with limitations.	L4	CO5	5 M
	b)	Describe UV-Visible spectroscopy instrumentation.	L3	CO3	5 M
OR					
11	a)	Explain principle and applications of HPLC.	L4	CO5	5 M
	b)	Classify chromatography techniques with examples.	L4	CO5	5 M

Code:23BS1202 **PVP23**

PRASAD V. POTLURI SIDDHARTHA INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

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

June- 2026

Scheme of Valuation

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

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

PART-A
1.a) Define the bond order and explain its significance.-------------------------------------2M
1.b)State Heisenberg's uncertainity principle. -------------- 2M
1.c) Explain the intrinsic semi conductors with example.--------------------------------- 2M
1.d)Identify any two applications of nanomaterials.--2M
1.e)Describe electrode potential.--- 2M
1.f)Explain concept of fuel cell. Give an example.-- 2M
1 .g) Describe thermo plastics with example. --2M
1.h) Identify the two properties of Buna-s. ---2M
1.i) State the Beer-Lambert's law.--2M
1.j) Describe mobile phase in Chromatography.--2M
PART-B
UNIT-1
2.a) Molecular orbital diagram of O2 Molecule -- 4M
Bond order --- -1M
b) Calculate bond order of CO andcomment on stability.-------------------------------- 5M
OR
3.a) Explain the particle in one –dimensional box. --5M
b) Draw the π-molecular orbital diagram of Benzene .--------------------------------- 5M
UNIT-2
4.a) Explain classification of Nano materials.--5M
b) Discuss properties of graphene and CNTs-- 2M
Applications of graphene and CNTs---3M
OR
5. a) Explain the band theory of semiconductors. --5M
b) Describe superconductors --2M
Any three applications of Superconductors ---3M
UNIT-3
6. a) Derive Nernst equaton-------- ---5M
b) CalculateEMF of Daineal cell .---5M
OR
7. a) Construction of Li-ion battery ---3M

Working of Li-ion battery .---2M
b) Construction of H2-O2 Fuel cell .---3M
Working of H2-O2 Fuel cell .--- 2M
UNIT-4
8.a) Explain Chain growth polymerization --2M
Step growth polymerization ---3M
b)Describe preparation of nylon-6,6--3M
Applications--2M
OR
9.a) Explain the Conducting polymers with Mechanism.---------------------------------------5M
b) Discuss Biodegrade polymer – PGA ---3M
PLA---2M
UNIT-5
10.a) Explain the Beer-Lambert's law --4M
Limitations --1M
b) Instrumentation UV-Visible diagram --2M
Explanation of UV-Visible --- 3M
OR
11.a) Explain principle of HPLC -- 3M
Applications -- 2M
b) Classification of Chromatography Techniques with examples. --------------------------- 5M

ANSWERS

PART- A

1.a) Define the bond order and explain its significance.

Bond order means the difference between the No of electrons present in bonding Molecularorbitals to the No of electrons present in anti- bonding molecular orbitals.

Bond Order = No of electrons in BMO - No of electrons in ABMO/2

1. b)) 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.c) Explain the intrinsic semi conductors with example

Intrinsic semiconductors are pure semiconductors, and these are substances without the presence of any impurity or doping. Example Pure form of silicon

1.d)) Identify any two applications of nanomaterials

-They can easily accept electrons hence can be used as charge carriers in batteries.

- They can be used as organic photovoltaics

(NOTE: write any two applications)

1.e)Describe electrode potential.

Electrode potential is the potential generated when a metal is submerged in a solution containing its own ions. It's a measure of the tendency of a metallic electrode to lose or gain electrons when it's in contact with a solution of its own salt.

1.f) Explain the concept of fuel cell Give an example.

Fuel – cell are the electrochemical devices which can convert the energy of fuel – cell into electrical energy without the use of a heat engine, I.e without combustion by combining hydrogen and oxygen to produce water and heat.

Eg: Hydrogen – oxygen fuel cell.

1.g)Describe thermoplastics with examples.

These are linear, long chain polymers that soften on heating and hardens on cooling.

Ex: PE, PS, PVC etc.

1.h) Identify any two properties of Buna-S.

Properties:

- **Excellent abrasion resistance.**
- **Very tough.**
- **high load bearing capacity**
- **Sensitive to oil, waste water and ozone.**
- **Good electrical properties.**

(Note : Write any two properties)

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) Describe mobile phase in chromatography.

The mobile phase is a solvent or solvent combination that is pushed through the separation column under high pressure

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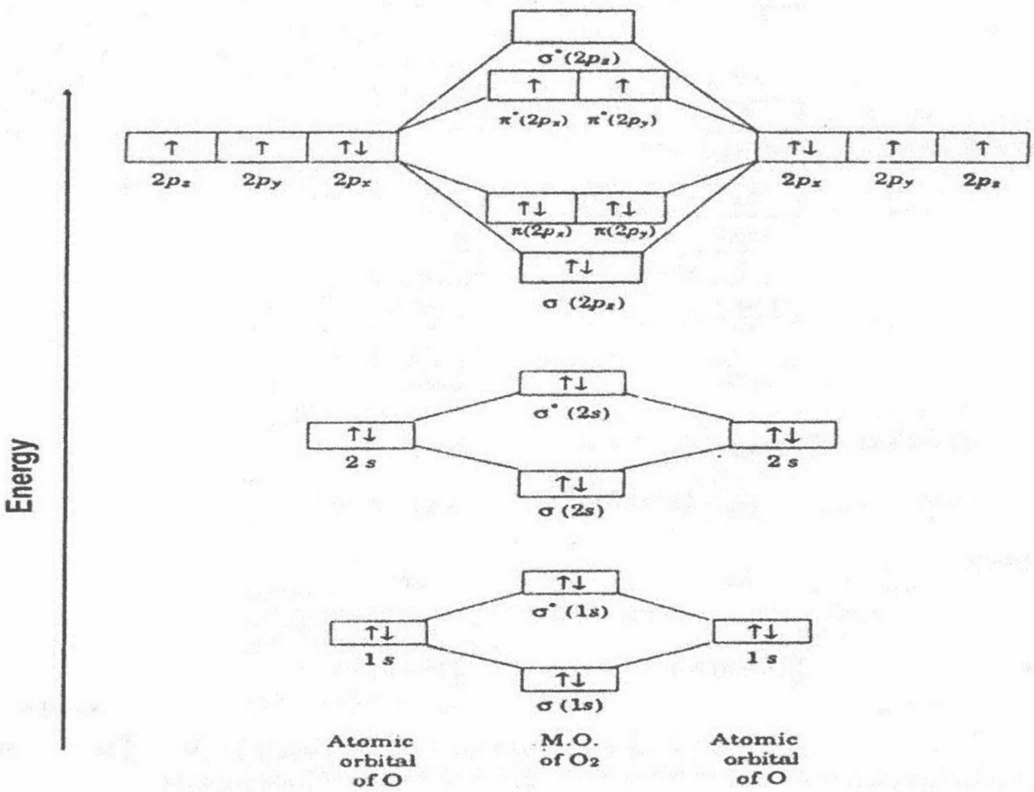
PART-B:

UNIT-1:

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

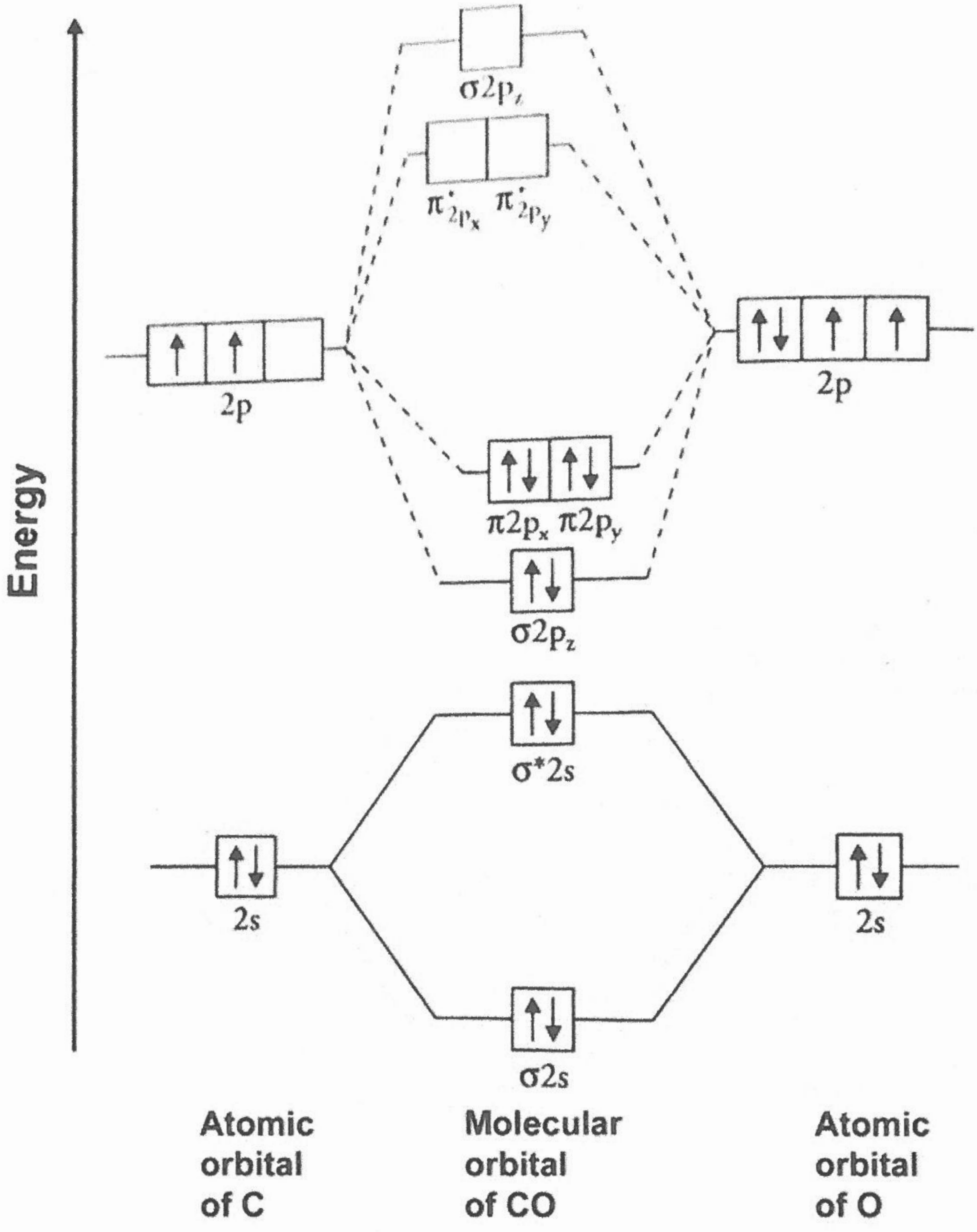
$$\text{Bond order} = \frac{N_b - N_a}{2} = \frac{8 - 4}{2} = 2.0$$

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) Calculate bond order of CO andcomment on stability.

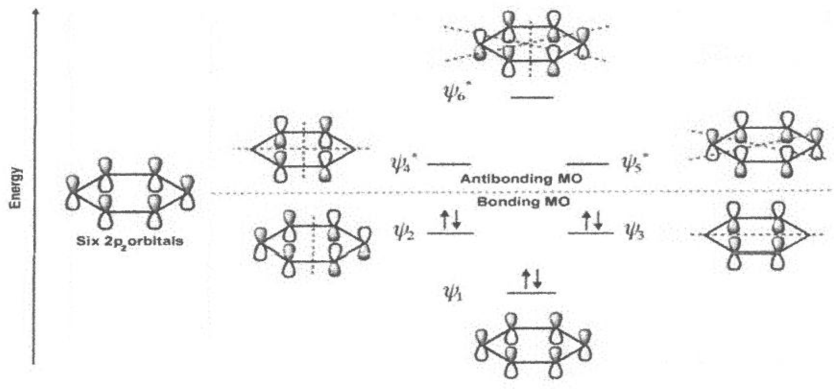
Carbon monoxide (CO): Atomic number of carbon is 6 and that of oxygen is 8.
C (Z=6): 1s2 2s2 2px1 2py1 2pz0 O (Z=8): 1s2 2s2 2px2 2py1 2pz1
The molecular orbital configuration of CO is:
σ(1s2) < σ*(1s2) < σ(2s2) < σ*(2s2) < σ(2pz2) < [π(2px2) = π(2py2)]
Nb - Na 8 - 2
Bond order = = = 3.0
2 2
Thus, CO molecule is quite stable and has a shorter bond length. The molecular orbital configuration of CO is similar to that of N2 (isoelectronic). CO has a triple bond (one σ, two π).
Since the molecular orbitals of CO has no unpaired electron, it is diamagnetic.

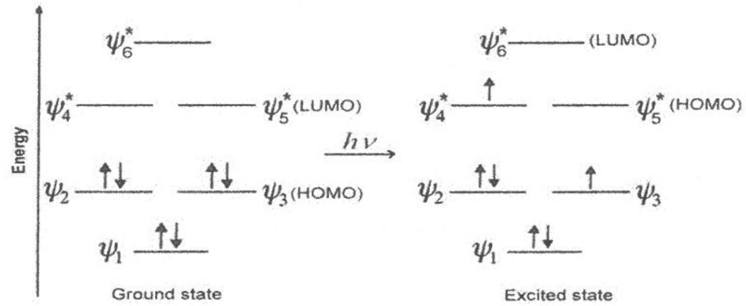


Energy
$\sigma 2p_z$
$\pi^*_{2p_x}$ $\pi^*_{2p_y}$
2p
2p
$\pi 2p_x$ $\pi 2p_y$
$\sigma 2p_z$
$\sigma^* 2s$
2s
2s
$\sigma 2s$
Atomic orbital of C
Molecular orbital of CO
Atomic orbital of O

3.a) Explaine the particle in one-dimensional box.
(Note: plz consider the dervation of particle- in one- dimenstion box)

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) **Explain classification of Nano materials**

. Nano materials in 1-dimension are layers like thin films or surface coating nano materials.

Nano materials in 2-dimensions are tubes like nano tubes and nano wires.

Nano materials in 3-dimensions are particles like precipitates, collides and quantum dots.

b) Discuss properties and applications of graphene and CNT's

Properties of carbon nanotubes:

Mechanical properties: Carbon nanotubes possess amazing mechanical properties. They are the strongest and stiffest materials in terms of tensile strength and elastic modulus respectively.

Hardness: A super hard material could be synthesized by compressing SWNTs to above 24Gpa at room temperature. The hardness of this material was measured by nanoindenter and was found to be 62-152 Gpa.

Electrical properties: Carbon nanotubes can be metallic or semiconducting depending upon their structure. For a given nanotube with n=m, the nanotube is metallic. If n-m is a multiple of 3 then a nanotube is semiconducting and possesses a very small band gap. Otherwise a nano tube is a moderate semiconductor. Thus all arm chair nanotubes are metallic with conductivities higher than that of copper. Others behave more like silicon.

Vibration properties: Carbon nanotubes show two normal modes of vibration

A_1g mode: It involves in and out oscillation.

E_2g mode: It involves oscillation between sphere and an ellipse.

Engineering applications of carbon nanotubes:

Carbon nanotubes have high strength, small dimensions and remarkable physical properties.

Due to this they find application in different fields.

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. They are the alternative and efficient tools for transporting and translocating therapeutic molecules.

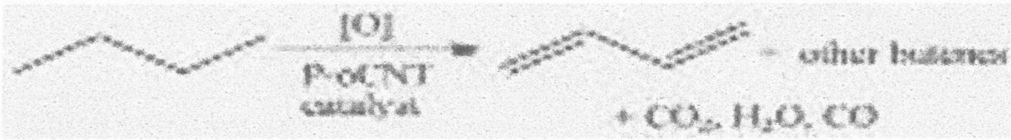
Applications in fuel cells:

1. Carbon nanotubes can be used to store hydrogen which in turn can be used for fuel cells.
2. A new fuel electrode made-up of a network of single walled carbon nanotubes was created by a group of scientists .It is very thin and light in weight. This electrode can work as a conventiol electrode. Use of this electrode makes the entire fuel cell much lighter.

Applications in cataysis:

1. Carbon nanotubes work as materials for catalyst or as catalyst additives.
2. A catalyst having CNT makes the reaction milder, safer and more selective.

3. Oxidized CNT with phosphorous added to it are used as catalyst for oxidative dehydrogenation of butane to butadiene.



<u>Applications in medicine:</u>

a) Carbon nanotubes are highly used in drug delivery and biosensing methods for disease treatment and health monitoring.

Fictionalization of SWNTs increases the solubility hence more efficient for tumor

5.a)Explain the band theory of 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.

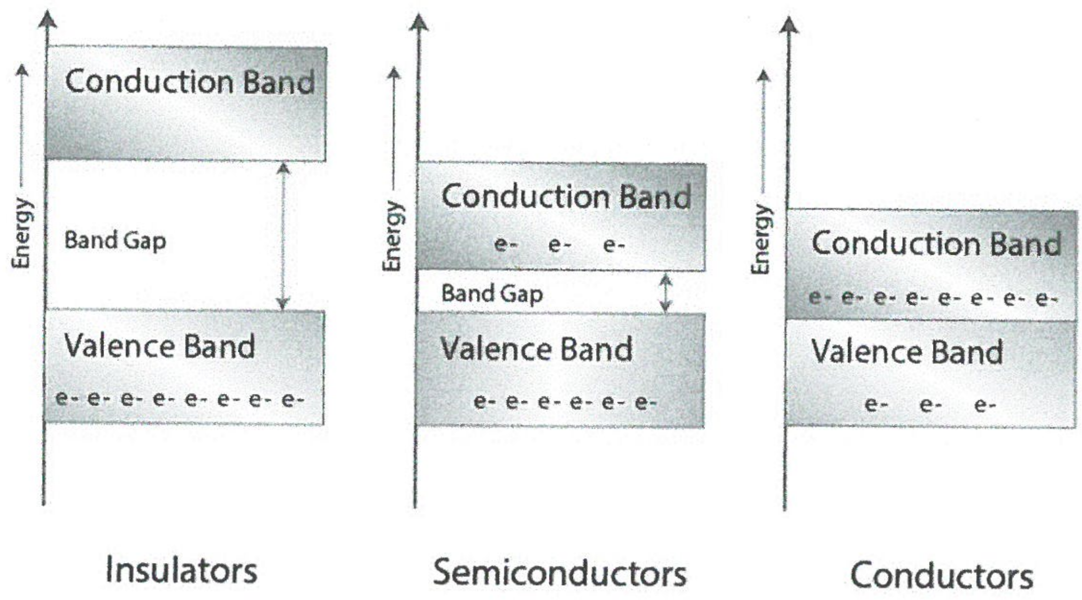
In solids these are called as valence band and conduction band.

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) Describe the superconductors and their applications.

Superconductivity is a remarkable physical phenomenon where certain materials can conduct electric current with zero electrical resistance

Applications of Superconductors:

Magnetic Resonance Imaging (MRI): Superconducting magnets are widely used in MRI machines to generate strong, stable magnetic fields for medical imaging. The absence of electrical resistance and the Meissner effect contribute to the high-quality images produced by these machines.

Particle Accelerators: Superconducting magnets are essential components in particle accelerators like the Large Hadron Collider (LHC). They generate powerful magnetic fields to guide and accelerate particles.

Magnetic Levitation (Maglev): Superconducting materials are used in Maglev trains to create a magnetic cushion that allows the trains to hover above the tracks, eliminating friction and enabling high-speed, efficient transportation.

Energy Transmission: Superconductors can be used for high-capacity, low-loss electrical power transmission. While this technology is still in the experimental stage, it has the potential to significantly improve the efficiency of electrical grids.

Superconducting Quantum Devices: Superconductors are used in quantum computing and quantum sensing applications. They can be used to create qubits in quantum computers and enable extremely sensitive detectors for various scientific and industrial purposes.

Energy Storage: Superconducting magnetic energy storage (SMES) systems store energy in the form of a magnetic field and can release it when needed. These systems can be used for grid stabilization and as backup power sources.

UNIT-3:

6. a) Derive the Nernst equation .

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

$\Delta G° = -nFE°$ (1)

By analogy we can write the more general equation $\Delta G = -nFE$ (2)

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

$$\Delta G = \Delta G° + RT \ln \frac{[\text{Products}]}{[\text{Reactants}]} \quad (3)$$

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

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

which can be rearranged to

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

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)

$$\Delta G = \Delta G° + RT \ln \frac{[\text{Products}]}{[\text{Reactants}]} \quad (3)$$

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

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

which can be rearranged to

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

:

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

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

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

b)Calculate EMF of the Daniell cell.

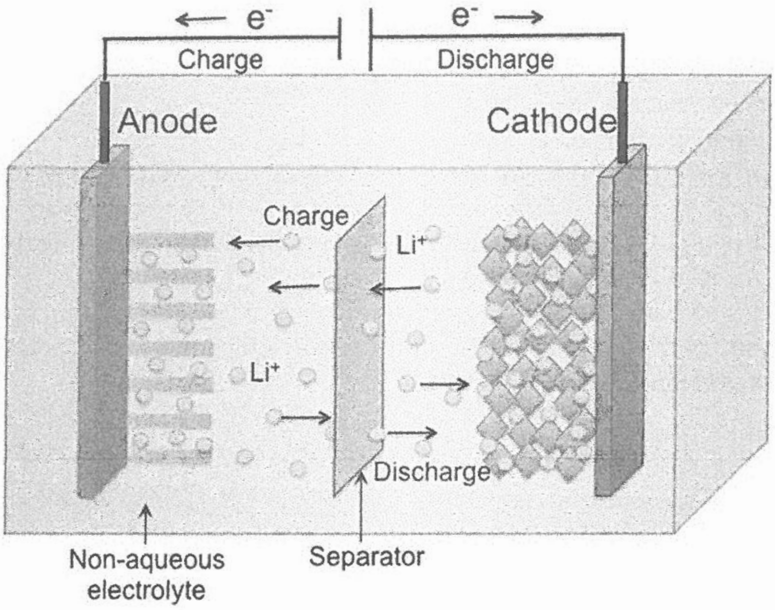
EMF = E cathode- Eanode
EO cell = Ecathode-Eanode
E0 cel = 0.34-(- 0.76)= 1.1 ev

(OR)

7.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)

Explain Construction and working of H2-O2 Fuel cell.

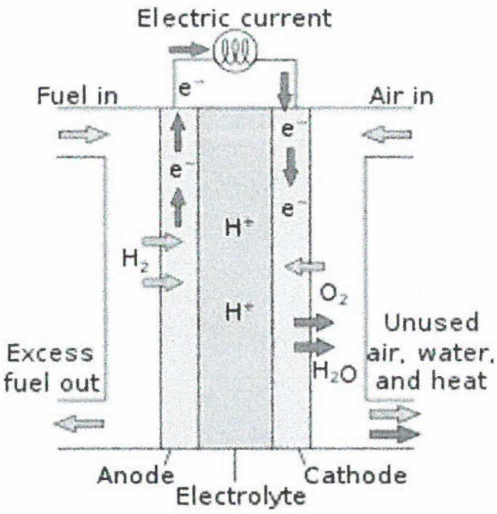
Construction and working ofH_2-O_2 fuel cell

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

UNIT-4:

8. a)Explain the chain growth and step growth polymers.

Chain growth polymers: Addition polymers

Step growth polymers are condensation polymers

Addition polymerization:

Polymer is formed by addition of monomers without elimination of small molecules.

No by-products are formed.

Monomer with unsaturation undergoes addition polymerisation

Ex: PS, PVC etc.

Condensation polymerization:

Polymer is formed by two or more monomers by the elimination of small molecules.

By products are formed like H2O,NH3

Monomers with functional group undergo condensation polymerisation.

Ex: Nylon-6, Bakelite

8 (b)Describe preparation and properties of Nylon-6,6

Nylon 66

Nylon 66 is synthesized by polycondensation of hexamethylenediamine and adipic acid. Equivalent amounts of hexamethylenediamine and adipic acid are combined in water.

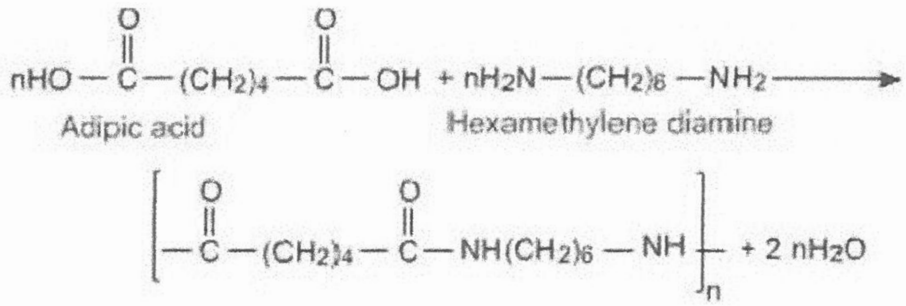
Properties: These are

1. Rigid

2. high mechanical strength

3. Hard , resistant to heat

4. With stand to high temperature



(OR)

9.a)Explain the conducting polymers with mechanism.

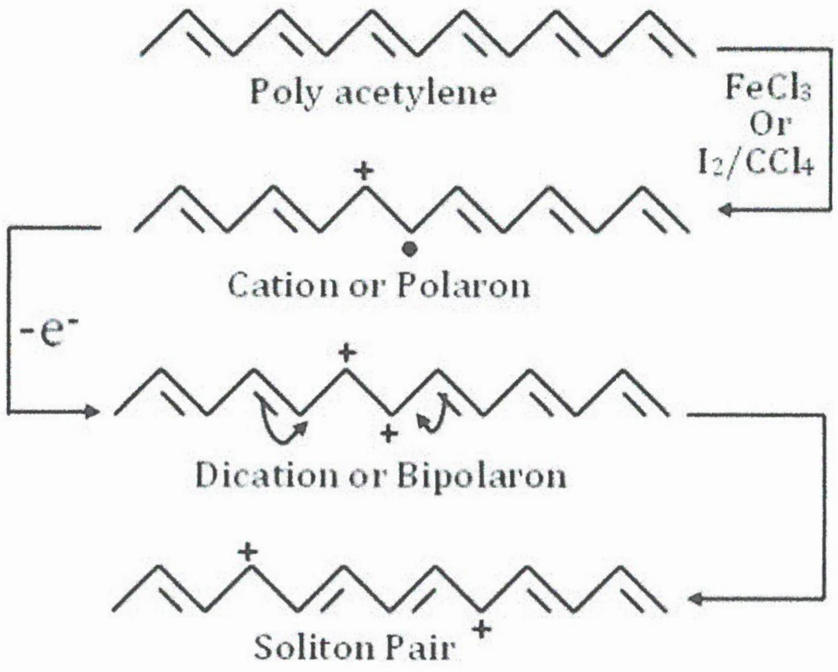
Conducting polymers: The polymers which can conduct electricity are called conducting polymers.

Ex. poly acetylene, polyaniline etc.

Mechanism of p-Doping:

- During this process, oxidation of polymer takes place due to dopant and forms a cation called Polaron.

- On further oxidation of polymer results in the formation of a dication or bipolaron.
- The charges get separated by forming a soliton pair.
- The cation occupies the band gap between valency band and conduction band, thereby creating a conducting path.



b)Discuss biodegradable polymers(PGA&PLA)

Polyglycolic acid (PGA) or Polyglycolide, is a biodegradable, thermoplastic polymer and the simplest linear, aliphatic polyester.

PLA is being considered as the most promising biodegradable fiber produced from renewable resources for replacing conventional PET fibers in textile industry.

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 catalysts, including antimony compounds, such as antimony trioxide or antimony trihalides, zinc compounds (zinc lactate) etc.

A catalytic amount of initiator is added to glycolide under a nitrogen atmosphere at a temperature of 195 °C. The reaction is allowed to proceed for about two hours, then temperature is raised to 230 °C for about half an hour.

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.
4. Fibers of PGA exhibit high strength and are particularly stiff.

Applications:

PGA and its copolymers have been used in medical fields such as in drug delivery systems, dental and orthopedic applications due to their good biocompatibility.

Preparation

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Polylactic acid

Polylactic acid, also known as poly(lactic acid) or polylactide (PLA), is a thermoplastic polyester wit backbone formula $(C3H4O2)n$ or $[–C(CH3)HC(=O)O–]n$

PLA has become a popular material due to it being economically produced from renewable resources.

The monomer is typically made from fermented plant starch such as from corn, sugarcane or sugar beet pulp.

Two main monomers are used for synthetic preparation: lactic acid, and the cyclic di-ester, lactide.

UNIT-5:

10.a)Explain the Beer's –Lambert's law with limitations.

The Beer-Lambert law is a linear relationship between the absorbance and the

concentration, molar absorption coefficient and optical path length of a solution:

$$A = \varepsilon c l$$

A	Absorbance	
ε	Molar absorption coefficient	$M^{-1}cm^{-1}$
c	Molar concentration	M
l	optical path length	cm

- The lineari… chemical and instrumental…

\# Causes of n… ditions:

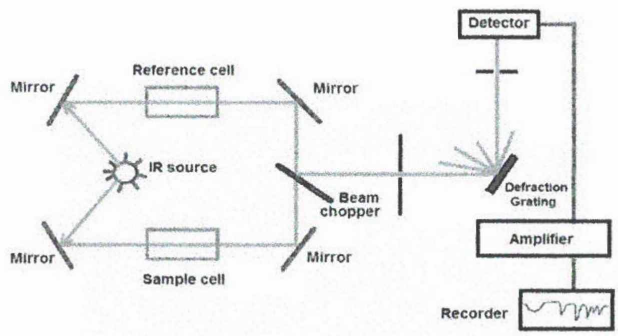
- deviations i… ons (>0.01M) due to electr… roximity
- scattering of light due to particulates

10.b)Describe UV-Visible spectroscopy instrumentation.

- 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.

Double beam spectrophotometer:



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).

(OR)

11.a) Explain the principle and applications of HPLC.

- A separation column separates the stationary and mobile phases during purification.
- In a separation column, the stationary phase is a granular substance with very small porous particles.
- The mobile phase is a solvent or solvent combination that is pushed through the separation column under high pressure.
- The sample is loaded into the mobile flow regime from the pump to the separation column using a syringe through a valve with a linked sample loop, i.e. a tiny tube or capillary made of stainless steel.
- A chromatogram is generated in the HPLC software at the conclusion of this operation/run.
- The chromatogram allows the various compounds to be identified and quantified.

- As a result, owing to interactions with the stationary phase, the constituent components of a mixture migrate through the column at different speeds.
- Individual compounds are identified by an appropriate detector after exiting the column and transmitted as a signal to the computer's HPLC software.

Applications:

- Purification of water.
- Impurity detection in the pharmaceutical industry.
- Trace components are pre-concentrated.
- Chromatography based on ligand exchange.
- Protein chromatography via ion exchange.

11.b)Classify chromatography techniques with examples.

Note:Write any four chromatography techniques. With examples

1. **Gas chromatography**
2. **Paper chromatography**
3. **Thin layer chromatography**
4. **HPLC**