Important Questions Chemistry

Q-1 What do you mean by electrochemistry and state its advantages?

Ans-1 Electrochemistry is that branch of
chemistry which primarily deals with the relation between chemical energy and electrical energy and their inter conversions. The principles of electrochemistry help us to understand production of electricity from energy released during chemical reactions and the use of electrical energy to carry out chemical reactions.

Importance of Electrochemistry:

1 Extraction of more electropositive metals like Na, Mg. Ca and Al.
2 Electroplating, Electrolytic refining, Electrometallurgy.
3 Electrochemical cells and batteries and used in various instruments.
4 Understand corrosion of metals and develop preventive techniques.
5 Production of fuel cells.

Q-2 What do ypu mean by Oxidation and Reduction?

Ans-2 The oxidationis a process in which a substance looses one or more electrons. Consider the following examples:

Na(s)□Na+1
(g)+ 1 e-1}

Sodium metal atom loose an electron, hence it is
said to be oxidized to form sodium cation.

The reduction is a process in which a substance gains one or more electrons. Consider the following examples:

Na+1
(g)+ 1 e-1□Na(s)}

Sodium cation gains an electron, hence it is said to be oxidized to form sodium metal atom. Thus, sodium metal is manufactured by the electrolytic reduction of molten sodium chloride

Q-3 What do you mean by redox reaction?

Ans-3 Oxidation and reduction take place simultaneously. Therefore, redox reaction is a process in which oxidation and reduction take place simultaneously.

4 Fe(s)□4Fe+3 + 12 e-1} 1. Iron oxidized to form ferric ion

Q-4 Explain different types of electrolytes?

Ans-4 There are two types of electrolytes:

1-Strong electrolytes-The electrolytes which dissociate or ionize completely into ions in either molten or aqueous state are called strong electrolytes. e.g., HCl, H2SO4, HNO3, KOH, NaOH, NaCl, KCl, K2SO4 etc.

2-Weak electrolytes-The electrolytes which dissociate into ions partially in their

aqueous or molten state are called weak electrolytes, e.g., CH3COOH, H2CO3, NH4OH, AgCl etc.

Q-5 Define electrolysis?

Ans-5 The process of decomposition of an electrolyte when electric current is passed through either its aqueous solution or molten state is called electrolysis

Q-6 Define Faraday's law of electrolysis?

Ans-6 **5.7 FARADAYS LAWS OF ELECTROLYSIS:**
Faraday's first law of electrolysis: According to Faraday's first law ofelectrolysis, "The amount of the substance deposited or liberated at electrodesisdirectly proportional to thequantity of electricity passed through electrolyte."
Mathematically,if
'W' is the mass of substance deposited or liberated at electrode.
Then,

W = I x t x Z or
W = Q x Z, where Q = It
Here, I= current in ampere (A), t = time in second (s), Q = quantity of charge in coulomb (C). Z is a constant known as electrochemical equivalent of substance grams per coulomb (g/C).
When I = 1 A, t = 1 s or Q = 1 C, then, W= Z.

Faraday's second law of electrolysis : According to Faraday's second law o felectrolysis, "The amount of the substances deposited or liberated at the electrodes by passing the same quantity of electricity through solutions of different electrolysis directly proportional to their equivalent weights or their electrochemical Equivalent

$$\frac{\text{MASS OF A}}{\text{MASS OF B}} = \frac{\text{EQUIVALENT WEIGHT OFA}}{\text{EQUIVALENT WEIGHT OF B}}$$

Q-7 What are the industrial applications of electrolysis?

Ans-71) **Electrolytic refining**: The process of purification of metals (crude or impure metal) by electrolysis method is called electrolytic refining. The metals like Copper and aluminum are refined (purified) by using electrolytic refining.

2 Electrometallurgy : The process of extraction of highly electropositive metals by electrolysis of their fused oreis called electrometallurgy. The more reactive metals like alkali metals (Li, Na, K), alkaline earth metals(Mg, Ca,Sr) and Aluminum (Al) are extracted from their ore by principles of electrometallurgy.

3 Electroplating: The process of coating a layer of superior metal on inferior metals surface by electrolysis is called electroplating.
The electroplating is done:
1 To protect the metal or alloy from corrosion.
2 To improve the surface and provide aesthetic look to metal.

Q-8 What do you mean by metals and nonmetals?
Ans-8 **Metals:**The elements which are hard, dense, malleable, ductile, good conductor of electricity, electropositive in character and have bright luster and having high melting and boiling point are called metals. Examples are copper, silver, iron, aluminum etc.

Non-Metals: The elements which are generally not malleable, not ductile, bad conductor of electricity, electronegative in character are called non- metals. Examples are hydrogen, oxygen, carbon, sulfur etc.

Q-9 Define metals and its ore ?
Ans-9 **MINERA**L:The natural substance in which metal occur either in native state or in the combined state is called mineral.
Ore: The mineral from which the metal can be extracted easily and economical is called ore.
Hematite ($Fe_2O_3.xH_2O$) is ore of iron.
Bauxite ($AI_2O_3.2H_2O$) is the ore of aluminum
Copper pyrite ($CuFeS_2$) is the ore of copper.

Q-10 Explain metallurgy and types of metallurgy?
Ans-10 The extraction of metals from their chief ore is called metallurgy.
Types of metallurgy:
Metallurgy is of three types:
a) Pyrometallurgy**:** Extraction of metals from their ore by heating with coke (carbon)

or Carbon monoxide is called pyro-metallurgy. Iron (Fe) is extracted fromHematite ($Fe_2O_3.xH_2O$)by heating with coke.
b) Electrometallurgy:Extraction of metals from their ore by the process of electrolysis is called electrometallurgy. Aluminum is extracted from fused alumina mixed with cryolite by electrometallurgy.
c) Hydrometallurgy: The extraction of metal from their ore by dissolving insuitable solvent then precipitating the metal from the solution by more reactive metal is called hydrometallurgy. Au (gold) and Silver (Ag) are extracted from their ore by hydrometallurgy.

Q-11 What are the general steps of mettalurgy?
Ans-11 **GENERAL STEPS OF METALLURGY:**
a) Crushing of ore: The process of converting big piece (lumps) of ore into smaller pieces is called Crushing of ore. It is done with the help of jaw crusher
b) Pulverization of ore: The process of converting crushed ore into powder form is called pulverization of ore. This process is carried with the help of ball mill or stamp mill.
c) Concentration of ore/ benefaction process: The process of removing impurities from pulverized ore is called concentration of ore.Depending on the nature of ore and impurities the following methods are used for concentration of ore
Gangue or matrix: The siliceous and earthy impurities of associated with ore is called gangue/ matrix.
Flux: The substance which is added in the ore to remove gangue (impurities) during reduction is called flux. It is of two types: Acidic flux: SiO_2, Basic flux: CaO, FeO, MgO
Slag: The fusible mass formed by combination of flux and gangue is called slag.
$CaO + SiO_2 \rightarrow CaSiO_3$

i) Gravity separationii) Froth floatation process
i) Gravity separation method: This method is used for concentration of oxide and carbonate ore.
ii) **Froth floatation process:** This process is generally used for concentration of sulfide ore like copper pyrite (CuFeS2).

Oxidation of ore: The process of converting non oxide ore into oxide form is called oxidation of ore. Depending on the nature of ore the following methods are used for oxidation of ore**.**
i) Roasting:The process of heating concentrated ore in the excess of airbelow its melting point is called roasting.Roasting is carried out for the oxidation of sulfide ore like copper pyrite to oxide ore . During roasting the sulfide ore changes into oxide ore
$ZnS + 3O2 \rightarrow 2ZnO + 3SO2$
ii) Calcination: The process of heating concentrated ore either in limited supply of air or in the absence of air below itsmelting point is called calcinations.**Calcination** is the process of oxidation of **oxide or carbonate orelike Heamatite (Fe2O3.xH2O), an ore of Iron.**
During calcination the Carbonate ore changes into oxide ore
$ZnCO3 \rightarrow ZnO+ CO2$
e) Reduction: The process of obtaining metal from roasted or calcinated oreis called reduction. Depending on nature of metal and oredifferent methods of reductions are used

i) Smelting: The process of extraction of metal from its ore by heating itwith coke or

CO at its melting point is called smelting. e.g. Ironis extracted from Heamatite ($Fe_2O_3.xH_2O$) by heating with Coke

ii) Electrolytic Reduction: The process of obtaining metal by passing electricity from molten state of its ore is called electrolytic reduction.

f) Refining of metal:*The process of removing impurities from crude (impure) metal iscalled refining of metal.* There are different methods of refining of metaldepending on. Some of them are nature of metal and impurities. Some of them are

1. Electrolytic refining
2. Mond Process

Electrolytic refining: The process of purification of metals (crude or impure metal) byusing electrolysis is called electro- refining.The metals like Copper and aluminum are refined (purified) by sing electrolytic refining.

Q-12 What do you mean by alloys their types and purpose?

Ans-12 An alloy is homogeneous mixture of two or more metals or metals and non- metals. e.g., sodium amalgam is an alloy of sodium and mercury.

Types of alloys: Alloys are mainly of two types:

1. Ferrous alloys: The alloys which contain iron as a main constituent is called ferrous alloys. Example Steel, invar, alnico are ferrous alloys.

2. Non-ferrous alloys:The alloys which *not* contain iron as a constituent is callednon-ferrous alloys.Example Brass, bronze and solder, duralumin are non ferrous alloys.

Purpose of alloying:

The main purpose of making an alloy is as follows:

1. **To improve the hardness of metal**: Alloys are made to make the metal hard e.g. pure iron is soft and cannot be used as such for machinery part. Thus it is mixed with small quantity of carbon to harden it.
2. **To lower the melting point of metal**: The melting point of an alloy is lower than its constituents. The solder an alloy of lead and tin has lower melting point than both.
3. **To increase the tensile strength**: The alloying is used to increase the tensile strength of metals. Addition of 1% carbon increases the the tensile strength of pure iron by 10 times.
4. **To prevent metal from corrosion**: Alloy is made to prevent metal from corrosion. For example (e.g.) iron can be protected from corrosion by alloying it with Cr (for making steel)
5. **To modify color**: Alloy is made to modify the color of metal. e.g. Brass, an alloy of copper and Zn has beautiful golden color.

Q-13 What do you mean by fuel classify it?

Ans-13 The combustible substances which on burning produce large amount of heat that can be used for domestic and industrial processes are called fuels.

Classification of fuels

a) On the basis of physical state: On the basis of physical states fuels are of three types:

Solid fuels: wood, coal, charcoal, coke is example of solid fuels.

Liquid fuels: crude oil, petrol, diesel, kerosene oil, power alcohol, are example of liquid fuels.
Gaseous fuels: natural gas, bio gas, water gas, producer gas, oil gas and CNG are example of Gaseous fuel.
b) On the basis of source: On the basis of source fuels are of two types:
1) Natural Fuels or Primary Fuels: The fuels which occur in nature are callednatural fuels. For example wood, coal, crude oil, natural gas
2) Artificial or secondary fuel: The fuels which are prepared artificially are called natural fuels. For example charcoal, coke, petrol, diesel, keroseneoil, power alcohol, water gas, producer gas, oil gas.

Q-14 Define calorific value of fuel?
Ans-14 The total amount of heat produced by complete combustion ofunit amount of fuel is called calorific value.In CGS system calorie/gramis the unit of calorific value. In SI system kilo joules/kilograms (kJ/kg) is the unit of calorific value of solid or liquid fuels and generally gaseous fuels calorific value will be expressed as kilo joules/ cubic meter (kJ/m3).

Q-15 What are the qualities of a good fuel?
Ans-15 **:**A good fuel should possess following Characteristics:
1) **High Calorific value**: A good fuel should possess high calorific value that is it should produce large heat on combustion.
2) **Moderate ignition temperature:** Low ignition temperature is dangerous for storage and transportation and high ignition temperature cause difficulty in burning of fuel. So a good

quality fuel should have moderate ignition temperature.
3) **Low moisture content**: A good fuel should have low moisture content because moisture decreases calorific value of fuel.
4) **Cheap:** A good fuel should be cheap and easily available.
5) **Easy transportation**: A good fuel should be easily transported from one place to other.
6) **Controllable combustion**: A good fuel is that whose combustion can be easily controlled.
7) **Low ash (non combustible matter content)**: Non combustible substance left after burning fuel is called ash. It reduces calorific value, so a good quality fuel should not contain ash.
8) **Moderate rate of combustion**: The rate of combustion of good quality fuel should be low.
9) **Low storage cost**: The storage cost of a good quality fuel should be low.
10) **Minimum smoke and poisonous gases**: The gaseous products of combustion of fuel should not pollute the atmosphere.

Q-16 What are the advantages of gaseous fuel over solid fuels?
Ans-16 The advantages of gaseous fuel over other solid of fuels are:
1) **High Calorific value**: The calorific value of gaseous fuel is high calorific value as compared to solid and liquid fuel.
2) **No smoke and poisonous gases**: The gaseous fuel on burning, do not produce any smoke.
3) **Easy transportation**: A gaseous fuel should be easily transported from one place to other with the help of pipelines.

4) **Controllable combustion**: The combustion of gaseous fuel can be easily controlled by using knob.
5) **Economical:** The gaseous fuel is cheap as no extra heat is required for igniting them. The hot waste gaseous can be reused in certain operations
6) **Easily lightened:** The gaseous fuel can be easily lightened.
7) The flame can be made oxidizing, reducing and normal by regulating air supply to burner.

Q-17 What do you mean by proximate analysis of coal? What are its advantages?
Ans-17 The determination of percentage of moisture,
volatile matter,ash and fixed carbon in coal is known as proximate analysis of coal.
a) Determination of moisture: The known weight of powdered dried coal sample is taken in a crucible which is already weighted. The crucible is heated in a hot air oven at 100-110 oC for one hour. After this, the crucible is taken out, cooled and weighted again. The process of heating, cooling and weighing is repeated till constant weight is obtained. Knowing the loss in weight of coal, the percentage of moisture is calculated as:
Weight of crucible= x g
Weight of crucible + Coal = y g
Weight of crucible + residue (Coal without moisture) = z g
Weight of coal = (y-x) g
Weight of moisture = (y-z) g
So Percentage of moisture = X 100
= X 100

b) Determination of volatile matter: The known weight of moisture free coal sample is taken in a crucible which is already weighted. The crucible is heated in a muffle furnace at 925+25oC for 7 minutes. After this, the crucible is taken out, cooled and weighted again. The process of heating, cooling and weighing is repeated till constant weight is obtained. Knowing the loss in weight of coal, the percentage of volatile matter is calculated as

Weight of crucible= x g

Weight of crucible + Coal = y g

Weight of crucible + residue (Coal without volatile matter) = z g

Weight of coal = (y-x) g

Weight of volatile matter = (y-z) g

So Percentage of volatile matter = X 100

= X 100

c) Determination of ash: The known weight of coal after determination of moisture and volatile matter is taken in a crucible which is already weighted. The coal in crucible is heated in a muffle furnace at 700+ 50oC for 30 minutes. After this, the crucible is taken out, cooled and weighted again. The process of heating, cooling and weighing is repeated till constant weight is obtained. Knowing the weight of residue (ash), the percentage of ash is calculated as

Weight of crucible= x g

Weight of crucible + Coal = y g

Weight of crucible + residue (ash) = z g

Weight of coal = (y-x) g

Weight of ash (residue) = (z-x) g

So Percentage of ash = □ 100
= □ 100

Importance of proximate analysis of coal: Proximate analysis is useful in determining the quality of coal.

It gives following in formations

1) Moisture: Moisture evaporates during burning of coal and reduces calorific value of coal. So, lesser the moisture content, the better is the quality of coal.

2) Volatile matter: The volatile matter present in coal burns with high flame and reduce calorific value of fuel. So, lesser the volatile matter, the better is the quality of coal.

3) Ash: Non combustible substance left after burning coal is called ash. It causes hindrance in the flow of heat and reduces calorific value, so a good quality fuel should not contain ash.

4) Fixed Carbon: Higher percentage of fixed carbon , greater the calorific value , So, in a good quality coal the percentage of fixed carbon should be high

Q-18 Define octane number and cetane number?

Ans-18 **Octane number:**The percentage of iso- octane by volume in the mixture of isooctane and n-heptane which has same ignition (knocking) properties as the petrol under examination is called octane number of petrol. Octane number is used to determine to quality of petrol.

Cetane number:The percentage of cetane (n-hexadecane) by volume in the mixture of cetane and α-methyl naphthalene which has same ignition (knocking) properties as

the diesel under examination is called cetane number of diesel. Cetane number is used to determine to quality of diesel.

Q-19 Define composition,calorific value and applications of cng,lpg and bio gas?
Ans- **CNG:**
CNG is known as Compressed Natural Gas.It mainly containsmethane and may contain small amount of ethane and propane which are compressed at high pressure. It burns completely and reduces pollution. Uses/ Application: It is being used as a fuel for running automobiles i,e buses, cars and three wheeler in metropolitan cities.

Gaseous fuel-Composition, calorific value and application of LPG: LPG is known as Liquefied Petroleum Gas. It is the mixture of hydrocarbons containing 3-4 carbon atoms. It mainly contains iso-butanealong with small quantity of n-butane, propane and propene. A strong smelling substance called ethyl mercaptan (C_2H_5SH) is added to detect its leakage.The calorific value of LPG is 27800 kcal/ m^3.
Use: LPG is mainly used domestic and industrial fuel. Now a day it is used as motor fuel.

Gaseous fuel-Composition, calorific value and application of biogas:
Biogas is produced by bacterial degradation of biological matter in the absence of air.The cheapest biogas is gobar gas.
Composition: The average composition of biogas is
Methane (CH_4)=55%
Carbon dioxide (CO_2)= 35%
Hydrogen (H_2)=8%Nitrogen (N_2)=2%
Properties:

1. It burns with blue flame
2. It burns with low flame.
3. Its gross calorific value is 12000 kcal/m3.
Uses:1. It is used as domestic fuel in villages.
2. Used animal waste to go out for manure

Q-20 What is softness and hardness of water and various types of hardness of water?
Ans-20 Soft water: The water which forms lather with soap easily is called soft water.It contains no dissolved salts in it.Example Rain water, distilled water, demineralized water
Hard water: The water which *not* forms lather *with soap easily* is called hard water.It contains dissolved salts of anions like SO42-, CO32- , HCO31- withcalciumand magnesium in it. Tap water, river water, spring water, sea water are some of theexamples of hard water.
TYPES OF HARDNESS: Hardness of water is of two types:
a) Temporary hardness ii)Permanent hardness
Temporary hardness of water:The hardness of water which can be simply removed by boiling the water is known as temporary hardness.
Cause of Temporary hardness:Temporary hardness is due to the presence of bicarbonates of calcium and magnesium. This type of hardness is removed by boiling the water.
Permanent hardness of water:The hardness of water which cannot be removed by simple boiling the water is called permanenthardness.
Cause of Permanent hardness:Permanent hardness of water is due to the presence of chlorides and sulfates of calcium and magnesium. This type of hardness is removed by washing soda process.In commercial scale, temporary hardness is removed by

Clarke’s process.

Q-21 What are the units of hardness of water?
Ans-21 The hardness of water is caused by the presence of soluble bicarbonates (HCO_3^{-1}), chlorides (Cl^{-1}), sulfate (SO_4^{-2}) of calcium (Ca^{+2}) andmagnesium (Mg^{+2}). But hardness of water is measured in terms $CaCO_3$ equivalents of thesehardness causing substances.Degree of hardness in ppm (parts per million):The number ofparts by mass of hardness causing substances interms of $CaCO_3$present per million (106) parts by mass of water is called parts per million (ppm). These concentrations are very lowand practically assume the density of water unchanged that is 1 g/mL. Thus, it can be expressed as 1 parts per million = 1 ppm = 1 mg/L
Example: If hardness of water is 200 ppm, it means hardness of water in terms of $CaCO_3$ is 200 parts by mass in 106 parts by mass of water.ppm is also termed as mg/L.
Example A sample of water is found to contain 0.30 g $MgSO_4$ per liter. Calculate its hardness in ppm?(Atomic masses of Mg=24, Ca=40,C=12,S=32 and O=16 respectively)
Solution: $MgSO_4 \equiv CaCO_3$
24+32+ 4X16=120 40+12+4X16=100
120 g of $MgSO_4 \equiv$ 100g of $CaCO_3$
0.30 g of $MgSO_4 \equiv$ g of$CaCO_3$ =0.25 g of $CaCO_3$
Thus,hardness causing substances in terms of $CaCO_3$=0.25g/liter
i,e 1 liter water = 1000g of water contain=0.25 g of $CaCO_3$
106g of water contain= g of $CaCO_3$=250g of $CaCO_3$
So, Hardness of water= 250 ppm
Example: A sample of water is found to contain 9.5 mg $MgCl_2$ per liter. What will be its hardness in ppm?(Atomic masses of Mg=24, Ca=40,Cl=35.5, and O=16 respectively)

Solution $MgCl_2 \equiv CaCO_3$
$24+35.5x2=95 \equiv 40+12+4x16=100$
95mg of $MgCl_2 \equiv$ 100 mg of $CaCO_3$
9.5mg of $MgCl_2 \equiv$ g of $CaCO_3$ =10mg of $CaCO_3$
Thus,hardness causing substances in terms of $CaCO_3$=10 mg/liter
i,e. 1 liter or 1000g of water contain=10 mg of $CaCO_3$
106mg of water contain=10 mg of $CaCO_3$
So, Hardness of water is =10 ppm

Q-22 What are the disadvantages of using haed water in boiler?
Ans-22 **DISADVANTAGES OF USING HARD WATER IN BOILER**:
In industries, water is largely used in boiler for generation of steam. Hard water if used in boiler gives rise to following defects:
i) Formation of scale and sludge
ii) Corrosion
iii) Caustic embitterment.
Scale and Sludge formation:
Scale: The hard, adherent and thick layer (crust) formed on the inner walls of boiler is called Scale.
Sludge: The soft, loose and thin layer (crust) formed on the inner walls of boiler is called Sludge.
Disadvantages of scale and sludge formation:
i) Wastage of Fuel: Scale and sludge are bad conductors of heat, so rate of transfer of heat from boiler walls to water decrease which results wastage of fuel.

ii) Decrease in efficiency of boiler:Due to the formation of scale and sludge the area of cross section of boiler pipes decreases, so rate of formation of steam decreases i.e efficiency of boiler decrease.
iii) Chances of explosion increase:If water enters in cracks of scale and sludge and formation of steam develop huge pressure, then chances of explosion will increases.
iv) Shorten boiler life:Scale and sludge are bad conductors of heat, so rate of transfer of heat from boiler walls to water decrease and overheating of boiler pipes to maintain the steady supply of steam. Due to overheating of boiler pipes, it becomes weak.

Corrosion: The slow and continuous eating of boiler pipes of boiler is called corrosion.
Disadvantages of corrosion:
i) Corrosion decreases the life of the boiler.
ii) The cost of repair and maintenance of boiler increase.
iii) Chances of leakage of boiler pipes from joints and rivets increase.

Caustic embitterment: The leaking (cracking) of boiler pipes and plates from joints and rivets when it becomes brittle due to the presence of alkaline substances in boiler feed water is called caustic embitterment.
Disadvantages of caustic embitterment:
i) Caustic embitterment decreases the boiler life.
ii) The cost of repair and maintenance of boiler increase.

iii) Efficiency of boiler decreases due to leakage.

Q-23 What are the qualities of drinking water?
Ans-23 1. Drinking water should be soft.
2. It should be colorless.
3. It should beodourless.
4. The pH of drinking water should be 6.9 to 8.5.
5. It should be free from disease- producing micro-organisms.
6. The hardness of drinking water should not be more than 200 mg /L or 200ppm.
7. The alkalinity of drinking water should not be greater than 200ppm or 200 mg/L.
8. It's TDS (total dissolved solid) should not be greater than 500ppm.
9. It should not be turbid.
10. It should not contain suspended impurities.
11. It should not contain impurities of heavy metals.
12. It should be tasteless.

Q-24 What do you mean by lubricants? What are its functions?
Ans-24 **Lubrication:** The process of applying a lubricant such as oil or grease to the surfaces to make surface smooth and minimize friction is known as lubrication.
FUNCTIONS OF LUBRICANTS: Without lubrication it is not possible to move any vehicles or machines. A Lubricant performs many functions;some of them are described below:
i) It gives lubrication or oiling by keeping two sliding surfaces.
ii) Lubricants protect the different parts of machines from wear and tear.

iii) A Lubricant gives cooling effect by reducing friction.
iv) It decreases the force of friction between sliding surfaces.
v) It decreases the maintenance and running cost of machine.
vi) It reduces the noise level during running of machine.
vii) It increases the efficiency of machine.

Q-25 Explain the classification of lubricants?
Ans-25 **LUBRICANTS:**Lubricants can be simply classified into three main types:
1. Liquid Lubricants or lubricating oils
2. Semi Solid Lubricants or greases
3. Solid Lubricants
1. Liquid Lubricant: These types of Lubricants include mineral oil, vegetable oil and animal oil.
(i) Mineral oil: Mineral oils of higher hydrocarbon and thick so by mixing with vegetable oil they can be made thin. These are cheap and easily available. These are obtained by fractional distillation of petroleum at about 4000oC. They are cheap and available easily in abundance. These contain impurities like wax. Their oiliness can be improved by adding oleic or steric acid.
(ii) Vegetable oil: These are obtained from vegetables which include
a) **Olive oil**: Obtained from olive tree and is used for lubrication of bearings.
b) **Palm oil**: Obtained from kernels of Palm and is used for Lubrication of watches and clocks.
c) **Castor oil**: obtained from seeds of castor and is used for lubricants of

vehicles and bearings

(iii)Animal oil: These are obtained from different animals.

a) Neat foot oil :obtained from neat by boiling in with water and is used for lubrication of sewing machines, watches & clocks

b) Whale oil : used for light machinery

c) Lord oil : obtained from kidneys and fats of pigs and is used for various machine

d) Blended oil: it is mixture of animal or vegetable oil with mineral oil. It is a good lubricant. It is done to reduce pour point improve viscosity, increase oiliness and resist oxidation. Example: mixture of coconut oil and fatty acid to increase oiliness and polystyrene for thickness.

e) Synthetic oil: These type of lubricants are chemically prepared compounds. These are used when mineral oils do not work. They are used in jet engines rocket motors.

2. Semi Solid Lubricants: These Lubricants include grease and emulsion.

(i) Greases: This include metallic soap in lubricating oil. It is usedwhen

Machine is working at low speed and high load.

For stealing bearing against dirty and dust particles

When lubricating oil is not suitable for machines.

Grease is of following types:-

a) **Calcium based Grease:** obtained by mixing calcium soap with petroleum oil. It isused for lubricating of water pumps & workshop.

b) **Soda based grease:** obtained by mixing sodium soap with petroleum oil and is used for ball bearing

c) **Lithium based grease:** By mixing lithium soap with petroleum oil and is suitable at high temperature

d) **Axle grease:** By adding hydroxides of metal to fatty acids. These are water resistant and used in tractors rollers and machines bearings

(ii) Emulsion bearings: These are obtained by mixing twoimmiscible liquid by using high speed machines. These are used in many machines. They include two phase system in which one liquid will act as disperse phase and others dispersion medium.

3. Solid Lubricant: These are present in solid form. They are used in heavymachines with high load and low speed. The two main solidlubricants are graphite and molybdenum disulphide. These are used where oil and grease are undesirable.

i) Graphite: It is a crystalline substance and allotropes of carbon. Its density is low. It forms a lubrication film which remains strongly adhered to the surface of machine. This graphite film provides good resistance to wear and tear. Graphite contains layers of carbon atoms which slide over each other because they have weak forces between them making graphite slippery. **Uses**: It is used in steel industry. It is used to make brake liningsused in air compressor ball bearings and in locks.

ii) Molybdenum disulphide: (MoS2) it is an inorganic compound composed of molybdenum & sulfur. It has a layered structure in which molybdenum atoms are sandwiched in planes of sulfide ions. It is used as lubricants n in motorcycle engine, bullets.

Q-26 What are the types of lubricants ?

Ans-26 Lubrication is the process of using lubricant to reduce friction between two surfaces in contact. Lubrication gives oiliness to the surface thus making it smooth by reducing friction. It is of mainly two types.

(i) Hydrodynamic Lubricationor Thick Layer Lubricationorfluid film lubrication:t is used in those machines where speed is high and load is very low. This type of lubrication is done in case of delicate instruments like watches, clocks, guns, sewing machine and scientific instruments. In this type of lubrication, the lubricant fill the irregularities of moving surface and form a thick layer (1000Å) in between them so that there is no contact between the sliding surface. Here lubricant used should be viscous fluids and load is taken by oil film completely.

This type of lubrication is done with liquid lubricants having minimum viscosity under working condition. The lubricant should remain between and separate the sliding surface of machine. The resistance to movement of sliding parts is only due to the viscosity of the lubricant. So lubricant should be chosen in such a way that it posses minimum viscosity under working condition.

(ii) Boundary Lubrication (Thin Film of Lubrication): It is used when speed is very low and load is very high and also when shaft starts moving from rest. It exists when it is not possible to form a full fluid condition especially at low speed between the moving surfaces.

The lubricating oil is filled between the sliding surfaces, which is adsorbed on both metallic surfaces by any physical or chemical forces. The adsorbed layers avoid metal to metal contact.The load is carried by the layers of adsorbed lubricant on both metal surfaces.Vegetable oil and animal oils and their soaps possess great property of

adsorption and are used in thin film lubrication. Graphite or molybdenum disulphide either alone or in the form of suspension are also used in thin film lubrication.In boundary lubrication thickness of oil film is so small that oiliness is restricted mainly to the boundaries of two surfaces. The thin film lubrication is done in piston rings when piston changes direction and in two stroke engines & lubrication of bearing in Diesel engine.

Q-27 What are the properties of lubricant?

Ans-27 PROPERTIES OF LUBRICANT:

Physical properties of a Lubricant include some basic properties such as (i) Viscosity (ii) Viscosity Index (iii) Cloud point and Pour point (iv)Flash point (v) Fire point and (vi) Oiliness.

These are described below:

i) **Viscosity**: Viscosity means thickness – A fluid which is more viscous mean thick fluid. Example: Honey is more viscous (thick) than water.

Definition: Viscosity of a liquid may be defined as the property of a liquid by virtue of which it resists its flow (oppose its flow). orThe force of friction which one part of liquid offer to other part to resist its flow is called viscosity.Unit: In SI system unit of viscosity is newton second per square meter (Ns/m2)

Significance: Machines moving at slow speed should use more viscous lubricant and machines with high speed should use less viscous fluid.

(ii) Viscosity Index: The rate of change of viscosity of lubricant withrespect to temperature is called viscosity index.It has been seen that viscosity of lubricant changes with change in temperature. Low viscosity index means viscosity of

lubricant falls rapidly with temperature and high viscosity index means viscosity does not fall rapidly with temperature. It is measured on a scale from 0 to 100.

Significance of viscosity index A fluid lubricant should have high viscosity index(otherwise it will create problem)

(iii) Cloud point and pour point: The temperature below which a lubricant form a cloudy appearance on cooling and pour point is that temperature at which oil ceases to flow (as its turn into semi solid and loses its flow characteristics). So if lubricant ceases to flow machine may stop and its working will effect.

Significance: A good lubricant should have low pour point so that it can be used at low temperature. Olive oil begins tosolidify at around 4 oC.So by to knowing cloud point and pour point we can know that at to what lowest temperature a lubricant can be used safely.

(iv) Flash point: Flash point of a lubricant may be defined as the lowest temperature at which it ignites for a very short moment (briefly) after vaporization but not continue to burn after ignition. Flash point is lower than fire point.

Significance: Flash point is very important because with the help of this we can find that at upto what temperature a lubricant can form an ignitable, mixture which will burn further on increasing of temperature. At flash point vapour may not be produced at a rate to sustain the fire Flash point of diesel fuel varies 520C to 960C depending on type of diesel fuel. It is also very important for proper handling of diesel fuel so flash points are experimentally calculated depending upon density and quality of a fuel.

(v) Fire point: Fire point of a lubricant is thatminimum temperature at which vapours of a lubricant continue to burn after being ignited even after source of ignition is

removed (lubricant will continue to burn for at least 5 seconds). Fire point of a lubricant is few degree (near about 100C) higher then flash point.

Significance: it gives an idea about risk of fire hazards during storage and use of fuel.This temperature point is very important because it helps in determining that how a fuel is transported and stored.

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(vi) Oiliness: The property of lubricant to form continuous film even at high temperature and pressure is called oiliness.OrOiliness means covered with oil or greasy. “Oiliness is defined as property of a substance by virtue of which one fluid gives lower coefficient of friction than another substance of same viscosity”.OrOiliness can also be defined as “the capacity of lubricant to stick on the surface of machine under high pressure and load”. A good lubricant should have good (high) oiliness.

Significance: Oiliness of a lubricant reduces wear and friction under different conditions. So a lubricant should have proper oiliness required on the basis of its application.

CHEMICAL PROPERTIES OF A LUBRICANT: As we have studied Physical properties of lubricant. Similarly, Chemical properties of lubricant like (i) TAN, (ii) emulsification, (iii) aniline points and (iv) iodine nature. These properties are described below:

(i) TAN or TAV: TAN or TAV stands for total Acid Number or Total Acid value. Definition:TAN or TAV: The amount of KOH (Potassium hydroxide) in milligrams required to neutralize the free acids present in one gram of lubricant (oil). Total Acid No is the measurement of acid present in the lubricant.

Significance: TAN No. is very important in selecting a good lubricant. Its value should be less than 0.1. if it is more than 0.1 then lubricant will oxidize easily which will further create corrosion problems.
Depending upon the oil's formulation compressor oil may be able to maintain low TAN.
A good lubricant should have low acidity or TAN or TAV.
Determination of TAN No. **:** TAN can be determined by volumetric and potentiometric titrations.
(ii) Emulsification:Emulsion is a intimate mixture of oil and water so emulsification may be defined as **"Property of a lubricant to emulsify with water".** Emulsion has property of absorbing dust particles and other foreign particles. These particles after combining with emulsion cause abrasion of metals and in this way role of a lubricant get disturbed.A good lubricant should not easily form emulsion. Thus, while selecting good lubricant emulsification should also be tested.
Significance of emulsification: It a lubricant is forming emulsion then it will be able to cause abrasion of metal and metal will become weak which will decrease the life of machine. A good lubricant should not form emulsion if emulsion if formed then it should be renamed or break quickly. No a day's refined lubricant are used which has very less chances of emulsion formation.
(iii) Aniline point:
Aniline is an aromatic organic compound: formula C6H5—NH2or having phenyl group attached to amino group.
NH2
Definition: Aniline point may be defined as minimum temperature at which equal

volume of lubricant (oil) and aniline is completely miscible or form homogeneous mixture.

Significance: A good lubricant should have adequate aniline value. If aniline point is low then content of aromatic compound in oil will be more. So this value gives an approximation for content of aromatic compounds in the oil. “High aniline point indicates that fuel is highly paraffinic and very good ignition quality. Diesel oil with aniline point below 49oC is probably risky to use.

Determination of aniline point: For the determination of aniline point equal volume of aniline and lubricants are stirred continuously until to form a homogeneous solution, when homogeneous solution is formed heating is stopped and solution is allowed to cool. The temperature at which two given compound (Aniline and aromatic compound (Lubricant)) separated out is called aniline point.

(iv) Iodine value: Iodine value is also very important chemical property of lubricant

Definition: The amount of iodine in grams taken up by 100 grams of lubricant (Oil, Fat or Wax) is called iodine value.

Significance: It is used to determine amount of unsaturated (C = C or C = C bond) “More the iodine value of lubricant more will be unsaturated compound present in it”. Example: Saturated oil, fats and waxes take up no iodine (because of absence of double or triple bond) so there iodine value is zero.Olive oil is used for making soap because of low iodine value (having less unsaturated). On the other hand unsaturated lubricants have high iodine value (because of presence of double or triple bond.)Drying oil is used in point and varnish industry because these have high Iodine value (about 90).

Determination of Iodine value: Iodine value of a lubricant can be determined by volumetric titration using sodium standard thiosulfate solution and starch indicator.

Q-28 What do you mean by polymer,monomer and degree of polymerization?
Ans-28 **Polymers**: Macromolecules obtained by combination of large number simple (small) molecules are called polymers. The polymer contains repeated structure units.All the macromolecules are not polymers but all polymers are macromolecules.OrPolymers are high molecular mass (103 - 107μ) substances which consist of simple repeating structural units joined together by covalent bonds.
Monomers: Monomers are simple molecules from which repeating structural units (Polymers) are derived are called monomers.
Example ethene is monomer unit of Polyethene
The process by which simple molecules are converted into polymeris called Polymerization.
Degree of Polymerization (DP):The number of repeating units which linked together to form polymer is called degree of Polymerization.

Q-29 What are the uses of monomers?
Ans-29 **1) Polyethene:** Monomer= Ethene. Polyethene is poor conductor of electricity. On the basis of density, low density and high density Polyethene are used for different purposes.
a) Uses of Low Density Polyethene (LDPE):
i) These are transparent Polymers of moderate tensile strength. These are used as

packaging material in the form of thin plastic films and bags.
ii) Used in electric wires and cables as these are insulator of electricity.
iii) In manufacture of squeeze bottles, toys and flexible pipes.

b) High Density Polyethene:

HDPE have more toughness hardness and tensile strength

Uses:

i) It is used in the formation of containers like buckets, tubes.
ii) It is used in house wares, pipes and bottles
iii) It is also used for making toys for children.

3) Poly Vinyl Chloride (PVC):

Monomer – Vinyl Chloride

Uses:

i) It is used in making rain coat and shower curtains
ii) Used as insulator for Coating wires, Cables and other Electric Gadgets
iii) It is used for making hand bags.
iv) It is also used for making water pipes.

4) PS (Polystyrene) :

Monomer: Styrene

Uses:

i) It is used for making Telephone, Radio, T.V. bodies and Refrigerator linings.
ii) Used as wrapping material due to its insulator properties.
iii) For making soft drink bottles.
iv) Also used in making of baby feeding bottles.

5) Teflon (Polytetrafluoroethene)

Monomer: Tetra fluoroethene

Uses

i) Because of its high thermal stability Teflon is used for making nonstick utensils. To make non-stick a thin layer of Teflon is coated on inner side of venal.

ii) It is used for making gaskets.

iii) It is used in no lubricating bearings and as filler of clothes.

iv) It is also used in valves and seals.

6) Nylon 6,6

Monomers – Hexamethylenediamine and Adipic acid. Nylon-6,6has high tensile strength and do not rot. It is tough and somewhat elastic material.

Uses:

i) It is used in manufacture of carpets textile fibers.

ii) Used for making ropes and bristles for brushes

iii) For making elastic hosiery

iv) It is used as substitute for metals in bearings and gears.

7) Bakelite:

Monomer: Phenol and FormaldehydeBakelite is water resistant polymers and is a good electric insulator.

Uses:

i) It is used in making combs, fountain pen barrels computer disc and photograph record.

ii) Used in varnishes

iii) Used as binding glue for lamination
iv) Used as ion exchange resin in water filters
v) Also used in electric goods (switches, plugs) and also in making handles of utensils

Q-30 What do you mean by addition and condensation of polymers?
Ans-30 On the basis of mode of Polymerization the Polymers have been divided into two groups
(A) Addition Polymers and
(B) Condensation Polymers
(A) **Addition Polymers:**The polymers which are obtained by addition of monomer in growing polymeric chain are called addition polymer.
These are formed by repeated addition of large no of same or different monomers.
This process of addition by which different polymers are formed is called addition polymerization. The different examples are given below:-
(i) PE: Polyethene
Ethene (Monomer) Polyethene (Polymer)
(ii) PVC: Polyvinylchloride
Vinyl Chloride Polyvinyl Chloride
(iii) Teflon: PTFE (Polytetrafluoroethene)
Tetra floroethylene Polytetrafloroethylene
(iv) PS: Polystyrene
Polystyrene
(B) **Condensation Polymers**:The polymers which are obtained by series of condensation reaction are called condensation polymers.

This type of Polymers are formed by repeated addition of large numbers of monomers molecules with elimination of simple molecules like H2O, Alcohol and Ammonia takes place examples Nylon 66 and Bakelite.

Examples:

i) Formation of Nylon 6,6:

Monomers:Haxamethylenediamine and adipicacidboth of these monomers combine or polymerise to form Nylon 6,6. This reaction takes place at 525 K and removal of n water molecules takes place.

Nylon 6,6

ii) Bakelite:

Monomers:Phenol and Formaldehyde formortho-hydroxymethylphenol and para-hydroxylmethylphenol, both these polymerize to from Bakelite.

Q-31 What do you mean by plastic,thermoplastic and thermosetting polymers ?

Ans-31 a) **Plastic**:

It is a group of materials either synthetic or naturally occurring which may be shaped when soft and then they are hardened to retain given shape. Plastic is also a Polymer.

b) **Thermoplastic**:

These are linear, slightly branched polymers which are hard at room temperature.These become soft and viscous on heating and again become rigid on cooling.

Example:Polyethene, Teflon and Polystyrene.

c) **Thermosetting Plastic:**

On heating these polymers undergo permanent change in chemical composition to give a hard; infusibleand insoluble mass. These are semi fluid whose molecular mass islow.

They become hard after heating as due to the formation of cross link between different polymeric chains. Example: Bakelite

Q-32 What are the uses of polymer and plastic in daily life and in industries?
Ans-32 **Uses of Polymers**: Polymers are used in everyday life for many purposes:
1. It making electronic components: like, DVD
2. In making paints, plastic bottles and polybags and cables etc.
3. For medical equipment's like medical cup, Heart valves, medical key boards, test tubes and Petri dishes etc.
4. Natural Polymers like cotton, silk, wool and rubber are used for many purposes in daily life.
5. Used for construction purposes to insulate ceiling walls floors etc.
6. Teflon is used to make nonstick cook wares.
7. Nylon is used for textile &fibers
8. Bakelite is a non-conductor so it is used in radioand telephone coating and cables coveringsetc.
9. Plastic is used for packaging or for wrapping materials.
10. In making house hold items like bucket, mug, water bottles, bowls, plates and many more.
11. In making automobiles, furniture and toys.
12. It is used to make ropes that are very strong glues and paints
13. All disposable items, baby products, containers.
14. In agriculture – Irrigation, drainage pipes, fishing nets etc are made up of Plastics
15. For making raincoats, toothbrushes, washing machines and laundry detergents.

16. As fillers to fill cushions and also used in making photographic film.