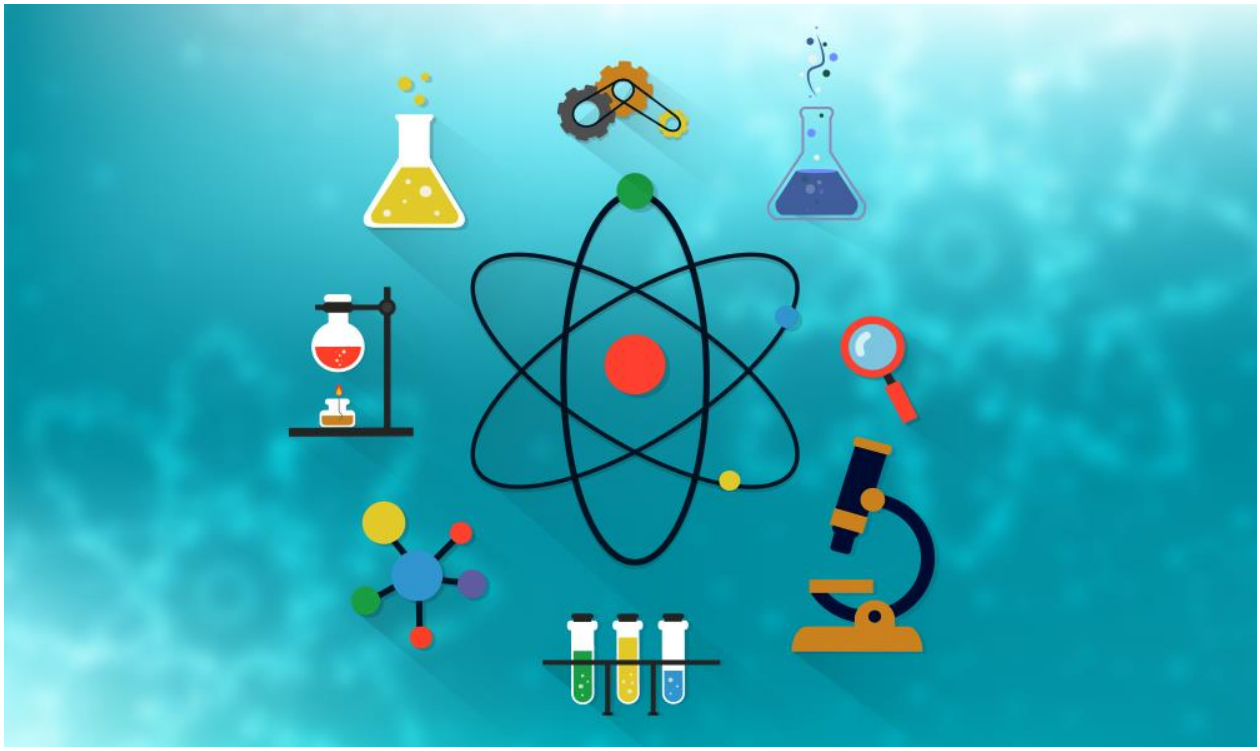
ENGINEERING CHEMISTRY II



Questions and Answers Engineering Chemistry II

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AIR POLLUTION, WATER POLLUTION, SOLID WASTE MANAGEMENT, GREEN CHEMISTRY

PART – A

1. Define pollution.
Discharge of harmful substances into the environment that pollutes air, water, land etc is called pollution

2. Define air pollution.
Discharge of harmful substances that pollute air is called air pollution.
Eg) Sulphur dioxide, carbon monoxide, Dust

3. Give examples for air pollutants.
Sulphur dioxide, carbon dioxide, carbon monoxide, dust, smoke.

4. Give examples for gases causing acid rain.
Sulphur dioxide, Nitric oxide, HCl

5. Give two examples for green house gases.
Carbon dioxide, carbon monoxide, CFC

6. Give the problems of Sulphur dioxide, hydrogen sulphide
Eye irritation, throat pain

7. Give the problems of hydrogen fluoride, carbon monoxide
Respiratory disease, liver damage

8. What is global warming?
Warming up of earth due to green house gases

9. Mention the names of pollutants responsible for depletion of ozone layer.
CFC, Carbon dioxide

10. Give two examples for water pollutants.
Sewage, Effluent, Algae.

11. What is sewage?
Liquid waste of community from homes, industries.

12. What is sewerage?
Treatment of sewage is called sewerage.

13. What are industrial effluents?
Effluents are Waste water from industries that pollutes water bodies

14. Give the problems of lead,cadmium in water.
Affects liver. Kidney, intestine

15. Give the problems of coper,zinc in water.
Vomitting and liver damage, stomach upset

16. What is eutrophication?
Nutrient enrichment of lakes due to phosphates and nitrates from fertilizers, pesticides is called eutrophication.

17. What are solid wastes? Give examples.
Solid waste is a substance which is thrown away from industries, kitchen, hospitals etc. Eg) Cement bag, blood bags, Cotton waste etc.

18. What are the two methods employed for disposal of solid waste?
Land fill, Incineration

19. What is landfill?
Solid waste is dumped in pits and covered by soil.

20. What is incineration?

Solid waste is burnt to reduce volume and disposed later.

21. Define green chemistry.

Green Chemistry is study of chemistry for useful purposes. Mainly to minimise or remove dangerous substances.

22. Give any two goals of green chemistry.

1.Prevent formation of waste
2.Convert all reactants to final products
3.Use renewable materials

23. What is recycling?

Recycling is a process of converting used materials (waste) into new products.

It reduces use of fresh raw materials, reduces energy usage, reduces air pollution and water pollution.

PART – B

1. What is acid rain?

Rain contains Nitric acid and sulphuric acid . These acids are formed by oxides of sulphur and nitrogen which dissolve in rain water. These gases come from industries.

2. Mention the harmful effects of acid rain.

1.Affects skin and eyes
2.Affetcs plants and trees
3.Affects soil

3. What is green house effect?

The warming up of earth's surface due to carbon dioxide is called green house effect.

4. Mention the harmful effects of global warming.

1.Cyclone occurs
3.Food production is decreased
5.Spreads diseases like malaria, typhoid etc

5. What is the importance of ozone layer?

- It absorbs UV rays. It allows only visible and infrared radiation to earth.
- It saves humans and animals from UV rays.
- There will be no life on earth without ozone in the atmosphere.

6. Mention the harmful effects of ozone layer depletion.

1.It affects food production
2.It affects life on earth
3.Spreads diseases

7. Mention any three harmful effects of sewage.

1. It affects the pipelines.
2. It gives bad odour.
3. It helps bacteria &Viruses to spread.

8. Write a note on sewage disposal.

Removal of sewage by some treatment methods is called "Sewerage".

Nature of impurity in sewage	Method of removal
Floating impurities	Filter by mesh screens
Corrosive acid and bases	Neutralization
Bacterial impurities	Chlorination
Inflammable organic impurities	Oxidation
Sewage after treatment	Used for other purposes

9. Mention the harmful effects of effluents.

1.Damages water life
2.Affects growth of plants
3.Corrodes pipe lines 4.Affects human health

10. Mention the harmful effects of algae. How it is controlled?

1.Algae blocks filters.
2.Gives bad smell to water
3.Kills water life

Algae growth can be controlled by copper sulphate, Lime, and making tanks exposed to sunlight.

11. Mention the harmful effects of microorganisms. How it is controlled?

Bacteria and Virus cause diseases like cholera and typhoid etc.
It can be controlled by

12. Mention any three harmful effects of eutrophication.

1. It gives bad taste and smell to water
2. It blocks pipe lines and filters
3. Animals like fish are killed

13. Write a note on land fill.

- The solid wastes are dumped in pits and are covered by soil
- Pit bottom is lined with rubber.
- Methane gas etc are produced in landfill

14. Write a note on incineration.

- Soild waste is burnt in incinerators.
- Volume of waste is reduced up to 20 to 30%
- Ash is removed later.
- Wood wastes, cloth wastes can be burnt into charcoal and ash.

15. Give any three goals of green chemistry.

1.Prevent formation of waste
2.Convert all reactants to final products
3.Use renewable materials

16. What is recycling? Give an example.

Recycling is a process of converting used materials (waste) into new products.
Eg)1.Conversion of jute wastes into paper.
2. Conversion of waste vegetables into bio fertilizer.

PART - C

1. What are the major air pollutants? Give their problems

Air Pollutant	Industrial Source	Harmful effect
Sulphur dioxide	Petroleum industry, Sulphuric acid plant	Eye irritation, Throat pain
Hydrogen sulphide	Petroleum, Paper industry	Eye irritation, Throat pain
Hydrogen fluoride	Fertilizer, Aluminium	Respiratory disease, Tooth disorder
Carbon monoxide	Automobile, refinery	Headache, visual disorder
Nitrogen dioxide	Fuel burning, acid industry	Respiratory disease, eye irritation
Dust	Cement industry, ceramic industry	Respiratory disease, lung disease

2. What is acid rain? Give its problems

Acid Rain : Rain contains Nitric acid and sulphuric acid. These acids are formed by oxides of sulphur and nitrogen which dissolve in rain water.

Effects of acid rain:

1.Affects fish and other water life
2.Affects skin and eyes
3.Affects monuments like Taj Mahal and paint coatings
4.Affetcs plants and trees
5.Affects soil
6.Affects Hair

3.What is global warming? What are its harmful effects

Increase in temperature of earth due to green house effect is called global warming.

Harmful effects of global warming

1.Glaciers and polar ice caps melt
2.Season changes drastically
3.Food production is decreased
4.Cyclones, hurricanes occur
5.It spreads diseases like malaria, typhoid etc
6.Sea water evaporates

4.What is Ozone Layer? Give the importance of ozone layer

- Ozone layer is made of ozone.
- It is in the upper layer of earth's atmosphere.
- It is at about 20 KM above earth's surface.

It is produced by photochemical reaction

$$3O_2 \longrightarrow 2O_3$$

- It absorbs UV rays. It allows only visible and infrared radiation to earth.
- It saves humans and animals from UV rays.
- There will be no life on earth without ozone in the atmosphere.
- If Ozone layer is not present then UV rays reach earth. It will increase global temperature and cause season changes, rain fall and diseases.

5.What are the effects of ozone layer depletion?

Ozone layer depletion allows UV rays to enter earth. So

1It affects skin and eyes
2.It affects food production
3.It affects eco system
4.It affects life on earth
5.It spreads diseases

6.Write a note on control of air pollution

1.More trees should be grown.
2.Non polluting fuels can be used
3.Chimneys can be used
4.Smoke can be filtered by Cottrell's precipitator
5.Exhaust gases from automobiles should be minimised by use of catalyst

7.Explain green house effect

The warming up of earth's surface due to carbon dioxide is called green house effect.

- ✓ Radiations like UV, Visible and Infrared come from Sun.
- ✓ Only the UV rays are screened by ozone layer.
- ✓ Visible and Infrared rays enter earth and heat it.
- ✓ Carbon dioxide does not allow this heat to escape to atmosphere
- ✓ Hence earth gets heated

Gases which cause effect are carbon dioxide, methane, water vapour, CFC.

8.What is Sewage? What are its problems? How is it treated?

Sewage is the liquid wastage of the community which contains human wastes, kitchen wastes and street wastes.

Problems caused by Sewage

1. Due to corrosive nature, it affects the pipelines.
2. It gives bad odour.
3. It helps bacteria &Viruses to spread.
4. Inflammable substances in it may cause fire accident.
5. Hydrogen sulphide gas is produced.

Treatment of Sewage

Removal of sewage by some treatment methods is called "Sewerage".

Nature of impurity in sewage	Method of removal
Floating impurities	Filter by mesh screens
Corrosive acid and bases	Neutralization
Bacterial impurities	Chlorination
Inflammable organic impurities	Oxidation
Sewage after treatment	Used for other purposes

9.What is effluent? What are its problems? How can it be treated?

Effluent : The waste water from industries is called effluent

Effluent nature	**Problems**
From leather, paper etc industries	Damages aquatic life
Metals in effluent	Affects kidney, brain
Acidic nature	Corrodes pipe lines, affects growth of plants
Effluent from nuclear power plants	Affect health of human and animals

Treatment of effluents

Nature of effluent	**Method of Treatment**
Toxic	Chemical method
Acidic, Basic	Neutralization
Radioactive	Buried under ground
Metallic	Special methods

10.What are the metallic pollutants in water? Give their sources and harmful effects?

Metal	**Sources**	**Harmful Effects**
Lead	From automobiles, mining	Affects liver, kidney and intestine
Cadmium	From electroplating, welding	Affects liver, kidney and intestine
Zinc	Galvanization, Plumbing	Vomiting and Diarrhoea
Copper	Electroplating, Plumbing	Vomiting and diarrhoea and liver disorder

11.What is eutrophication? What are the effects of eutrophication?-

Eutrophication is the nutrient enrichment of lakes and water bodies due to phosphates and nitrogen compounds from fertilizers and organic wastes.

Problems caused by eutrophication.

1.It gives bad taste and smell to water
2.It blocks pipe lines and filters
3.Animals like fish are killed
4.It produces bacteria and spreads diseases
5.It allows growth of algae

12.What are the types of solid wastes? Explain their problems.

Type of solid waste	Problems
Cement and sand	Asthma and lung problems
Herbicides and pesticides	Allergy and affects soil fertility
Animal and poultry waste	Produces bad smell and helps growth of bacteria
Plastic waste	Affects soil
Metallic container	Pollutes soil
Food waste	Bad smell, bacteria and virus grow

13.Write a note on land fill and incineration methods (or) Write a note on solid waste management

Land Fill

- The solid wastes are dumped in pits and are covered by soil
- The bottom of pit is lined by plastic or rubber.
- This layer prevents waste polluting soil or underground water.
- If pit is not covered by soil, plastic paper etc are carried away by wind.
- Methane gas etc are produced in land fill.
- It kills birds, plants nearby.

Incineration.

- Soild waste is burnt in incinerators.
- Volume of waste is reduced uptp 20 to 30%, Ash is removed later.
- Wood wastes, cloth wastes can be burnt into charcoal and ash.
- "Thermal treatment" is used to convert wastes into heat, gas, steam and ash.

14.Write a note on recycling process with its advantages.

Recycling is a process of converting used materials (waste) into new products.

It reduces use of fresh raw materials, reduces energy usage, reduces air pollution and water pollution.

Advantages of Recycling

1. It helps in the conservation of natural resources.
2 It protects the environment from pollution.
3. It protects our health.
4. Air is clean and is free from bad smell.
5. It reduces water pollution.
6. I helps to know methods to reuse things.

Recycling technology on conversion of different wastes

1. Conversion of waste into solid fuel.
2. Composting garbage into manure
3. Conversion of bio mass into compost.
4. Conversion of jute wastes into paper.
5. Conversion of waste vegetables into bio fertilizer.

15.What is green chemistry? What are the goals of green chemistry?

Green Chemistry is study of chemistry for useful purposes. Mainly to minimise or remove dangerous substances.

Goals of green chemistry

1.Prevent formation of waste before it is created.
2.Convert all reactants to final products
3.Reduce formation of harmful by-products
4.Use renewable materials
5.Conduct chemical processes in a safety way

FUELS,COMBUSTION,REFRACTORIES

PART – A

1. Define fuel.

Fuel is a substance that gives heat energy on combustion. Eg.Wood,Coal

2. Define fossil fuel.

Fossil fuels are main sources of fuels. They are coal and petroleum oils.

3. Define calorific value of a fuel.

Amount of heat energy liberated when unit mass of fuel is completely burnt

4. How are fuels classified?

Solid fuel, Liquid fuel, Gaseous fuel

5. Give two examples for solid fuels.

Wood, Coal

6. Give two examples for liquid fuels.

Petrol, Diesel, Kerosene

7. Give two examples for gaseous fuels.

Water gas, Producer gas

8. What are the varieties of coal?

Peat, Lignit, Bituminous coal, Anthracite coal.

9. What is petroleum?

Petroleum (Crude oil) is a naturally available liquid fuel. It is a dark greenish-brown viscous oil. It is made of hydrocarbons with organic compounds as impurities.

10. What is meant by cracking?

Breaking hydrocarbons of high molecular mass into hydro carbons of low molecular mass. Alumina silica gel is catalyst.

11. What is producer gas?

Mixture of Carbon monoxide and nitrogen.

CO = 22-30%; H_2 = 8-12%; N_2 =52-55% and CO_2 = 3%

12. What is water gas?

Mixture of carbon monoxide and hydrogen

CO = 41%; H_2 = 51%; N_2 = 4% and CO_2 = 4%.

13. What are the components present in CNG?

CNG is a good alternative fossil fuel. It mainly contains methane.

14. Mention the uses of CNG.

Used as fuel for buses, taxis and three wheelers.

15. What are the components present in LPG?

Propane, Butane.

16. Mention the uses of LPG.

Used as fuel in Home, Industries, Car, Hotels.

17. Define combustion.

Combustion is an exothermic chemical reaction accompanied by heat and light.

18. Write the complete equation for the combustion of methane present in a fuel.

$$\underset{1\text{ vol}}{CH_4} + \underset{2\text{ vol}}{2\,O_2} \longrightarrow \underset{1\text{ vol}}{CO_2} + \underset{2\text{ vol}}{2\,H_2O}$$

19.What is flue gas?

Flue gas is a mixture of gases produced from the products of combustion of a fuel. Its major constituents are CO, CO2, O2 and N2.

20. What are refractories?

Substances that can withstand high temperature. Eg.Silica bricks

21. What are the types of refractories?

Acid refractory, Basic refractory, Neutral refractory.

22. Give two examples for acidic refractories.

Silica bricks, fire clay bricks

23. Give two examples for basic refractories.

Alumina bricks, Magnesite bricks

24. Give two examples for neutral refractories.

Graphite, Silicon carbide

PART – B

1. What is refining of petroleum?

The crude oil is treated with

1.Copper oxide to remove sulphur impurities.
2.With sulphuric acid to remove basic impurities.
3.Sodium hydroxide to remove acidic impurities.
4.Finally subjected to fractional distillation and various fractions are collected.

2. Write a note on liquid hydrogen as fuel.

1.Liquid hydrogen is a favourable rocket fuel.
2. On combustion, it produces more heat per gram than any other fuel.
3. Further, it produces only water on combustion

3. Give the composition and uses of producer gas.

Mixture of Carbon monoxide and nitrogen.

CO = 22-30%; H_2 = 8-12%; N_2 =52-55% and CO_2 = 3%

Uses of producer gas

Used as a fuel in steel manufacture
Used as a fuel in glass manufacture
When petrol is less it may be used in vehicles

4. Give the composition and uses of water gas.

Mixture of carbon monoxide and hydrogen

CO = 41%; H_2 = 51%; N_2 = 4% and CO_2 = 4%.

Uses of water gas

Used as industrial fuel, Used for welding purposes
Used as source of industrial hydrogen

5. Give the composition and uses of CNG.

CNG is a good alternative fossil fuel. It mainly contains methane.
Used as fuel for buses, taxis and three wheelers.

6. Give the composition and uses of LPG.

Propane, Butane, Used as fuel in Home, Industries, Car, Hotels.

7. Mention the use of flue gas analysis.

Based on flue gas analysis, improvement in the design of internal combustion engines, combustion chamber, furnace, etc., can be done.

8. Name the reagents used for the absorption of CO_2, O_2 and CO in flue gas analysis.

Pipette 1 = Carbon dioxide – Potassium hydroxide
Pipette 2 = Carbon dioxide and Oxygen – Alkaline pyrogallol
Pipette 3 = Carbon dioxide and Oxygen ,Carbon monoxide – Amoniacal cuprous chloride

9. Mention any three requirements of a good refractory.

Thermal expansion	Refractory should have low thermal expansion
Thermal conductivity	Refractory should have low thermal conductivity
Porosity	A good refractory should not be porous

10. List the specific uses of fire clay bricks.

1.Used in furnace where charge and slag are acidic

2.Used in blast furnace

11. List the specific uses of silica bricks.

1.used in acid converters

2.used in Bessemer converter

3.used in electric furnaces

12. List the specific uses of alumina bricks.

1.used to line glass and steel furnaces

2.used to line cement rotary kiln

PART – C

1.Write a note on solid fuels

Wood : Obtained from forests

Products obtained by fractional distillation of wood are,

Wood gas	**used as gaseous fuel**
Wood tar	**Used to preserve timber**
Wood charcoal	**Used as fuel**

Coal : formed by carbonisation of vegetable matter.

Types of coal,

Peat	**Used as Domestic fuel**	**58%carbon, 4000Kcal/gm**
Lignite	**Used in power station**	**75% carbon, 5500Kcal/gm**
Bituminous coal	**Used in boilers**	**90%carbon, 7000Kcal/gm**
Anthracite coal	**Used as industrial fuel**	**92%carbon, 8500Kcal/gm**

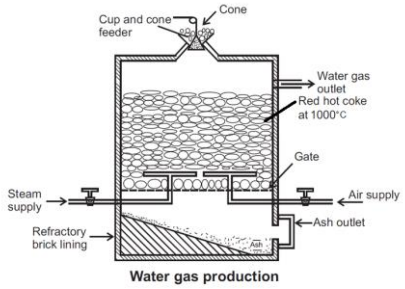
2.What are the products obtained during fractional distillation of petroleum? Mention their uses.

S.No	Fraction with carbon number	Temperature	Uses
1	**Gases (upto C_4)**	Upto 30	Used as LPG fuel
2	**Petroleum Ether (Upto C_7)**	$30^o – 70^o$	Used as solvent
3	**Petrol (C_5 to C_9)**	$70^o – 120^o$	Used as solvent, fuel
4	**Kerosene (C_{10} to C_{16})**	$180^o – 250^o$	Used as fuel
5	**Diesel (C_{10} to C_{18})**	$250^o – 320^o$	Used as fuel
6	**Residue oil (C_{17} to C_{30})**	$320^o – 400^o$	Used in wax

3.Describe the manufacture and uses of water gas.

Water gas : is a mixture of hydrogen 50% Carbon monoxide 44% and Carbon dioxide 3%

Manufacture : It is produced by passing steam over red hot coke at 1000^0C. The furnace is lined with refractory bricks. Coke is added from the top. Steam is supplied through pipes.



Water gas production

$$C + H_2O \longrightarrow CO + H_2$$ (Endothermic reaction)
(Coke) (Steam)

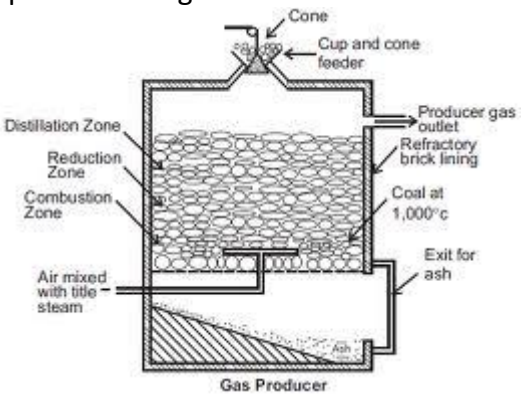
If temperature falls below 1000^0C Carbon dioxide will be formed.
Calorific Value of water gas is 2700 K.Cal/m^3

Uses:

Used as industrial fuel, Used for welding purposes
Used as source of industrial hydrogen

4.Describe the manufacture and uses of producer gas.

Producer gas : is a mixture of 50 to 55% hydrogen and 25 to 30% carbon monoxide
Manufacture: It is produced by passing air over red hot coke.The furnace is lined with refractory bricks. Air is passed through red hot coke at bottom.



Gas Producer

$$C + O_2 \longrightarrow CO_2$$
$$CO_2 + C \longrightarrow 2CO$$

Calorific value of producer gas is 1300K.Cal/m^3

Uses:

Used as a fuel in steel manufacture, Used as a fuel in glass manufacture
When petrol is less it may be used in vehicles

5.State the relative advantages of various fules.

Property	Solid Fuel	Liquid Fuel	Gaseous Fuel
Produce ash	Produce ash	No ash is produced	No ash is produced
Calorific Value	Low	Higher than solid fuels	Highest calorific value
To light	Difficult	Easy	easy
Produce smoke	Large	Low	No smoke
Adjusting flame	Cannot be adjusted	Cannot be adjusted	Can be adjusted
Wastage	Large	Less than solid fuel	No wastage

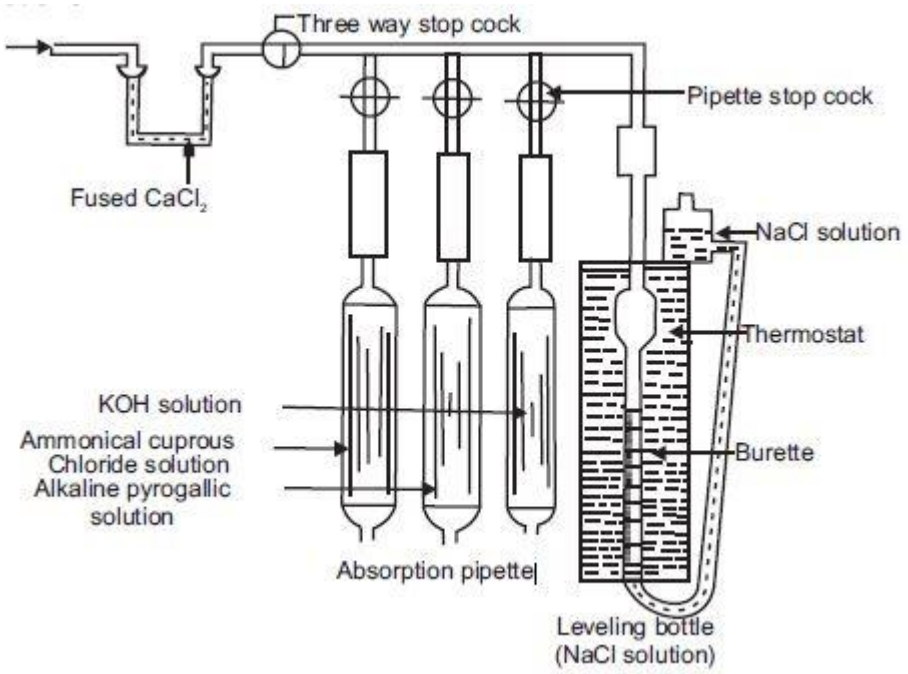
6.State the advantages of gaseous fules over other fuels.

1.No ash is produced
2.No smoke is produced
3.Lighting is easy
4.Flame is adjusted easily
5.No wastage is produced.
6.can be transported easily
7.Have highest calorific value

7. Explain analysis of flue gas with Orsat apparatus

Aim: Orsat apparatus measures the volume of CO_2, CO and O_2 in the given sample of flue gas.

Apparatus: It has burette with water jacket. One end of burette is connected to pipettes and other end to levelling bottles. Three way cocks are used to control flow of gas.



Analysis of flue gas:

- The apparatus is cleaned and air is removed.
- Flue gas is taken in burette.
- Flue gas is then passed in three pipettes.
- The first pipette with Hydrochloric acid absorbs Carbondioxide in flue gas.
- The second pipette with alkaline pyrogallic acid absorbs oxygen in flue gas.
- The third pipette with ammoniacal cuprous chloride absorbs carbon monoxide.
- The decrease in volume of flue gas after absorption of each gas is noted.
- The concentration of Carbondioxide, carbon monoxide and oxygen can be got from this value.

8.What are the requirements of good refractory?

Refractoriness	**Refractory should withstand high temperature**
Refractoriness under load	**Refractory should withstand high temperature under heavy load**
Thermal expansion	**Refractory should have low thermal expansion**
Thermal conductivity	**Refractory should have low thermal conductivity**
Porosity	**A good refractory should not be porous**
Spalling	**Good refractory should not peel off**

9.What are refractories?How are they classified? Give their uses.

Refractory : Substances which can withstand high temperature

TYPE	EXAMPLE	USES
Acid refractory	**Fire clay**	**1.Used in furnace where charge and slag are acidic 2.Used in blast furnace**
	Silica	**1.used in acid converters 2.used in Bessemer converter 3.used in electric furnaces**
Basic refractory	**Alumina**	**1.used to line glass and steel furnaces 2.used to line cement rotary kiln**
Neutral refractory	**1.Graphite 2.Silicon carbide**	**Used to line acidic or basic type furnaces**

EXTRACTION OF METALS,POWDER METALLURGY,ALLOYS,ABRASIVES

PART – A

1. Name two ores of tungsten.
Wolframite, Scheelite, Tungstenite
2. Name two ores of titanium.
Rutile, Ilmunite
3. Define powder metallurgy.
Making objects by heat treatment of compressed metallic powder.
4. Mention the methods of preparation of metal powders.
Atomization and reduction.
5. What are alloys?
Alloy is a homogeneous mixture of two or more metals.
6.What are the two types of alloys?
Ferrous alloys and nonferrous alloys.
7. What are abrasives?
Abrasives are substances that are used to polish the surface of another substance
8. What is Moh's scale?
Moh's scale gives hardness of abrasives in scale 1 to 10
9. Give two examples for natural abrasives.
Diamond,Garnet
10. Give two examples for synthetic abrasives.
Silicon carbide, Boron carbide

PART – B

1. List the uses of tungsten.
1.Tungsten filament is used in electric bulbs.
2.Tungsten used in Surgical instruments
3.Strings of musical instruments
2. List the uses of titanium.
1.Titanium is used in air crafts
2.Missiles 3.used in repairing damaged skull
3. Explain the preparation of metal powder by atomization.
Atomisation: The process of breaking down molten metal into metal powder using air, water and inert gas is called atomisation. Eg Tin, Aluminium powder

- Molten metal is sent through nozzle.
- The tiny droplets solidify into metal powder.

4. Explain the preparation of metal powder by reduction of metal oxide.
Reduction of metal oxide:

- It involves heating metal oxide with hydrogen or carbon monoxide at a temperature
- It is done in tube furnace or mesh furnace.
- Spongy metal powders are produced.

$$WO_3 + 3H_2 \longrightarrow W + 3H_2O$$

- This method is used to produce powders of Iron, Copper, Tungsten.

5. What are ferrous alloys? Give examples.

Alloys containing Iron as major metal. Eg)Steel, Vanadium steel,Chromium steel

6. What are non-ferrous alloys? Give examples.

Alloys which contain Iron as minor composition.

Eg)Nichrome,German Silver,Bronze

7. How are abrasives classified? Give examples.

Natural abrasive	Diamond	Jewelry, rock drilling machine
	Garnet	Finishing hard wood, pivots in watches
Artificial abrasive	Silicon carbide	To cut brass, bronze
	Boron carbide	To cut steel, tungsten carbide

8. List the uses of diamond.

Used in Jewelry, rock drilling machine,cutting tools

9. List the uses of corundum.

It is mainly used in grinding wheels.

It is specially used for grinding paper pulp.

10. List the uses of emery.

1.It is mainly used for scratching and rubbing surfaces.

2.It is used for making abrasive paper

3.To make abrasive cloth

11. List the uses of garnet.

1.It is used for grinding glass.

2.It is used for making abrasive paper

3.to make abrasive cloth.

12. List the uses of silicon carbide.

1.It is used for cutting and grinding glass.

2.It is used for grinding granite.

3.It is used for grinding carbides.

13. List the uses of boron carbide.

1.It is used for cutting steel.

2.It is used for cutting tungsten carbide.

3.It is used for grinding other hard materials.

PART – C

1.Explain the metallurgy of tungsten. Or What are the ores of tungsten. Explain how tungsten is extracted from wolframite ore.

Ores: 1.Wolframite

2.Scheelite 3.Tungstenite

Extraction of tungsten from wolframite:-

1.Ore is powdered and concentrated by electromagnetic separation method.

2.The ore is fused with sodium carbonate

4.Then extracted with water and sodium tungstate

5. the crystals dissolved in dilute hydrochloric acid

6.The precipitate is heated to get oxide

7. Oxide is then reduced with hydrogen at 1200^{o}C to get tungsten powder

$$H_2WO_4 \longrightarrow WO_3 + H_2O$$

$$WO_3 + 3H_2 \longrightarrow W + 3H_2O$$

2.What are the ores of titanium. Explain extraction of titanium from rutile or illuminate ore.

Ores:- 1.Rutile
2.Ilmenite

Extraction of titanium from rutile or ilmenite ore:-

The ore is heated with carbon and chlorine to get $TiCl_4$

Titanium + Carbon + Chlorine ⟶ Titanium tetra chloride + Carbon monoxide

$$TiO_2 + 2C + 2Cl_2 \longrightarrow TiCl_4 + 2CO$$

Then titanium is obtained as follows

Titanium tetrachloride + Sodium ⟶ Titanium + Sodium chloride

$$TiCl_4 + 4Na \longrightarrow Ti + 4NaCl$$

Purification of titanium by VanArkel method

when heated with iodine ,titanium tetraiodide is formed

$$Ti + 2I_2 \longrightarrow TiI_4$$

It is decomposed to titanium when it comes near titanium filament at 1400^oC

Pure titanium is deposited on the filament

$$TiI_4 \longrightarrow Ti + 2I_2$$

3.Write a note on preparation of metal powders

Atomisation: 1) The process of making molten metal into metal powder.
2)It is done using air, water or inert gas
Example : Making Tin, Aluminium metal powders

- Molten metal is sent through nozzle.
- The tiny droplets solidify into metal powder.

Reduction of metal oxide:

- Heating metal oxide with hydrogen or carbon monoxide at a temperature
- It is done in tube furnace or mesh furnace.
- metal powders are produced.

$$WO_3 + 3H_2 \longrightarrow W + 3H_2O$$

- This method is used to produce powders of Iron, Copper, Tungsten.

4.Write a note on industrial applications of powder metallurgy

1.Powder metallurgy techniques are used in surgical implants

; 2.Complex shapes like gears,cams are prepared

3.Self lubricating alloy bearings (alloy of tin, copper and graphite) are made

4.Refractory materials are prepared. By mixing metal powders with carbides, nitrides

5.Tungsten filament is made by using tungsten powder

5.What are alloys? What are the purposes of alloying?

Alloy: Alloy is a homogeneous mixture of two or more metals.

Purpose of alloying:

1.To improve hardness of metal. 2.To improve appearance
3.To improve ductility 4.To improve elasticity
5.To improve metal tensile strength 6.To make metal corrosion resistance

6.Write a note on ferrous alloys.

Stainless steel	Iron, Carbon Chromium Nickel	Hard Corrosion resistance	Utensils, Cutting tools, Surgical instruments
Vanadium steel	Iron, Carbon Vanadium	Shock resistant High tensile strength	To make gears, springs, Axles
Chromium steel	Iron, Carbon Chromium	Hard High tensile strength	Rock drilling machine and Automobile parts

7.Write a note on non ferrous alloys

Nichrome	Nickel 60% Chromium 12% Manganese 2% Iron 26%	Heat resistant, Electrical resistant	Used to make electric irons, electric stove coils
Dutch metal	Copper 80%, Zinc 20%		To make cheap jewelry In music instrument
German Silver	Copper 50%, Zinc 20%, Nickel 30%		To make coins, Ornaments
Gun metal	Copper 88%, Tin 10%, Zinc 2%		To make canons, guns
Duralumin	Aluminim 95% Copper 4% Manganese 0.5% Magnesium 0.5%	corrosion resistant, hard	Used in automobiles, aircrafts

8.Write a note on natural abrasives

Natural abrasive	Hardness on Moh's scale	Property	Uses
Diamond	10	Hard and Non siliceous	1.In pure form used in jewelry 2.In impure form Used in rock drilling and as teeth in rock cutting saws
Corundum	9	Hard and Non siliceous , naturally occurring alumina	1.Used as ruby stone 2.used as abrasive for grinding glass, lenses and metals
Garnet	6 to 7.5	Tri silicate of alumina, magnesia and ferrous oxide	1.Used for finishing hard wood 2.Used as pivots in watches

9.What is Silicon carbide(carborundum)? Give its preparation and uses

Moh's Scale	9 and 9.8
Preparation	➢ Silica burnt with coke at 2500^{o}C ➢ $SiO_2 + 3C \longrightarrow SiC + 2CO$ ➢ Saw dust added to give porosity ➢ Washed with sulphuric acid and sodium hydroxide to remove impurities
Property	highly crystalline, Unreactive and heat resistant
Uses	Grinding wheel for brass, bronze, glass

10.What is Boron Carbide(Norbide)? Give its preparation and uses

Nature : Norbide is boron carbide with Moh's scale hardness between 9.5 and 9.7

Manufacture :

- It is prepared by fusing boron oxide and coke at 2500^0C in electric furnace

  $2B_2O_3 + 7C \longrightarrow B_4C + 6CO$

- Boron carbide is treated with sulphuric acid and sodium hydroxide to dissolve impurities
- It is washed with water and dried

Properties:

- highly crystalline, Unreactive and heat resistant
- Harder than silicon carbide

Uses:

Used to cut steel, tungsten carbide
Used for grinding hard materials.

CEMENT,CERAMICS,LUBRICANTS,ADHESIVES

PART – A

1. What is cement?

It is a mixture of silicates of calcium and aluminium. It is applied in the form paste with sand and water. It sets into a hard mass.

2. What is Portland cement?

A paste of cement with water on setting gave a hard mass. It resembled stones from Portland in England. So it is called Portland cement. It is a mixture of silicates of calcium and aluminium.

3. Why is gypsum added during the manufacture of cement?

3 to 4% Gypsum delays the setting time of cement.

4. What are ceramics?

Ceramics are inorganic non-metallic materials that are processed at high temperature and subsequent cooling.

Examples: Ceramic wash basin, ceramic tiles

5. Define white pottery.

They are ceramic materials of china clay which is in white colour after firing is called white wares. They consist of a refractory body and glossy coating.

6. What is called bisque?

Bisque porous ceramic body ware. It is obtained after drying and firing ceramic body ware in biscuit oven.

7. What is glazing?

Glazing : Glazing is the process of making the porous ware water tight.

8. What is a lubricant?

Lubricant is a substance that reduces friction between moving parts of a machine

9. How are lubricants classified?

Solid lubricant, Semi solid lubricant, Liquid lubricant

10. Mention the uses of graphite.

Used in lathe, In railway track, Industries

11. Mention the uses of molybdenum sulphide.

Used as high temperature lubricant. Stable upto 400^0C

12. Define adhesive.

Adhesive is a substance that holds two substances together Eg) Gum, Glue

13. Name two natural adhesives.

Shellac, Ashpalt

14. Name two synthetic adhesives.

Cellulose nitrate, PVC

15. Mention the uses of shellac.

Joining small meal pieces, Electrical equipments

16. Mention the uses of asphalt.

Laminting paper, bonding clothes

17. Mention the uses of cellulose nitrate.

Bonding agent for foot wear, clothes

18. Mention the uses of PVC.

Boning pipes, packing industry

L19. Mention the uses of phenol-formaldehyde.

In Aircraft articles,House hold articles

PART – B

1. What are the raw materials required for the manufacture of Portland cement?

1. Limestone, chalk, marble
2. Clay
3. Powdered Coal
4. Gypsum

2. Write a note on setting of cement.

When water is added to cement, sudden setting of cement occurs.

The setting and hardening of cement are mainly due to hydration and Hydrolysis.

3. What are the raw materials required for the manufacture white pottery?

Raw Materials : Chain clay, Feldspar, Quartz, Flint, Kadine

4. List the uses of white pottery.

Whitwares as used as electrical insulators, Spark plugs, Crucible, Dishes etc

5. Explain salt glazing.

Salt Glazing: Common salt is used to get glossy surface on white wares. The article is heated to red hotness and sodium chloride is thrown on it. Sodium chloride vaporizes and reacts with silica to form glossy films of sodium silicate

6. How are lubricants classified? Give examples.

Solid Lubricant	**Graphite,Molybdenum sulphide**
Liquid lubricant	**Castor oil,Whale oil**
Semi soild lubricant	**Grease**

7. Write a note on semi-solid lubricant.

Grease : It is a mixture of oil and soap., It is used in machines, cycles, windows etc.

PART - C

1.Explain wet process for manufacture of cement

Raw materials: Lime stone,clay,gypsum

Wet Process:

1.Mixing:

1.Lime is powdered.
2.Clay is mixed with water.
3.These are mixed to get slurry.

2.Burning

1.Slurry is put into rotary kiln
2.Coal is burnt to give 1500^{o} C inside kiln.
3.Slurry gives clinker

3.Grinding

1.Clinker is powdered in ball mill
2. 2 to 3% gypsum is added, thus cement is made.

2.Explain setting of cement

1.When water is added cement sets into hard mass. Its called setting
2.Large amount is liberated during setting.
3.Hydration and hydrolysis takes place.
4.The following reaction occurs

Anhydruos soluble compounds → Hydrated insoluble compounds

5.Dehydration of insoluble gel sets into hard mass
6.inter locking crystals of calcium hydroxide takes place

3.Explain the manufacture of white pottery.

Raw Materials : Chain clay, Feldspar, Quartz, Flint, Kadine

Step 1 : Preparation of bodyware:

The raw materials powdered well and mixed with water to make it into a paste. Using the paste articles are prepared by hand moulding or in potters wheel. It is then dried in oven at $1350^0C - 1500^0C$ called bisque.

Step 2 : Glazing

Inorder to make bisque water tight it is coated with glaze. It is dipped in glaze and slurry and heated at high temperature to get a glossy finish.

Step 3: Decoration

The article is coated with paint after glazing or decorated with coloured glasses

Uses : Whitwares as used as electrical insulators, Spark plugs, Crucible, Dishes and other laboratory equipments and decorative articles

4.Write a note on glazing

Glazing : Glazing is the process of making the porous ware water tight.

Glaze is prepared by mixing quartz, feldspar, boric oxide and lead oxide with water. This is called slurry or slip.Bisque is dipped in slurry and heated to mature it.

Decoration : two types of decoration are **Under Glaze** and **Over Glaze**

Under glazed : Design is painted on the article before glazing (eg) Metallic oxide

Over glazed : Design is painted on article and fired once again (eg) colured glasses

Salt Glazing: Common salt is used to get glossy surface on white wares. The article is heated to red hotness and sodium chloride is thrown on it. Sodium chloride vaporizes and reacts with silica to form glossy films of sodium silicate

5.State the characteristics of lubricants.

1.It should be chemically inert
2.It should not be corrosive
3.It should not form emulsion with water
4.It should have enough viscosity
5.It should have enough oiliness
6.It should have high flash point
7.It should have high fire point

6.Explain solid and liquid lubricants

Solid Lubricant	**Graphite**	1.Soapy to touch 2.Non-inflammable 3.Non oxidized in air	Used in lathe, industry, railway track
	Molybdenum sulphide	1.Low coefficient of friction 2.Stable upto 400 C	Used as high temperature lubricant
Liquid Lubricant	**Vegetable oil Eg.Castor oil**	Obtained from plants Oxidizes easily	Used in cycles, bearings
	Animal Oil Eg.Whale oil	Obtained from animal fats	Used in clocks, guns
	Mineral oil Eg.Paraffin	Obtained from distillation of petroleum	Used as low temperature lubricant

7.What are the requirements of a good adhesive

1.It should be chemically inert.
2.It should be stable at high temperature
3.It should have enough viscosity
4.It should not burn
5.It should not be affected by fungi, insect

PLASTICS,RUBBER,COMPOSITE MATERIALS

PART – A

1. What is polymerization?

Polymerization is the process of converting small, low molecular weight organic molecules into long, high molecular weight organic molecules either by addition reaction or by condensation reaction.

2. What are the types of polymerization?

Addition polymerization, Condenzation polymerization

3. How polythene is formed?

Addition polymerization of ethylene gives polythene.

4. How Bakelite is formed?

Condenzation polymerization of phenol and formaldehyde gives bakelite.

5. Define plastic.

plastics or plastic materials in general is given to organic materials of high molecular mass, which can be moulded into any desired form when subjected to heat and pressure in presence of catalysts.

6. What are the types of plastics?

Thermo plastics and thermos setting plastics.

7. What are reinforced plastics?

The plastics polymers compounded with filers are called as reinforced or filled plastics.

8. What are biomaterials?

Biomaterials are the materials that can be implanted in the body to provide special prosthetic functions and used in diagnostic, surgical and therapeutic applications without causing adverse effect on blood and other tissues.

9. What is rubber?

Rubber is a natural elastic polymer of isoprene (C5H8). It is obtained from the milk of rubber called 'Latex'.

10. What is Latex?

Rubber milk obtained from rubber trees is called latex.

11. What is compounding of rubber?

Addition of some substances to improve quality of rubber

12. What is vulcanization?

Heating rubber with Sulphur at 140^0C. Hardness of rubber is improved.

13. Define reclaimed rubber.

Rubber prepared from waste rubber articles such as worn out tyres, tubes, gaskets, hoses, foot wears and other rubber wastes is called reclaimed rubber.

14. Give any two defects of natural rubber.

1. It becomes soft and sticky during summer.

2. It becomes hard and brittle during winter. 3. It swells up in oils.

15. What are composite materials?

A multiphase material consisting of a mixture of two (or) more substances with different properties which are mutually insoluble is called as Composite material.

16. Give examples for composite materials.

Concrete, Plywood

PART – B

1. Explain addition polymerization with an example

Polymer formed by addition reaction between molecules with double or triple bonds.

Eg) Ethylene forms polyethylene or polythene.

Ethylene has a double bond. This double bond breaks at 160^{o}-250^{o}C

Monomers join to give polymer

$nCH_2 = CH_2 \longrightarrow (-CH\text{ -}CH\text{ -})_n$

Ethylene Polyethylene

2. Explain condensation polymerization with an example.

- Polymers formed by reaction between molecules.
- water, ammonia etc are eliminated

Eg)Formation of Phenol-formaldehyde

1. Phenol and formaldehyde react.
2. React in the presence of acidic or basic catalys.
3. It follows step growth mechanism.

$C_6H_5OH + HCHO \longrightarrow (-C_6H_4 - CH_2 -)_n$

Phenol Formaldehyde Phenol formaldehyde

3. What are thermoplastics? Give an example.

Thermoplastics soften on heating and set on cooling.

They can be resoftened again.

Eg)Polytehene,PVC

4. What are thermosetting plastics? Give an example.

They set on heating.

It cannot be resoftened

Eg)Bakelite,Polymers

5. Mention the advantages of reinforced plastics.

1. Production cost is reduced
2. Tensile strength is improved
3. Have good dimensional stability

6. Give the applications of reinforced plastics.

To Make doors , To make windows

To make chairs To make tubes

7. Give any three defects of natural rubber.

1.becomes brittle in winter

2.swells up in oils

3.changes shape under stress

8. Mention the properties of reclaimed rubber.

Cheaper than fresh rubber

Easy to fabricate

Uniform composition

9. Mention the uses of reclaimed rubber.

To make belts

To make hoses

To make tubes

To make tyres

10. Write any three advantages of composite materials over metals and polymers.

1.They have lower thermal conductivity
2.They have lower electrical conductivity
3.They are more corrosion resistant

11. Mention any three applications of composite materials.

They are used to make the following
1.Concrete 2.Raincoats
3.Car parts 4.Cycle parts

PART - C

1.Write a note on addition polymerisation

Polymer formed by addition reaction between molecules with double or triple bonds.

Steps in addition polymerization

1.Chain initiation : Reactive particles are formed

2.Chain propagation : Reactive particles form polymer chain

3.Chain termination: Growth of chain is ended

Example: Eg) Ethylene forms polyethylene or polythene.

Ethylene has a double bond. This double bond breaks at 160^o-250^oC

Monomers join to give polymer

$nCH_2 = CH_2 \longrightarrow (-CH\text{ }-CH\text{ }-)_n$

Ethylene Polyethylene

2.Write a note on condensation polymerisation

- Polymers formed by reaction between molecules.
- water, ammonia etc are eliminated

Eg)Formation of Phenol-formaldehyde

4. Phenol and formaldehyde react.
5. React in the presence of acidic or basic catalys.
6. It follows step growth mechanism.

$C_6H_5OH + HCHO \longrightarrow (-C_6H_4 - CH_2 -)_n$

Phenol Formaldehyde Phenol formaldehyde

3.What are the differences between thermoplastics and thermo setting plastics

Property	Thermoplastics	Thermosetting plastics
Solubility in organic solvents	Soluble	Insoluble
Expansion on heating	Expands very much	Expands marginally
Use of scrap	Scrap can be reused	Scrap can not be used
Processd by	Injection moulding	Compression moulding
Resemblance	Glass	Cement and ceramics

4.Write a note on mechanical properties of plastics

1.Plastics degrade at high temperature
2.Plastics are electrical insulators
3.If plastic is subjected to heavy stress it undergoes change in shape. Its called creep
4.Stress-strain curve is not same as metal.
5.Strength to weight ratio of plastic is higher than light metals like aluminium or magnesium

5.State the advantages and applications of reinforced plastics

Reinforced plastics are the combination of polymers with solid fillers.

Fillers used are carbon black, china clay, quartz, mica.

Advantages of reinforced plastics:

1. Production cost is reduced
2. Tensile strength is improved
3. Have good dimensional stability
4. External appearance is improved
5. Rigidity is improved
6. Transparency is improved

6.Explain the extraction of rubber from latex

1.Natural rubber is extracted from latex which has 35% rubber.
2.Latex is diluted with water. Impurities settle down.
3.Then acetic acid or formic acid is added to coagulate the rubber.
4.It is washed with water.
5.Then the rubber is sent through rollers to produce sheets of rubber.
6.These sheets are then dried in air or smoke.
7.Isoprene $-C_5H_8-$ is the repeating unit in rubber.

Defects of natural rubber:

1.It becomes soft and sticky in summer
2.becomes brittle in winter
3.swells up in oils
4.changes shape under stress

7.Explain compounding of rubber

The raw rubber obtained from latex has many defects.
So some compounds are added to improve the quality of rubber.

	Compound	Property	Example
1	**Colouring matter**	Gives color to rubber	Carbon black-black color
2	**Reinforcing agents**	Gives strength to rubber	Carbon black
3	**Vulcanization**	Makes rubber tough	Sulphur is added at 140^oC
4	**Accelerators**	Reduce time for vulcanization	Benzo thiozole
5	**Softeners**	Gives softness to rubber	Vegetable oils

8.Write a note on vulcanisation of rubber

- **Vulcanization** is a process heating natural rubber with sulphur to 140^oC.
- The amount of sulphur added is from 0.15% to 32%.
- For Soft rubber 2 to 5% sulphur added
- For getting hard rubber 30% sulphur is added.

1.In vulcanization the double bonds are broken
2.adjacent atoms are joined by sulphur.

Vulcanization benfits: Vulcanized rubber is

- resistant to heat and corrosive chemicals.
- It gives elasticity, durability.
- low thermal coductivity
- Low electrical conductivity

9.How is rubber reclaimed? Give its uses

Rubber is reclaimed as follows

1. Waste rubber pieces are powdered
2. Then by electromagnetic separation metallic impurities are removed
3. It is then heated with caustic soda at 200^{o}C for 10 to 12 hours
4. Now rubber gets digested
5. So fibre is hydrolysed and removed
6. Sulphur gets removed as sulphide
7. Hence rubber is devulcanized and reclaimed

Uses of reclaimed rubber:-

1.To making rubber hoses 2.To make floor mats 3.To make tyres 4.To make chappals

10.What are the advantages of composite materials over metals and polymers?

Composite materials have several advantages over polymers, metals and ceramics

1.They have lower thermal conductivity 2.They have lower electrical conductivity
3.They are more corrosion resistant 4.They have higher toughness
5.They have lower specific gravity 6.They have low thermal expansion
7.They are cheaply manufactured

11.What are the applications of composite materials?

Composite materials are used to make the following

1.Concrete
2.Rain coat
3.Car Parts
4.Tennis rackets
5.Bicycle
6.Baseball bats