JECRC Foundation

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

Year & Sem – B.Tech I year I Sem
Subject –Engg.Chemistry
Unit – IV
Presented by – Ms.Rekha Vijay
Designation - Asst.Professor
Department - Chemistry

VISION OF INSTITUTE

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

MISSION OF INSTITUTE

❖**Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.**

❖**Identify, based on informed perception of Indian, regional and global needs, the areas of focus and provide platform to gain knowledge and solutions.**

❖**Offer opportunities for interaction between academia and industry.**

❖**Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders may emerge in a range of profession.**

Engineering Chemistry: Course Outcomes

Students will be able to:

CO1: Explain the impurities of water (mainly hardness) and boiler troubles.

CO2: Describe processing technologies of fuel with numerical aspects of combustion of fuel.

CO3: Describe the engineering material (cement, glass and lubricant) with respect to their manufacturing, composition, classification & properties.

CO4: Explain corrosion with its controlling measures, organic reaction mechanism and synthesis of drugs (Aspirin & Paracetamol) with their properties and uses.

JECRC
Department of Applied Sciences
Lecture Plan (Session- 2020-2021)

Course Name: Engineering Chemistry **Year/Semester: 1st Year/ Semester- I**

Course code: 1FY2-03 **No. of Lecture Req. /(Avl.): /(40/44)**

Semester starting: 21 Sept. 2020 **Semester Ending: 24 Dec. 2020**

Unit No./ Total Lect. Req.	Topics	Lect. No.	Date of Delivery	Book Referred	Pg. No.
Unit-I 10	Introduction to syllabus, Common natural impurities, hardness, Degree of hardness,	1			
	Units of hardness, Determination of hardness by complexometric (EDTA method).	2			
	Municipal water supply, Requisite of drinking water, purification of water, Sedimentation,	3			
	Filtration, disinfection, Breakpoint chlorination.	4			
	Boiler troubles: Scale and Sludge formation, Internal treatment Methods	5			
	Priming and Foaming, Boiler corrosion and caustic embrittlement	6			
	Water softening: Lime-Soda process	7			
	Water softening: Zeolite (Permutit) process, Demineralization process.	8			
	Numerical problems based on Hardness, EDTA,	9			
	Numerical problems based on Lime-Soda and Zeolite process.	10			

Unit-II 10	**2.Organic Fuels: Solids fuels: Coal, Classification of Coal, Proximate analyses of coal and its significance**	**11**			
	Ultimate analyses of coal and its significance,	12			
	Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter.	13			
	Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method.	14			
	Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking	15			
	Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number	16			
	Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas	17			
	Determination of calorific value of gaseous fuels by Junker's calorimeter, Numerical problems based on Junkers calorimeter	18			
	Numerical problems based on determination of calorific value bomb calorimeter, /Dulongs formula, proximate & ultimate Analysis.	19			
	Numerical problems based on combustion of fuel.	20			

Unit-III 3	**3.Corrosion and its control: Definition and significance of corrosion, Mechanism of chemical (dry) corrosion**	**21**			
	Mechanism of electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion.	22			
	Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.	23			

Unit-IV 10	**4.Engineering Materials: Portland Cement; Definition, Manufacturing by Rotary kiln.**	**24**			
	Chemistry of setting and hardening of cement. Role of Gypsum.	25			
	Glass: Definition, Manufacturing by tank furnace, significance of Annealing	26			Engg. Chemistry (New Age International)
	Types and properties of soft glass, hard glass	27			
	Borosilicate glass, glass wool, safety glass.	28			
	Lubricants: Classification	29			
	Lubricants: Mechanism	30			
	Properties; Viscosity and viscosity index	31			
	Flash and fire point, cloud and pour point.	32			
	Emulsification and steam emulsion number.	33			

Unit-V 7	**5. Organic reaction mechanism and introduction of drugs: Organic reaction mechanism: Substitution; SN1, SN2.**	**34**			
	Electrophilic aromatic substitution in benzene, free radical halogenations of alkanes,	35			
	Elimination: elimination in alkyl halides, dehydration of alcohols,	36			
	Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones	37			
	Rearrangement: Carbocation and free radical rearrangements	38			
	Drugs : Introduction, Synthesis, properties and uses of Aspirin	39			
	Drugs : Introduction, Synthesis, properties and uses of Paracetamol, Revision	40			

Lecture-26 (Unit-IV) Engineering Materials

GLASS

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- INTRODUCTION
- PROPERTIES
- MANUFACTURING

INTRODUCTION

- Glass can be defined as a hard , brittle , amorphous, transparent super cooled liquid with infinite or very high vicosity.
- It has no sharp melting point but is a good electrical insulator.
- It is a vitrified solid which has no definite composition .
- It is represented as $XM_2O.YNO.6SiO_2$

↓ ↓

Monovalent metal atom

Bivalent metal atom

properties

Physical Properties

1. Glass is a good electrical insulator .
2. It can incorporate colouring material , preserving transpa-rency .
3. They have high compressive strenght .
4. They are hard & do not have definite melting point .

Chemical Properties

1. Glass is not attacked by air & oxidising agent .
2. It is alkaline in nature . Thus, water react slowly with glass to form NAOH .
3. The reaction with water is enhanced in presence of acids . If acids in glass bottles are kept for long period , silicic acid deposit on bottle .

Manufacturing

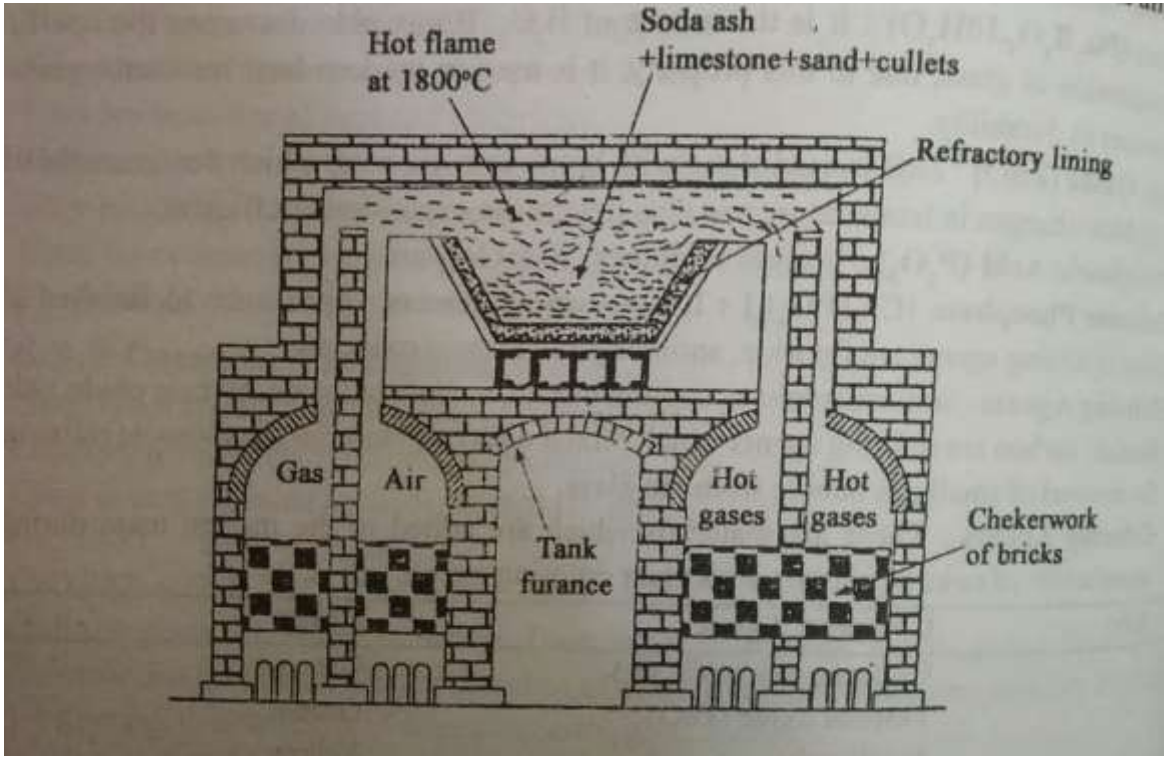
- **Raw Materials :** Silica , Sodium carbonate(Na_2CO_3), Calcium Carbonate($CaCO_3$) , Cullets , Colouring agents.

- **Process :** The Process of manufacturing of glass includes 5 important processes whch includes:

a) **Mixing**
b) **Melting**
c) **Shaping**
d) **Annealing**
e) **Finishing**

- **Devitrification :** After the melting of glass we obtain a viscious liquid after the slow cooling it is converted into amorphous solid instead of crystalline solid , this is know as vitrification and its opposite is called devitrification where we get crystalline products.

Tank Furnace



Chemistry of melting

(ii) Silica (SiO_2) reacts with soda ash (Na_2CO_3) to form sodium silicates and CO_2 escapes out.

$$Na_2CO_3 + SiO_2 \xrightarrow{700-900^\circ C} Na_2SiO_3 + CO_2\uparrow$$

(iii) $CaCO_3$ decomposes to CaO and CO_2

$$CaCO_3 \xrightarrow{900-960^\circ C} CaO + CO_2\uparrow$$

(iv) CaO reacts with SiO_2 to form calcium silicate

$$CaO + SiO_2 \xrightarrow{1010^\circ C} CaSiO_3$$

Sodium calcium silicate is produced when both Na_2CO_3 and $CaCO_3$ are present.

$$Na_2CO_3 + CaCO_3 + 6SiO_2 \rightarrow Na_2O.\ CaO.\ 6SiO_2 + 2CO_2$$

ratio of $Na_2CO_3 : CaCO_3$: sand are 35 : 15 : 100.

The above reaction may also take place as under if Na_2SO_4 and C (charcoal) are present instead of Na_2CO_3.

$$2Na_2SO_4 + 2SiO_2 + C \rightarrow 2Na_2SiO_3 + CO_2 + 2SO_2$$

$$Na_2SiO_3 + CaCO_3 + 5SiO_2 \rightarrow Na_2O.\ CaO.\ 6SiO_2 + CO_2$$

Preparation

MIXING

In this step all the raw materials are ground and mixed with cullet and again ground to get finally powdered and this mixture is called BATCH

MELTING

Melting of glass is done by heating in tank furnace.The cullet is the broken pieces of glass and is used to lower the melting point.The tank is heated at about 1800 ˚C , the materials melt and fused with hot gases.On continued heating ,the entire amount of CO_2 escapes out and viscous fused mass is obtained it is known as PLAIN.Heating is now stopped and now it is allowed to cool

Shaping, Annealing, Finishing

- Molten glass is shaped into desired shape by either blowing or moulding

- The glass articles are allowed to cool gradually at room temperature by passing through a series of different chambers with descending temperature this is known as “ANNEALING”.

  Glass is bad conductor of heat so rapid cooling makes only outer surface cool as compare to inner surface and this situation may cause for stress and strain therefore to avoid such problem glass should b cooled slowly.This slow cooling process is termed as ANNEALING.
- After annealing process,all types of glass require finishing.It is by cleaning,washing,polishing etc

Suggested links from NPTEL

https://www.fzu.cz/~sestak/yyx/Glasses.pdf

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Thank you!