

VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CHEMISTRY

QUESTION BANK



II SEMESTER

CY 6251 – Engineering Chemistry-II

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Prepared by

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VALLIAMMAI ENGINEERING COLLEGE

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DEPARTMENT OF CHEMISTRY



UNIT I - WATER TECHNOLOGY			
PART - A			
Q.No	Questions	BT Level	Competence
1.	What is hardness? How is it classified?	1	Remembering
2.	Why is water softened before using in the boilers? List out the disadvantages of using hard water in boilers.	3	Applying
3.	Distinguish priming and foaming?	2	Understanding
4.	How is boiler corrosion prevented?	3	Applying
5.	What is meant by caustic embrittlement?	2	Understanding
6.	Define softening or conditioning of water?	1	Remembering
7.	How is calgon conditioning better than phosphate conditioning?	4	Analyzing
8.	How is the exhausted resin regenerated?	2	Understanding
9.	What are boiler compounds?	1	Remembering
10.	Every soft water is not a demineralized water whereas every demineralized water is a soft water. Justify.	4	Analyzing
11.	Mention any two advantages of zeolite or permutit process.	3	Applying
12.	Define desalination.	1	Remembering
13.	Compare internal conditioning with external conditioning.	4	Analyzing
14.	What is ion exchange resin?	1	Remembering
15.	What is reverse osmosis (RO)?	1	Remembering
16.	Name the salts responsible for scale and sludge.	2	Understanding
17.	Mention any four methods of converting brackish water into fresh water.	1	Remembering
18.	How is blow down operation applied to remove hard water?	3	Applying
19.	How is desalination carried out?	4	Analyzing
20.	Explain about the carry over? How is it caused?	2	Understanding
PART - B			
1.	i. How do you identify the hard and soft water? Explain the types of hard water.	2	Understanding
	ii. What are the boiler troubles or disadvantages of using hard water in the boiler? How are they caused? Suggest steps to minimize the boiler troubles.	1	Remembering
2.	i. Differentiate scales and sludges.	2	Understanding
	ii. Discuss the causes and prevention of priming and foaming.	4	Analyzing
3.	i. Explain the caustic embrittlement with example. How do you solve this problem?	3	Applying
	ii. Indicate the reason for boiler corrosion. How can it be prevented?	3	Applying
4.	i. What is boiler feed water? What are its requirements and explain its drawbacks?	1	Remembering
	ii. Explain with chemical reaction of the demineralization or ion exchange process. Or how is hard water converted into soft water using ion exchange process?	1	Remembering
5.	i. How is hard water softened by zeolite or permutit process?	3	Applying

	i. Explain the advantages and disadvantages of zeolite process?	2	Understanding
6.	i. What are the differences between ion exchange process and zeolite process?	4	Analyzing
	ii. How is internal treatment of boiler water carried out using carbonate, phosphate and calgon conditioning method?	4	Analyzing
7.	i. Compare internal conditioning with external conditioning.	2	Understanding
	ii. Write the advantages and disadvantages of external treatment of water.	2	Understanding
8.	i. What is desalination? With a neat diagram describe the Reverse Osmosis method for the desalination of brackish water.	1	Remembering
	ii. How will you regenerate the exhausted ion exchange resin and zeolite?	3	Applying
9.	i. Explain the following a. Carry over process b. Blow down operation c. Boiler feed water d. Brackish water	4	Analyzing
	ii. How are oxygen and carbon dioxide removed from water?	3	Applying
10.	i. How is calgon conditioning is superior to phosphate conditioning?	4	Analyzing
	ii. Explain the disadvantages of scale formation?	1	Remembering
11.	i. What are the requirements of boiler feed water?	4	Analyzing
	ii. What are the factors which causes boiler corrosion? How can it be minimized?	1	Remembering
12.	i. Give an account of internal treatment of boiler water.	2	Understanding
	ii. Draw a suitable diagram and describe the Ion exchange process for the softening of boiler water.	1	Remembering
13.	i. Define the term Desalination with a neat diagram describe Desalination by Reverse osmosis method.	3	Applying
	ii. Describe the principle and procedure involved in the Zeolite process for water treatment.	3	Applying
14.	i. Write briefly the various methods of internal condition of boiler feed water.	2	Understanding
	ii. Explain the boiler troubles, Scales and Caustic embrittlement in detail.	3	Applying



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DEPARTMENT OF CHEMISTRY



UNIT II - ELECTROCHEMISTRY AND CORROSION			
PART - A			
Q.No	Questions	BT Level	Competence
1.	Define Electrochemical (Galvanic) cell?	1	Remembering
2.	Describe Standard Electrode Potential?	2	Understanding
3.	What are the factors which affects the emf of the cell?	3	Applying
4.	Can we use nickel spatula to stir a solution of copper sulphate?	4	Analyzing
5.	Define a reference electrode. Give an example.	1	Remembering
6.	Write the significance of electrochemical series.	3	Applying
7.	Illustrate the conditions for an electrochemical cell to act as a standard cell.	3	Applying
8.	What is corrosion? Give an example.	1	Remembering
9.	What is Pilling-Bedworth rule? Discuss its importance.	1	Remembering
10.	State Pilling-Bedworth ratio?	2	Understanding
11.	Compare Dry corrosion and Wet corrosion.	4	Analyzing
12.	Bolt and nut made of same metal is preferred in practice. Why?	4	Analyzing
13.	What is water line corrosion? Give example.	1	Remembering
14.	Discuss pitting corrosion.	1	Remembering
15.	Explain cathodic protection. Mention its two applications.	2	Understanding
16.	How is galvanic corrosion prevented?	2	Understanding
17.	What is a paint? Mention its constituents.	1	Remembering
18.	Describe electroplating? (or) Give the principle of Electrodeposition.	1	Remembering
19.	Compose the Nernst equation for the cell, $Zn_{(s)}/Zn_{(aq)} \parallel Mg_{(aq)}/Mg_{(s)}$	6	Creating
20.	Classify the advantages of electroless plating over electroplating.	4	Analyzing
PART - B			
1.	i. Derive Nernst equation and give its significance (applications).	3	Applying
	ii. Calculate the standard electrode potential of zinc electrode dipped in 0.1 M $ZnSO_4$ at 25 C ($E^0 Zn/Zn^{2+} = 0.76$ V)	3	Applying
2.	i. Compare electrolytic cell and electrochemical cell.	4	Analyzing
	ii. Discuss the measurement of single electrode potential.	2	Understanding
3.	i. Consider the cell reaction $Zn + Fe^{2+} (0.005) \rightarrow Zn^{2+} (0.01) + Fe$. Given that the standard emf of the cell is 0.323V at 298K. Construct the cell and calculate emf of cell.	3	Applying
	ii. Calculate the reduction potential of $Cu^{2+} (0.5M) / Cu$ at 25°C. $E^0(Cu^{2+}/Cu) = 0.337$ V	6	Creating
4.	i. Compose the cell reactions of the following cells. 1. $Zn_{(s)}/Zn^{2+} (0.01M) \parallel Ni^{2+} (0.5M)/Ni_{(s)}$ 2. $Zn_{(s)}/Zn^{2+} (aq) \parallel Ag^+ (aq)/Ag_{(s)}$ 3. $Ni_{(s)}/Ni^{2+} (1M) \parallel Pb^{2+} (1M)/Pb_{(s)}$ 4. $Zn_{(s)}/Zn^{2+} (0.01M) \parallel Ni^{2+} (0.5M)/Ni_{(s)}$	6	Creating

	5. $\text{Ag(s)/Ag}^+(\text{aq})\parallel \text{pt,H}_2(\text{g})/\text{H}_2(\text{g})$ i. What is electrochemical series? Give its applications	4	Analyzing
5.	i. Analyse dry (or) chemical corrosion with suitable examples and diagrams. (OR) What is chemical corrosion? Explain the mechanism of oxidation corrosion.	2	Understanding
	ii. State the differences between electrochemical corrosion and chemical corrosion.	2	Understanding
6.	i. Discuss wet (or) electrochemical corrosion with suitable examples and diagrams. (OR) Describe the mechanism of electrochemical corrosion.	3	Applying
	ii. Explain differential aeration corrosion and galvanic corrosion with suitable illustrations.	1	Remembering
7.	i. What are the factors which influences the rate of corrosion?	1	Remembering
	ii. Explain the sacrificial anode and impressed current cathodic techniques for the prevention of corrosion.	2	Understanding
8.	i. How will you control corrosion by material selection and design aspects?	2	Understanding
	ii. Formulate the mechanism for drying oil.	5	Analyzing
9.	i. What are paints? Give its constituents and function with examples.	1	Remembering
	ii. Explain the process of electrodeposition taking a suitable example (or) How is electroplating of copper carried out?	3	Applying
10.	i. What is meant by electroless plating? With a neat sketch explain the electroless plating of nickel.	2	Understanding
	ii. Differentiate electroplating and electroless plating.	2	Understanding
11.	i. Explain the terms, cell potential and single electrode potential and describe the method of determination of electrode potential	1	Remembering
	ii. How electrode potential can be obtained from Nernst Equation.	3	Applying
12.	i. Define EMF Series. Explain its significance	1	Remembering
	ii. Discuss the importance of design and material selection in controlling corrosion.	3	Applying
13.	i. Illustrate Electroless plating and explain the plating of Ni by this process	4	Analyzing
	ii. Explain how corrosion is controlled by sacrificial anode	3	Applying
14.	i. Bring out the application of emf series.	5	Analyzing
	ii. Discuss the factors which influence the chemical and electrochemical corrosion.	3	Applying



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DEPARTMENT OF CHEMISTRY



UNIT III - ENERGY SOURCES AND STORAGE DEVICES

PART - A

Q.No	Questions	BT Level	Competence
1.	Define nuclear fission with example.	1	Remembering
2.	Mention a few important characteristics of nuclear fission.	1	Remembering
3.	What is nuclear fusion reaction? Give an example.	1	Remembering
4.	Illustrate nuclear chain reaction?	3	Applying
5.	Distinguish nuclear fission and nuclear fusion reaction.	2	Understanding
6.	What is critical mass, super and sub critical mass?	1	Remembering
7.	Give the role of moderators in a nuclear reactor.	1	Remembering
8.	Differentiate fissile and fertile nucleides.	2	Understanding
9.	What are the components of a nuclear reactor?	1	Remembering
10.	Discuss breeder reactor.	2	Understanding
11.	Describe the construction of photo galvanic cell.	2	Understanding
12.	List the advantages of wind energy.	1	Remembering
13.	Explain primary and secondary batteries with example.	4	Analysing
14.	Write the charging and discharging reaction of lead acid accumulator?	1	Remembering
15.	Construct a NICAD battery and give its cell reactions.	3	Applying
16.	Lithium battery is the widely used battery. Comment on it.	3	Applying
17.	Analyse the advantages of alkaline battery over dry battery.	4	Analysing
18.	Will the emf of a battery vary with size? Give reasons.	4	Analysing
19.	Describe the factors that impede the nuclear chain reaction.	2	Understanding
20.	Explain about batteries and its basic requirements.	4	Analysing

PART - B

1.	i. What is fission reaction? Illustrate the mechanism with example.	4	Analysing
	ii. What is meant by nuclear energy? How to improve nuclear energy in a nuclear reactor.	2	Understanding
2.	i. Differentiate nuclear fission and nuclear fusion reaction. With the help of a neat sketch explain the working of a nuclear reactor.	2	Understanding
	ii. With the help of a neat sketch explain the working of a nuclear reactor.	2	Understanding
3.	i. Explain the following with example Nuclear fission ii) Nuclear fusion	2	Understanding
	v. Illustrate breeder reactor with an example.	3	Applying
4.	i. What is a nuclear chain reaction? Explain its principles and characteristics.	1	Remembering
	ii. What is nuclear fusion? Give an example and explain why the energy cannot be harnessed.	5	Evaluating

5.	i. Analyse the components and its functions of a Light water nuclear reactor with a suitable diagram.	4	Analysing
	ii. How a fertile nuclei can be converted to a fissile nuclei? Explain.	4	Analysing
6.	i. Compare and contrast nuclear reactions.	4	Analysing
	ii. What is a photovoltaic cell? Explain its construction and working with a neat diagram.	2	Understanding
7.	i. How wind energy is converted into electrical energy? Explain	2	Understanding
	ii. Discuss the principle and applications of photo galvanic cell.	2	Understanding
8.	i. Describe the principle behind the functioning of solar cell.	2	Understanding
	ii. State the merits and demerits of solar energy	2	Understanding
9.	i. State the advantages and limitations of wind energy.	1	Remembering
	ii. Construct an alkaline battery and explain its working.	4	Analysing
10.	i. Describe the construction and working of H ₂ O ₂ fuel cell.	4	Analysing
	ii. Explain the construction and working of Lead acid battery.	4	Analysing
11.	i. Discuss how Li – S battery works	2	Understanding
	ii. Write a note on NICAD battery.	1	Remembering
12.	i. Write notes on Li- TiS ₂ battery.	1	Remembering
	ii. Write in detail about the classification of energy storage devices.	1	Remembering
13.	i. Describe the construction of Lead acid accumulator with reactions occurring during discharging and recharging.	3	Applying
	ii. How is a solid state Li battery constructed? Describe its functioning.	2	Understanding
14.	i. Describe the first charge and discharging reactions of Ni-Cd cell. Give the advantages of it over Lead acid battery.	3	Applying
	ii. With a neat diagram explain the working principle of any one of the flow battery.	3	Applying



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DEPARTMENT OF CHEMISTRY



UNIT IV - <u>ENGINEERING MATERIALS</u>			
PART - A			
Q.No	Questions	BT Level	Competence
1.	What is abrasive? How it is measured?	1	Remembering
2.	How abrasives are classified?	2	Understanding
3.	Give the role of Garnet and Emery in engineering field	1	Remembering
4.	Describe about preparation of Carborundum	2	Understanding
5.	Describe the preparation alundum.	2	Understanding
6.	Explain the preparation of norbide.	4	Analyzing
7.	Define refractories. How can they be classified?	1	Remembering
8.	Mention objectives of PCE test.	1	Remembering
9.	What is refractoriness? How it is measured?	1	Remembering
10.	Illustrate RUL Test?	3	Applying
11.	What is porosity of refractories	1	Remembering
12.	List the stages in manufacture of a refractory.	1	Remembering
13.	Explain thermal spalling? How will it be controlled?	4	Analyzing
14.	What is white cement?	2	Understanding
15.	Discuss about Portland cement? Give its properties.	2	Understanding
16.	Write a note on Hydrophobic cement?	1	Remembering
17.	Construct wet process in the preparation of cement.	3	Applying
18.	Comment on it hardening and setting of cement.	3	Applying
19.	Analyse the composition of flint glass and borosilicate glass.	4	Analyzing
20.	What is Glass? Mention few types of it.	1	Remembering
PART - B			
1.	i. Describe the synthetic abrasives. i. What are the abrasives? Give a detailed account of non- siliceous types of abrasives.	4 1	Analyzing Remembering
2.	i. Describe about i] abrasive paper ii] abrasive cloth iii] grinding wheel. i. What is SiC? Explain its manufacturing and properties.	2 2	Understanding Understanding
3.	i. Write in detail about siliceous types of abrasives i. What is norbide and alundum? Mention its properties.	1 1	Remembering Remembering
4.	i. How are abrasives classified? Explain the properties of any two in each category. i. Explain RUL test and refractoriness of refractory.	2 3	Understanding Applying

5.	i. How alumina, zirconia and magnesite bricks are prepared and write its properties and uses.	2	Understanding
	i. Discuss thermal spalling, porosity and dimensional stability of a Refractory.	2	Understanding
6.	i. Define refractoriness of a refractory. How it is measured by using PCE test.	3	Applying
	i. Mention the characteristics (or) requisites of a good refractory.	1	Remembering
7.	i. Write notes on manufacturing of refractory brick with an example.	1	Remembering Understanding
	i. Discuss in detail about any 4 properties of refractory	2	
8.	i. What is refractory? Write the manufacturing process, properties and uses of basic and neutral refractory.	2	Understanding
	i. State about Zirconia and magnesite bricks.	1	Remembering
9.	i. Illustrate the manufacture of cement by any one process.	3	Applying
	i. Construct the manufacturing of cement by dry and wet process and explain its working.	4	Analysing
10.	i. With the help of reactions explain mechanism of hardening and setting of cement.	2	Understanding
	i. What is Portland cement? Illustrate the manufacturing it by wet process.	4	Analysing
11.	i. What is water proof cement? Write its properties and uses.	2	Understanding
	i. What is white cement? Write its properties and uses.	2	Understanding
12.	i. Discuss about various zones of kiln in cement preparation.	2	Understanding
	i. Explain the construction and working manufacturing of glass.	4	Analysing
13.	i. Explain elaborately on the composition and uses of any four glasses.	2	Understanding
	i. Differentiate lead glass, bullet proof glass and Tempered glass.	2	Understanding
14.	i. Describe the manufacturing process of Borosilicate glass.	4	Analysing
	i. Explain the composition, properties and uses of Borosilicate glass.	2	Understanding



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DEPARTMENT OF CHEMISTRY



UNIT V - <u>FUELS AND COMBUSTION</u>			
PART - A			
Q.No	Questions	BT Level	Competence
1.	Define calorific value of a fuel.	1	Remembering
2.	Differentiate caking coal and coking coal?	4	Analyzing
3.	Justify coke superior to coal.	5	Evaluating
4.	Explain the term knocking.	2	Understanding
5.	Define octane number? How it is improved?	1	Remembering
6.	Give the composition and uses of CNG?	1	Remembering
7.	Illustrate how cetane number is improved?	3	Applying
8.	Evaluate the composition and uses of water gas.	5	Evaluating
9.	What is metallurgical coke?	1	Remembering
10.	Calculate the volume of air required for complete combustion of two litres of CO. Given that volume of O ₂ in air is 24%.	3	Applying
11.	List out demerits of sulphur in coal?	5	Evaluating
12.	Formulate TEL. Mention its uses?	6	Creating
13.	Distinguish between HCV and LCV.	4	Analyzing
14.	A sample of coal was found to have the following composition C=75%, H ₂ =5.2%, S=1.2%, O ₂ =12.8%, N ₂ =3.7% and ash =2.1%. Find the minimum quantity of air required for complete combustion.	3	Applying
15.	Differentiate coke from coal.	4	Analyzing
16.	Why is water gas used as reducing agent?	5	Evaluating
17.	Formulate the net and gross calorific value if a coal sample has the following composition, C=85%, H=8%, S=1%, N ₂ =2% and ash=4%.	6	Creating
18.	List out any four properties of biodiesel.	2	Understanding
19.	What is meant by refining of petroleum?	1	Remembering
20.	State the characteristics of a good fuel.	2	Understanding
PART - B			
1.	i. How is ultimate analysis carried out? Bring out its significance. How does it differ from proximate analysis?	2	Understanding
	ii. Demonstrate the petroleum refining process in detail with neat sketches.	3	Applying
2.	i. Compare the Gross and Net calorific values.	4	Analyzing
	ii. Explain how is proximate analysis carried out? Bring out its significance.	2	Understanding

3.	i. Evaluate the manufacturing method of water gas in detail. Mention its composition and uses.	5	Evaluating
	ii. Illustrate how synthetic petrol is manufactured by Bergius process.	3	Applying
4.	i. Demonstrate the Otto-Hoffman process of coke manufacture and the recovery of byproducts.	3	Applying
5.	i. What is power alcohol? How it is obtained? Explain its advantages and disadvantages.	1	Remembering
	ii. What is meant by bio-diesel? How is it obtained? Explain its advantages and disadvantages.	2	Understanding
6.	i. What is producer gas? How it is manufactured? Give the chemical reaction taking place in different zones.	1	Remembering
	ii. Explain how synthetic gasoline is manufactured by Fischer-Tropsch method.	1	Remembering
7.	i. With neat diagram discuss the analysis of flue gas by Orsat apparatus	2	Understanding
8.	ii. How the proximate and ultimate analyses are carried out and term its significance.	2	Understanding
9.	i. List out the difference between petrol and diesel as IC engine fuels	4	Analyzing
	ii. Give a comparative account of water gas and producer gas	4	Analyzing
10.	i. What is meant by knocking? How it is related to chemical constitution?	1	Understanding
	ii. Estimate the minimum quantity of air required for complete combustion of 1 kg of the sample if 40% of excess air is supplied. Given that the composition of coal was C=81%, H=4%, O=2%, N=1%.	6	Creating
11.	i. Evaluate the followings a. Ignition temperature b. Explosive range of a fuel. c. LPG d. Cracking	5	Evaluating
12.	i. Solve the gross and net calorific values of a coal with the following ultimate analysis: carbon 84%, sulphur 1.5%, nitrogen 0.6%, hydrogen 5.5%, and oxygen 8.4%.	3	Applying
	ii. Calculate the volume of air required for complete combustion of 100 m ³ of gaseous fuel having H=50%, CH ₄ =36%, N=1.5%, CO=6%, C ₂ H ₄ =4% and CO ₂ =2.5%.	6	Creating
13	i. Evaluate how flue gas is analyzed by Orsat method.	5	Evaluating
14	i. Formulate the manufacturing of metallurgical coke by Otto-Hoffman method.	6	Creating