**QUESTION BANK**

1. a) Why is GCV always greater than NCV?

b) A sample of coal was found to have the following composition by mass:

C=75%, H=5.2%, O=21.1%, N=3.2% and ash =4.5% calculate:

1. Minimum air required for complete combustion of 1 kg of coal.
2. Highest and the lowest calorific value of the coal.
3. Name the analysis of coal in which moisture, volatile matter, ash and fixed carbon are determined. Give significance of each components.
4. a) What are the advantages of catalytic cracking over thermal cracking?

b) 20g sample of coal was used for nitrogen estimation by Kjeldahl method. The evolved NH3 was collected in 50mL (N/10) H2SO4 to neutralise excess acid, 25 mL of 0.1 N NaOH was required. Determine the percentage of Nitrogen in the given sample of coal.

1. a) 5g CaCO3 was dissolved in HCl and the solution made upto 1 L with distilled water,

50 mL of the solution required 48ml of EDTA solution for titration. 50 ml of hard water sample required 15 ml of EDTA solution and after boiling and filtering 50 ml of water sample required 10 ml of EDTA solution. Calculate the hardness of water.

b) Differentiate between permanent and temporary hardness of water.

c) Calculate the temporary and total hardness of a sample of water containing:

Mg [HCO3)2 = 7.3 mg/L, Ca (HCO3)2 =16.2 mg/L, MgCl2 = 0.5Mg/L, CaSO4 =13.6

mg/L.

1. a) Explain the application of phase rule to ice-water-vapour system. What is meant by

triple point?

b) State and derive Gibb’s Phase rule.

1. a) Differentiate between cetane number and octane number.

b) Draw and explain the phase diagram of water system. What is the significance of metastable state and triple point?

1. a) Explain the term inhibitor and poisoning agents in a catalytic reaction with suitable examples.
2. Determine the number of components in the mixture of N2, H2 and NH3 gas.
3. What is Pilling-Bed Worth rule?
4. What are the conditions for dry and wet corrosion? Explain why impure metal corrode faster than pure metals under identical conditions?
5. a) How is coke manufactured by Otto-Hoffman oven?
6. Why it is better than Beehive method?
7. How does by-products are recovered from flue gases?
8. Why NH3 gases are removed prior to recovery of other fractions from flue gases?
9. A sample of coal was found to contain the following:

C= 81%, H=4%, O=2%, N=1% the remaining being the ash. Estimate the quantity of minimum air required for complete combustion of 1 kg of the sample. Find the composition of dry flue gas by volume, if 40% excess air is required.

1. Calculate the HCV (in kJ/Kg) of 0.75 g of a fuel containing 85% of carbon, when burnt in bomb calorimeter, increased the temperature of water from 27.5 to 29.3◦C. the calorimeter contains 250g of water and its water equivalent is 150 g.
2. What is pattinson’s process for desilverization of lead? Draw its phase diagram also.
3. Derive the Michaelis-Menten equation for enzyme catalysts. Explain the effect of adding an inhibitor on the equation.
4. a) Describe the different type of corrosion and discuss the factors that affect the corrosion.

b) Explain the term “Passivity”. What are the factors which affect corrosion?

1. Explain the following protective measures for corrosion:
2. Galvanizing and
3. Tinning
4. Cathodic protection
5. Electroplating
6. a) What type of coke is produced from high temperature carbonization and low temperature carbonization?
7. Differentiate between positive and negative catalysis with suitable examples.
8. Write short note on homogenous and heterogeneous catalysis.
9. Explain catalysis by metal salts (Wilkinson’s Catalysis)
10. a) 100 ml of water sample when titrated against N/50 sulphuric acid using phenolphthalein as an indicator, gave the end point with 10ml acid. Another 100 ml of the sample also required 10 ml of the acid to obtain methyl orange end point. What type of alkalinity is present in the sample and what is its magnitude?
11. What is auto catalysis?
12. a) Draw and explain the phase diagram of Pb-Ag system.
13. Find out the number of phases, component and degree of freedom in following system:
14. NH3(g) at 42◦C
15. Crystals of CuSO4.5H2O
16. An aqueous solution of glucose
17. Solid iodine in equilibrium with its vapour
18. Explain the following terms:
19. Reverse osmosis
20. Electro Dialysis
21. Priming and foaming
22. What happen and why?
23. Iron sheets gets corroded, when retrieved with copper rivets
24. An iron pole is buried under earth
25. Zinc plate fixed below the ship
26. Write short note on soil corrosion and its causes.
27. Why noble metals are resistant towards corrosion?
28. a)An eutectic mixture has a definite composition and a sharp melting point yet it is not a compound.
29. How is alkalinity caused in natural water? ExplainPhenolphthalein alkalinity of water?
30. Differentiate caking and coking coal.
31. Explain why hydrocarbons that are poor gasoline fuels are quite good diesel fuels.
32. Differentiate between physical adsorption and chemical adsorption.
33. What is the criteria for choosing catalyst for industrial purposes?
34. What is Caustic Embrittlement? Explain its causes and prevention.
35. a) What are the methods of water softening by external treatment of water? Discuss any one in detail.
36. What are ion-exchange resins? How are they used for softening of water, explain with reaction and diagram? How can they be regenerated after getting exhausted?
37. Calculate the lime (84% pure) and soda (92% pure) required for treatment of 50000 L of water containingCa(HCO3)2= 40.5 ppm, Mg(HCO3)2= 36.5ppm, MgSO4 = 30.0 ppm, CaSO4= 34ppm, CaCl2 = 27.75ppm and NaCl= 10.0 ppm.
38. i) Explain adsorption theory of catalysis. Which step is rate determining step?

ii) Derive the rate expression for the following acid catalysed reaction:

HA+S H+ + SA fast

SA+ H2O product slow

Where H2O is the solvent. Discuss different cases.

1. a) How the calorific value of a fuel can be determined by Bomb’s calorimeter? Explain with the help of diagram.

b) The following data were obtained in a bomb calorimeter experiment:

Weight of coal = 0.996g

Weight of water in calorimeter = 2490g

Weight of bomb calorimeter = 3900g

Rise in temperature of water = 2.592◦C

Mean specific heat of apparatus = 0.099. if the fuel contains 6% hydrogen, calculate its NCV assuming 587 cal/g as latent heat of steam.

1. a) Write applications of eutectic mixture.
2. In phase diagram of water, the fusion curve of ice has a negative slope. Explain.
3. Name the catalyst used for following reactions
4. Fisher Tropsch process
5. Contact process
6. Zigler Natta polymerization
7. Haber’s process
8. Homogenous hydrogenation reactions
9. Differentiate between chemical fuel and nuclear fuel.
10. a) Write condensed phase rule and explain why is it used for two component system?
11. Differentiate between fixed bed and fluidized bed catalytic cracking.
12. Define component, phase and degree of freedom.
13. What are cooling curves?
14. Explain Langmuir-Hinshelwood mechanism of catalysis in detail.
15. How does a catalyst increase the rate of reaction by affecting the reaction pathway? Will it affect the reaction pathway? Will it affect the rate of backward reaction in case of a reversible reaction?
16. Oxidation of SO2 to SO3 is catalysed by NO. Explain giving chemical equations, the various steps involved in this conversion.
17. Explain the effect of pH and temperature on the rate of bio catalytic reactions.
18. Explain shape selective catalysis with examples.
19. Why a rough surface piece of Pt acts as a good catalyst in comparison to a smooth surface in the manufacture of H2SO4 by contact process.
20. What is caustic embrittlement? Explain its causes and prevention.
21. Describe the principle and procedure involved in Zeolite process for the treatment of water.
22. Why Calgon conditioning is better than phosphate conditioning?
23. a) Describe the process for removal of Sulphur in Ultimate Analysis.

b) 1.56 g of a sample was used in bomb’s calorimeter for the determination of calorific value. The ash formed in the bomb’s calorimeter was extracted with acid and the acid extract was heated with barium chloride solution and a precipitate of barium sulphte was obtained. The precipitate was filtered, dried and weighed. The weight of precipitate was 0.1755g. Calculate the percentage of sulphur in the coal sample.

39) a) How antiknocking properties of petrol and diesel can be increased?

b) Why should an ideal fuel have moderate ignition temperature?

40) a) Explain the mechanism of dry and wet corrosion.

b) Why corrosion rate is higher in pittig corrosion?

c) Explain the term Passivity.