**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 component.
4. a) What are the advantages of catalytic cracking over thermal cracking?
5. 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.
6. 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) Draw phase diagram of Sulphur. Explain why all 4 phases of sulphur cannot exists at one time.

1. Differentiate between cetane number and octane number.
2. Draw and explain the phase diagram of water system. What is the significance of metastable state and triple point.
3. a) Explain how physical and chemical properties of nanoparticles vary with their size.
4. Determine the number of components in the mixture of N2, H2 and NH3 gas.
5. What is Pilling-Bed Worth rule?
6. What are the conditions for dry and wet corrosion? Explain why impure metal corrode faster than pure metals under identical conditions?
7. a) How is coke manufactured by Otto-Hoffman oven?
8. Why it is better than Beehive method?
9. What is sweetening of petrol?
10. What is Glyptal resin?
11. 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. 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 HDPE and LDPE
8. Write short note on conducting polymers.
9. Describe preparation and properties of Nylon 6 and Nylon 66.
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 are biopolymers?
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) A eutectic mixture has a definite composition and a sharp melting point yet it is not a

 compound.

1. How is alkalinity caused in natural water? Explain Phenolphthalein alkalinity of water?
2. Differentiate caking and coking coal.
3. Explain why hydrocarbons that are poor gasoline fuels are quite good diesel fuels.
4. Differentiate between physical adsorption and chemical adsorption.
5. What is the difference between traditional efforts to reduce pollution and green chemistry approach?
6. What is Caustic Embrittlement? Explain its causes and prevention.
7. a) What are the methods of water softening by external treatment of water? Discuss any one in detail.
8. 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?
9. Calculate the lime (84% pure) and soda (92% pure) required for treatment of 50000 l of water coating Ca (HCO3)2= 40.5 ppm, Mg (HCO3)2= 36.5ppm, MgSO4 = 30.0 ppm, CaSO4= 34ppm, CaCl2 = 27.75ppm and NaCl= 10.0 ppm.
10. i) What are the types of feedstocks recommended by principles of green chemistry? why?

ii) What are twelve principles of Green chemistry?

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. What are nano materials? Give examples.
4. Differentiate between chemical fuel and nuclear fuel.
5. a) Write condensed phase rule and explain why is it used for two component system?
6. What are differences between Top-down and Bottom-up approaches for the preparation of nanomaterials?
7. Define component, phase and degree of freedom.
8. What are cooling curves.
9. Write the important applications of nanomaterials.
10. Explain Zn-Mg system with phase diagram.
11. Differentiate between Thermosetting and Thermoplastic Polymers.
12. What are biopolymers? Give example.
13. Write short note on Biological Feedstock.
14. Write characteristics of ideal green solvents.
15. What is caustic embrittlement? Explain its causes and prevention.
16. Describe the principle and procedure involved in Zeolite process for the treatment of water.
17. Why Calgon conditioning is better than phosphate conditioning?
18. 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.