

I B.Tech Supplementary Examinations, November/December 2005
INORGANIC & ANALYTICAL CHEMISTRY
(Chemical Engineering)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Discuss Mohr method & Volhard method for determining chlorides in sample solutions.
(b) Explain the use of UV-Visible spectrophotometry in estimation of manganese in steel sample. [8+8]
2. (a) What are electroanalytical methods? Explain different electro analytical methods with suitable examples. [10]
(b) Give the value of diffusion current if $c=1$ mole/litre $D=3.2 \mu$ a, $m=1.41$ mg/sec, $t=1.85$ sec ($n=1$). [6]
3. (a) Explain Bessemer converter process for manufacture of steel with diagram. [10]
(b) How is steel classified? Give one example of each. [6]
4. (a) Describe the moving bed catalytic cracking method to obtain petrol from heavy oil with neat diagram.
(b) How is the recovery of by product of coke oven gas possible? [8+8]
5. (a) What is flue-gas? [3]
(b) Describe the Orsat apparatus for the analyses of the gas. [7]
(c) When 1.235 gms of a fuel underwent complete combustion in excess of oxygen, the increase in temperature of water in the bomb calorimeter containing 1520 gms of water was 3.23°C . Calculate the gross calorific value of the fuel, if the water equivalent of the calorimeter is 128 gms. [8]
6. (a) Explain the regeneration of ion-exchange resins once used for softening of water.
(b) Compare the Zeolite process with ion-exchange process used for removal of hardness. [8+8]
7. (a) Write notes on refractories and various properties of refractories. [10]
(b) What are Askarels? [5]
8. The hardness of 50,000 lit of a sample of water was removed by passing it through a Zeolite softner. The softner then required 300 lit of sodium chloride solution containing 150 g/lit of NaCl for regeneration. Calculate the hardness of the sample of water. [16]

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1. (a) State Beer Lambert's law and explain the terms transmittance, absorbance and molar extinction coefficient. How are they related to each other?
(b) What is Cupferron? Discuss its use as an organic precipitant with suitable examples. [8+8]
2. (a) What are electroanalytical methods? Explain different electro analytical methods with suitable examples. [10]
(b) Give the value of diffusion current if $c=1 \text{ mole/litre}$ $D=3.2 \mu \text{ a}$, $m=1.41 \text{ mg/sec}$, $t=1.85 \text{ sec}$ ($n=1$). [6]
3. (a) What is metallurgy? [3]
(b) Write the basic Principle of furnace. [4]
(c) Name different type of furnaces with their uses. [4]
(d) What is ore dressing? [4]
4. (a) What are the various factors which affect the calorific value of a fuel? [4]
(b) Discuss the process of coal carbonization. [8]
(c) Why should an ideal fuel have moderate ignition temperature? [4]
5. (a) What is coal gas? How is coal gas manufactured? Write properties and uses of coal gas? [9]
(b) A coal has the following ultimate analysis: Carbon 84% ; Sulphur 1.5% ; Nitrogen 0.6% ; Hydrogen 5.5% ; and Oxygen 8.4% . Find the gross and net calorific values with the help of Dulong's formula. [7]
6. (a) What are Zeolites? [6]
(b) How is the softening of water carried out in the Permutit process? [10]
7. (a) Mention the significance of refractories and spalling in the evaluation of a refractory brick. [10]
(b) Explain the uses of Thermal insulators. [6]
8. Determine the temporary, permanent and total hardness in PPM units for water which showed the following analysis:-
 $\text{NaCl} = 5.85 \text{ mg/litre}$; $\text{KCl} = 7.45 \text{ mg/litre}$; $\text{CaCl}_2 = 11.1 \text{ mg/litre}$; $\text{Mg}(\text{HCO}_3)_2 = 14.6 \text{ mg/litre}$; $\text{MgSO}_4 = 12 \text{ mg/litre}$; $\text{Ca}(\text{HCO}_3)_2 = 16.2 \text{ mg/litre}$.
Assume that the atomic weights of Na, Mg, K and Ca are 23, 24, 39 and 40 respectively. [16]

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1. (a) Derive Beer Lambert's law. Give its application in quantitative analysis.
(b) Evaluate the concentration of a solution if it had an absorbance of 0.555 with molar absorptivity of 2.22×10^4 and optical path 1.5 cm. [8+8]
2. (a) Define polarographic maxima. How is it eliminated in polarographic technique?
(b) Describe the potentiometric titration of ferrous ammonium sulphate versus potassium dichromate. [8+8]
3. (a) What is metallurgy? [3]
(b) Write the basic Principle of furnace. [4]
(c) Name different type of furnaces with their uses. [4]
(d) What is ore dressing? [4]
4. (a) Explain briefly the ultimate analysis of fuel.
(b) Bring out the difference and utility of proximate and ultimate analysis of coal. [8+8]
5. (a) Write short notes on Cetane number and its importance. [6]
(b) A sample of petrol was found to contain 15.2% of hydrogen & 84.8% of carbon by weight. Calculate the weight of air for the complete combustion of 1Kg of petrol (% composition of air by weight oxygen:23%; nitrogen:77%). [10]
6. (a) What are ion-exchange resins? Explain their types.
(b) Describe the ion-exchange process for the softening of water used in boilers. [8+8]
7. (a) Discuss the four essential properties of a refractory.
(b) Classify the electric insulators. [8+8]
8. Two litres of water from a borewell in Dilsukhnagar in Hyderabad gave the following analysis:-
 $\text{Mg}(\text{HCO}_3)_2 = 162\text{mg}$; $\text{Ca}(\text{HCO}_3)_2 = 81\text{mg}$; $\text{CaSO}_4 = 136\text{mg}$; $\text{MgSO}_4 = 120\text{mg}$;
Suspended matter = 100 mg; Organic matter = 700mg.
Find out the lime and soda required in kgs for 10,000 litres of this water to soften it if the lime used is 80% pure and soda is 90% pure assuming at.wt. of Mg to be 24 and that of Ca to be 40 respectively. [16]

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1. (a) Write short notes on
 - i. Digestion of a precipitate [4]
 - ii. Deviations of Beer's law [4]
- (b) The absorbtivity of a coloured complex was 3.2×10^3 at 240nm. Calculate the absorbance of a 5×10^{-5} M solution in 50 mm cell when it was measured at 240nm. [8]
2. (a) What are potentiometric titrations? Give atleast 2 important applications of potentiometric titrations.
- (b) What was the concentration of Cd solution if in polarographic analysis, the diffusion coefficient was $0.72 \times 10^{-5} \text{cm}^2/\text{sec}$, with rate of flow is 2mg/sec with drop time 4.4 sec and magnitude of average diffusion current was $10\mu \text{A}$? [8+8]
3. (a) Explain froath floatation process with neat sketch. [6]
- (b) Write short note on: [10]
 - i. Levigation
 - ii. Electro magnetic separation.
4. (a) What are the various factors which affect the calorific value of a fuel? [4]
- (b) Discuss the process of coal carbonization. [8]
- (c) Why should an ideal fuel have moderate ignition temperature? [4]
5. (a) Explain the difference between straight-run gasoline and synthetic petrol [5]
- (b) Describe the manufacture of synthetic petrol by polymerization process. [5]
- (c) When 0.935g of a fuel underwent complete combustion in excess of oxygen, the increase of temperature of water in the bomb calorimeter containing 1365g of water was 2.4°C . Calculate the higher calorific value of the fuel, if the water equivalent of the calorimeter etc. is 135gms. [6]
6. (a) How is boiler corrosion caused?
- (b) Describe methods used to avoid boiler corrosion. [8+8]
7. (a) Discuss the four essential properties of a refractory.
- (b) Classify the electric insulators. [8+8]

8. An exhausted Zeolite softner was regenerated by passing 150 lit of Nacl solution, having strength of 150 g/L of Nacl. If the hardness of water is 800 ppm, calculate the total volume of water that is softned by this softner. [16]
