

I B.Tech Supplementary Examinations, Aug/Sep 2008
INORGANIC AND ANALYTICAL CHEMISTRY
(Chemical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Discuss briefly the use of internal oxidation -reduction indicators in redox titrations.
(b) What should be the magnitude of molar absorptivity if 1.25×10^{-5} M solution had an absorbance of 0.210 with optical path of 10mm at 430 nm ? [9+7]
2. (a) What are electroanalytical methods ? Explain different electro analytical methods with suitable examples.
(b) Give the value of diffusion current if $c=1\text{mole/litre}$ $D=3.2 \mu \text{ a}$, $m=1.41\text{mg/sec}$, $t=1.85\text{ sec}$ ($n=1$). [10+6]
3. (a) Explain Bessemer converter process for manufacture of steel with diagram.
(b) How is steel classified? Give one example of each. [10+6]
4. (a) What are the various factors which affect the calorific value of a fuel?
(b) Discuss the process of coal carbonization.
(c) Why should an ideal fuel have moderate ignition temperature? [4+8+4]
5. (a) How are the flue gases analysed by orsat apparatus? How would you interpret the results?
(b) The composition of producer gas was found to be; H_2 :14%; CH_4 :2%; CO : 22%; CO_2 :5%; N_2 :55% & O_2 :2% by volume. Find the air required for the perfect combustion of 1m^3 of this gas if 40% excess air is used. Find the volume analysis of the dry products of combustion. [8+8]
6. (a) What is meant by "Potable Water"?
(b) Describe the treatment processes used to obtain "Municipal Water". [8+8]
7. (a) Discuss the four essential properties of a refractory.
(b) Classify the electric insulators. [8+8]
8. Calculate the quantities in kilograms of lime and soda required for softening 10,000 litres of water which showed the following analyses:-
 $\text{NaCl} = 5.85 \text{ PPM}$; $\text{KCl} = 7.45 \text{ PPM}$; $\text{Mg}(\text{HCO}_3)_2 = 14.6 \text{ PPM}$; $\text{Ca}(\text{HCO}_3)_2 = 16.2 \text{ PPM}$; $\text{CaCl}_2 = 11.1 \text{ PPM}$; $\text{Mg}(\text{HCO}_3)_2 = 14.8 \text{ PPM}$.
Given that the At.Wt. of Ca is 40, Mg is 24, Na is 23 and K is 39. [16]

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1. (a) Differentiate co precipitation and post precipitation.
(b) Give the principle and procedure of estimation of Mn in steel sample by spectrophotometry. [8+8]
2. (a) Give important applications of conductometric measurements.
(b) Evaluate the half potential for the cell combination given below
 $\text{Pt/Fe}^{2+}(0.01\text{M})\text{Fe}^{3+}(0.0001\text{M})//\text{Ce}^{4+}(0.01\text{M})\text{Ce}^{3+}(0.001\text{M})\text{1M HCl/Pt}$
Given $E^0_{\text{Fe}} = 0.70$ $E^0_{\text{Ce}} = 1.28$. [7+9]
3. (a) Explain froth floatation process with neat sketch.
(b) Write short note on: [6+10]
 - i. Levigation
 - ii. Electro magnetic separation.
4. (a) Describe the Otto Hoffman's process for preparing coke. What are its advantages over the earlier method?
(b) What is synthetic petrol and how is it manufactured?
(c) What is the use of catalytic converter in automobiles? [4+8+4]
5. (a) What is Boy's Calorimeter.
(b) Describe its construction and working.
(c) What are the calculations involved in it. [6+5+5]
6. Write short notes on:
 - (a) Potable water.
 - (b) Water used in industry for steam-boilers.
 - (c) Natural water. [5+6+5]
7. (a) Explain the need for using refractories in metallurgical industries.
(b) Write a short note on various gaseous dielectrics. [8+8]
8. Find out the quantities of soda and lime (Kgs) required for softening 10,000 litres of hard water which showed the following analysis given that soda is 90% pure and lime is 80% pure and the atomic masses of Na, Mg and Ca are 23, 24 and 40: -
 $\text{NaCl} = 58.5 \text{ PPM}$; $\text{CaCl}_2 = 111 \text{ PPM}$; $\text{Ca}(\text{NO}_3)_2 = 82 \text{ PPM}$; $\text{MgSO}_4 = 60 \text{ PPM}$;
 $\text{Mg}(\text{HCO}_3)_2 = 73 \text{ PPM}$. [16]

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2. (a) Discuss the use of polarography in the determination of inorganic cations and give its advantages over other methods.
(b) Calculate diffusion coefficient of divalent metal if polarogram of 1.25mM of solution had diffusion current of 7.12μ a if the capillary properties were as $t=3.47$ sec, $m=1.42$ mg/sec? [8+8]
3. (a) Explain froath floatation process with neat sketch.
(b) Write short note on: [6+10]
 - i. Levigation
 - ii. Electro magnetic separation.
4. (a) What are the various factors which affect the calorific value of a fuel?
(b) Discuss the process of coal carbonization.
(c) Why should an ideal fuel have moderate ignition temperature? [4+8+4]
5. (a) What is Boy's Calorimeter.
(b) Describe its construction and working.
(c) What are the calculations involved in it. [6+5+5]
6. (a) Explain the difference between carbonate and non-carbonate hardness of water.
(b) State the harmful effects of silica present in water.
(c) Write a note on sterilization of drinking water. [5+6+5]
7. (a) Enumerate the various properties of a refractory.
(b) Write a note on the applications of solid thermal insulators. [8+8]
8. A water sample an anlysis gives the following data: $\text{Ca}^{2+} = 20\text{ppm}$; $\text{Mg}^{2+} = 25\text{ppm}$; $\text{CO}_2 = 30\text{ppm}$. $\text{HCO}_3 = 150\text{ppm}$, $\text{K}^+ = 10\text{ppm}$. Calculate the lime(82%pure) and soda (94%pure) required to soften 1 million lit of water sample. [16]

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1. (a) What is the principle and advantages of precipitation from homogeneous solution?
(b) Calculate absorbance of 3.4×10^{-4} M colored thiocyanate complex of iron which had molar absorptivity of 3.2×10 at 580 nm taking path length as unity. [8+8]
2. (a) What are potentiometric titrations? Give at least 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 froth floatation process with neat sketch.
(b) Write short note on: [6+10]
 - i. Levigation
 - ii. Electro magnetic separation.
4. (a) What are fuels and give their classification.
(b) What are the characteristics of good fuel?
(c) What is meant by calorific value of a fuel? Why gross calorific value is higher than net calorific value? [5+6+5]
5. (a) Distinguish between bio-gas and natural gas.
(b) 1 gm of an organic compound (mol.wt.100) was burnt in oxygen in a bomb calorimeter. The temperature of 800 gms of water in the calorimeter rose by 2.1°C . If the water equivalent of the calorimeter is 200 gms, calculate (in Kcals) the heat of combustion of the compound. [8+8]
6. (a) What is meant by "Potable Water"?
(b) Describe the treatment processes used to obtain "Municipal Water". [8+8]
7. (a) Mention the significance of refractories and spalling in the evaluation of a refractory brick.
(b) Explain the uses of Thermal insulators. [10+6]

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]
