Final Assessment Test – November 2018

VIT
Vellore Institute of Technology

Course: CHY1701 - Engineering Chemistry
Class NBR(s): 6501/6507/6514/6533/6539/6569/6579/ 6580/6601/6610/6614/6619/6628/6831/ 6837
Slot: E1+TE1

Time: Three Hours
Max. Marks: 100

PART – A (10 X 4 = 40 Marks)
Answer ALL Questions

1. Water samples A and B were analyzed for their hardness. Sample A contains 146 mg/L of $Mg(HCO_3)_2$ and 1 gm of $CaCO_3$ per 500 mL. Sample B contains 820 mg/L $Ca(NO_3)_2$ and 2 mg/L of silica. Determine water samples hardness in ppm.
2. Identify which water mentioned below is expected to have more dissolved oxygen. Justify.
   a) Flowing river water b) Bore-well water.
3. Chloramine is preferred over bleaching powder or liquid chlorine in the sterilization of drinking water. Justify with the chemical reactions involved in the sterilization process.
4. Corrosion occurs in steel pipe connected to copper plumbing. Reason out.
5. Illustrate any four metal parameters that influence corrosion.
6. Assume that a crack is formed on an anodic coating as well as cathodic coating. Upon prolonged exposure to the surrounding environment, what will happen to the underlying metal part?
7. Analyse categorically impressed current cathodic protection in underground pipelines with a suitable diagram.
8. List out the main differences between lithium and lithium-ion batteries. Justify that aqueous electrolytes can't be utilized in lithium batteries.
9. On burning 0.75 g of a fuel containing C = 85%, H = 10% and ash = 5% in a bomb calorimeter, the temperature of 600 g of water increased from 27 to 33° C. Water equivalent of calorimeter and latent heat of steam are 2200 g and 587 cal/g, respectively. Calculate the net and gross calorific values of the fuel. Cooling correction is 0.02° C, fuse wire correction is 20 cal and acid correction is 40 cal.
10. The conductivity of polyacetylene is enhanced by the processes of p-doping and n-doping. Justify with relevant chemistry.

PART – B (5 X 12 = 60 Marks)
Answer any FIVE Questions

11. a) A 0.5 g of $CaCO_3$ was dissolved in HCl was made up to 500 ml with distilled water. 20 mL of the solution required 18 ml of EDTA solution for titration. 20 mL of hard water required 10 mL of EDTA and after boiling and filtering, required 10 mL of EDTA solution. Calculate the total hardness, permanent hardness and temporary hardness of sample hard water. [4]
    b) The hard water utilization in industrial boilers leads to various troubles and consequences. Elaborate any two of them with necessary sketches. How can the boiler troubles be minimized? [8]
12. a) Identify and elaborate on water softening method that could be employed to obtain residual hardness of around 2 ppm. [8]
    b) Explain the desalination of water by reverse osmosis process. [4]

13. a) A galvanized iron pipe used in water line is expected to get corroded at the junction where the pipe is coming out from the ground. Explain the phenomenon of corrosion using a neat diagram. [6]

b) Suggest a corrosion protection method which is efficient in the seaside bridge and buried oil pipeline? Explain with relevant diagrams. [6]

14. a) Identify the PVD coating technique that employs sputtering method. Elaborate with a neat diagram. [6]

b) Illustrate the technique used in Ni coating for achieving micro-scale thickness. [6]

15. a) The limitation of solid oxide fuel cell is the temperature of operation, which is > 1000 °C. Why this fuel cell pack is still considered for continuous power generation application? [4]

b) Illustrate the working principle, characterization and applications of dye sensitized solar cells. [8]

16. a) Elaborate on the method of determination of calorific value of a gaseous fuel with necessary sketch. [6]

b) A coal sample was found to contain C = 90%; H = 5%; O = 2%; S = 2.5% and ash = 0.5 % by weight. Calculate the quantity of air required for complete combustion. [6]

17. a) Give the structure, properties and applications of a thermoplastic ter-polymer. [6]

b) Suggest and explain the moulding technique for PET bottles with a relevant sketch. [6]

18. Illustrate the following with necessary sketch and examples wherever necessary.

a) Electro dialysis. [6]

b) Significance of Octane and Cetane number. [6]

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