18CHE12/22

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First/Second Semester B.E. Degree Examination, Jan./Feb. 2023
Engineering Chemistry

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What is single electrode potential? Derive the Nernst equation for single electrode potential. **(06 Marks)**

   b. What are concentration cells? The cell potential of Cu concentration cell
   $Cu \mid CuSO_4$ (0.005 M) $\parallel CuSO_4(X) \mid Cu$ is 0.0295 V at 25°C. Write the cell reaction and calculate the value of X. **(07 Marks)**

   c. Explain the construction and working of Ni-MH battery. Mention its applications. **(07 Marks)**

OR

2 a. What is ion selective electrode? Explain the method of determining the pH of a given solution using glass electrode. **(07 Marks)**

   b. Write the cell reaction and calculate the emf of a cell at 298 K, if the standard electrode potential of Fe and Ag electrodes are – 0.44 V and +0.8 V respectively.
   $$Fe \mid Fe^{2+}(0.01M) \parallel Ag^+(0.1M) \mid Ag$$ **(07 Marks)**

   c. Define the terms : (i) Free energy   (ii) Entropy   (iii) Cell potential. **(06 Marks)**

Module-2

3 a. What is metallic corrosion? Explain the electro-chemical theory of corrosion by taking iron as an example. **(07 Marks)**

   b. Explain the process of (i) Galvanization of zinc (ii) Anodizing of aluminium. **(07 Marks)**

   c. What is electroplating? Explain the electroplating of chromium. **(06 Marks)**

OR

4 a. What is meant by metal finishing? Mention any five technological importance of metal finishing. **(06 Marks)**

   b. What is electrolessplating process? Explain the electrolessplating of copper. **(08 Marks)**

   c. Explain the factors affecting the rate of corrosion :
   (i) Nature of corrosion product
   (ii) pH
   (iii) Ratio of anodic to cathodic areas. **(06 Marks)**

Module-3

5 a. Define the term calorific value of the fuel? Explain the experimental determination of calorific value of solid or liquid fuel using Bomb calorimeter. **(08 Marks)**

   b. 0.80g of coal sample (containing Carbon : 90%, H_2 : 2.5% and Ash 7.5%) was subjected to combustion in a Bomb calorimeter. Mass of water taken in the calorimeter was 2200 g and the water equivalent of the calorimeter was 800g. The initial temperature of water : 25.52°C, final temperature of water : 34.43°C. Calculate gross and net calorific values of the coal sample. [Given specific heat of water = 4.187 kJ/kg/°C ; Latent heat of steam = 2454 kJ/kg] **(08 Marks)**

   c. Explain the construction and working of a typical PV cell. **(04 Marks)**

OR

6 a. What are fuel cells? Explain the construction and working of methanol oxygen fuel cell. Mention its advantages. (07 Marks)

   b. Explain the preparation of solar grade silicon by Union Carbide (UC) process. (07 Marks)

   c. What is knocking? Explain its mechanism, mention its ill effects. (06 Marks)

Module-4

7 a. Discuss the sources, environmental effects and control of sulphur dioxide pollution. (06 Marks)

   b. What are the causes, effects and disposal methods of e-waste? (07 Marks)

   c. In a COD test 28.5 ml and 13.5 ml of 0.05N FAS solution are required for blank and titration (sample) respectively. The volume of the test sample used was 25 ml. Calculate the COD of sample solution. (07 Marks)

OR

8 a. Define the term COD. Explain the determination of COD. (07 Marks)

   b. What is potable water? Explain the process of desalination of sea water by reverse osmosis. (06 Marks)

   c. Explain the ozone formation, depletion, role of CFCs and importance of ozone layer. (07 Marks)

Module-5

9 a. Explain the theory, instrumentation and applications of Flame Photometry. (07 Marks)

   b. Explain the theory and instrumentation of conductometry. (07 Marks)

   c. What are nano-materials? Explain the synthesis of nano-materials by chemical vapor deposition method. (06 Marks)

OR

10 a. Explain the size dependent properties of nano-materials (06 Marks)

    b. Write a short notes on :
        i) Fullerenes   (ii) Carbon nano-tubes   (iii) Graphenes (08 Marks)

    c. Explain the theory and instrumentation of colorimetry. (06 Marks)

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