Question Paper

Exam Date & Time: 17-Mar-2021 (02:00 PM - 05:00 PM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

FIRST SEMESTER B.TECH END SEMESTER EXAMINATIONS, MARCH-2021

ENGINEERING CHEMISTRY [CHM 1051 - 2020 -CHM]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Give reason for the following statements; (2)
i) Pyrex glass is used in the manufacture of oven-wares.
A) ii) Buried iron oil pipes are connected to zinc blocks at regular intervals.

B) About 0.234 g of a coal sample with 72 % carbon and 6 % hydrogen was burnt in bomb calorimeter and the ash obtained on extraction with dil. HCl, followed by treatment with $BaCl_2$ provided 0.123 g of $BaSO_4$. The NH_3 evolved from the sample when subjected to Kjeldahl's method neutralized 2 mL of 1N H_2SO_4. Calculate the % sulphur, nitrogen and oxygen in the coal sample if % of ash is 1. (3)

C) Describe the construction, working principle and reactions of alkaline fuel cell and lithium ion battery. (5)

2) Write two differences between the following; (2)
i) Top-down and bottom-up approaches in nanomaterials
A) ii) Calamitic & discotic liquid crystals

B) Write the cell scheme and net cell reaction of a galvanic cell containing $Ag|Ag^+$ and $Zn|Zn^{2+}$ couples. Compute the cell potential if the concentration of Ag^+ and Zn^{2+} are 2.2×10^{-6} M and 2.2×10^{-3} M respectively. If E^0_{cell} = 1.56 V, what is the value of ΔG in kJ for the reduction of Ag^+ by Zn at the indicated ionic concentration? (3)

C) List any four requirements of a standard cell. Describe the construction and working of calomel electrode. Explain how calomel electrode is employed in the determination of pH of a given solution? (5)

3) Justify the following statements; (2)
i) Chromium anodes are not used in the chromium electroplating.
A) ii) The risk due to gassing is avoided in modern maintenance free lead acid batteries.

B) A polyvinylchloride sample has the following composition. (3)

Degree of polymerization	200	300	400	500
% composition	10	20	30	40

Calculate the number average molecular weight, weight average molecular weight and polydispersity index of the polymer sample. The atomic weights of C, H and Cl are 12, 1 and 35 respectively.

C) Explain the classification of composite materials based on matrix material and reinforcement geometry. List one advantage and disadvantage of Kevlar composites. (5)

4) Define the following. (2)
i) Two dimensional nanomaterial
A) ii) Decomposition potential of an electrolyte

B) An emf of 0.2112 V was recorded when saturated calomel (E = 0.2422 V) and glass electrodes (3)

were introduced into a HCl solution with pH = 4 at 298 K. Find the pH of another HCl sample, if the same combination of electrodes offered an emf of 0.1010 V at identical temperature conditions. Explain why normal glass electrode can be employed only for measuring pH values in the range 2-10.

C) Describe the role of corrosion inhibitors with appropriate examples. (5)

5) Account for the following; (2)
i) All solid materials cannot function as biomaterials.
A) ii) Boiling point of 2- and 4-hydroxy benzoic acids vary significantly.

B) State Beer-Lambert's law. Calculate the absorbance and molar absorptivity of $KMnO_4$ if 7.25×10^{-5} M solution has a transmittance of 44.1 % when measured in a 2.10 cm cell at a wavelength of 525 nm. (3)

C) Explain the preparation of thin films by vacuum deposition technique. Give two advantages and disadvantages of PVD technique. Explain any two ceramic materials based on their application. (5)

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