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CH 171102

Roll No. of candidate | | | | | | | | | | |

2018

B.Tech. 1st Semester End-Term Examination

ENGINEERING CHEMISTRY – I

(New Regulation & New Syllabus)

(w.e.f. 2017 – 2018)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *Four* from the rest.

1. Answer the following : (10 × 1 = 10)

   (i) In a galvanic cell

   (a) Chemical energy is converted into electrical energy

   (b) Electrical energy is converted into chemical energy

   (c) Chemical energy is converted into heat energy

   (d) Electrical energy is converted into heat energy

[Turn over

(ii) In which one of the following changes does entropy decrease

(a) Evaporation of water

(b) Solidification of liquid

(c) Sublimation of a solid

(d) Expansion of a gas

(iii) CO_2 is IR insensitive because it has ———— dipole moment.

(iv) If the oxidation potential of Zn metal is 0.76 V, the E_{cell} for the redox reaction

$Zn + 2H^+(aq, 1M) \rightarrow Zn^{2+} + H_2(1\ atm)$ is

(a) 0.76 V (b) –0.76 V

(c) +0.38 V (d) –0.38 V

(v) Name a fibre-reinforced composite.

(vi) The metal ———— (higher/lower) in electrochemical series undergoes corrosion.

(vii) The region around the nucleus where $\psi^2 = 0$ is known as

(viii) Which of the following compounds show microwave spectra?

(a) O_2 (b) CO_2

(c) H_2O (d) Cl_2

(ix) ———— can be used as sacrificial anodic protection.

(x) Give one example of solid lubricants.

2. (a) Derive Nernst's equation and explain the terms involved in it. Write its applications. (6 + 3)

(b) Explain the role of bottom up and top down approaches in nanotechnology. (6)

3. (a) What types of nuclei will give NMR spectra. Give two examples of each type. (3 + 6)

(b) Define spontaneity and free energy. (3)

(c) Mention the advantages of fuel cells over ordinary battery. (3)

4. (a) What is ψ ? What are the significance of ψ and ψ^2 ? Write the Schrodinger wave equation and explain the each term involved. (2 + 4 + 4)

(b) Write down the cell reactions and calculate the emf of the following cell at 25°C :

Ni/Ni^{2+} (0.01 M)II Pb^{2+} (0.1M)/Pb

Standard reduction potentials of nickel and lead are –0.24 V and –0.13 V respectively.(2 + 3)

5. (a) What are composite materials? What are the advantageous characteristics of composites? (2 + 4)

(b) An electron in a one-dimensional box of width 1 Å undergoes a transition from the ground state (n = 1) to the first excited state (n = 2). Calculate the transition energy. (5)

(c) 2 mole of H_2 and 8 moles of N_2 are mixed at 298 K and 1 atmosphere. Assuming the ideal behavior for the gas, calculate the entropy of mixing per mole of the mixture formed. (4)

6. (a) Write notes on (any *two*) : $(2 \times 3 = 6)$

(i) Lead storage battery

(ii) Ni – Cd battery

(iii) Dry battery

(b) Discuss the entropy change in reversible and irreversible processes. Explain the statement "Entropy of the universe is always increasing". (3 + 2)

(c) Explain the mechanism of extreme-pressure lubrication. (4)

7. (a) Derive Gibbs – Helmholtz equation. (4)

(b) Explain the following types of corrosion : $(2 \times 3 = 6)$

(i) Pitting corrosion

(ii) Chemical corrosion

(c) ΔG for a reaction at 300 K is –18 kcal, ΔH for the reaction is –10 kcal. What is the entropy of the reaction? What will be ΔG at 330 K? (5)