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11/IV/18

# CH 171102

Roll No. of candidate



**2019**

**B.Tech. 1st Semester End-Term Examination**

**ENGINEERING CHEMISTRY – I**

**(New Regulation) & (New Syllabus)**

**(W.e.f. 2017-18)**

Full Marks – 70 Time – Three hours

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

Answer Question No. 1 and any *four* from the rest.

1. Answer ALL the questions. (10 × 1 = 10)

(i) For isobaric process

(a) $\Delta E = 0$ (b) $\Delta P = 0$

(c) $\Delta V = 0$ (d) $\Delta T = 0$

(ii) The example of solid lubricant is

(a) grease (b) vaseline

(c) graphite (d) mustard oil

(iii) Example of fibre reinforced polymer composite

(a) CFRP (b) Concrete

(c) Cement (d) Mica

(iv) The electrode potential of standard hydrogen electrode (S.H.E.) has assigned value

(a) 0 (b) 100 V

(c) 10 V (d) 5 V

(v) Which of the following is infra-red (IR) active

(a) HCl (b) $O_2$

(c) $N_2$ (d) $H_2$

(vi) Which of the following cell converts chemical energy of $H_2$ Gas into electrical energy?

(a) Fuel cell (b) Daniel cell

(c) Electrolytic cell (d) Storage cell

(vii) Which of the following is true for an equilibrium state?

(a) Equal amounts of reactants and products are present

(b) The reactants are completely changed into products.

(c) Small amount of product is formed and the reaction stops.

(d) The rate of forward reaction is equal to rate of reverse reaction.

(viii) Which of the following is a rechargeable cell?

(a) Nickel-cadmium cell

(b) Leclanche cell

(c) $H_2 - O_2$ fuel cell

(d) Silver oxide-zinc cell



(ix) Example of allotrope of carbon

(a) Composites (b) Olive oil

(c) CaO (d) CNT

(x) Electrochemical corrosion takes place at

(a) Anodic area (b) Cathodic area

(c) Salt bridge (d) None of the above

2. (a) What is $\psi$ ? What informations are conveyed by $\psi$ and $\psi^2$. (2+3=5)

(b) What are Eigen functions and Eigen values? Show that sin nx (n is an integer) is an Eigen function of the operator $d^2/dx^2$ but not of d/dx. Find the corresponding Eigen values in the former case. (2+2+1=5)

(c) Write the energy equation for a particle in one dimensional box and explain each term involed What is zero point energy of a particle in a one dimensional box. (3+2=5)

3. (a) Give the statement of the second law of thermodynamics. What is efficiency of a carnot engine? Calculate the maximum efficiency of an engine operating between 100°C and 20°C. (2+1+3=6)

(b) Derive the Gibbs-Helmholtz equation

$$\Delta G = \Delta H + T(\Delta G/\delta T)_P .$$ (4)

(c) $\Delta$G for a reaction at 300K is -16 Kcal, $\Delta$H for the reaction is -10 Kcal. What is the entropy of the reaction? What will be $\Delta$G at 330K? (5)

4. (a) Calculate the electrode potential of copper, if the concentration of $CuSO_4$ is 0.206 at 23.1°C. Given that $E^\circ\ Cu^{+2}/Cu = +0.34V$. (4)

(b) What is galvanic cell? Distinguish primary cells from secondary cells with examples. (2+3=5)

(c) What is corrosion. Why impure metal corrodes faster than pure metal tinder identical conditions. (2+3=5)

(d) Give two examples of reference electrodes. (1)

5. (a) Define NANO TECHNOLOGY? Discuss in brief about "top down" and "bottom up" approach in nanotechnology? (2+2+2=6)

(b) Write short notes on any *three* (3 × 3=9)

(i) Molecular vibrations in infra-red spectroscopy.

(ii) UV-VISIBLE spectroscopy

(iii) Waterline corrosion

(iv) Fuel cell

6. (a) Define Gibbs free energy and Helmholtz free energy. What is the physical significance of decrease in Gibbs free energy? (2+2+2=6)

(b) 1 mole of $H_2$ and 9 moles of $O_2$ are mixed at 298 K and 1 atmosphere. Assuming the ideal behaviour for the gas. Calculate the entropy of mixing per mole of the mixture formed. (5)

(c) What is meant by rusting of iron. Rusting of iron is quicker in saline water than in ordinary water. Give reason. (4)

7. (a) How many nmr signals are observed in the spectrum of

(i) $CH_3CH_2OH$

(ii) $CH_2CL-CHCL_2$

(iii) $CH_3CH_2CH_2CH_3$

(iv) $CH_3COCH_3$ (4)

(b) Define composites. How are composite materials classified? Name three fibres used for preparing composites. Give one example of natural composite. (2+2+2+1=7)

(c) What is meant by lubricant? What are the functions of a lubricant? (1+3=4)

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