

Total No. of printed pages = 4

CH 171102

Roll No. of candidate

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21/31

2022

B.Tech. 1st Semester End-Term Examination

ENGINEERING CHEMISTRY - I

(New Regulation and New Syllabus)

(w.e.f. 2017 - 18)

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 all the questions :

(10 × 1 = 10)

(i) In an isothermal expansion of an ideal gas

(a) $\Delta E = 0$

(b) $W = 0$

(c) $\Delta V = 0$

(d) $\Delta P = 0$

(ii) Which of the following is not a state function?

(a) Energy

(b) Heat

(c) Entropy

(d) None of the above

(iii) Example of fibre reinforced polymer composite

(a) CFRP

(b) Concrete

(c) Cement

(d) Mica

(iv) In an electrochemical series, electrodes are arranged in the

(a) increasing order of their standard reduction potential

(b) decreasing order of their standard reduction potential

(c) increasing order of their oxidation potential

(d) decreasing order of oxidation potential

[Turn over

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

- (a) HCl (b) O₂
(c) N₂ (d) H₂

(vi) The Nernst equation is useful in the

- (a) calculation of potential of an electrode and EMF of cell
(b) Electrolytic conductance
(c) Eigen value
(d) All of the above

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(vii) Graphite is an example of

- (a) Semisolid lubricant (b) Solid lubricant
(c) Gaseous lubricant (d) Mineral oil

(viii) In Lithium batteries anode is composed of

- (a) MnO₂ (b) Lithium
(c) Cadmium (d) None of the above

(ix) Example of allotrope of carbon

- (a) Composites (b) BF₄⁻
(c) CaO (d) Fullerene

(x) Waterline corrosion in steel tank is an example of

- (a) stress corrosion (b) differential aeration corrosion
(c) pitting corrosion (d) differential metal corrosion

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

(b) What are Eigen functions and Eigen values? Show that $\sin 2x$ (n is an integer) is not an Eigen function of the operator d/dx but of d^2/dx^2 . What is the Eigen value? (3 + 2 + 1 = 6)

(c) Write the energy equation for a particle in one dimensional box and explain each term involved. What is zero point energy of a particle in a one dimensional box? (3 + 1 = 4)

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 27 °C and 127°C. (2 + 1 + 3)
- (b) Derive the Gibbs-Helmholtz equation.

$$\Delta G = \Delta H + T(\delta(\Delta G)/\delta T)_P$$
 (4)
- (c) Calculate the change in entropy accompanying the isothermal expansion of 5 moles of an ideal gas at 330 K, until its volume has increased six times. (5)
4. (a) The EMF of cell, Cd(s)/Cd²⁺ (0.01M) | Cu²⁺(0.5M)/Cu, is 0.79 V. Determine the standard reduction potential of Cd electrode, if the standard electrode potential of copper is 0.34V. (4)
- (b) What is an electrochemical cell? What are the differences between a galvanic cell and an electrolytic cell? Why do electrochemical cells stop working after some time? (2 + 3 + 2 = 7)
- (c) What is wet or electrochemical corrosion? A pure metal rod half-immersed vertically in water starts corroding at the bottom. Give reason. (2 + 2 = 4)
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) Lead -Acid storage cell.
- (ii) Passivity
- (iii) Pitting corrosion
- (iv) Infrared spectroscopy
6. (a) Define Gibb's free energy and Chemical potential. Explain the variation of Gibb's free energy with temperature. (2 + 2 + 2 = 6)
- (b) What is entropy? Show that entropy change in a reversible adiabatic process is zero. (2 + 2 = 4)
- (c) What is corrosion of metals? Explain, how the following factors influence corrosion rate. (1 + 4 = 5)
- (i) Nature of the metal
- (ii) Surface state of the metal.

7. (a) How many nmr signals are observed in the spectrum of (4)



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

(c) What is meant by lubricant? What are the functions of a lubricant?

(1 + 3 = 4)