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B.Sc. 4th Semester New Scheme Examination,

April-2018

BIO TECHNOLOGY

Paper-BT-405

Physical Chemistry

Time allowed : 3 hours]

[Maximum marks : 40

Note : Attempt five questions in all, selecting one question from each section. Question No. 1 is compulsory.

1. (a) Why Zn metal reacts with dil H_2SO_4 to give H_2 gas but copper does not ?
- (b) What is standard state of a substance ?
- (c) What happens to entropy of system if the mixture is separated into constituents ?
- (d) Give physical significance of work function.
- (e) What are units of entropy ?
- (f) Explain pH scale.
- (g) Under what conditions, ΔG becomes equal to ΔA ?
- (h) Which is the most commonly used reference electrode ?

1×8=8

Section-A

2. (a) Derive expression for calculating entropy change of an ideal gas when the temperature changes from T_1 to T_2 and volume changes from V_1 to V_2 . 4
- (b) Describe Carnot's cycle. Derive an expression for the efficiency of a reversible heat engine working between temperature T_1 & T_2 ($T_2 > T_1$). 4
3. (a) Explain how thermodynamic scale of temperature was developed. Why is it considered to be more basic than perfect gas scale of temperature? 4
- (b) Show that for an irreversible process : 2
- $$\Delta S_{\text{sys}} + \Delta S_{\text{surr}} > 0$$
- (c) What was the need to have second law of thermodynamics? 2

Section-B

4. (a) What is Residual entropy? How the concept of residual entropy originated? How is it calculated? 4
- (b) Derive thermodynamically the relationship : 4

$$\Delta G = RT \ln \frac{P_2}{P_1} = RT \ln \frac{V_1}{V_2}$$

5. (a) Calculate the free energy change accompanying the compression of 1 mole of CO_2 at 57°C from 5 atm to 50 atm. Assume that CO_2 behaves like ideal gas. 4
- (b) Show that $\Delta G \leq 0$ is criterion of spontaneity and equilibrium. 4

Section-C

6. (a) What are reversible and irreversible cell? Explain each of them with suitable example. 4
- (b) Can a solution of 1 m CuSO_4 be stored in vessel made of Nickel metal? Given $E^\circ_{\text{Ni}, \text{Ni}^{2+}} = 0.25\text{V}$
 $E^\circ_{\text{Cu}, \text{Cu}^{2+}} = -0.34\text{V}$. 4
7. (a) Derive Nernst equation for measuring EMF of a cell. 3
- (b) Give the function of salt bridge in an electrochemical cell. 2
- (c) What is electrochemical series? Give its applications. 3

Section-D

8. (a) Using EMF measurements of concentration cells, how the valency of mercurous ions is determined. 4

- (b) Discuss the determination of pH of a solution using Quinhydrone electrode. 4
9. (a) What is liquid junction potential ? Derive expression for the liquid junction potential. How it can be minimized or eliminated. 5
- (b) What is the principle of potentiometric titrations ? Give the advantage of potentiometric titrations. 3