2022/TDC(CBCS)/EVEN/SEM/
CHMHCC-202T/337

TDC (CBCS) Even Semester Exam., 2022

CHEMISTRY

(Honours)

(2nd Semester)

Course No. : CHMHCC-202T

(Physical Chemistry—II)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *ten* questions : 2×10=20

1. Write the importance of thermodynamics.

2. Explain extensive properties with example.

3. What is adiabatic flame temperature?

4. State the third law of thermodynamics.

5. What is residual entropy?

6. What is Debye T^3 law?

7. What is law of mass action?

8. Explain spontaneous reaction with example.

9. Distinguish between ΔG and ΔG°.

10. State the law of chemical equilibrium.

11. Show the variation of chemical potential with temperature graphically.

12. Show that $\left(\frac{\partial \mu_i}{\partial T}\right)_{P,N} = -\bar{S}_i$.

13. Mention two differences between osmosis and diffusion.

14. State Henry's law and its one application.

15. Define ideal and non-ideal solutions.

SECTION—B

Answer any *five* questions : 6×5=30

16. *(a)* Prove thermodynamically $C_P - C_V = R$. 3

(b) Show that $\left(\frac{\partial A}{\partial V}\right)_T = -P$. 3

17. *(a)* Deduce Kirchhoff's equation. 3

(b) Explain Hess' law of constant heat summation and write one application of Hess' law. 2+1=3

18. *(a)* Explain Nernst heat theorem. How does it lead to the enunciation of the third law of thermodynamics? 2+2=4

(b) Show that the entropy of any substance at low temperature ($0<T<20$ K) where Debye's relation for heat capacities of crystals is valid, is one-third of the molar heat capacity. 2

19. *(a)* Deduce Gibbs-Helmholtz equation. 4

(b) Show that Joule-Thomson effect is isoenthalpic. 2

20. *(a)* Deduce Gibbs-Dühem equation. 4

(b) Mention one important conclusion that can be drawn from Gibbs-Dühem equation. 2

21. *(a)* What do you mean by partial molar quantities? 3

(b) Discuss the variation of chemical potential with pressure. 3

22. *(a)* What do you mean by fugacity? Discuss the variation of fugacity with pressure. 2+2=4

(b) Explain the coupling of exoergic and endoergic reactions. 2

23. *(a)* Derive thermodynamically the relation between Gibbs free energy of reaction and reaction quotient. 3

(b) Derive Henderson-Hasselbalch equation. 3

24. *(a)* Define van't Hoff factor. Find a relation between van't Hoff factor and degree of dissociation taking one mole of a uni-univalent electrolyte as an example. 2+2=4

(b) State and explain Rault's law. 2

25. *(a)* Apply thermodynamics to derive a relationship between osmotic pressure and elevation of boiling point of an ideal solution. 4

(b) What do you mean by colligative properties and abnormal colligative properties? 2

★★★