

D 51478

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Name.....

Reg. No.....

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2013

(UG-CCSS)

Core Course—Chemistry

CH 3B 05—PHYSICAL CHEMISTRY—I

Time : Three Hours

Maximum : 30 Weightage

Section A

*Answer **all** questions.
Each question carries $\frac{1}{4}$ weight.*

Fill in the blanks :

1. Reciprocal of viscosity is called
2. K_p is related to K_c as
3. The Joule-Thomson **coefficient** for an ideal gas is
4. Molar heat capacity of a system is defined as the increase in _____ of the system per degree rise of temperature.

Answer in a word or sentence :

- 5 Define critical volume of a gas.
6. What is Boyle temperature ?
7. What are **fermions** ?
- 8 Give the SI unit of viscosity.

State whether True or False :

E. Surface tension in terms of **parachor** is given by $\gamma = \frac{MD^{1/4}}{[P]}$.

10. For a given sample of gas most probable velocity > root mean square velocity > average velocity.
11. A process is spontaneous if its free energy change is positive.
12. Electron is an example of a Boson.

(12 x $\frac{1}{4}$ = 3 weightage)

Section B

*Answer **all** the questions.
Each question carries 1 weightage.*

13. Write down the expression for Maxwell distribution of molecular velocities and explain the terms.
14. Define the terms collision frequency and collision number.

Turn over

15. Calculate the inversion temperature of Hydrogen. The van der Waals' constants for it are $a = 2.44 \times 10^{-1} \text{ dm}^3 \text{ atm mol}^{-2}$ and $b = 2.66 \times 10^{-2} \text{ dm}^3 \text{ mol}^{-1}$.
16. Predict the effect of temperature and pressure on the reaction :



17. For the reaction : $\text{N}_2 + \text{O}_2 \longrightarrow 2\text{NO}$; $\Delta G^\circ = 92.0 \text{ kJ}$ at 2000 K. Calculate K_p at 2000 K.
18. Explain Joule-Thomson effect.
19. Differentiate between Intensive and Extensive properties giving example.
20. How is entropy related to thermodynamic probability ?
21. Why do a drop of liquid assume spherical shape ?

(9 x 1 = 9 weightage)

Section C

*Answer any five questions.
Each question carries 2 weightage.*

22. Define mean free path. How does it vary with pressure ?
23. The van der Waals' constant $a = 3.6 \text{ L atm mol}^{-2}$ and $b = 4.28 \times 10^{-2} \text{ L mol}^{-1}$ for CO_2 . Calculate the critical temperature and critical volume.
24. Calculate the temperature at which the r.m.s velocity of H_2 is same as that of the molecules in O_2 at 1000 K.
25. State Le Chatelier principle. Illustrate its application in two industrial processes.
26. Express internal energy, pressure, free energy and Helmholtz work function in terms of partition function.
27. How does equilibrium constant vary with temperature ?
28. Explain the concept of activity and activity coefficient.

(5 x 2 = 10 weightage)

Section D

*Answer any two questions.
Each question carries 4 weightage.*

29. Why do real gases deviate from ideal behaviour ? Express the critical constants in terms of van der Waals' constants.
30. Describe the Carnot's cycle and obtain an expression for efficiency.
31. (a) Derive the Van't Hoff equation.
- (b) The equilibrium constant for the reaction $\text{I}_2 + \text{cyclopentene} \rightleftharpoons 2\text{HI} + \text{cyclopentadiene}$ in the gas phase is given by $\log K_p = 7.55 - (22160/4.575 T)$. Calculate ΔG° at 300°C .

(2 x 4 = 8 weightage)