

17U318

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Name: .....

Reg. No. ....

**THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018**

(Regular/Supplementary/Improvement)

(CUCBCSS - UG)

**CC15U CHE3 B03 - PHYSICAL CHEMISTRY- I**

(Chemistry - Core Course)

(2015 Admission onwards)

Time: Three Hours

Maximum: 80 Marks

**Section A**

Answer *all* questions. Each question carries 1 mark.

1. Give the expression for RMS velocity.
2. Write the Vander Waal's equation for n moles of a gas.
3. The entropy that a crystal of a substance has at 0 K is called -----
4. The average distance travelled by a gas molecule between successive collisions is called -----
5. The SI unit of viscosity is -----
6. For the gaseous equilibrium  $\text{H}_2 + \text{I}_2 \rightarrow 2\text{HI}$  the value of  $K_p$  and  $K_c$  are related at any temperature as -----
7. Thermodynamic property which does not depend on the amount of substance is called -----
8. With rise in temperature, the surface tension of a liquid -----
9. The observed molar refraction of an aliphatic conjugated polyenes is found to be greater than the calculated value. The phenomenon is called -----
10. The relation between T and P in an adiabatic process is -----

(10 x 1 = 10 Marks)

**Section B**

Answer any *ten* questions. Each question carries 2 marks.

11. Calculate the temperature at which the RMS velocity of oxygen equals that of  $\text{CO}_2$  at 283K
12. Give an expression for inversion temperature.
13. Define parachor of a liquid.
14. Define Joule - Thomson coefficient.
15. Calculate the number of ways of distributing two indistinguishable objects in two boxes.
16. Give the expression for Van't Hoff reaction isotherm. Explain the terms involved.
17. Define collision frequency.
18. The heat of neutralization of a strong acid by a strong base is always constant. Why?

19. State first law of thermodynamics.
20. Calculate the maximum efficiency of a steam engine which operates between 383K and 298K
21. Define partial molal free energy.
22. Calculate the free energy change accompanying the expansion of 2.5 moles of an ideal gas at 25°C from 55L to 120L

**(10 x 2 = 20 Marks)**

### Section C:

Answer any *five* questions. Each question carries 6 marks.

23. Explain the effect of temperature on collision number and mean free path.
24. Discuss the relationship between critical constants and Vander Waal's constants.
25. What is third law of thermodynamics? State and explain Nernst heat theorem.
26. Define coefficient of viscosity. Explain how molecular mass can be determined from viscosity measurements.
27. Derive the relationship between heat capacities at constant volume and at constant pressure thermodynamically.
28. Derive an equation for the change in entropy of n moles of an ideal gas, undergoing a simultaneous change in temperature and pressure.
29. What is meant by thermodynamic probability? Derive the relation between entropy and probability of a system.
30. Derive Vant Hoff's equation giving the temperature dependence of equilibrium constant  $K_p$ .

**(5 x 6 = 30 Marks)**

### Section D

Answer any *two* questions. Each question carries 10 marks.

31. Discuss the Carnot cycle and derive the expression for the efficiency of a reversible engine. State the Carnot's theorem.
32. a) Derive the law of chemical equilibrium thermodynamically.  
b) State and explain Le Chatelier's principle. Discuss the effect temperature and pressure on the formation of ammonia during the Haber's process.
33. a) What is meant by compressibility factor of a gas? Explain its significance.  
b) How is critical volume of a gas determined?
34. a) Derive the Clausius - Clapeyron equation and discuss the important applications of the equation.  
b) For the reaction  $N_2O_4(g) \rightarrow NO_2(g)$   $K_p = 0.148$  atm at 303K. Calculate  $K_c$

**(2 x 10 = 20 Marks)**

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