16U316 (Pages:3) Name: …….

Reg. No……

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2017

(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. The compressibility factor (Z) is given by the equation , Z = ----------
2. The average number of collisions suffered by a single molecule per unit time per unit volume of a gas is called ----------
3. The temperature at which the Joule-Thomson coefficient changes sign is the ----------
4. When a system undergoes free expansion (expansion against zero pressure) then work done (w) = ----------
5. Entropy of CO at absolute zero is ----------
6. The Born –Haber cycle is an application of ---------- Law
7. Pc in terms of Vander waals constants is ----------
8. The SI unit of surface tension is ----------
9. Kp is related to Kc by the expression ----------
10. A process is spontaneous if its free energy change is ----------

(10 x 1= 10 Marks)

Section B

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

11. Define mean free path. How does it vary with (a) increase in temperature and (b) decrease of pressure?
12. Calculate the temperature at which the average speed of H_2 equals that of O_2 at 320K.
13. Give the Maxwells equation for the distribution of molecular velocities.
14. Write down the Clapeyron – Claussius equation (integrated form) for liquid - vapour equilibrium and explain the terms.
15. Explain any two statements of second law of thermodynamics.
16. Explain Carnot's theorem.
17. Define the term fugacity.

Turn Over

18. Give Kirchoffs equation.
19. How is molar refraction of a liquid related to its refractive index and density?
20. What is meant by optical exaltation? Illustrate giving an example.
21. State and explain law of mass action.
22. Calculate the work done when 14 g of nitrogen gas expands isothermally and reversibly from 2L to 20L at 27^0c assuming ideal behavior.

(10 x 2 = 20 Marks)

Section C

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

23. Calculate the molecular diameter of Nitrogen. Given that Vander Waal's constant b=3.18×10^5 m^3 mol^{-1}
24. Derive the expressions for critical constants in terms of Vander Waal's constants.
25. Derive the Gibbs- Helmholtz equation .
26. Derive the relation between temperature and volume for reversible adiabatic expansion of an ideal gas.
27. Show that the decrease in free energy in a process is equal to the useful work done by the system.
28. Calculate the entropy change (ΔS) when 4 moles of an ideal gas expands reversibly from an initial volume of 10 dm^3 to a volume of 20dm^3 at constant temperature of 298K.
29. A capillary tube of internal dia 0.21mm is dipped into a liquid whose density is 0.79g cm^{-3}. The liquid rises in this capillary to a height of 6.30 cm. Calculate the surface tension of the liquid. (g =980 cm s^{-2})
30. State Le-Chatlier's principle. Apply Le- Chatlier's principle to the equilibrium $2SO_{2\,(g)} + O_2\,(g) \leftrightarrows 2SO_3$+ heat

(5 x 6 = 30 Marks)

Section D

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

31. Give Vander waals equation for one mole of a real gas. Convert Vander Waal's equation into virial form and deduce an expression for Boyle Temperature.
32. (a) Describe Linde's process and Claud's method for the liquefaction of gases.

    (b) Calculate the change in freezing point of ice when the pressure is increased by 1atm. Molar volume of water and ice are respectively 18.0 cm^3 and 19.6 cm^3 and the enthalpy of fusion for ice is 6008Jmol $^{-1}$ (1J= 9.87x 10^{-3} dm^3 atm)
33. (a) Give the criteria for a process to be spontaneous based on ΔH, ΔS and T.

    (b) Calculate the free energy change accompanying the expansion of 3 moles of an ideal gas at 25^0 C from 100L to 300L
34. Derive the Vant Hoff's equation showing the temperature dependence of equilibrium constant and arrive at it's integrated form.

(2 x 10 = 20 Marks)

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