Avinashilingam Institute for Home Science and Higher Education for Women

(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956)
Re-accredited with 'A+' Grade by NAAC. Recognised by UGC Under Section 12B
Coimbatore - 641 043, Tamil Nadu, India

Bachelor's Degree Examination – July 2020
IV Semester

Class : II UG **Time : 3 Hours**
Major : Chemistry **Max. Marks: 100**

18BCHC11 Thermodynamics -II and Dilute solutions

Part A
Choose the Correct Answer **10 x 1 = 10**

1. The mathematical expression for first law of thermodynamics
   a. $\Delta E = q - w$ b. $\Delta E = q$ (isochoric) c. $\Delta E = 0$ (cyclic) d. all the above

2. A reaction proceeds with increase in both enthalpy & entropy. It will be spontaneous if
   a. $\Delta H = T\Delta S$ b. $\Delta H > T\Delta S$ c. $\Delta H < T\Delta S$ d. none of the above

3. The entropy is measured in
   a. cal K^{-1} mol^{-1} b. J K^{-1} mol^{-1} c. entropy unit d. all the above

4. The free energy function, G is of the form
   a. G = H + TS b. G = H - TS c. G = TS - H d. none of the above

5. The equation for van't Hoff isotherm is
   a. $\Delta G = -RT \ln Kp$ b. $\Delta G = RT \ln Kp$ c. $\Delta G = -RT^2 \ln Kp$ d. $\Delta G = RT^2 \ln Kp$

6. The process is in equilibrium state when
   a. $\Delta G > 0$ b. $\Delta G < 0$ c. $\Delta G = 0$ d. none of the above

7. The equilibrium expression, $K = [Ag^+][Cl^-]$ describes the reaction
   a. $Ag^+ + Cl^- \rightarrow Ag + Cl$ b. $Ag^+ + Cl^- \rightarrow AgCl$ c. $AgCl \rightarrow Ag^+ + Cl^-$ d. none of the above

8. For which one of the following equilibrium equations, will K_p equal K_c
   a. $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ b. $COCl_2 \rightleftharpoons CO + Cl_2$ c. $H_2 + I_2 \rightleftharpoons 2HI$ d. all the above

9. Boiling of a liquid occurs when its vapour pressure becomes equal to
   a. 1 atm pressure b. zero c. 20 atm pressure d. -20 pressure

10. Colligative properties depend upon
    a. number of particle b. size of particle c. temperature d. nature of particles

Part B **5 x 6=30**

Answer all Questions

Each answer should not exceed 400 words or two pages

11. a. Define entropy and derive an expression for the dependence of entropy on temperature and volume.

(or)

11. b. Calculate the efficiency of a Carnot engine working between the boiling point of water (at 1 atm) and that of liquid nitrogen viz –195 ºC

12. a. Derive an equation for the variation of chemical potential with respect to temperature.

(or)

12. b. State chemical potential. Derive Gibb's Duhem equation.

13. a. The equilibrium constant K_P for the reaction $2HN_{3(g)} \rightleftarrows 3H_{2(g)} + N_{2(g)}$ is 1.22×10^{-3} at 298 K and 2.16 at 498 K. Calculate ΔH^0 for the reaction.

(or)

13. b. The partial pressure of CO_2 in the reaction $CaCO_{3(s)} \rightleftarrows CaO + CO_{2(g)}$ is 0.773 mm at 500 ^{0}C. Calculate K_p at 600 ^{0}C at 600 ^{0}C for the above reaction. ΔH for the reaction is 43.2 k cal mol^{-1} and does not change in the given range of temperature.

14. a. State the third law of thermodynamics and explain its applications.

(or)

14. b. Account for the exception to the third law of thermodynamics with N_2O as an example.

15. a. The freezing point of a solution decreases by 0.40 K when 1 gram of solute is dissolved in 50.5 gram of benzene. The molal depression constant of benzene is 5.12 K kg mol^{-1}. Calculate the molecular mass of the solute.

(or)

15. b. Appraise the Berkeley and Hartley's method of determination of osmotic pressure.

PartC **5 x 12=60**

Answer all Questions

Each answer should not exceed 800 words or four pages

16. a. Calculate the entropy of mixing of one mole of hydrogen gas and two moles of oxygen gas. (assume ideal gas behavior).

(or)

16. b. Derive an expression to find the efficiency of a Carnot cycle operating between two temperatures.

17. a. Derive the two forms of Gibb's Helmholtz equation.

(or)

17. b. Derive the Clausius – Claypeyron equation and write the integrated form of it.

18. a. Establish the temperature dependence of equilibrium constant.

(or)

18. b. Derive the van't Hoff equation in terms of K_c.

19. a. State Le Chatelier principle. How does change in temperature and pressure affect equilibrium?

(or)

19. b. Evaluate the absolute entropy of solids, liquid and gases.

20. a. Derive a relation between relative lowering of vapour pressure and osmotic pressure

(or)

20. b. Explain the Rast method of molecular weight determination.

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