

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2017

CHE3B03 - Physical Chemistry I

(2016 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

**Section A (One word)****(Answer all questions. Each question carries 1 mark)**

1.  $K_p = K_c$  for a reversible reaction when  $\Delta n = \dots\dots$
2. Claude's process is a method for.....
3. A non-linear molecule with ' $n$ ' atoms has.....vibrational degrees of freedom.
4. The unit of van der Waal's constant ' $b$ ' is.....
5. Among *work, enthalpy and entropy*,..... is not a state function.
6. The viscosity of a liquid .....with increases in temperature.
7. If the RMS velocity of a gas at a certain temperature is  $100\text{ms}^{-1}$ , what is its average velocity at the same temperature.
8. The relation between T and P in an adiabatic process is.....
9. The chemical potential of a constituent in a mixture ..... with temperature.
10. The maximum efficiency of a steam engine working between  $100^\circ\text{C}$  and  $25^\circ\text{C}$  is.....%

**(10 x 1 = 10 Marks)****Section B (Short Answer)****(Answer any 10 questions. Each question carries 2 marks)**

11. Discuss the determination of molecular mass of polymers from viscosity measurements.
12. Explain Nernst heat theorem.
13. State Le Chatelier principle and predict the effect of a change of pressure on the equilibrium:  $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$
14. State the Second law of thermodynamics in terms of entropy.
15. Explain the relation between entropy and thermodynamic probability.
16. What is meant by mean free path? How is it related to average velocity?
17. Explain the Lorentz - Lorenz equation and the phenomenon of optical exaltation.
18. Show that  $T_C = 8T_B/27$  for a gas, where  $T_B$  and  $T_C$  are respectively the Boyle temperature and critical temperature.
19. Calculate the temperature at which the average velocity of  $\text{O}_2$  equals that of  $\text{H}_2$  at  $40\text{ K}$ .
20. What is fugacity? What is its significance?
21. 10 moles of an ideal gas expand isothermally and reversibly from a pressure of 10 atm to 2 atm at  $300\text{ K}$ . What is the largest mass which can be lifted through a height of 1 metre in this expansion.
22. Derive an expression for work done in a reversible adiabatic expansion of an ideal gas.

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

### Section C (Paragraph)

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

23. What is meant by heterogeneous equilibrium? Apply the law of chemical equilibrium to the dissociation of ammonium hydrosulphide ( $\text{NH}_4\text{HS}$ ).
24. Derive Stirling's approximation.
25. Three moles of an ideal gas ( $C_v = 5 \text{ cal deg}^{-1} \text{ mol}^{-1}$ ) at 10 atm and  $0^\circ\text{C}$  are converted to 2 atm at  $50^\circ\text{C}$ . Find  $\Delta U$  and  $\Delta H$  for the change.
26. Explain the determination of molecular mass of a gas by the limiting density method.
27. Calculate the entropy change produced from the reversible expansion of 3 moles of an ideal gas from a pressure of 1.5 atm at 300 K to a pressure of 0.8 atm at 400 K. Assume  $C_v = 1.5R$
28. Derive the kinetic gas equation. Calculate the average translational KE of an ideal gas per mole at  $28^\circ\text{C}$ . What will be the average KE per molecule?
29. What is meant by Joule-Thomson effect? Derive an expression for Joule Thomson coefficient.
30. Derive the Gibb's Duhem equation. 4 moles of an ideal gas are compressed isothermally at 300K from  $2.02 \times 10^5 \text{ Nm}^{-2}$  to  $4.04 \times 10^5 \text{ Nm}^{-2}$  pressure. Calculate the Gibb's energy change for the process.

(5 x 6 = 30 Marks)

### Section D (Essay)

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

31. (i) State and illustrate Hess's law of constant heat summation.  
(ii) The standard enthalpy of reaction for the hydrogenation of ethylene ( $\text{C}_2\text{H}_4$ ) to ethane ( $\text{C}_2\text{H}_6$ ) is  $-136.8 \text{ kJmol}^{-1}$ . The standard enthalpy of formation of ethane is  $-84.4 \text{ kJmol}^{-1}$ . Calculate the standard enthalpy of formation of ethylene.
32. (i) Derive the van't Hoff equation showing the temperature dependence of equilibrium constant and arrive at its integrated form.  
(ii) The equilibrium constant for a reaction at 298K is  $1.4 \times 10^3$ . Calculate  $\Delta G^\circ$  for the reaction in calories.
33. Describe in detail the Carnot reversible cycle for establishing the maximum convertibility of heat into work.
34. Derive the van der Waal's reduced equation of state. State the law of corresponding states and explain its significance.

(2 x 10 = 20 Marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2017

CHE3C03 - Organic Chemistry

(2016 Admission onwards)

Max. Time: 3 hours

Max. Marks: 64

**SECTION A (One word)****(Answer all questions. Each question carries 1 mark)**

1. A neutral species that has an unpaired electron is called .....
2. The acidity of chloroacetic acid is .....than that of acetic acid.
3. The most stable conformation of ethane is .....conformation.
4. By what name is cis-2-butene-1,4 dioic acid commonly known ?
5. Cycloheptatrienyl cation is otherwise known as .....
6. -NO<sub>2</sub> group has.....directing influence in aromatic electrophilic substitution.
7. What is the structural formula of but-2-enoic acid.
8. In normal DNA base-pairing, guanine pairs with .....
9. Which is the monomer of starch ?
10. Draw the structure of piperine.

**(10 x 1 = 10 Marks)****SECTION B****(Answer any seven questions. Each question carries 2 mark)**

11. Explain the modes in which the free radicals are formed.
12. Arrange formic acid, acetic acid and propionic acid in the decreasing order of their acidities. Justify your answer
13. Among CH<sub>3</sub>-CH(Cl)-CH<sub>2</sub>OH, HOOC-CH<sub>2</sub>-CH<sub>2</sub>OH, and (HO)H<sub>2</sub>C-(HO)HC-CH<sub>2</sub>OH, which one shows optical isomerism ? Why ?
14. Draw the conformations of methyl cyclohexane. Which is more stable ? Why ?
15. What are benzenoid and non benzenoid aromatic compounds ? Give examples.
16. How can benzene be converted to toluene ?
17. Which is more acidic; phenol or P- nitro phenol? Justify.
18. What is TNT ? Mention two uses of TNT .
19. What are anomers ?
20. Give the structural formula of the tripeptide Ala-Gly-Phe.

**(7 x 2 = 14 Marks)**

### SECTION C (paragraph)

(Answer any four questions. Each question carries 5 marks)

21. Discuss the optical isomerism in tartaric acid.
22. State and explain isoprene rule.
23. Explain the term saponification number and iodine number with respect to fats and oils.
24. State and illustrate Markonikoff's rule
25. Explain why p-nitroaniline is less basic than aniline.
26. How is phenolphthalein prepared? What are its uses?

(4 x 5 = 20 Marks)

### SECTION D (Essay)

(Answer any two questions. Each question carries 10 marks)

27. Discuss the structure of proteins. How are they classified?
28. (a) What are the products obtained when aqueous benzenediazonium chloride solution is (i) heated with  $H_3PO_2$  (ii) warmed with cuprous chloride dissolved in HCl (iii) heated with stannous chloride and HCl. Explain the reactions involved with suitable equations.  
(b) Explain the Lucas test for the distinction between primary, secondary and tertiary alcohols.
29. (a) Draw the ring structures of glucose, fructose and sucrose.  
(b) Comment on the structure of natural rubber. What is meant by vulcanization? Explain with example.
30. Discuss the different kinds of structural isomerism exhibited by organic compounds with suitable examples.

(2 x 10 = 20 Marks)