

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCBCSS—UG)

Complementary Course

CHE 3C 03—ORGANIC CHEMISTRY

Time : Three Hours

Maximum : 64 Marks

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

1. The IUPAC name of $(\text{CH}_3)_3\text{C-OH}$ is _____.
2. The hybridisation of carbon in carbonyl group is _____.
3. Which is a better nucleophile, Br^- or I^- ?
4. The electrophile in Friedel-Craft's alkylation is _____.
5. Draw the structure of indol.
6. Which is more acidic, Phenol or *p*-nitrophenol ?
7. Optical isomers which are mirror images are called _____.
8. Methylbromide on treating with metallic sodium in presence of dry ether gives _____.
9. Give the name of an alkaloid _____.
10. Structural formula of cis 2-butene is _____.

(10 × 1 = 10 marks)

Section B*Answer any seven questions.**Each question carries 2 marks.*

1. Explain functional isomerism with one example.
2. Explain the mechanism of nitration in benzene.
3. Briefly compare the basicity of ammonia and methyl amine.
4. Write a method of preparation of benzene diazonium chloride.
5. What is HVZ reaction ?
6. Compare the stability of 1°, 2° and 3° alkyl carbocations. Justify your answer.
7. Differentiate between rectified spirit, absolute alcohol and denatured spirit.
8. Explain the terms racemisation and resolution.
9. State and explain isoprene rule.
10. Explain Huckle's rule by taking a non-benzenoid aromatic compound as example.

(7 × 2 = 14 marks)

Turn over

15. State and explain I law of thermodynamics.
16. Distinguish between a thermodynamic closed and isolated system.
17. What is meant by residual entropy ?
18. How is molar refraction of a liquid related to its refractive index and density ?
19. What is meant by heterogenous equilibria ? Give one example.
20. Enthalpy of neutralization of strong acid by a strong base is always constant. Explain.
21. One mole of an ideal gas expands isothermally at 300 K from a volume of 10 dm^3 to 20 dm^3 against a constant external pressure of 1 atmosphere. Calculate the work done by the system.
22. The equilibrium constant of a reaction is 7.5×10^{-5} at 300 K. Calculate the value of ΔG^0 .

(10 × 2 = 20 marks)

Section C (Paragraphs)

Answer any five questions.

Each question carries 6 marks.

23. State Le Chateliers principle. What is the effect of increase of pressure and temperature in the reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ $\Delta H = -92.38 \text{ KJ}$. Explain.
24. Derive van der Waals equation for n moles of a gas.
25. Show that Joule-Thomson expansion is an isenthalpic process.
26. Derive Gibbs Helmholtz equation.
27. Define critical constants. Explain the determination of critical temperature and critical pressure of a gas.
28. The standard enthalpy of formation of gaseous water at 298 K is -241.82 KJ/mol . Estimate its value at 373 K. Given the following value of C_p (Molar) :
 - (i) $\text{H}_2\text{O}(\text{g}) = 33.58 \text{ JK}^{-1} \text{ mol}^{-1}$.
 - (ii) $\text{H}_2(\text{g}) = 28.84 \text{ JK}^{-1} \text{ mol}^{-1}$ and
 - (iii) $\text{O}_2(\text{g}) = 29.37 \text{ JK}^{-1} \text{ mol}^{-1}$.
 Assume that C_p are independent of temperature.
29. State and explain Nernst heat Theorem. What is its significance ?
30. Obtain the thermodynamic derivation of Law of Chemical equilibrium.

(5 × 6 = 30 marks)

Section D (Essays)

Answer any two questions.

Each question carries 10 marks.

31. (a) Derive kinetic gas equation. (7 marks)
- (b) Calculate the mean free path for a gas at STP. Collision diameter $\sigma = 2 \times 10^{-10}$ m. (3 marks)
32. (a) Derive Clausius- Clapeyron equation and discuss its application in liquid- vapour equilibria. (7 marks)
- (b) Calculate the efficiency of heat engine working between a source at 480 K and sink at 200K. (3 marks)
33. (a) Derive an equation relating change in entropy of an ideal gas with respect to a change in temperature and pressure. (7 marks)
- (b) For the reaction $\text{CaCO}_3(\text{s}) \rightarrow \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ $\Delta H = 170.85$ KJ and $\Delta S = 0.15$ KJ.K⁻¹ at 300 K. Predict whether the reaction is spontaneous or not at 300 K. Explain. (3 marks)
34. (a) Derive vant Hoff's equation. (7 marks)
- (b) Express the value of equilibrium constant in terms of concentration of reactants and products for a hypothetical reaction $aA + bB \rightarrow cC + dD$. How is the value related to K_p ? (3 marks)
- [2 × 10 = 20 marks]