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Name.....

Reg. No.....

**SECOND SEMESTER (CBCSS—UG) DEGREE [SUPPLEMENTARY]  
EXAMINATION, APRIL 2025**

Chemistry

CHE 2C 02—PHYSICAL CHEMISTRY

(2019 Syllabus)

Time : Two Hours

Maximum : 60 Marks

**Section A (Short Answer)***Answer all questions.**Each question carries 2 marks with ceiling of marks 20.*

1. What is Enthalpy ? What is its significance ?
2. What are isolated systems ? Give examples.
3. What is free energy ? Explain its significance.
4. Briefly explain the behaviour of real gases ?
5. What do you mean by RMS velocity of gas molecule ?
6. Explain proper axis of symmetry.
7. What are Miller indices ?
8. What is vapour pressure of a liquid ?
9. What are the factors influencing the viscosity of a liquid ?
10. What are Calomel electrodes ?
11. Write Nernst equation and explain the terms.
12. State Kohlrausch's law.

(Ceiling of marks : 20)

**Turn over**

**Section B (Short Answers)**

*Answer any **seven** questions.*

*Each question carries 5 marks with ceiling of marks 30.*

13. Explain briefly the influence of temperature on the spontaneity of a chemical reaction.
14. State and explain two statements for second law of thermodynamics.
15. Briefly explain the Maxwell's distribution of molecular velocities.
16. Explain briefly Bravais lattices.
17. Explain briefly the laws of osmotic pressure.
18. Write notes on Ostwald's dilution law.
19. Briefly explain the working of SHE.

(Ceiling of marks : 30)

**Section C (Essay)**

*Answer any **one** question.*

*The question carries 10 marks.*

20. Explain briefly the principle and applications of conductometric titrations in neutralisation titrations.
21. Discuss in detail non stoichiometric and stoichiometric defects in crystals.

(1 × 10 = 10 marks)

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Name.....

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**SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
APRIL 2024**

Chemistry

CHE 2C 02—PHYSICAL CHEMISTRY

(2019—2023 Admissions)

Time : Two Hours

Maximum : 60 Marks

**Section A (Short Answers)***Answer questions up to 20 marks.**Each question carries 2 marks.*

1. What is the entropy change of the universe for a reversible process and irreversible process ?
2. Define closed system and isolated system.
3. Write down the van der Waal's equation and explain the terms involved.
4. Define molar conductance of an electrolyte solution. How is it related to specific conductance.
5. Explain the effect of temperature and pressure on viscosity of a liquid.
6. What are buffer solutions ? Give one example each for an acidic and basic buffer.
7. Write the electrode reactions in a Daniell cell.
8. What are fuel cells ? Write down the overall cell reaction of a  $H_2-O_2$  fuel cell.
9. What are anisotropic substances ? Give an example.
10. Explain reverse osmosis and mention one of its application.
11. What are real gases ? Mention the condition at which real gases obey ideal gas equation.
12. Define RMS velocity and most probable velocity.

(Ceiling of marks : 20)

**Turn over**

**Section B (Paragraph)**

*Answer questions up to 30 marks.*

*Each question carries 5 marks.*

13. Briefly explain Maxwell distribution of molecular velocities using suitable diagram.
14. What are reference electrodes ? Briefly explain the calomel electrode.
15. Write down the van't Hoff equation and explain the terms. Calculate the molar mass of a non-volatile solute if, at 25°C its solution containing 2.5 g dm<sup>-3</sup> has an osmotic pressure of 1 atm. Given  $R = 0.0821 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$ .
16. Define vapour pressure and surface tension of a liquid. Explain the variation of these properties with temperature.
17. Write a short note on stoichiometric point defects in crystals.
18. (a) State first law of thermodynamics and give any *two* limitations of the law.  
(b) Mention the condition for equilibrium and spontaneity based on  $\Delta G$  value.
19. Describe buffer solutions with an example. Explain the buffer action of acetic acid/sodium acetate buffer.

(Ceiling of marks : 30)

**Section C (Essay)**

*Answer any **one** question.*

*The question carries 10 marks.*

20. a) State and explain Kohlrausch's law.  
(5 marks)  
b) Briefly explain conductometric titrations with reference to any two types of acid- base titrations.  
(5 marks)
21. a) Write down the postulates of kinetic molecular theory of gases. Explain for the deviation of real gases from ideal behaviour.  
(5 marks)  
b) What are non-stoichiometric defects in crystals. Explain any *two* non-stoichiometric defects in detail.  
(5 marks)

[1 × 10 = 10 marks]

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Name.....

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**SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
APRIL 2022**

Chemistry

CHE 2C 02—PHYSICAL CHEMISTRY

(2019—2020 Admission)

Time : Two Hours

Maximum : 60 Marks

**Section A (Short Answers)***Answer questions up to 20 marks.**Each question carries 2 marks.*

1. Calculate internal energy produced when 800J of work is done on a system which gives off 220 J of heat.
2. Explain term isotropy and anisotropy.
3. Calculate miller indices of plane which cut through axis at (2a, -3b, -3c).
4. Distinguish between average velocity and root mean square velocity.
5. In what units can Vander Waals constant be expressed and why ?
6. Define surface tension of a liquid. What is its unit ? How does it vary with temperature ?
7. Explain reverse osmosis and its use.
8. State and explain Charles-Vant Hoff law.
9. Define specific conductance of an electrolyte solution. What is the unit ?
10. The conductivity of 1M  $\text{H}_2\text{SO}_4$  at 298K is  $0.26 \text{ ohm}^{-1} \text{ cm}^{-1}$ . Calculate equivalent conductivity of solution.
11. What is a calomel electrode ?
12. Give an example each for acidic and basic buffers.

**Section B (Paragraph)***Answer questions up to 30 marks.**Each question carries 5 marks.*

13. State and explain zeroth law of thermodynamics and bring out its significance.
14. For reaction :  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3(\text{g})$   $\Delta H^\circ = -92.22\text{KJ}$  and  $\Delta S^\circ = 0.1981\text{KJK}^{-1}$  at  $25^\circ\text{C}$ . Calculate standard free energy of formation of  $\text{NH}_3$  at  $25^\circ\text{C}$ .
15. Show that decrease in Gibbs free energy in a process is equal to useful work done by system.

**Turn over**

16. Give Maxwell's equation for distribution of molecular velocities. Explain influence of temperature on distribution.
17. What are isotonic solutions ? A 4.75% aq. solution of solute X found to be isotonic with 2.9% solution of urea at 298K. Calculate molar mass of solute.
18. What do you understand by viscosity of liquids ? What are the factors affecting viscosity of liquids ? Explain viscosity and temperature on basis of intermolecular attraction.
19. The resistance of 0.01 M solution of an electrolyte was found to be 212 ohm at room temperature when taken in a cell containing electrodes of area  $2.25\text{cm}^2$  placed 2cm apart. Calculate molar conductance of solution at same temperature.

**Section C (Essay)**

*Answer any **one** question.*

*The question carries 10 marks.*

20. Discuss defects in crystal system with suitable example and diagram.
21. Illustrate the principle of conductometric titrations with reference to acid base titrations.

(1 × 10 = 10 marks)

C 22063

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Name.....

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**SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
APRIL 2022**

Chemistry

CHE 2C 02—PHYSICAL CHEMISTRY

(2021 Admissions)

Time : Two Hours

Maximum : 60 Marks

**Section A (Short Answers)***Answer at least **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. What is isothermal process ?
2. Discuss different types of systems.
3. Distinguish between extrinsic and intrinsic properties.
4. What is most probable velocity ?
5. What is Maxwell distribution law of velocity ?
6. Define Boyle's law.
7. What is real gas ?
8. Define isotonic solution with example.
9. What are the units of viscosity ? How does it vary with temperature ?
10. Define osmosis and osmotic pressure.
11. What is a buffer solution ?
12. Define specific conductance and molar conductance.

(8 × 3 = 24 marks)

**Turn over**

**Section B (Paragraph)**

*Answer at least **five** questions.*

*Each question carries 5 marks.*

*All questions can be attended.*

*Overall Ceiling 25.*

13. Explain third law of thermodynamics.
14. Explain Gibbs free energy and its physical significance.
15. Derive Bragg's equation and explain its application.
16. How is viscosity of a liquid determined? Discuss the effect of temperature on it.
17. Define surface tension. How does surface tension of liquid vary with temperature.
18. What is electrode potential? Discuss the effect of concentration on it.
19. Distinguish between galvanic cell and electrolytic cell.

(5 × 5 = 25 marks)

**Section C (Essay)**

*Answer any **one** question.*

*The question carries 11 marks.*

20.
  - a) What is an ideal gas?
  - b) What are the causes of deviation of gas from ideal behaviour?
21. Explain the following conductometric titration with graph :
  - a) Strong acid × strong base .
  - b) Weak acid × strong base.

(1 × 11 = 11 marks)

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Name.....

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**SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
APRIL 2021**

Chemistry

CHE 2C 02—PHYSICAL CHEMISTRY

Time : Two Hours

Maximum : 60 Marks

**Section A (Short Answers)***Answer at least **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. Give the statement of first law of thermodynamics and its mathematical formulation.
2. Define term unit cell and space lattice.
3. A crystal plane makes intercepts of  $(1/2a, 1/2b, c)$ . What are miller indices of plane ?
4. Define average velocity and most probable velocity.
5. Write down van der Waals equation for  $n$  moles of real gas and explain the terms.
6. Define term vapour pressure of a liquid. How does it depend on temperature ?
7. What are the factors that influence viscosity of a liquid ?
8. State and explain Boyle Vant Hoff law.
9. What are strong electrolytes ? Give two examples.
10. The cell constant of a cell is  $0.5 \text{ cm}^{-1}$ . The resistance of an electrolyte solution taken in cell is 50 ohms. Calculate conductivity of solution.
11. What is meant by standard electrode potential ?
12. What are buffer solutions ? Give two examples.

(8 × 3 = 24 marks)

Turn over

**Section B (Paragraph)**

*Answer at least five questions.*

*Each question carries 5 marks.*

*All questions can be attended.*

*Overall Ceiling 25.*

13. Define enthalpy and free energy. How is enthalpy change in process related to free energy change? Under what condition would a process for which  $\Delta H = +$  and  $\Delta S = -$  ve take place spontaneously?
14. Diethyl ether boils at  $35^{\circ}\text{C}$ . Its heat of vaporization at its boiling point is  $27.2 \text{ KJ mol}^{-1}$ . Calculate entropy of vaporization?
15. At what temperature would hydrogen gas molecules have same average speed as Helium atoms at  $300 \text{ K}$ .
16. State and explain second law of thermodynamics. Explain criterion for spontaneous process in terms of entropy change.
17. Describe how osmotic pressure of solution can be measured experimentally.
18. What do you understand by surface tension of liquids and what is the unit? Explain term interfacial surface energy. Explain surface tension on basis of intermolecular attraction.
19. What are fuel cells? Explain the electrode and cell reaction in a  $\text{H}_2 - \text{O}_2$  fuel cell. List advantage of fuel cell.

(5 × 5 = 25 marks)

**Section C (Essay)**

*Answer any one question.*

*The question carries 11 marks.*

20. Give reasons for deviation of real gases from ideal behavior.
21. (a) Derive Ostwald's dilution law and mention its limitations.  
(b) Explain why an aqueous solution of potassium acetate is basic while that of ammonium nitrate is acidic.

(1 × 11 = 11 marks)

C 82418

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Name.....

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**SECOND SEMESTER B.A./B.Sc. DEGREE EXAMINATION, APRIL 2020**

(CBCSS—UG)

Chemistry

**CHE 2C 02—PHYSICAL CHEMISTRY**

(2019 Admissions)

Time : Two Hours

Maximum : 60 Marks

**Section A (Short Answers)**

*Answer questions up to 20 marks.*

*Each question carries 2 marks.*

1. Define free energy. How is free energy change related to enthalpy and entropy change in a process at constant temperature ?
2. What are Bravais lattices ? How many Bravais lattices are possible ?
3. Find miller indices of plane making intercept on axes at  $(-a, b, a)$ .
4. Distinguish between most probable velocity and root mean square velocity.
5. What are the causes of deviation of real gas from ideal behaviour ?
6. Define viscosity of a liquid. How does it vary with temperature ?
7. What are colligative properties ? Give two examples.
8. What is an isotonic solution ? Write an expression for it.
9. What is specific conductance ? How is it related to equivalent and molar conductance ?
10. The conductivity of decimolar solution of an electrolyte is  $0.0025 \text{ ohm}^{-1} \text{ cm}^{-1}$ . It offers a resistance of 350 ohm when taken in conductivity cell. Calculate cell constant.
11. What is meant by reference electrode ? Give an example.
12. What is buffer action ? Give an example.

**Turn over**

**Section B (Paragraph)**

*Answer questions up to 30 marks.*

*Each question carries 5 marks.*

13. State second law of thermodynamics. Explain criterion for spontaneous process in terms of entropy change.
14. Explain term entropy. What is the physical significance of entropy ?
15.  $\Delta H$  and  $\Delta S$  for the reaction  $2\text{NO}_{(g)} + \text{O}_{2(g)} \rightarrow 2\text{NO}_{2(g)}$  at 700K are  $-112.9 \text{ KJ}$  and  $-145.5 \text{ JK}^{-1}$ . Calculate  $\Delta G$  and predict whether reaction is spontaneous or not at 700K.
16. How do Frenkel defect arise ? What is the cause of Schottky defects ?
17. Describe the Berkley and Hartleys method of determining osmotic pressure of a solution.
18. State and explain Kohlrausches law and its applications.
19. Calculate osmotic pressure of a solution by mixing 200 ml each of 5% aqueous solution of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) and 4% solution of urea [ $\text{CO}(\text{NH}_2)_2$ ] at 300K.  $R = 0.0821 \text{ Latm K}^{-1}\text{mol}^{-1}$ .

**Section C (Essays)**

*Answer any one questions.*

*The question carries 10 marks.*

20. Derive Bragg's equation and mention its application.
21. (a) What is meant by term standard electrode potential ? Outline method for its determination  
(b) Write a brief note on fuel cells.