C 62627 (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2019

(CUCBCSS—UG)

Chemistry

CHE 2C 02—PHYSICAL CHEMISTRY

Time : Three Hours Maximum : 64 Marks

Section A

Answer **all** *questions.*

Each question carries 1 *mark.*

1. ———— liquid crystals show the flow behavior of liquids.
2. The number of axes of symmetry in a cubic crystal are ————.
3. The net work that can be obtained from a system at constant pressure and temperature is called ————.
4. A calomel electrode is represented as ————.
5. Write down van't Hoff equation for osmotic pressure.
6. For a reversible process, the condition for entropy change is ————.
7. The cell dimension for a triclinic crystal is ————.
8. Give an example for basic buffer solution.
9. Write the Nernst equation to find out the potential of an electrode.
10. The smallest repeating units in a space lattice is called ————.

(10 × 1 = 10 marks)

Section B

Answer any **seven** *questions.*

Each question carries 2 *marks.*

11. What is standard hydrogen electrode ?
12. Why drops of a liquid or bubbles of a gas are spherical in shape ?
13. Give any two applications of liquid crystals.
14. Differentiate between intrinsic and extrinsic properties.
15. State Boyle's law.

Turn over

16. What is Ostwald's dilution law ?
17. Explain the term absolute entropy.
18. Define reverse osmosis.
19. What are Miller indices ? How are they determined ?
20. By conductance measurements how will you find out the solubility of a sparingly soluble salt ?

(7 × 2 = 14 marks)

Section C

Answer any **four** *questions.*
Each question carries 5 *marks.*

21. Explain the relation between specific conductance, equivalence conductance and molar conductance.
22. Comment on the criteria for spontaneity of a reaction based on free energy.
23. Calculate the r.m.s. velocity, average velocity and most probable velocity of hydrogen gas at 0°C.
24. Explain the effect of temperature and pressure on viscosity.
25. Describe the defects in crystals.
26. Write a note on conductometric titrations.

(4 × 5 = 20 marks)

Section D

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

27. (i) Give the van der Waal's equation for describing the P-V-T relationship in real gases. How the equation satisfactorily explains the deviation of real gases from ideal behavior ?
    (ii) Derive Bragg's equation.
28. (i) What are fuel cells ? Describe the functioning of H_2-O_2 fuel cell.
    (ii) Derive the degree of hydrolysis and hydrolysis constant of salt of a weak acid and strong base.
29. What are the factors influencing the solubility of gases in liquids ? Explain using Henry's law.
30. (i) What are the terms internal energy change and enthalpy change of a system ? Derive the relation between ΔU and ΔH.
    (ii) Calculate the entropy change in the evaporation of one mole of water at 100°C. (Heat of vaporization of water at 100°C is 2259.4 Jg^{-1})

(2 × 10 = 20 marks)

C 4120 **(Pages : 3)** **Name.....**

Reg. No.....

SECOND SEMESTER (CUCBCSS–UG) DEGREE EXAMINATION, APRIL 2021

Chemistry

CHE 2C 02—PHYSICAL CHEMISTRY

Time : Three Hours Maximum : 64 Marks

Section A (One word)

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

1. Thermodynamic system, which can exchange neither energy nor matter with the surroundings is called ———— system.
2. According to third law of thermodynamics, the entropy of a perfect crystal is zero at ————.
3. The deviation of a gas from ideal behaviour is maximum at high pressure and ————.
4. The edge lengths and interfacial angles of the unit cell of a crystal are given as $a = b = c$ and $\alpha = \beta = \gamma \neq 90^{o}$. The crystal system is ————.
5. The maximum number of Bravais lattices is ————.
6. The vapour pressure of a liquid becomes equal to one atmosphere at its normal ————.
7. Properties of solutions which depend on the number of particles dissolved and not on their nature are called ————.
8. The conductance of a column of electrolyte of unit volume is called ————.
9. For an aqueous solution of $Al_2(SO_4)_3$, the equivalent conductance λeq and molar conductance λm are related as ————.
10. The relation between the hydronium ion concentration $\left[H_{3O}^{+}\right]$, dissociation constant of the acid Ka and concentration of the acid 'C' is given a $\left[H_{3O}^{+}\right]$ = ————.

(10 × 1 = 10 marks)

Section B (Short Answer)

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

11. State the second law of thermodynamics in terms of entropy.
12. A gas contained in cylinder expands from a volume of 10 L to 20 L against a constant external pressure of one atmosphere. For this the gas absorbs 800 J heat from the surroundings. Calculate the change in internal energy of the gas, during the process.

Turn over

13. Amorphous solids are isotropic while crystalline solids are anisotropic. Explain.
14. Write the van der Waal's equation for '*n*' moles of a gas and explain the terms.
15. Find the Miller indices of a plane whose intercepts are 2*a*, 3*b* and 3*c*.
16. Mention any two applications of Henry's law.
17. What is the reason for surface tension of a liquid ?
18. What is the nature of NH_4Cl in water ? Give reason.
19. Write any two limitations of a Standard Hydrogen Electrode.
20. Calculate the osmotic pressure of an aqueous solution containing 6 gram glucose in one litre solution, at 300 K.

(7 × 2 = 14 marks)

Section C (Paragraph)

Answer any **four** *questions.*
Each question carries 5 *marks.*

21. The heat of combustion of $CH_4(g)$ is – 855 kJ mol^{-1} at 300 K, under constant volume condition. Calculate the heat of combustion of $CH_4(g)$ at constant pressure.
22. What is meant by the term 'entropy' ? How will you explain the spontaneity of a process in terms of entropy ?
23. With the help of a diagram, explain the effect of temperature in the distribution of velocities among different molecules in a gas.
24. Write briefly on the classification and applications of liquid crystals.
25. Compare the effect of dilution on the molar conductance of a strong electrolyte with that of a weak electrolyte.
26. Discuss the conductometric titration curves of :
    (i) Strong acid – strong base titration.
    (ii) Strong acid – weak base titration.

(4 × 5 = 20 marks)

Section D (Essay)

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

27. (i) What is meant by Gibb's free energy ? How is it physically significant ? (4 marks)
    (ii) Explain the effect of temperature in the spontaneity of a process in terms of ΔG, ΔS and ΔH. (4 marks)
    (iii) The enthalpy change associated with the fusion of 18 gram ice at 273 K is 6000 J. Calculate the molar entropy of fusion of ice, at 0^oC. (2 marks)

28. Give a brief account of the different types of imperfections in solids.

29. (i) From the laws of osmotic pressure derive the general solution equation. (4 marks)

(ii) Explain reverse osmosis. (3 marks)

(iii) What are reference electrodes ? Give example. (3 marks)

30. (i) What are buffer solutions ? How are they classified ? (4 marks)

(ii) In a buffer solution of CH_3COOH and CH_3COONa, the concentrations of the acid and salt are in the ratio 1 : 10. If the pKa value of CH_3COOH is 4.74, calculate the pH of the buffer. (3 marks)

(iii) The equivalent conductance at infinite dilution of NaCl, HCl and CH_3COONa are 126.5, 426 and 91 $Ohm^{-1}cm^2eq^{-1}$ respectively. Calculate the equivalent conductance at infinite dilution of CH_3COOH. (3 marks)

[2 × 10 = 20 marks]

C 4362 (Pages : 2) Name.....

Reg. No.....

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 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 ΔH = + and ΔS = – ve take place spontaneously ?

14. Diethyl ether boils at 35°C. Its heat of vaporization at its boiling point is 27.2 KJ mol^{-1}. Calculate entropy of vaporization ?

15. At what temperature would hydrogen gas molecules have same average speed as Helium atoms at 300 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 $H_2 – O_2$ 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 21782 **(Pages : 3)** **Name.....**

Reg. No.....

SECOND SEMESTER (CUCBCSS–UG) DEGREE EXAMINATION, APRIL 2022

Chemistry

CHE 2C 02—PHYSICAL CHEMISTRY

(2016–2018 Admissions)

Time : Three Hours Maximum : 64 Marks

Section A (One Word)

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

1. A cup of tea is an open system because it is in a position to exchange both energy and ———— with the surroundings.
2. A gas will show ideal behaviour at high temperature and ————.
3. The unit cell of a crystal resembled a match box in its geometry. The crystal system to which it belongs is ————.
4. Graphs plotted in accordance with Boyle's law are called ————.
5. The average velocity of a gas is directly proportional to the square root of ————.
6. At the normal B.P. of a liquid, its vapour pressure becomes equal to ————.
7. Van der Waal's constant 'a' is a measure of ———— in a gas.
8. Schottky defect is an example of ———— point defect.
9. The reduction potential value of SHE is taken as ————.
10. A decrease in value of specific conductance of a weak electrolyte on dilution is due to a decrease in the ———— per unit volume.

(10 × 1 = 10 marks)

Section B (Short Answer)

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

11. State the third law of thermodynamics.
12. What is the significance of internal energy change of a reaction ?
13. Write the Bragg's equation and explain the terms.
14. Why do gases deviate from ideal behaviour ?
15. Calculate the Miller indices of a plane whose intercepts are 2a, 3b and c.

Turn over

16. State Henry's law.

17. Explain the effect of temperature in the viscosity of a liquid.

18. Aqueous solution of Na_2CO_3 is basic in nature. Why ?

19. The molar conductance of 10^{-3} molar aqueous solution of a weak acid is 60 s cm^2 mol^{-1}, while that at infinite dilution is 400 s cm^2 mol^{-1}. Calculate the degree of ionisation of the acid, at this concentration.

20. What are reference electrodes ? Give example.

(7 × 2 = 14 marks)

Section C (Paragraph)

Answer any **four** *questions.*
Each question carries 5 *marks.*

21. (i) State and formulate the first law of thermodynamics. (3 marks)

(ii) A system does work equivalent to 350 J, by absorbing 500 J of heat from an external source. Calculate the change in internal energy associated with the system.

(2 marks)

22. (i) Derive an equation to relate the internal energy change and enthalpy change of a reaction.

(3 marks)

(ii) Calculate the entropy of fusion of ice at 0°C. Given the enthalpy of fusion of ice as 6×10^3 J mol^{-1}.

(2 marks)

23. Which are the different types of liquid crystals ? Write any three applications of liquid crystals.

24. (i) What are colligative properties ? Give examples. (3 marks)

(ii) A solution containing 10 gram of a non-volatile solute per litre of the solution shows an osmotic pressure of 1.3 atm at 27°C. Calculate the molar mass of the solute.

(2 marks)

25. What are conductometric titrations ? Explain the conductometric titration curve of a strong acid against strong base.

26. (i) Derive the Henderson equation for the pH of an acidic buffer. (3 marks)

(ii) A monoprotic acid in its 0.1 molar solution inonises to 10^{-3} %. Calculate the ionisation constant of the acid.

(2 marks)

(4 × 5 = 20 marks)

Section D (Essay)

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

27. (i) What is the physical significance of Gibb's free energy. (3 marks)

(ii) Explain the effect of temperature in the spontaneity of a process. (4 marks)

(iii) For a Chemical reaction, the values of ΔH and ΔS respectively are –49 $kJmol^{-1}$ and – 40.2Jk^{-1} mol^{-1}. Calculate the temperature upto which the reaction can proceed spontaneously. (3 marks)

28. (i) Write briefly on the features of Maxwell Boltzmann distribution curve. What is the effect of temperature in the distribution of molecular velocities ? (5 marks)

(ii) Calculate the most probable velocity of O_2 gas at 300 K. (3 marks)

(iii) What are the extrinsic and intrinsic imperfections ? (2 marks)

29. (i) Explain the process of 'reverse osmosis'. Mention any two applications of the process. (5 marks)

(ii) Explain Kohlrausch's law of independent migration of ions. How is the law applied in calculating the λ_m^o value of weak electrolytes ? (5 marks)

30. (i) Give a brief account of the construction and working of a calomel electrode. (3 marks)

(ii) Write the cell reaction and calculate the EMF of the cell $Fe \mid {}^{Fe^{2+}}_{(0.01M)} \mid \mid {}^{Ni^{2+}}_{(.001M)Ni}$ at 298K. Given $E^oFe^{2+}/Fe = -0.44\,V$ and $E^o\,Ni^{2+}/Ni = -0.25\,V$. (4 marks)

(iii) What are fuel cells ? Give example. (3 marks)

[2 × 10 = 20 marks]

C 22063 **(Pages : 2)** **Name.....**

Reg. No.....

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)

C 23851 **(Pages : 2)** **Name.....**

Reg. No.....

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 IM H_2SO_4 at 298K is 0.26 ohm^{-1} 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 : $N_2 + 3H_2 \longrightarrow 2NH_{3(g)}$ $\Delta H^o = -92.22KJ$ and $\Delta S^o = 0.1981KJK^{-1}$ at 25°C. Calculate standard free energy of formation of NH_3 at 25°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 2.25cm^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 43160 (Pages : 2) Name.....

Reg. No.....

SECOND SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2023

Chemistry

CHE 2C 02—PHYSICAL CHEMISTRY

(2019—2022 Admissions)

Time : Two Hours Maximum : 60 Marks

Section A (Short Answers)

Answer questions up to 20 *marks.*

Each question carries 2 *marks.*

1. State first law of thermodynamics and give its mathematical expression.
2. What is a spontaneous process ? Mention the criteria for spontaneity in terms of free energy.
3. Define surface tension ? What is the effect of temperature on surface tension of a liquid.
4. What are colligative properties ? Give one example.
5. Define specific conductance of an electrolyte solution. Explain the variation of specific conductance with dilution.
6. Give any *four* advantages of conductometric titrations.
7. Write down Bragg's equation and explain the terms involved.
8. What is meant by electrode potential? What is the value of electrode potential for Standard Hydrogen electrode ?
9. How does temperature and pressure influence the solubility of gases in liquids ?
10. Write any four postulates of kinetic molecular theory of gases.
11. If the pressure and temperature of 6 litres of a gas is doubled, what would be its volume ?
12. Define RMS velocity and give its mathematical expression derived from Maxwell equation.

[Ceiling of marks : 20]

Turn over

Section B (Paragraph)

Answer questions up to 30 *marks.*
Each question carries 5 *marks.*

13. What are fuel cells ? Describe the functioning of $H_2 - O_2$ fuel cell.

14. (a) Account for the entropy change of the universe for a reversible process with suitable explanation.

    (b) Calculate the entropy change in melting of 1 Kg of ice at 25°C. Heat of fusion of ice is 334.72 Jg^{-1}.

15. Briefly explain the principle of conductometric titration with reference to weak acid-strong base titration.

16. Explain Maxwell distribution of molecular velocities using suitable diagram.

17. What are miller indices? Determine the miller indices for a plane when the intercepts along the axis are : (i) 2a, 3b and 2c ; and (ii) 1a, 2b and 3c.

18. Explain the determination of molecular mass using any one of the colligative properties.

19. Write a short note on non-stoichiometric defects in crystals.

[Ceiling of marks : 30]

Section C (Essay)

Answer any **one** *question.*
The question carries 10 *marks.*

20. (a) Describe buffer solutions with an example each for acidic and basic buffer. Explain the buffer action of acetic acid/sodium acetate buffer.

(5 marks)

    (b) State Kohlrausch's law and explain any two applications of the law. (5 marks)

21. (a) Write a short note on various symmetry elements in crystals. (5 marks)

    (b) Write down the van der Waals equation and explain the terms. Give a detailed account for the deviation of real gases from ideal behaviour.

(5 marks)

[1 × 10 = 10 marks]