

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 $\Delta H = +$ and $\Delta S = -$ 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 $\text{H}_2 - \text{O}_2$ 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)

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SECOND SEMESTER B. Sc. DEGREE EXAMINATION

CBCSSUG - CHEMISTRY

CHE2C02; Complementary Course: II

PHYSICAL CHEMISTRY

Time: Two Hours

Maximum: 60 Marks

Scheme

(Answer questions up to 20 marks. Each question carries 2 marks)

1. The first law of thermodynamics states that energy can neither be created nor destroyed but can be transformed from one form to another. $\Delta E = q + W$
2. Unit cell is the fundamental unit from which entire crystal is constructed and space lattice is a three dimensional infinite array of points each of which is surrounded in an identical way by its neighbor.
3. (2 2 1)
4. Average velocity is arithmetic mean of different velocities of gas molecules. $\langle C \rangle = (C_1 + C_2 + C_3 + \dots + C_n)/n = (8RT/nM)^{1/2}$ and most probable velocity is defined as velocity possessed by maximum number of molecules. $C_{MPV} = (2RT/M)^{1/2}$.
5. $[P + (n^2a/V^2)][V-nb] = nRT$. Explain terms.
6. Vapour pressure of a liquid can be defined as the pressure of vapour in equilibrium with a liquid at a given temperature. As temperature increase V.P also increases as more molecules attain energy to escape from surface.
- ~~7. The factors that affect viscosity of a liquid increase in temperature decrease viscosity, presence of other colloidal substance increases viscosity. Higher molecular mass, branching of alkyl chain, intermolecular H-bonding increase viscosity.~~
8. Boyle-Vant Hoff law states that temperature remaining constant, osmotic pressure of a solution is directly proportional to its molar concentration.
9. Strong electrolytes undergoes complete dissociation at moderately high concentration. examples. HCl, NaOH.
10. Ans: $0.01 \text{ohm}^{-1} \text{cm}^{-1}$
11. The reduction potential of an electrode at standard conditions measured relative to normal hydrogen electrode is called standard electrode potential.
12. The solution that resist change in its p H on adding small amount of acids or bases is called buffer solution. Eg. CH_3COOH and CH_3COONa .

Section B (Paragraph)

(Answer questions up to 30 marks. Each question carries 5 marks)

13. Enthalpy is the heat content of a system, $H=E + PV$ (1.5 marks). Free energy is the maximum amount of energy available with it that can be converted into useful work. $\Delta G = \Delta H - T\Delta S$ (1.5 marks). A process for which $\Delta H = +$ and $\Delta S = -ve$ ΔG is +ve nonspontaneous (2 mark).
14. $\Delta S_{vap} = (\Delta H / Q) = 88.31 \text{JK}^{-1} \text{mol}^{-1}$. Equation-1 mark, correct substitution-2 marks, correct ans.- 1mark, unit- 1 mark.

15. Av. Speed = $(8RT/\pi M)^{1/2}$ MPV = $(2RT/M)^{1/2}$ Ans : 150 K correct equation 1 mark each, correct substitution 1 mark each correct ans. 1 mark each.
16. According to second law of thermodynamics, for an irreversible process, entropy change of the universe, sum total of entropy changes of the system and surroundings is positive. Illustrate and explanation (4 marks). $\Delta S_{\text{universe}} = \Delta S_{\text{system}} + \Delta S_{\text{surrounding}} > 0$ with explanation (1 mark)
17. osmotic pressure of solution can be measured experimentally by Berkeley and Hartley's method explain Diagram -1 mark, principle, working and explanation -4 marks
18. Surface tension of liquid is defined as the work required to increase the surface area by one unit. Unit of S.T is Jm^{-2} or Nm^{-1} (2 marks). The work required to enlarge the surface of separation between two immiscible liquids or liquid and vapour phase is called interfacial surface energy (1 mark). Greater the intermolecular forces greater is the S.T surface tension on basis of intermolecular attraction. As temperature increases S.T decreases. (2 marks).
19. fuel cells is a galvanic cell in which energy of a fuel oxidation reaction is directly converted to electrical energy. (1 mark) At anode: $2\text{H}_2 + 4\text{OH}^- \rightarrow 4\text{H}_2\text{O} + 4\text{e}^-$ (oxidation). At cathode: $\text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^- \rightarrow 4\text{OH}^-$ (Reduction). Net reaction: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ (3 marks)
List advantage of fuel cell. 1. High efficiency 2. Very light 3. since no direct combustion pollution free (1 mark)

Section C (Essay)

~~Answer any one. Each question carries 10 marks~~

- ~~20. Reasons for deviation (3 marks) volume correction & pressure correction (4marks). Vander Waals equation & Vander Waals constant (3 marks).~~
21. (a) Derivation of $K_a = [c\alpha^2/c(1-\alpha)]$, explain terms (3+2 marks) and its limitations: it applies only to weak electrolyte (1 marks) (b) give equation or explanation for both in aq. Solution (3 marks). Acetic acid and KOH, KOH being strong base, solution is basic. Ammonium hydroxide and nitric acid, nitric acid being strong medium acidic. With proper explanation (4 marks).

C 22063

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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 1M H_2SO_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°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 82418

(Pages : 2)

Name.....

Reg. No.....

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 $(-a, b, \alpha)$.
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. ΔH and ΔS for the reaction $2\text{NO}_{(g)} + \text{O}_{2(g)} \rightarrow 2\text{NO}_{2(g)}$ at 700K are -112.9 KJ and -145.5 JK^{-1} . Calculate ΔG 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.

C 5626

(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2016

(CUCBCSS—UG)

Complementary Course

CHE 2C 02—PHYSICAL CHEMISTRY

Time : Three Hours

Maximum : 64 Marks

Section A (One word/sentence)

Answer all questions.

Each question carries 1 mark.

1. A sealed thermosflask containing hot tea is an example of _____ system.
2. According to _____ law, the volume of a fixed mass of gas varies directly as the absolute temperature.
3. _____ solids are isotropic.
4. The unit cell of a crystal resembled a matchbox in its shape. The crystal belongs to _____ crystal system.
5. There are _____ Bravais lattices in a cubic crystal.
6. What is the SI unit of viscosity ?
7. At the normal B.P. of liquid its _____ becomes equal to atmospheric pressure.
8. The hydronium ion concentration, in an aqueous solution of CH_3COOH , in terms of dissociation constant K_a and concentration 'C' can be expressed as $[\text{H}_3\text{O}^+] = \text{_____}$.
9. When NH_4Cl is dissolved in water, the pH will _____.
10. For $\text{Fe}_2(\text{SO}_4)_3$ solution, the equivalent conductance λ_{eq} and molar conductance λ_{m} are related as _____.

(10 × 1 = 10 marks)

Section B (Short Answer)

Answer any seven questions.

Each question carries 2 marks.

11. Write the Mathematical formulation of the first law of thermodynamics.
12. What is the physical significance of Gibb's free energy ?
13. What are the faulty assumptions in kinetic molecular model ?
14. Calculate the most probable velocity of N_2 molecule at 300 K.
15. Derive the Miller indices of a crystal plane having intercepts $2a$, $2b$ and $3c$.

Turn over

16. Explain the effect of temperature in the surface tension of a liquid.
17. What is reverse osmosis ?
18. Write the principle of conductometric titrations.
19. The molar conductance of 10^{-3} M aqueous solution of weak acid HA is $60 \text{ S cm}^2 \text{ mol}^{-1}$. If the molar conductance at infinite dilution of H^+ and $\bar{\text{A}}$ are 250 and $150 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$, respectively. Calculate the degree of dissociation of the acid at this concentration.
20. The resistance of 0.01 M solution of a weak acid is 5×10^3 ohms, when taken in a conductivity cell of cell constant 0.5 cm^{-1} . Calculate the molar conductance of the solution.

(7 × 2 = 14 marks)

Section C (Paragraph)

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

21. Using Gibbs-Helmholtz equation, illustrate the effect of temperature on the spontaneity of a reaction.
22. (a) Giving any *one* statement of the second law of thermodynamics.
(b) The standard molar enthalpy fusion of ice is 6.00 kJ mol^{-1} at 0°C . Calculate the entropy of fusion of ice.
23. What are liquid crystals ? How are they classified ? Explain.
24. What are colligative properties ? Explain the determination of molecular mass of a solute from colligative property values.
25. Explain the construction and working of a calomel electrode.
26. Write the cell reaction and calculate the EMF at 25°C ., of the cell $\text{Fe} | \text{Fe}_{(0.1\text{M})}^{2+} || \text{Ni}_{(0.01\text{M})}^{2+} | \text{Ni}$; Given $E^\circ \text{Fe}^{2+}/\text{Fe} = -0.44 \text{ V}$ and $E^\circ \text{Ni}^{2+}/\text{Ni} = -0.25 \text{ V}$.

(4 × 5 = 20 marks)

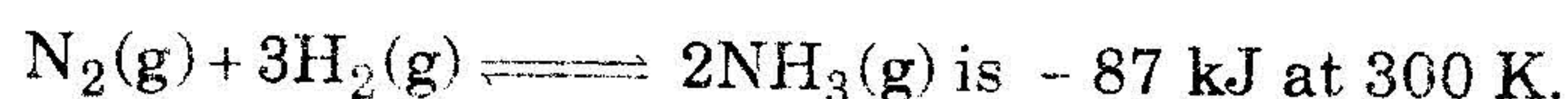
Section D (Essay)

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

27. (a) Derive the relation between Enthalpy change and Internal energy change of a reaction.

(4 marks)

- (b) The internal energy change for the reaction :



Calculate the value of ΔH at 300 K .

(3 marks)

- (c) State and explain Third law of thermodynamics.

(3 marks)

28. (a) What are the features of the kinetic molecular model of gases ? (4 marks)
(b) Write briefly on the different types of defects in crystals. (6 marks)
29. (a) State and explain Henry's law. Mention any *two* applications of the law. (5 marks)
(b) Derive an equation for the pH of an acidic buffer. (5 marks)
30. (a) Explain the effect of dilution in the conductance of weak and strong electrolytes.
(b) Discuss the construction and working of H_2-O_2 fuel cell.

(2 × 10 = 20 marks)

**SECOND SEMESTER B.Sc. DEGREE EXAMINATION
MAY 2014**

(UG-CCSS)

Complementary Course – Chemistry

CH 2C 03 – PHYSICAL CHEMISTRY – I

Time : Three Hours

Maximum : 30 Weightage

I. Answer all the *twelve* questions. Each question carries a weightage of $\frac{1}{4}$. This section contains multiple choice, fill in the blanks and one word answer type questions :

1. Which of the following molecules is IR inactive ?

- (a) HCl. (b) NO.
(c) N₂. (d) CO.

2. An isotropic solid among the following is :

- (a) Diamond. (b) Graphite.
(c) Glass. (d) NaCl.

3. The unit cell of a crystal resembled a match box in its shape. The crystal belongs to :

- (a) Tetragonal system. (b) Monoclinic system.
(c) Rhombohedral system. (d) Orthorhombic system.

4. When the N/P ratio is high, a radioactive isotope undergoes :

- (a) β emission. (b) Positron emission.
(c) K-electron capture. (d) Proton emission.

5. The unit of rate constant for a reaction is found to be the same as the unit of rate. The order of the reaction is :

- (a) Zero. (b) One.
(c) Two. (d) Three.

6. The rate of a reaction is dependent on :

- (a) Concentration of reactants. (b) Temperature.
(c) Nature of the reactants. (d) All these.

7. The essential requirement for a molecule to give rotational spectrum is that, the molecule should possess _____.

Turn over

8. In a body centered cube, the radius of the particle ' r ' and edge length of the unit cell ' a ' are related as _____.
9. The very high temperature of the sun is due to _____.
10. The minimum amount of energy that must be possessed by the reactant molecules, to undergo an effective collision is called _____.
11. A catalytic process in which the catalyst and reactants are in the same phase is known as _____.
12. 'Only that radiation which is absorbed by the reactants can bring about a photochemical change'. This statement is in accordance with _____ law.

(12 × ¼ = 3 weightage)

II. Answer all *nine* questions. Each question carries a weightage of 1 :

13. How is the unit of energy joule related to that in erg and electron volt?
14. State the Franck-Condon principle.
15. Name the different energy levels present in a molecule.
16. Which are the different types of symmetry elements present in crystals?
17. Crystalline solids are anisotropic. Why?
18. Find the Miller indices of a plane whose intercepts are $2a$, $3b$ and c ?
19. What are isotones? Give one example.
20. Define binding energy.
21. What is meant by quantum yield of a photochemical reaction?

(9 × 1 = 9 weightage)

III. Answer any *five* questions. Each question carries a weightage of 2 :

22. Write briefly on the principle of microwave spectra.
23. Discuss the structure of NaCl crystal.
24. Explain the detection of isotopes by Aston's mass spectrograph.
25. What is carbon dating? Explain.
26. Derive the integrated rate equation for a second order reaction of the type $2A \rightarrow \text{products}$.
27. Explain the adsorption theory of catalysis.
28. The half life period of a first order reaction is 120 minutes. Calculate the time required for 90% completion of the reaction.

(5 × 2 = 10 weightage)

IV. Answer any *two* questions. Each question carries a weightage of 4 :

29. Discuss the principle of NMR spectroscopy. What all information about a proton can be obtained from the NMR spectrum? Explain.

30. (i) Derive the Bragg's equation.

(ii) What are extrinsic and intrinsic imperfections? Give examples.

31. (i) Explain the effect of temperature on the rate of a reaction.

(ii) Write the Arrhenius equation and explain how the Arrhenius parameters are calculated.

(2 × 4 = 8 weightage)

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SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2015

(CUCBCSS-UG)

Complementary Course – Chemistry

CHE 2C 02 – Complementary Course II – PHYSICAL CHEMISTRY

Time : Three Hours

Maximum : 64 Marks

Section A (One Word/Sentence)*Answer all questions.**Each question carries 1 mark.*

1. According to the third law of thermodynamics, the entropy of a perfect crystal is zero at _____.
2. The average velocity of a gas varies directly as the square root of _____.
3. Name the most unsymmetrical crystal system.
4. _____ solids are anisotropic.
5. The maximum number of Bravais lattices possible for crystals is _____.
6. Write the S.I. unit of surface tension.
7. Viscosity of a liquid _____ with increase in temperature.
8. Specific conductance is the reciprocal of _____.
9. When Na_2CO_3 is dissolved in water the pH of the solution will _____.
10. For $\text{Al}_2(\text{SO}_4)_3$ solution, the equivalent conductance λ_{eq} and molar conductance λ_{m} are related as _____.

(10 × 1 = 10 marks)

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

11. State the first law of thermodynamics.
12. What are open and closed systems? Give one example each.
13. Write the vander Waal's equation for 'n' moles of a gas and explain the terms.
14. Calculate the RMS velocity of hydrogen molecule at 300 K.
15. Calculate the Miller indices of a plane whose intercepts are 2a, 3b and 2c.
16. State Henry's law.

Turn over

17. Write any *two* factors that affect the vapourisation of a liquid.
18. Write any *four* advantages of conductometric titrations.
19. The molar conductance of infinite dilution of CH_3COONa , HCl and NaCl in $\text{S cm}^2 \text{ mol}^{-1}$, are 91,426.2 and 126.5 respectively. Calculate the λ_m^∞ value of CH_3COOH .
20. The resistance of a 10^{-2} N solution of a weak acid is 5×10^3 ohms, in a conductivity cell of cell constant 0.5 cm^{-1} . Calculate the equivalent conductance of the solution at this concentration.

(7 × 2 = 14 marks)

Section C (Paragraph)

Answer any **four** questions.

Each question carries 5 marks.

21. (i) Derive an equation to relate the enthalpy change and internal energy change of a reaction.
 (ii) The enthalpy change for the reaction $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$ is -890.5 kJ at 300 K . Calculate the value of internal energy change at the same temperature.
22. (i) State the second law of thermodynamics based on entropy.
 (ii) The enthalpy of vapourisation of water is 40.6 kJ mol^{-1} at 100° C . Calculate the entropy of vapourisation at 100° C .
23. What are the features of Maxwell's distribution curve? Explain the effect of temperature on the distribution.
24. Explain reverse osmosis. Write any *two* applications of reverse osmosis.
25. What are reference electrodes? Explain the construction and working of a standard Hydrogen Electrode.
26. Explain the effect of dilution in the specific conductance and molar conductance of a strong electrolyte.

(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? Explain the effect of temperature in the spontaneity of a reaction.
 (ii) The enthalpy change and entropy change for the decomposition of H_2O_2 , are -212 kJ mol^{-1} and 132 J mol^{-1} respectively. Predict the feasibility of the process at 300 K .
28. (i) What are liquid crystals? Name the different types of liquid crystals. Mention any *four* applications of liquid crystals.
 (ii) Explain the different types of stoichiometric defects.

(6 + 4 = 10 marks)

(6 + 4 = 10 marks)

29. (i) From the laws of osmotic pressure, derive an equation for the molecular mass of a solute.
- (ii) Write the cell reaction taking place in the electrochemical cell $\text{Zn}/\text{Zn}^{2+} (10^{-3} \text{ m}) \parallel \text{Ag}^+ (10^{-1} \text{ m}) \mid \text{Ag}$ and calculate the EMF of the cell at 25°C . Given $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$ and $E^0_{\text{Ag}^+/\text{Ag}} = 0.80 \text{ V}$.
30. (i) What are buffer solutions? How are they classified? Derive an equation for the pH for a buffer.
- (ii) Explain the working of a $\text{H}_2\text{-O}_2$ fuel cell.

(6 + 4 = 10 marks)

[2 × 10 = 20 marks]

C 5626

(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2016

(CUCBCSS—UG)

Complementary Course

CHE 2C 02—PHYSICAL CHEMISTRY

Time : Three Hours

Maximum : 64 Marks

Section A (One word/sentence)

Answer all questions.

Each question carries 1 mark.

1. A sealed thermosflask containing hot tea is an example of _____ system.
2. According to _____ law, the volume of a fixed mass of gas varies directly as the absolute temperature.
3. _____ solids are isotropic.
4. The unit cell of a crystal resembled a matchbox in its shape. The crystal belongs to _____ crystal system.
5. There are _____ Bravais lattices in a cubic crystal.
6. What is the SI unit of viscosity ?
7. At the normal B.P. of liquid its _____ becomes equal to atmospheric pressure.
8. The hydronium ion concentration, in an aqueous solution of CH_3COOH , in terms of dissociation constant K_a and concentration 'C' can be expressed as $[\text{H}_3\text{O}^+] = \text{_____}$.
9. When NH_4Cl is dissolved in water, the pH will _____.
10. For $\text{Fe}_2(\text{SO}_4)_3$ solution, the equivalent conductance λ_{eq} and molar conductance λ_m are related as _____.

(10 × 1 = 10 marks)

Section B (Short Answer)

Answer any seven questions.

Each question carries 2 marks.

11. Write the Mathematical formulation of the first law of thermodynamics.
12. What is the physical significance of Gibb's free energy ?
13. What are the faulty assumptions in kinetic molecular model ?
14. Calculate the most probable velocity of N_2 molecule at 300 K.
15. Derive the Miller indices of a crystal plane having intercepts $2a$, $2b$ and $3c$.

Turn over

16. Explain the effect of temperature in the surface tension of a liquid.
17. What is reverse osmosis ?
18. Write the principle of conductometric titrations.
19. The molar conductance of 10^{-3} M aqueous solution of weak acid HA is $60 \text{ S cm}^2 \text{ mol}^{-1}$. If the molar conductance at infinite dilution of H^+ and $\bar{\text{A}}$ are 250 and $150 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$, respectively. Calculate the degree of dissociation of the acid at this concentration.
20. The resistance of 0.01 M solution of a weak acid is 5×10^3 ohms, when taken in a conductivity cell of cell constant 0.5 cm^{-1} . Calculate the molar conductance of the solution.

(7 × 2 = 14 marks)

Section C (Paragraph)

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

21. Using Gibbs-Helmholtz equation, illustrate the effect of temperature on the spontaneity of a reaction.
22. (a) Giving any *one* statement of the second law of thermodynamics.
(b) The standard molar enthalpy fusion of ice is 6.00 kJ mol^{-1} at 0°C . Calculate the entropy of fusion of ice.
23. What are liquid crystals ? How are they classified ? Explain.
24. What are colligative properties ? Explain the determination of molecular mass of a solute from colligative property values.
25. Explain the construction and working of a calomel electrode.
26. Write the cell reaction and calculate the EMF at 25°C ., of the cell $\text{Fe} | \text{Fe}_{(0.1\text{M})}^{2+} || \text{Ni}_{(0.01\text{M})}^{2+} | \text{Ni}$; Given $E^\circ \text{Fe}^{2+}/\text{Fe} = -0.44 \text{ V}$ and $E^\circ \text{Ni}^{2+}/\text{Ni} = -0.25 \text{ V}$.

(4 × 5 = 20 marks)

Section D (Essay)

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

27. (a) Derive the relation between Enthalpy change and Internal energy change of a reaction.

(4 marks)

- (b) The internal energy change for the reaction :



Calculate the value of ΔH at 300 K .

(3 marks)

- (c) State and explain Third law of thermodynamics.

(3 marks)

28. (a) What are the features of the kinetic molecular model of gases ? (4 marks)
(b) Write briefly on the different types of defects in crystals. (6 marks)
29. (a) State and explain Henry's law. Mention any *two* applications of the law. (5 marks)
(b) Derive an equation for the pH of an acidic buffer. (5 marks)
30. (a) Explain the effect of dilution in the conductance of weak and strong electrolytes.
(b) Discuss the construction and working of H_2-O_2 fuel cell.

(2 × 10 = 20 marks)

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(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 H₂-O₂ 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)

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(Pages : 3)

Name.....

Reg. No.....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2017

(CUCBCSS—UG)

Complementary Course

CHE 2C 02—PHYSICAL CHEMISTRY

Time : Three Hours

Maximum : 64 Marks

Section A

Answer all questions.

Each question carries 1 mark.

1. The number of atoms per unit cell with BCC lattice is _____.
2. The miller indices of a plane with intercepts $1a$, $2b$, $3c$ is given by _____
3. If the RMS velocity of CH_4 gas is 100 ms^{-1} , the RMS velocity of SO_2 gas molecules at the same temperature will be _____.
4. Name a property which is inversely proportional to critical volume.
5. What is meant by path function ?
6. A thermodynamic process without change in volume is called _____.
7. For an ideal solution, the value of $\Delta_{\text{mix}}H$ is _____.
8. In thermodynamics, what is the relationship between q_p and q_v ?
9. Which among the metals Zn, Cu and Ag will liberate hydrogen from dil. HCl ?
10. Write the Nernst equation for the electrode $\text{Cu} | \text{Cu}^{2+}$.

(10 × 1 = 10 marks)

Section B

Answer any seven questions.

Each question carries 2 marks.

11. For the reaction $\text{A}_{2(\text{g})} + \text{B}_{2(\text{g})} \rightarrow 2\text{AB}_{(\text{g})}$; $\Delta H = 80 \text{ kJ}$, $\Delta S = 130 \text{ J}$ at 300K . Is the reaction spontaneous ? If not predict the temperature above which the reaction is spontaneous
12. Using X-rays of wave length 0.0576 nm first order diffraction was recorded at $6^\circ 54'$ for a single crystal. Calculate the interplanar distance.

Turn over

13. What is electro chemical series ? Give any *two* of its utility.
14. Calculate the average velocity of nitrogen molecule at STP
15. Define conductivity of a conductor. How is it related to the resistance of the conductor ?
16. State and explain Kohlraush's law. Mention any *one* of its applications.
17. EMF of a galvanic cell formed by coupling hydrogen electrode with saturated calomel electrode was found to be 0.45 V. What is the P^H of the solution at the hydrogen electrode ? (Given $E^0_{(red)} = 0.24V$).
18. At 298K, the ionization constant of 0.1 M acetic acid has a value of 4.9×10^{-8} . Calculate P^H of the solution.
19. What is meant by anisotropic property ? Give one example.
20. Define Henry's law. Mention one of its applications.

(7 × 2 = 14 marks)

Section C

Answer any four questions.

Each question carries 5 marks.

21. Show that decrease in Gibbs free energy in a process is equal to the useful work done by the system.
22. Discuss how van der waal's equation address deviation of real gases from ideal behavior ?
23. Derive the Bragg equation.
24. At 25°C, the conductivity of 0.1M KCl is $0.01291 \text{ ohm}^{-1} \text{ cm}^{-1}$. Its resistance in a conductivity cell at the same temperature is found to be 192.4 ohm. A solution of another electrolyte BA with concentration 0.01M offers a resistance of 250 ohms in the same cell. Calculate the molar conductance of BA
25. What is calomel electrode ? Give the Nernst equation for the *emf* of the electrode.
26. What are liquid crystals ? Write a note on the types of liquid crystals

(4 × 5 = 20 marks)

Section D

Answer any two questions.

Each question carries 10 marks.

27. (a) What are liquid crystals? How are they classified? Give any *one* example for each type.
(b) Write a note on Maxwell's equation for the distribution of molecular velocity.
28. (a) Define and differentiate entropy and enthalpy. Explain the entropy criteria for reversible and irreversible processes.
(b) Write a note on the laws of crystallography.
29. (a) Define Raoult's law. Explain how the determination of elevation in boiling point can be used for the determination of molecular mass.
(b) Write a note on the different types of defects in crystals.
30. Define Kohlrausch's law. Discuss the different applications of it.

(2 × 10 = 20 marks)