

Version No.			

ROLL NUMBER						



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1	1	1	1
2	2	2	2
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Answer Sheet No. _____

Sign. of Candidate _____

Sign. of Invigilator _____

CHEMISTRY HSSC-I (2nd Set)

SECTION – A (Marks 17)

Time allowed: 25 Minutes

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

Q.1 Fill the relevant bubble for each part. Each part carries one mark.

- The least number of molecules are present in 30g of:

A. N ₂ O	<input type="radio"/>	B. NO	<input type="radio"/>
C. NO ₂	<input type="radio"/>	D. N ₂ O ₃	<input type="radio"/>
- The largest bond angle is present in:

A. CH ₄	<input type="radio"/>	B. SCl ₂	<input type="radio"/>
C. NH ₃	<input type="radio"/>	D. BCl ₃	<input type="radio"/>
- The difference in angular momentum of electron which jumps from 3rd orbit to 6th orbit of hydrogen atom will be:

A. $3\left(\frac{h}{2\pi}\right)$	<input type="radio"/>	B. $3\left(\frac{h}{\pi}\right)$	<input type="radio"/>
C. $6\left(\frac{h}{2\pi}\right)$	<input type="radio"/>	D. $6\left(\frac{h}{\pi}\right)$	<input type="radio"/>
- Which one of the following salts turns red litmus blue upon hydrolysis?

A. K ₂ SO ₄	<input type="radio"/>	B. NaCl	<input type="radio"/>
C. Na ₂ CO ₃	<input type="radio"/>	D. NH ₄ Cl	<input type="radio"/>
- Identify the unit of rate constant (K) for the given reaction:

2A+B $\xrightarrow{\hspace{2cm}}$ Product		when Rate= K [A][B]	
A. s ⁻¹	<input type="radio"/>	B. mol dm ⁻³ s ⁻¹	<input type="radio"/>
C. dm ³ mol ⁻¹ s ⁻¹	<input type="radio"/>	D. dm ⁶ mol ⁻² s ⁻¹	<input type="radio"/>
- The 3rd line in the Balmer Series of Bohr's Hydrogen spectrum is due to the transition of electron:

A. From 4 th shell to 1 st shell	<input type="radio"/>		
B. From 4 th shell to 2 nd shell	<input type="radio"/>		
C. From 5 th shell to 1 st shell	<input type="radio"/>		
D. From 5 th shell to 2 nd shell	<input type="radio"/>		

7. If Principal quantum number (n) = 3, the total magnetic quantum numbers (m) will be:
- A. 3 B. 6
 C. 9 D. 12
8. A gas x diffuses four times faster than SO_2 gas. The molar mass of gas x will be:
- A. 2 g/m B. 4 g/m
 C. 16 g/m D. 64 g/m
9. A real gas that obeys Vander Wall's equation $(p + \frac{an^2}{v^2} + (v - nb) = nRT)$ behaves like an ideal gas when
- A. 'a' is large & 'b' is small
 B. 'a' is small & 'b' is large
 C. 'a' & 'b' are large
 D. 'a' & 'b' are small
10. NaCl is a crystalline solid which has face centered cubic structure. The Na^+ ion at the face of the unit cell is shared by:
- A. Two unit cells B. Four unit cells
 C. Six unit cell D. Eight unit cells
11. The transition temperature of tin grey and tin white is:
- A. 13.2°C B. 18°C
 C. 95.5°C D. 128.5°C
12. The vapor pressure of a liquid depends upon the following, **EXCEPT**:
- A. Nature of liquid B. Temperature
 C. Inter molecular forces D. Amount of liquid
13. The standard electrode potential of different elements are measured with the help of Standard Hydrogen Electrode (SHE). The standard conditions at which SHE is operated are:
- A. 2.00M HCl solution, 1 atm H_2 at 0 K.
 B. 1.00M HCl solution, 1 atm H_2 at 298 K.
 C. 1.00M HCl solution, 2 atm H_2 at 0 K.
 D. 1.00M HCl solution, 1 atm H_2 at 273 K.
14. 20 grams of glucose dissolved in water to prepare a solution of 10 % w / v concentration. The volume of the solution will be:
- A. 100 cm^3 B. 200 cm^3
 C. 2000 cm^3 D. 2500 cm^3
15. A buffer solution resists the change of its pH upon adding small amount of strong acid or base. Which one of the following is an example of a buffer solution?
- A. Mixture of $\text{NH}_4\text{Cl}_{(\text{aq})}$ and $\text{NH}_4\text{NO}_3_{(\text{aq})}$
 B. Mixture of $\text{NH}_4\text{Cl}_{(\text{aq})}$ and $\text{NaCl}_{(\text{aq})}$
 C. Mixture of $\text{CH}_3\text{COONa}_{(\text{aq})}$ and $\text{NH}_4\text{Cl}_{(\text{aq})}$
 D. Mixture of $\text{NH}_4\text{Cl}_{(\text{aq})}$ and $\text{NH}_4\text{OH}_{(\text{aq})}$
16. If enthalpy of neutralization of the given reaction (a) is -57.3 k J / mol. What would be the enthalpy change of reaction (b)?
- (a) $\text{KOH}_{(\text{aq})} + \text{HCl}_{(\text{aq})} \rightarrow \text{KCl}_{(\text{aq})} + \text{H}_2\text{O}_{(\text{l})}$
 (b) $\text{H}_2\text{SO}_4_{(\text{aq})} + 2\text{KOH}_{(\text{aq})} \rightarrow \text{K}_2\text{SO}_4_{(\text{aq})} + 2\text{H}_2\text{O}_{(\text{l})}$
- A. -28.65 k J B. -114.6 k J
 C. -171.9 k J D. -229.2 k J

17. The unit of K_c for the following reversible reaction will be:
 $3\text{Fe}_{(s)} + 4\text{H}_2\text{O}_{(g)} \rightleftharpoons \text{Fe}_3\text{O}_{4(s)} + 4\text{H}_2(g)$ Which one is the unit of K_c ?
- A. No unit B. $\text{mole}^2\text{dm}^{-3}$
C. $\text{mole}^{-2}\text{dm}^{+6}$ D. $\text{mol}^{-1}\text{dm}^3$
-



Federal Board HSSC-I Examination
Chemistry Model Question Paper
(Curriculum 2006)

Time allowed: 2.35 hours

Total Marks: 68

Note: Answer any fourteen parts from Section 'B' and attempt any two questions from Section 'C' on the separately provided answer book. Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q.2 Attempt any **FOURTEEN** parts from the following. All parts carry equal marks.

(14 × 3 = 42)

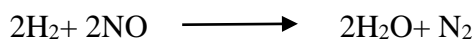
- i. Justify the following:
 - a. One mole of CO₂, CH₄ & H₂O has different masses but have same number of molecules.
 - b. Energy of 3d sub shell is greater than 4s.
- ii. For the following reaction:
$$\text{Ca(OH)}_{2(\text{aq})} + \text{H}_2\text{SO}_{4(\text{aq})} \longrightarrow 2 \text{H}_2\text{O}_{(\text{l})} + \text{CaSO}_{4(\text{s})}$$
Calculate the mass of calcium hydroxide needed to produce 680g of calcium sulphate? (Ca = 40, O = 16, S = 32, H = 1 g/mol)
- iii. Se²⁻ selenide and SO₃²⁻ Sulphite ions react spontaneously
$$2\text{Se}^{2-} + 2 \text{SO}_3^{2-} + 3\text{H}_2\text{O} \longrightarrow 2\text{Se} + 6\text{OH}^- + \text{S}_2\text{O}_3$$
E° cell = 0.35v If E° Sulphite is -0.57 v, calculate E° for selenium.
- iv. What is metallic bond? Describe electron sea theory.
- v. How Mosley used x-rays Spectrum to predict the atomic number of elements? Give one use of x-rays in medical field and chemistry.
- vi. The species H₂O, NH₃ and CH₄ have bond angles of 104.5°, 107.5°, 109.5° respectively. Prove by VSEPR theory, by drawing their structures.
- vii. Briefly describe the shape of subshells when the values of *l* are 0, 1 & 2.
- viii. Explain the shape and polarity of H₂O on the basis of dipole moment.
- ix. State Joule Thomson Effect and give one application.
- x. Boiling point of HF (19.5°C) is low as compared to H₂O (100°C) although the electronegativity of Fluorine is greater than oxygen. Explain.
- xi. Briefly describe the factors on which London forces depend?
- xii. Give three properties of covalent crystals.
- xiii. How can you measure the depression in freezing point using Beckman's Freezing point apparatus.
- xiv. What is the oxidation numbers of the relevant elements on each side of the following equation, state which atom is oxidized and which is reduced? Show your working.
$$2\text{FeCl}_3 + \text{SO}_2 + 2\text{H}_2\text{O} \longrightarrow 2\text{FeCl}_2 + \text{H}_2\text{SO}_4 + 2\text{HCl}$$

- xv. Standard enthalpy change of combustion of a substance is energy change when one mole of a substance is completely burnt in oxygen at standard conditions i.e 25 °C and 1 atm pressure. Using following standard enthalpy changes of combustion of propanol
 $\Delta H_{\text{CO}_2} = -293 \text{ KJ/mol}$ $\Delta H_{\text{H}_2\text{O}} = -286 \text{ KJ/mol}$ $\Delta H_{\text{C}_3\text{H}_7\text{OH}} = -1560 \text{ KJ/mol}$
 Calculate enthalpy change of formation of propanol.
- xvi. The dissociation constant of an acid is a measure of its strength. Derive an expression for the dissociation constant of an acid “CH₃COOH”.
- xvii. In the equilibrium
 $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \quad \Delta H = 90 \text{ KJ/mol}$
 predict the effect on the position of equilibrium if temperature is increased and pressure is decreased.
- xviii. Values of equilibrium constants can be calculated from measured values of concentrations or partial pressures. Write relationship between K_p and K_c in the following reactions?
 (a) $\text{COCl}_2(\text{g}) \rightleftharpoons \text{CO}(\text{g}) + \text{Cl}_2(\text{g})$
 (b) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$
- xix. A solution containing 0.13M potassium acetate and 0.07M acetic acid. Calculate the pH of buffer solution. The value of ionization constant for acid is 1.81×10^{-5} .
- xx. Calculate the molarity of 4.6% w/w solution of NaOH.

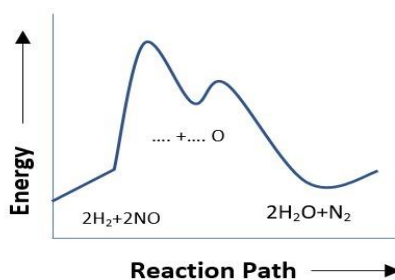
SECTION – C (Marks 26)

Note: Attempt any **TWO** questions. All questions carry equal marks. (2×13 = 26)

- Q.3**
- a. Derive energies expression for ${}^4_2\text{He}^{+1}$ according to Bohr’s atomic model. (7)
- b. 40dm³ HCl (g) at STP reacts with 50g Zn which is placed in water to form ZnCl₂ and H₂. Calculate the mass of H₂ produced and unreacted reactant left.
 (Zn =65, Cl=35.5, H=1) (3+3)
 $\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$
- Q.4**
- a. Explain and draw stepwise Born Haber Cycle for measurement of $\Delta H_{\text{lattice}}$ for potassium chloride (KCl) by using supposed values according to the steps. (5+3)
- b. Explain the potential energy diagram for the given reaction and propose reaction mechanism (3+2)



$$\text{Rate} = k[\text{H}_2][\text{NO}]^2$$



- Q.5** a. Define the following terms with a suitable example: **(2+2+2)**
- i. Isomorphism
 - ii. Polymorphism
 - iii. Anisotropy
- b. Summarize and illustrate the elevation of boiling point using graph. **(4+3)**

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CHEMISTRY HSSC-I (2nd Set)
Student Learning Outcomes Alignment Chart

SECTION A

Q.1

1. Use the mole to convert among measurements of mass, volume and number of particles.
2. Determine the shapes of some molecules from the number of bonded pairs and lone pairs of electrons around the central atom.
3. Summarize Bohr's atomic theory.
4. Use the concept of hydrolysis to explain why aqueous solutions of some salts are acidic or basic.
5. Given the order with respect to each reactant. Write the rate law of the reaction.
6. Relate the discrete-line spectrum of hydrogen to energy levels of electrons in the hydrogen atom.
7. Distinguish among principal energy levels, energy sub levels, and atomic orbitals.
8. State and use Graham's Law of diffusion.
9. Distinguish between real and ideal gases.
10. Explain the significance of the unit cell to the shape of the crystal using NaCl as an example.
11. Define and explain molecular and metallic solids.
12. Explain physical properties of liquids such as evaporation, vapour pressure, boiling point, viscosity and surface tension.
13. Define cathode, anode, electrode potential and S.H.E. (Standard Hydrogen Electrode).
14. Express solution concentration in terms of mass percent, molality, molarity, parts per million, billion and trillion and mole fraction.
15. Define a buffer, and show with equations how a buffer system works.
16. Use experimental data to calculate enthalpy
17. Write the equilibrium expression for a given chemical reaction.

SECTION B

Q.2

- i. Perform stoichiometric calculation with balance equation using mole and particles.
- ii. Construct mole ratio from balance equation in stoichiometric calculation.
- iii. Use activity series of metal to predict the product of single replacement reaction.
- iv. Define and explain molecular and metallic solids.
- v. Explain production properties of X rays.
- vi. Determine the shape of some molecules using orbital hybridization.
- vii. Describe the concept of orbitals.
- viii. Describe how knowledge of molecular polarity can be used to explain molecules.
- ix. Distinguish between real and ideal gasses.
- x. Use the concept of Hydrogen bonding to explain the properties of water.
- xi. Explain applications of dipole dipole force, Hydrogen bonding and London force.
- xii. Differentiate between ionic and covalent molecular and metallic crystal solids.
- xiii. Explain on a particle bases how the addition of the solute to the pure solvent.
- xiv. Determine oxidation number of and atom in substance.
- xv. Use the experimental data to calculate heat of reaction.
- xvi. Use the extent of ionization and dissociation constant.
- xvii. State Le-Chatelier principal. Explain concentration, pressure and temperature effect
- xviii. Relate the equilibrium expression in term of concentration and pressure.
- xix. Make buffer solution and explain how such solution maintain PH.
- xx. Express solution concentration in term of molality.

SECTION C

Q.3

- a. Use Bohr atomic model for calculating radii of orbits.
- b. Perform Stoichiometric calculation with balanced equation using moles.

Q.4

- a. Apply Hess's law to construct simple energy cycle.
- b. Give the potential energy diagram for the reaction. Discuss reaction mechanism.

Q.5

- a. Given the order with respect to each reactant write the rate law for the reaction.
- b. Describe the physical and chemical properties of molecules.

CHEMISTRY HSSC-I (2nd Set)

TABLE OF SPECIFICATION

Subject: Chemistry			Paper: Model 2				Class/Level HSSC-I			Year 2021-22			Code		
Topics/ Subtop ics	Stoichiometry 1	Atomic structure 2	Theories of covalent bonding 3	States of matter- Gases 4	States of matter- Liquids 5	States of matter- Solids 6	Chemical Equilibrium 7	Acids Bases and salts 8	Chemical kinetics 9	Solutions and colloids 10	Thermoc hemistry 11	Electro chemis try 12	Total marks for each Assessmen t Objective	%age of cogniti ve level	
Analysis of Questions of syllabus(contents) and assessment objectives															
(Knowl edge based)				2ix(03)	1xii(01)	1x(01) 1xi(01) 2iv(03) 2xii(03) 5a(06)	1xvii(0 1) 2xviii(0 3)	1iv(01) 2xvi(03)		2xiii(03)		1xiii(01) 2xiv(03)	33	28.4%	
(Under standin g based)	2i(03)	1iii(01) 1vi(01) 1vii(01) 2v(03) 3a(07) 2vii(03)	1ii(01) 2vi(03) 2viii(03)	1viii(01) 1ix(01)	2xi(03) 2x(03)		2xvii(0 3)	1xv(01)	1v(01) 4b(05)	5b(07)	1xvi(01) 4a(08)		60	51.7%	
(Applic ation based)	1i(01) 2ii(03) 3b(06)							2xix(03)		1xiv(01) 2xx(03)	2xv(03)	2iii(03)	23	19.8%	
Total marks for each Topic/S ubtopic	13	16	7	5	7	14	7	8	6	14	12	7	116	100%	

KEY:

1(1)1

Question No (Part No.) Allocated Marks

Note: (i) The policy of FBISE for knowledge based questions, understanding based questions and application based questions is approximately as follows:

- a) 30% knowledge based.
- b) 50% understanding based.
- c) 20% application based.

(ii) The total marks specified for each unit/content in the table of specification is only related to this model question paper.

(iii) The level of difficulty of the paper is approximately as follows:

- a) 40% easy
- b) 40% moderate
- c) 20% difficult