Version No.			

ROLL NUMBER						

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.

1. The least number of molecules are present in 30g of:

A.	N_2O	◯	B.	NO	◯
C.	NO_2	◯	D.	N_2O_3	◯

2. The largest bound angle is present in:

A.	CH_4	◯	B.	SCl_2	◯
C.	NH_3	◯	D.	BCl_3	◯

3. The difference in angular momentum of electron which jumps from 3rd orbit to 6th orbit of hydrogen atom will be:

A.	$3\left(\frac{h}{2\pi}\right)$	◯	B.	$3\left(\frac{h}{\pi}\right)$	◯
C.	$6\left(\frac{h}{2\pi}\right)$	◯	D.	$6\left(\frac{h}{\pi}\right)$	◯

4. Which one of the following salts turns red litmus blue upon hydrolysis?

A.	K_2SO_4	◯	B.	NaCl	◯
C.	Na_2CO_3	◯	D.	NH_4Cl	◯

5. Identify the unit of rate constant (K) for the given reaction:

$2A+B \longrightarrow$ Product when Rate= K [A][B]

A.	s^{-1}	◯	B.	$mol\ dm^{-3}\ s^{-1}$	◯
C.	$dm^3\ mol^{-1}\ s^{-1}$	◯	D.	$dm^6\ mol^{-2}\ s^{-1}$	◯

6. The 3rd line in the Balmer Series of Bohr's Hydrogen spectrum is due to the transition of electron:

A.	From 4th shell to 1st shell	◯
B.	From 4th shell to 2nd shell	◯
C.	From 5th shell to 1st shell	◯
D.	From 5th shell to 2nd shell	◯

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. 2500cm^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 $NH_4Cl_{(aq)}$ and $NH_4NO_{3(aq)}$ ◯
B. Mixture of $NH_4Cl_{(aq)}$ and $NaCl_{(aq)}$ ◯
C. Mixture of $CH_3COONa_{(aq)}$ and $NH_4Cl_{(aq)}$ ◯
D. Mixture of $NH_4Cl_{(aq)}$ and $NH_4OH_{(aq)}$ ◯

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) $KOH_{(aq)} + HCl_{(aq)} \rightarrow KCl_{(aq)} + H_2O_{(l)}$
(b) $H_2SO_{4\,(aq)} + 2KOH_{(aq)} \rightarrow K_2SO_{4(aq)} + 2H_2O_{(l)}$

A. -28.65 k J ◯ B. -114.6 k J ◯
C. -171.9 k J ◯ D. -229.2 k J ◯

17. The unit of Kc for the following reversible reaction will be:

$3Fe_{(s)} + 4H_2O_{(g)} \rightleftharpoons Fe_3O_{4(s)} + 4H_{2\,(g)}$ Which one is the unit of Kc?

A. No unit ◯ B. $mole^{2}dm^{-3}$ ◯

C. $mole^{-2}dm^{+6}$ ◯ D. $mol^{-1}dm^{3}$ ◯

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 CO_2, CH_4 & H_2O has different masses but have same number of molecules.
   b. Energy of 3d sub shell is greater than 4s.

ii. For the following reaction:
$$Ca(OH)_{2(aq)} + H_2SO_{4(aq)} \longrightarrow 2\,H_2O_{(l)} + CaSO_{4(s)}$$
Calculate the mass of calcium hydroxide needed to produce 680g of calcium sulphate? (Ca = 40, O = 16, S = 32, H = 1 g/mol)

iii. Se^{2-} selenide and SO_3^{2-} Sulphite ions react spontaneously
$$2Se^{2-} + 2\,SO_3^{2-} + 3H_2O \longrightarrow 2Se + 6OH^- + S_2O_3$$
E^o cell = 0.35v If E_o Sulphite is –0.57 v, calculate E^o 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 H_2O, NH_3 and CH_4 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 H_2O 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 H_2O (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.
$$2FeCl_3 + SO_2 + 2H_2O \longrightarrow 2FeCl_2 + H_2SO_4 + 2HCl$$

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 ^oC and 1 atm pressure. Using following standard enthalpy changes of combustion of propanol
ΔHCO_2= -293 KJ/ mol $\Delta H\ H_2O$= -286 KJ/ mol $\Delta Hc\ C_3H_7OH$ = -1560 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 "CH_3COOH".

xvii. In the equilibrium
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ $\Delta H = 90KJ/mol$
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 Kp and Kc in the following reactions?
(a) $COCl_{2\ (g)} \rightleftharpoons CO_{(g)} + Cl_2\ (g)$
(b) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3\ (g)}$

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 $1.81x10^{-5}$.

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 $^4_2He^{+1}$ according to Bohr's atomic model. **(7)**

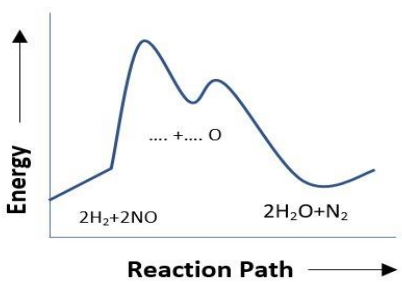
b. 40dm^3 HCl (g) at STP reacts with 50g Zn which is placed in water to form $ZnCl_2$ and H_2. Calculate the mass of H_2 produced and unreacted reactant left.
(Zn =65, Cl=35.5, H=1) **(3+3)**
$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

Q.4 a. Explain and draw stepwise Born Haber Cycle for measurement of $\Delta H_{lattice}$ 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)**

$$2H_2 + 2NO \longrightarrow 2H_2O + N_2$$

$$\text{Rate} = K[H_2][NO]^2$$



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 stochiometric calculation with balance equation using mole and particles.
ii. Construct mole ratio from balance equation in stochiometric 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-Chiliter 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 Hesses law to construct simple energy cycle.
b. Give the potential energy diagram for the reaction. Discus 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/ Subtopics	**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**	**Thermochemistry 11**	**Electrochemistry 12**	**Total marks for each Assessment Objective**	**%age of cognitive level**
Analysis of Questions of syllabus(contents) and assessment objectives														
(Knowledge based)				2ix(03)	1xii(01)	1x(01) 1xi(01) 2iv(03) 2xii(03) 5a(06)	1xvii(01) 2xviii(03)	1iv(01) 2xvi(03)		2xiii(03)		1xiii(01) 2xiv(03)	33	28.4%
(Understanding 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(03)	1xv(01)	1v(01) 4b(05)	5b(07)	1xvi(01) 4a(08)		60	51.7%
(Application 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/Subtopic	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**