Version No.			

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Answer Sheet No._____

Sign. of Candidate _____

Sign. of Invigilator _____

CHEMISTRY HSSC–I (3rd 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) When **6 MOLES** of CO are used in the following reaction, predict the maximum yield of Fe that can be obtained with:

$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

A. 1 mole of Fe_2O_3 ◯ B. 2 mole of Fe_2O_3 ◯

C. 3 mole of Fe_2O_3 ◯ D. 4 mole of Fe_2O_3 ◯

(2) Quote what Mosely was able to determine with the discovery of **X-Rays**:

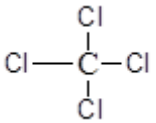
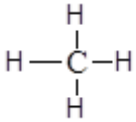
A. The number of protons in target metal atom ◯

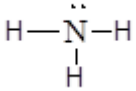
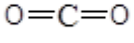
B. The number of neutrons in target metal atom ◯

C. The mass number of target metal atom ◯

D. The atomic mass of target metal atom ◯

(3) Categorize the polar molecule among the following:

A.  ◯ B.  ◯

C.  ◯ D.  ◯

(4) What are the conditions at which Real gases behave ideally:

A. Standard temperature and pressure ◯

B. High pressure and low temperature ◯

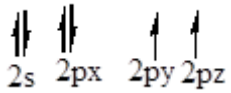
C. Low pressure and high temperature ◯

D. Low temperature and high pressure ◯

(5) Gases exert pressure on the walls of their container. Predict it is due to:

A. Force of attraction between their molecules ◯
B. Elastic collisions between their molecules ◯
C. Vander Waal's forces between their molecules ◯
D. Force of repulsion between their molecules ◯

(6) Label which of the following valence shell electronic configurations are correct **EXCEPT**:

A. 

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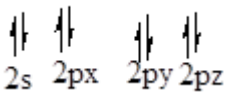
B. 

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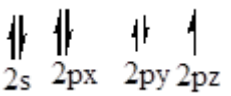
C. 

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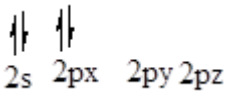
D. 

◯

(7) Light emitted or absorbed in form of energy packets called photons. What is the energy of photon?

A. E=hC ◯ B. E= hc/λ ◯
C. E = hλ ◯ D. E = c/λ ◯

(8) Predict which one has highest boiling point among the following:

A. Helium (He) ◯ B. Neon (Ne) ◯
C. Argon (Ar) ◯ D. Krypton (Kr) ◯

(9) Identify the temperature at which water (H_2O) exhibits lower density:

A. 34^oC ◯ B. 24^oC ◯
C. 14^oC ◯ D. 4^oC ◯

(10) Analyze what is true for the following chemical reaction?

$$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$$

A. $k_p > k_c$ ◯ B. $k_n < k_c$ ◯
C. $k_p = k_n$ ◯ D. $k_p > k_n$ ◯

(11) An acid X considered to be stronger one, when the value of its Dissociation constant (K_a) is:

A. 1.8×10^{-16} ◯ B. 1.0×10^{-4} ◯
C. 1.0×10^{9} ◯ D. 1.0×10^{10} ◯

(12) For a chemical reaction **A** the rate equation is given below:
Rate = $k[O_3]^2[O_2]^{-1}$
Distinguish the **INCORRECT** statement about the reaction **A**:

A. The rate of reaction increases four time when $[O_3]$ is doubled and $[O_2]$ is kept constant. ◯
B. The rate of reaction increases twice when $[O_2]$ is doubled and $[O_3]$ is kept constant ◯
C. The rate of reaction becomes half when $[O_2]$ is doubled and $[O_3]$ is kept constant. ◯
D. The overall order of this reaction A is First order. ◯

(13) Identify the temperature at which the solubility of $CuSO_4$ in water is maximum at:

A. 80^oC ◯ B. 90^oC ◯
C. 100^oC ◯ D. 110^oC ◯

(14) If the following reaction is performed at STP, predict which one of the following statement is correct for this reaction?

$CO_2(g) \longrightarrow C_{(s)} + O_{2(g)}$

A. ΔH is positive and the temperature of surrounding is increased. ◯
B. ΔH is positive and the temperature of surrounding is decreased. ◯
C. ΔH is negative and the temperature of surrounding is increased. ◯
D. ΔH is negative and the temperature of surrounding is decreased. ◯

(15) In the following reaction, quote the correct statement:

$Ca(s) + Cl_2(g) \longrightarrow CaCl_2$

A. Ca is oxidizing agent ◯ B. Cl_2 is reducing agent ◯
C. Ca is reducing agent ◯ D. $CaCl_2$ is reducing agent ◯

(16) Consider the following general chemical reaction at equilibrium. If it's Kc = 1, what is the best statement for the chemical reaction.

Reactant $\rightleftharpoons$ Product

A. Concentration of reactant = Concentration of product ◯
B. Concentration of reactant > Concentration of product ◯
C. Rate of forward reaction > Rate of backward reaction ◯
D. Rate of forward reaction < Rate of backward reaction ◯

(17) When two atoms bond with each other through overlapping of their sp^3 hybrid orbitals. Predict which one of the following statements best describes the nature of the bond between these atoms?

A. This is a Pi (π) covalent bond ◯
B. This is a Sigma (σ) covalent bond ◯
C. This is ionic bond ◯
D. This is hydrogen bond. ◯

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. $8.7X10^{24}$ H_2 molecules are produced by the reaction of zinc and 30%W/W H_2SO_4 solution of density 1.25g/ cm^3. For the following reaction:
$Zn_{(s)} + H_2SO_{4(aq)} \longrightarrow H_{2(g)} + ZnSO_{4(s)}$
Calculate the volume of sulphuric acid solution used.? (Zn = 65, O = 16, S = 32, H = 1 g/mol)

ii. Briefly describe the miscibility of phenol and water system.

iii. Describe briefly Zeeman and Stark effect on Bohr atomic model.

iv. List the quantum numbers value of 5p.

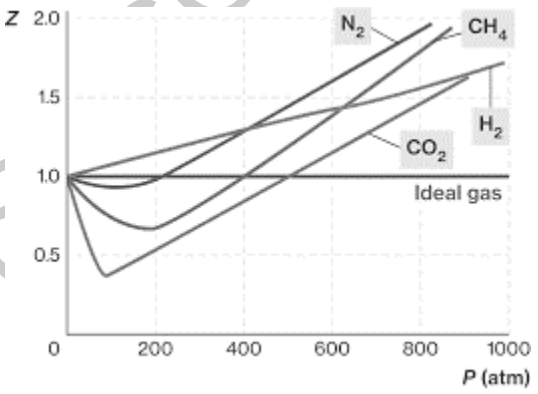
v. Interpret the change in the bond energy in the following.

Bonds	C-F	C-Cl	C-Br	C-I
Energy KJ/mol	485	329	276	240

vi. Demonstrate the values of bond pair, lone pair and total electron pair in AsH_3 by VSEPR theory, and draw its structure.

vii. Show by derivation the unit of density in the expression d = $\frac{PM}{RT}$ when R= 0.0821atm $dm^3mol^{-1}k^{-1}$.

viii. Deviation from ideal behavior is shown in following graph at 25°C. Sketch the deviation from ideal behavior at 5°C.



ix. A gas collected over water at 10^0C and 873 torr. If gas occupies 90cm^3,calculate the volume of dry gas at STP when aqueous tension is 9.2torr.

x. Describe the surface tension of the given solvents in term of intermolecular forces.

Solvent	**Surface Tension**
Water (H_2O)	$7.275x10^2$
Hexane (C_6H_{14})	$1.84x10^2$

xi. Ice floats at the surface of the water. Tabulate its three advantages.

xii. $CH_3COOH + HCl \longrightarrow CH_3COOH_2^+ + Cl^-$
What is conjugate acid and conjugate base pair, identify conjugate acid and conjugate base.

xiii. Calculate p^H of $1x10^{-3}$M $Fe(OH)_3$.

xiv. Briefly explain buffer action with the help of CH_3COOH and CH_3COONa.

xv. Discuss briefly the colligative property of $C_{12}H_{22}O_{11}$ and $CO(NH_2)_2$.

xvi. Prove first law of thermodynamics and show that $\Delta E = q_v$.

xvii. Differentiate between exothermic and endothermic with thermochemical equations.

xviii. Briefly describe cleavage planes and habit of crystal.

xix. Complete the reaction on the bases of reduction potentials of Pb^{+2}/Pb = -0.36v and Fe^{+2}/Fe = -0.44v
$PbSO_4 + Fe \longrightarrow$

xx. Calculate the energy of ${}_3^7Li^{+2}$ for Balmer series when electron jumps from n=5.

SECTION – C (Marks 26)

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

Q.3 a. $CH_{4(g)} + 4Cl_{2(g)} \rightleftharpoons CCl_{4(l)} + 4HCl_{(g)}$
Derive Kc expression at equilibrium of given reaction. (06)

b. Describe that increase in collision energy by increasing the temperature can improve the collision frequency. (3+2+2)

Q.4 a. Under what conditions synthesis of ammonia will give maximum yield by Haber's process. (2+2+2)

b. Describe dissolution of KCl and $C_6H_{12}O_6$ in water. (4+3)

Q.5 a. Demonstrate the reactions that occur in lead storage battery when it is recharged. (06)

b. Sulphuric acid can be prepared by contact process using following reactions when one ton (1000kg) sulphur is used then how much SO_3 will be produced and how much oxygen is used? (3+4)

$S + O_2 \longrightarrow SO_2$

$2SO_2 + O_2 \longrightarrow 2SO_3$ (S= 32, O=16)

* * * * *

CHEMISTRY HSSC-I (3rd Set)
Student Learning Outcomes Alignment Chart

SECTION A

Q.1

(1) Construct mole ratio from balanced equations for use as conversion factor in stochiometric problems.
(2) Explain production, properties, types and uses of X-rays.
(3) Explain the sequence of filling of electrons in many electron atoms.
(4) Define photon as a unit of radiation energy.
(5) Predict the molecular polarity from the shapes of molecules atom. (Analyzing)
(6) Describe the features of sigma and pi bonds.
(7) Distinguish between real and ideal gases.
(8) Use Kinetic Theory to explain gas pressure.
(9) Explain applications of dipole-dipole forces, hydrogen bonding and London forces.
(10) Explain the low density and high heat of fusion of ice.
(11) Define and explain molecular and metallic solids.
(12) Relate the equilibrium expression in terms of concentration, partial pressure, number of moles and mole fraction.
(13) State the necessary conditions for equilibrium and the ways that equilibrium can be recognized.
(14) Use the extent of ionization and the acid dissociation constant, Ka, to distinguish between strong and weak acids.
(15) Explain and use the terms rate of reaction, rate equation, order of reaction, rate constant and rate determining step.
(16) Explain the effect of temperature on solubility and interpret the solubility graph.
(17) Classify reactions as exothermic or endothermic.
(18) Give the characteristics of a Redox reaction.

SECTION-B

Q.2

i. Perform stoichiometric calculations with balanced equations using moles, representative particles, masses and volumes of gases (at STP).
ii. Explain the nature of solutions in liquid phase giving examples of completely miscible, partially miscible and immiscible liquid-liquid solutions.
iii. Relate the discrete-line spectrum of hydrogen to energy levels of electrons in the hydrogen atom
iv. Distinguish among principal energy levels, energy sub levels, and atomic orbitals.
v. Define bond energies and explain how they can be used to compare bond strengths of different chemical bonds
vi. Use VSEPR and VBT theories to describe the shapes of simple covalent molecules.
vii. Derive Ideal Gas Equation using Boyle's, Charles' and Avogadro's law.
viii. Explain why real gases deviate from the gas laws
ix. Derive Ideal Gas Equation using Boyle's, Charles' and Avogadro's law
x. Explain physical properties of liquids such as evaporation, vapour pressure, boiling point, viscosity and surface tension
xi. Use the concept of Hydrogen bonding to explain the following properties of water: high surface tension, high specific heat, low vapor pressure, high heat of vaporization, and

high boiling point. And anomalous behavior of water when its density shows maximum at 4 degree centigrade

xii. Define salts, conjugate acids and conjugate bases.

xiii. Explain ionization constant of water and calculate pH and pOH in aqueous medium using given Kw values.

xiv. Define a buffer, and show with equations how a buffer system works.

xv. Define the terms colligative. Explain on a particle basis how the addition of a solute to a pure solvent causes an elevation of the boiling point and depression of the freezing point of the resultant solution.

xvi. Relate change in internal energy of a system with thermal energy at constant temperature and constant pressure.

xvii. Classify reactions as exothermic or endothermic.

xviii. Describe properties of crystalline solids like geometrical shape, melting point, cleavage planes, habit of a crystal, crystal growth, anisotropy, symmetry, isomorphism, polymorphism, allotropy and transition temperature.

xix. Use the activity series of metals to predict the products of single replacement reactions.

xx. Relate the discrete-line spectrum of hydrogen to energy levels of electrons in the hydrogen atom.

SECTION-C

Q.3 a. Write the equilibrium expression for a given chemical reaction.

b. Use the collision theory to explain how the rate of a chemical reaction is influenced by the temperature, concentration, size of molecules

Q.4 a. Explain industrial applications of Le Chatelier's Principle using Haber's process as an example.

b. Distinguish between the solvation of ionic species and molecular substances.

Q.5 a. Explain how a lead storage battery produces electricity.

b. Perform stoichiometric calculations with balanced equations using moles, representative particles, masses and volumes of gases (at STP).

CHEMISTRY HSSC-I (3rd Set)

TABLE OF SPECIFICATION

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**	**Electro chemistry 12**	**Total marks for each Assessment Objective**	**%age**
(Knowledge based)		1(2)(1) 1(6)(1) 1(7)(1) 2 iii(3) 2 iv(3)	1(17)(1)	1(4)(1) 2 viii(3)	2 x(3) 2 xi(3)	2 xviii(3)	1(16)(1)	1(11)(1)	3 b(7)	2 ii(3)		1(15)(1)	36	31%
(Understanding based)			2 v(3) 2 vi(3)	1(5)(1) 2 vii(3)	1(8)(1)	1(9)(1)	3 a(6) 4 a(6)	2 xii(3) 2 xiv(3)		1(13)(1) 2 xv(3) 4 b(7)	1(14)(1) 2 xvi(3) 2 xvii(3)	2 xix(3) 5 a(6)	57	49.1%
(Application based)	1(1)(1) 2 i(3) 5 b(7)	2 xx(3)	1(3)(1)	2 ix(3)			1(10)(1)	2 xiii(3)	1(12)(1)				23	19.8%
Total marks for each Topic/Subtopic	11	12	08	11	07	04	14	10	08	14	07	10	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