



Federal Board HSSC-I Examination
Chemistry Model Question Paper

Time allowed: 2.40 hours

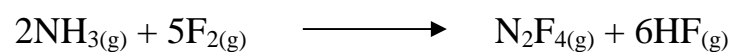
Total Marks: 68

Note: Sections 'B' and 'C' comprise pages 1-6 and questions therein are to be answered on the separately provided answer book. Answer all the questions from section 'B' and attempt any two questions from section 'C'. Use supplementary answer sheet i.e., sheet B if required. Write your answers neatly and legibly.

SECTION – B
(42 marks)

Note: Attempt **ALL** the questions. The answer to each part of a question should not exceed 5 to 6 lines.

Q.2 Ammonia and fluorine react to produce dinitrogen tetra fluoride according to the following reaction



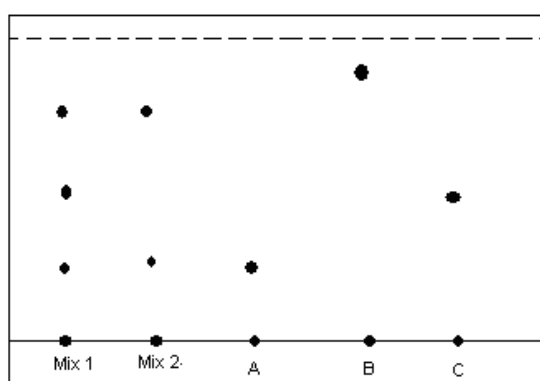
If 4.00g of ammonia and 14.0g of fluorine are allowed to react

- i. How many grams of dinitrogen tetra fluoride are produced? (2)
- ii. Name the reactant, which is in excess. Also calculate its volume at STP, which is left un-reacted. (3)

(OR)

- i. A gaseous hydrocarbon has the following composition by mass:
C = 85.7 % and H = 14.3%
Calculate empirical formula of the gaseous hydrocarbon. (2)
- ii. A 0.25g sample of the hydrocarbon has a volume of 100cm³ at STP
 - a. Calculate the relative molecular mass. (2)
 - b. Also calculate molecular formula for the hydrocarbon. (1)

- Q.3 Sodium atom imparts a characteristic yellow colour when excited in a flame. The wavelength of this colour in emission spectrum is 589.0nm.
- What is the frequency of this radiation? (1)
 - What is the energy of this radiation per photon and per mole of photon? (2)
- Q.4 The diagram given below shows the chromatogram of following five spots
- Unknown mixture 1
 - Unknown mixture 2
 - Dye A
 - Dye B
 - Dye C



- Write down the composition of mixture 1. (1)
 - Which dye A, B or C is not present in either of the two mixtures. (1)
 - Write down in two lines, the basic principle of paper chromatography. (2)
- Q.5 For the distribution of Iodine between two immiscible solvents (H_2O and CCl_4) Iodine reacts with iodide ion to form tri-iodide ion in a reversible reaction.
- Write the reaction for this process. (1)
 - Name and state the law followed. (1)
 - Write the distribution co-efficient for this reaction. (1)

(OR)

The following sets of quantum numbers are not allowed. For each set state why?

- $n = 3$ $l = 3$ $m = 0$ $s = -\frac{1}{2}$ (1)
- $n = 2$ $l = 1$ $m = -1$ $s = -1$ (1)
- $n = 3$ $l = 1$ $m = -2$ $s = -\frac{1}{2}$ (1)

Q.6

Substance	Critical Temperature (K)	Critical Pressure (atm)
H ₂ O	647.6	217.0
Ar	150.9	111.5
NH ₃	405.6	48.0
N ₂	?	33.5

The above gases can be liquefied under the given conditions.

- State the two conditions under which gases can be liquefied. (1)
- What will happen to gas molecules under the conditions you have mentioned in part (a)? (2)
- See the table and state whether the critical temperature of N₂ will be higher or lesser than NH₃ and why? (2)

Q.7 The table below gives the boiling points of three substances:

Name	Formula	Relative molecular mass	Boiling point/°C
Pentane	CH ₃ - CH ₂ - CH ₂ - CH ₂ - CH ₃	72	36
Propanol	CH ₃ - CH ₂ - CH ₂ - OH	74	117
Diethyl ether	CH ₃ - CH ₂ - O - CH ₂ - CH ₃	74	35

- Compare pentane with diethyl ether, why both have nearly same boiling points. (1)
- Why does propanol have a higher boiling point than pentane and diethyl ether, name the intermolecular forces involved? (2)

Q.8 Dipole moment is the product of the electric charge and distance between the positive and negative centres.

- Write the formula and units of dipole moments. (2)
- Explain the polarity of H₂O and CO₂ on the basis of dipole moment. (2)

(OR)

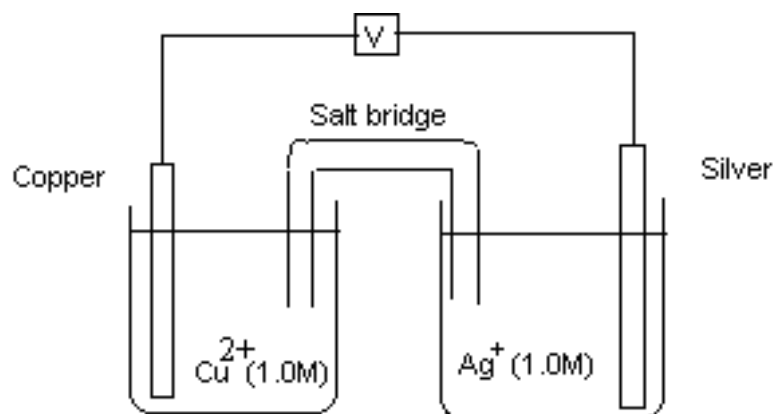
Following table shows the ionic radii in pm.

Li ⁺ (60)	Be ²⁺ (31)		O ²⁻ (132)	F ⁻¹ (136)
Na ⁺ (95)	Mg ²⁺ (61)	Al ³⁺ (50)	S ²⁻ (184)	Cl ⁻¹ (181)
K ⁺ (133)	Ca ²⁺ (99)			Br ⁻¹ (195)

- Discuss the variation of ionic radii in the periodic table. Give a reason for your answer. (3)

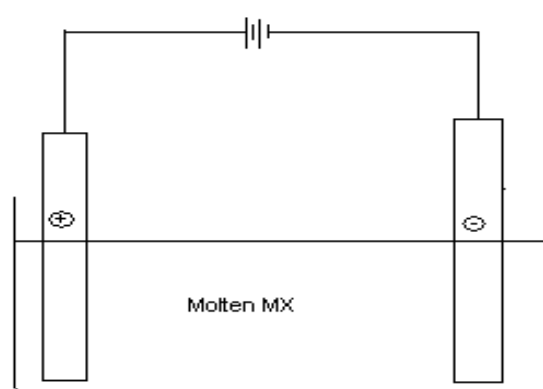
- ii. Calculate the distance between potassium and chloride ions in the potassium chloride crystal. (1)

Q.9 The diagram below shows a simple galvanic cell



- a. What is meant by the term standard electrode potential? (1)
- b. The standard electrode potential of the $\text{Ag}^+_{(\text{aq})}/\text{Ag}_{(\text{s})}$ and $\text{Cu}^{2+}_{(\text{aq})}/\text{Cu}_{(\text{s})}$ couples are +0.8 volt and +0.34 volt respectively.
- i. Name the positive electrode. (1)
- ii. Write the direction of the electron flow in the external circuit. (1)
- c. Give equations for the reactions, which are taking place at each electrode under standard conditions. (2)

Q.10 Consider the following general electrolytic cell:



- i. At which electrode does oxidation occur? (1)
- ii. At which electrode does element M form? (1)
- iii. At which electrode are electrons being released by ions? (1)

(OR)

- i. What is the direction of electron flow with respect to anode and cathode in a battery? (1)
- ii. How many alkaline batteries must be placed in series to light a flashlight? (1)
- iii. Write the reaction in the alkaline battery occurring at anode. (1)

Q.11 Calcium nitrate is a soluble salt. It ionizes in water to produce calcium and nitrate ion. Calculate the molarities of positive and negative ions produced by the dissociation of 5gdm^{-3} calcium nitrate. (3)

- Q.12 a. State buffer solution? (1)
- b. Explain using equations, why an aqueous mixture of acetic acid (HA) and sodium acetate (Na^+A^-) can act as a buffer solution on the addition of an acid or an alkali. (3)

SECTION – C

(Marks: 26)

Note: Attempt any **TWO** questions.

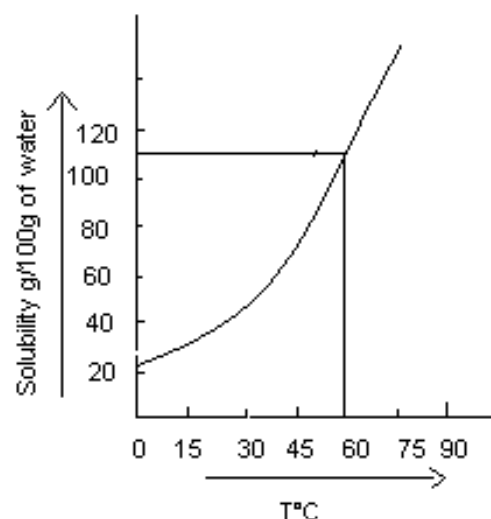
- Q.13 a. Acetylene (C_2H_2) is used in welding. If the heats of formation of acetylene, CO_2 and H_2O are $+226\text{KJ/mol}$, -393.5KJ/mol and -285.7KJ/mol respectively.
- i. Calculate the enthalpy of combustion of acetylene. (3)
- ii. Which law is helpful to calculate the above data? State this law. (2)
- b. i. What is meant by lattice energy? (1)
- ii. Lattice energy of the compounds cannot be measured directly by any method. State indirect method used for its measurement. (1)
- iii. Draw stepwise flow sheet diagram for the measurement of $\Delta H_{\text{lattice}}$ for potassium chloride (KCl). (3)
- c. In the equilibrium
- $$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3 \quad \Delta H = -92.46\text{KJ/mol}$$
- What is the effect on the position of equilibrium if
- i. Temperature is increased (1)
- ii. Pressure is decreased (1)
- iii. Any amount of nitrogen is added to the equilibrium mixture. (1)
- Q.14 a. i. State Raoult's Law. (1)

- ii. Derive a relationship between mole fractions of two volatile compounds and their vapour pressure. (3)

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Turn Over

- b. Using the graph answer the questions below:



- i. How many grams of KNO_3 are dissolved in 525g saturated solution at 60°C . (1)
- ii. 280g of KNO_3 is dissolved in a 250g of water at 60°C . How many grams of water should be evaporated from the solution to make the solution saturated? (3)
- c. Non-ideal solutions show two types of deviations. What are these deviations and what are the conditions under which these deviations are shown by these solutions? (2+3)
- Q.15 a. Both BF_3 and NH_3 are tetra-atomic molecules, still they have different geometries.
- i. Draw their structures and discuss bond angles according to VSEPR theory. (3)
- ii. Give hybridization in these molecules and draw the structure of hybridized orbitals. (3)
- iii. These compounds exhibit different dipole moments. Comment on this behaviour. (2)
- b. Using the Molecular Orbital Treatment of oxygen molecule. Prove that:
- i. O_2 is paramagnetic while O_2^{2-} is diamagnetic. (4)
- ii. There is double bond between oxygen atoms in O_2 . (1)