Roll No. ☐☐☐☐☐☐

Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

CHEMISTRY HSSC–I

SECTION – A (Marks 17)

Time allowed: 25 Minutes   (Revised Syllabus)

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1   **Circle the correct option i.e. A / B / C / D. Each part carries one mark.**

(i)   Born – Haber cycle is a special application of:
A.   Hess's law   B.   Rate law   C.   Boyle's law   D.   Henery's law

(ii)   Oxidation number of 'Mn' in $KMnO_4$ is:
A.   +6   B.   +5   C.   +8   D.   +7

(iii)   The relative atomic mass of chlorine (Cl) is 35.5 amu. The mass in grams of 0.5 moles of chlorine gas is:
A.   35.5 grams   B.   18.75 grams   C.   142 grams   D.   71 grams

(iv)   Charge on one Kg electrons is:
A. $1.7588 \times 10^{-11} C$ B. $1.7588 \times 10^{11} C$
C. $1.6 \times 10^{-19} C$ D. $6.67 \times 10^{34} C$

(v)   Which one of the followings is not produced by neutrons decay?
A.   Electron   B.   Neutrino   C.   Positron   D.   Proton

(vi)   According to VSEPR theory the shape of AB_3E type molecule is:
A.   Triangular pyramidal   B.   Octahedral
C.   Trigonal planar   D.   Tetrahedral

(vii)   Bond energy is independent of:
A.   Atomic size   B.   London forces C.   Bond length   D.   Bond order

(viii)   Which of the following gas will diffuse more rapidly at STP?
A.   Oxygen gas (O_2) B.   Carbondioxide gas (CO_2)
C.   Chlorine gas (Cl_2) D.   Methane gas (CH_4)

(ix)   Pressure exerted by a real gas is always less than that of an ideal gas at same conditions due to:
A.   Intermolecular forces of attraction   B.   Zero kinetic energy of molecules
C.   Large empty spaces   D.   High kinetic energy of molecules

(x)   Distillation under reduced pressure is called:
A.   Steam Distillation   B.   Destructive Distillation
C.   Fractional Distillation   D.   Vacuum Distillation

(xi)   Existence of $CaCO_3$ in trigonal and orthorhombic forms is an example of:
A.   Isomorphism   B.   Anisotropy   C.   Polymorphism D.   Allotropy

(xii)   At equilibrium state:
A.   Concentration of products becomes zero.
B.   Concentrations of reactants and products become constant.
C.   Concentrations of reactants and products become equal.
D.   Concentration of reactants becomes zero.

(xiii)   If a reaction does not proceed appreciably in forward direction it shows:
A.   Zero Kc value   B.   Very large Kp value
C.   Very large Kc value   D.   Very small Kc value

(xiv)   Which one of the following is not a Lewis Base?
A. NF_3 B. BF_3 C. NH_3 D. H_2O

(xv)   For an endothermic reaction the energy of products is:
A.   Equal to that of reactants   B.   Equal to the energy of activation of reaction
C.   Higher than that of reactants   D.   Lower than that of reactants

(xvi)   Red blood cells will not be affected by osmosis if they are placed in:
A. $95\% NaCl$ Solution   B. $0.95\% NaCl$ Solution
C.   Pure water   D. $9.5\% NaCl$ Solution

(xvii)   Depression of freezing point for one molal solution of a non-volatile, non-electrolyte solute is called:
A.   Cryoscopic constant   B.   Ebullioscopic constant
C.   Rate constant   D.   Equilibrium constant

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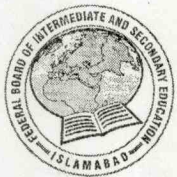
Total Marks: | 17 |

Marks Obtained: | |

CHEMISTRY HSSC–I
(Revised Syllabus)

Time allowed: 2:35 Hours   **Total Marks Sections B and C: 68**

NOTE: Sections B and C comprise pages 1 – 2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Periodic table will be provided on demand.

SECTION – B (Marks 42)

Q. 2   Answer any **FOURTEEN** parts. The answer to each part should not exceed 5 to 6 lines.   (14 x 3 = 42)

(i)   How many covalent bonds are present in 34 grams of ammonia (NH_3) ? [At.masses N=14,H=1]   **03**

(ii)   Using Bohr's equation calculate the distance travelled by an electron of a Hydrogen atom when it jumps from 1st to 2nd orbit.   **03**

(iii)   Write three properties of canal rays.   **03**

(iv)   Describe the shape of following molecules by using VSEPR concept: **03**

     a. PH_3 b. H_2S

(v)   Explain sigma bond and Pi bond giving one example in each case.   **03**

(vi)   Hydrogen gas collected at $6\ °C$ and 765 mmHg, occupied $35cm^3$ volume. Calculate the volume of Hydrogen gas at STP.   **03**

(vii)   What is plasma? Give its four properties.   **01+02**

(viii)   What is vapour pressure of a liquid? Discuss the effect of temperature and intermolecular forces on the vapour pressure.   **03**

(ix)   Give two definitions of Lattice Energy with an example in each case.   **03**

(x)   Write K_c expression for the following reactions: **03**

     a. $FeO(s)+CO(g) \rightleftharpoons Fe(s)+CO_2(g)$

     b. $P_4(s)+5O_2(g) \rightleftharpoons P_4O_{10}(s)$

     c. $CH_4(g)+4Cl_2(g) \rightleftharpoons CCl_4(l)+4HCl(g)$

(xi)   Define solubility product and write K_{sp} expression for a sparingly soluble salt A_mB_n.   **01+02**

(xii)   Calculate pH of a Buffer solution containing 0.1 M acetic acid (CH_3COOH) and 1.0 M sodium acetate (CH_3COONa). The pK$_a$ for acetic acid is 4.76.   **03**

(xiii)   Use the concept of Hydrolysis to explain why aqueous solutions of some salts are acidic, basic or neutral.   **03**

(xiv)   Define the following: **03**

     a.   Average rate of reaction

     b.   Instantaneous rate of reaction

     c.   Order of reaction

(xiv)   The reaction given below is first order in H_2 and half order in Br_2 :

$$H_2(g)+Br_2(g) \rightarrow 2\,H\,Br(g)$$

     Write rate equation (rate law) of the reaction and deduce overall order of reaction.   **03**

(xvi)   Calculate the mass percent of a solution containing 10 grams of sugar and 100 grams of water.   **03**

(xvii)   Using Raoult's law prove that the Relative Lowering of vapour pressure is equal to the mole fraction of the non-volatile, non-electrolyte solute.   **03**

(xviii) State and explain Hess's law using a general reaction. 03

(xix) Balance the following Redox equation by using oxidation number method: 03

$$NaClO_2 + Cl_2 \rightarrow NaCl + ClO_2$$

SECTION – C (Marks 26)

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

Q. 3   a.   Draw Molecular orbital diagram of O_2 and explain its paramagnetic behaviour. 04

b.   What mass of silver chloride be produced by reacting 120 grams of silver nitrate with 52 grams of sodium chloride. 05

$$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3 \quad \text{[At.masses Ag=108, N=14, Na=23, Cl=35.5, O=16]}$$

c.   Derive the Ideal Gas Equation and determine the value of ideal Gas Constant (R) using S.I units. 04

Q. 4   a.   State and explain the Law of mass action and derive the equilibrium constant (K_c) expression for a general reaction. 02+03

b.   In an acid-base titration $25\,cm^3$ of 0.12M solution of $NaOH$ is neutralized by $30\,cm^3$ of HCl solution. Calculate the concentration and strength of HCl solution. 04

c.   Discuss the effect of change in concentration of reactants and the change in surface area of the reactants on the rate of reaction. 02+02

Q. 5   a.   Define molality of a solution and calculate the molality of a solution prepared by mixing 1 gram of Ethanol (C_2H_5OH) with 100 grams of water. [At.masses C=12, O=16, H=1] 01+03

b.   Derive an expression to calculate the molar mass of a non-volatile, non-electrolyte solute by the lowering of vapour pressure. 04

c.   What is standard Enthalpy of atomization? Give an example. 01+01

d.   Discuss the Construction of standard Hydrogen Electrode using its labelled diagram. 03

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Page 2 of 2 (Chem)

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Answer Sheet No._____

Sig. of Candidate._____

Sig. of Invigilator._____

CHEMISTRY HSSC–I
SECTION – A (Marks 17)

Time allowed: 25 Minutes

(Old Syllabus)

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) The rate of reaction:
A. May decrease or increase as the reaction proceeds
B. Increases as the reaction proceeds
C. Decreases as the reaction proceeds
D. Remains the same as the reaction proceeds

(ii) The mass of 6.02×10^{23} electrons is:
A. $2.7\ mg$ 　 B. $1.008\ g$ 　 C. $0.184\ g$ 　 D. $0.55\ mg$

(iii) Solvent extraction is an equilibrium process and is controlled by:
A. Law of conservation of mass 　 B. Law of mass action
C. Amount of solvent 　 D. Distribution law

(iv) Number of molecules in $1\ dm^3$ of water is close to:
A. $\dfrac{6.0}{22.4} \times 10^{23}$ 　 B. $55.6 \times 6.02 \times 10^{23}$
C. $\dfrac{18}{22.4} \times 10^{23}$ 　 D. $\dfrac{12}{24} \times 10^{23}$

(v) Diamond is a bad conductor because:
A. It is transparent to light
B. It has tight structure
C. There are no free electrons in the crystal of diamond
D. It has high density

(vi) Which of the following is a pseudo solid?
A. $MgCl_2$ 　 B. Glass 　 C. $NaCl$ 　 D. CaF_2

(vii) Quantum number values for $2P$ orbitals are:
A. $n=2, l=0$ 　 B. $n=2, l=1$ 　 C. $n=2, l=3$ 　 D. $n=1, l=0$

(viii) For which species, Bohr's theory does not apply?
A. Be 　 B. H 　 C. He^+ 　 D. Li^{+2}

(ix) According to MOT, the bond order value of N_2 and Ne_2 is:
A. 3 and 4 　 B. 1 and 3 　 C. 3 and zero 　 D. 3 and 2

(x) pH of 10^{-3} mol dm^{-3} of an aqueous solution of H_2SO_4 is:
A. 1.5 　 B. 3.0 　 C. 2.7 　 D. 2.0

(xi) The pH of Human blood is:
A. 14.00 　 B. 7.00 　 C. 8.00 　 D. 7.35

(xii) $18\ g$ of glucose is dissolved in 90 gram of water. The relative lowering of vapour pressure is equal to:
A. 6 　 B. $\dfrac{1}{5}$ 　 C. 5.1 　 D. $\dfrac{1}{51}$

(xiii) Which of the following solutions in water has the highest boiling point?
A. 34.2% solution of sucrose 　 B. 5.85% solution of $NaCl$
C. 18.0% solution of glucose 　 D. 6.0% solution of urea

(xiv) If salt bridge is not used between two half cells, then the voltage of cell:
A. Decreases rapidly 　 B. Drops to zero
C. Does not change 　 D. Decreases slowly

(xv) The stronger the oxidizing reagent is, the greater is:
A. EMF of the Cell 　 B. Oxidation potential
C. Reduction Potential 　 D. Redox Potential

(xvi) In zero order reaction, the rate of reaction is independent of:
A. Pressure 　 B. Temperature
C. Concentration of reactants 　 D. Concentration of products

(xvii) Which enzyme is used in conversion of sugar into glucose and fructose?
A. Maltase 　 B. Urease 　 C. Zymase 　 D. Invertase

For Examiner's use only:

Total Marks: 　 | 17 |

Marks Obtained: 　 | ☐ |

—— 1HA 1609 ** ——

CHEMISTRY HSSC–I
(Old Syllabus)

Time allowed: 2:35 Hours   **Total Marks Sections B and C: 68**

NOTE: Sections B and C comprise pages 1 – 2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Periodic table will be provided on demand.

SECTION – B (Marks 42)

Q. 2   **Answer any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines.**   (14 x 3 = 42)

(i)   Calculate the number of molecules, positive and negative ions in 10.0 g of H_3PO_4 when dissociated in water. $H_3PO_4 \rightarrow 3H^+ + PO_3^{-3}$ (Molar mass of H_3PO_4 is 98 $g\ mol^{-1}$)   **03**

(ii)   Consider the distribution of I_2 between two immiscible layers $^{CCl_4}/_{H_2O}$. State Partition law and give expression of distribution coefficient and suggest reason that that I_2 dissolves in presence of KI.   **01+02**

(iii)   What is critical temperature of gases? What is its importance in liquefaction of gases?   **02+01**

(iv)   A gas has a volume of 255 cm^3 at a temperature of 25°C and under a pressure of 10.0 torrs. The gas weighed 12.1 mg. What s the molecular mass of the gas?   **03**

(v)   Vacuum distillation can be used to avoid decomposition of a sensitive liquid. How will you explain it?   **03**

(vi)   Boiling points of elements of group VII A increase down the group. Explain it in terms of inter-molecular forces.   **03**

(vii)   Define Lattice energy. What factors affect it?   **1.5+1.5**

(viii)   Define and explain Heisenberg's uncertainty principle.   **01+02**

(ix)   Define with examples: **1.5+1.5**

     (a) $(n + l)$ rule

     (b)   Hund's rule for distribution of electrons in an atom.

(x)   How will you explain oxygen molecule and its paramagnetic nature on the basis of molecular orbital theory?   **03**

(xi)   Define bond energy. Explain the parameters which determine its strength.   **01+02**

(xii)   How will you differentiate between ΔE and ΔH? Is it true that ΔH and ΔE have same values for the reactions taking place in solution state?   **02+01**

(xiii)   Define first law of thermodynamics. How does it explain that: **01+02**

     (a) $qv = \Delta E$ (b) $qp = \Delta H$

(xiv) H_2SO_4 is prepared by burning $SO_2 - SO_3$ through reversible exothermic reaction.   **01+01+01**

     (a)   Write balanced chemical equation.

     (b)   What is the effect of pressure change on this reaction?

     (c)   Reaction is exothermic but it requires a temperature of $400 - 500°C$. Why?

(xv)   Define Raoult's Law in three different ways.   **03**

(xvi)   Aqueous solutions of NH_4Cl, $AlCl_3$ and $CuSO_4$ are acidic in nature. Why?   **03**

(xvii)   Why SHE acts as Anode when connected with Cu but as Cathode when connected with Zn?   **03**

(xviii)   Write reactions taking place during discharging and recharging of Lead accumulator.   **03**

(xix)   Define order of reaction. Write 1st, 2nd and 3rd order reactions.   **01+02**

SECTION – C (Marks 26)

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

Q. 3   **a.**   50 grams each of $NH_4Cl_{(s)}$ and $Ca(OH)_{2\,(s)}$ react as under: 04

$$2NH_4CL_{(s)} + Ca(OH)_{2\,(s)} \rightarrow CaCl_{2\,(s)} + 2NH_{3\,(g)} + 2H_2O_{(l)}$$

Calculate the mass of NH_3 formed and the amount of non-limiting reactant left behind.

$(H = 1.008, \quad O = 16, \quad N = 14, \quad Cl = 35.5, \quad Ca = 40)$

     b.   Describe the kinetic interpretation of absolute temperature of gases by applying kinetic gas equation.   04

     c.   Derive the equation for radius of nth orbit of hydrogen atom using Bohr's Atomic model.   05

Q. 4   **a.**   Define Atomic orbital Hybridization. How will you explain SP^2 Hybridization in Ethene and SP Hybridization in Acetylene?   01+2.5+2.5

     b.   What are the main points of Planck's Quantum theory?   03

     c.   Calculate the heat of formation of Ethyl Alcohol from the following information: 04

         (i)   Heat of combustion of Ethyl Alcohol = $-1367\ kJ\ mol^{-1}$

         (ii)   Heat of formation of CO_2 = $-393.7\ kJ\ mol^{-1}$

         (iii)   Heat of formation of H_2O = $-285.8\ kJ\ mol^{-1}$

Q. 5   **a.**   (i)   What are buffer solutions? Why do we need them?   01+01

         (ii)   What is Buffer Capacity? Explain with the help of an example.   02

     b.   Freezing points of solutions are depressed when non-volatile solute is present in a solvent. Justify it and plot a graph to elaborate your answer.   03+01

     c.   Define Galvanic Cell. Draw a labelled diagram and working of the cell using $Zn - Cu$ electrodes. Also write the reactions taking place at the electrodes.   01+03+01

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Roll No. ☐☐☐☐☐☐☐   Answer Sheet No._____

Sig. of Candidate._____   Sig. of Invigilator._____

CHEMISTRY HSSC–I
SECTION – A (Marks 17)

Time allowed: 25 Minutes   (Revised Syllabus)

NOTE: Section–A is compulsory. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

**Q. 1**   Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i)   Which of the following substances has zero value of its standard enthalpy of formation?
   A. $H_2O_{(g)}$ B. $C_{graphite\,(s)}$ C. $CO_{2(g)}$ D. $H_2O_{(l)}$

(ii)   1 Faraday is equal to:
   A.   101325 Coulombs B.   96487 Coulombs C.   964 Coulombs D.   9648 Coulombs

(iii)   One mole of propane (C_3H_8) has the same:
   A.   Mass as half a mole of Hexane (C_6H_{14})
   B.   Number of Hydrogen atoms as in one mole of Butane (C_4H_{10})
   C.   Number of carbon atoms as in one mole of Methane (CH_4)
   D.   Number of molecules as in one mole of Ethane (C_2H_6)

(iv)   Wavelength of a photon is $2\times10^{-6} m$. its wave number is:
   A. $0.5\times10^6 m^{-1}$ B. $50\times10^6 m^{-1}$ C. $0.5\times10^5 m^{-1}$ D. $5\times10^6 m^{-1}$

(v)   Which one of the following is a diamagnetic species?
   A. He B. H C. He^{+1} D. He^{-1}

(vi)   Geometry of PF_5 molecule is:
   A.   Square planar   B.   Trigonal bipyramidal
   C.   Trigonal planar   D.   Trigonal pyramidal

(vii)   In the formation of N_2^+ from N_2 the electron is removed from:
   A. $\pi 2p_y$ B. $\pi^* 2p_y$ C. $\sigma^* 2p_x$ D. $\sigma 2p_x$

(viii)   1 atm is equal to:
   A.   22.414 Pa   B.   101325 Pa   C.   760 Pa   D.   1 Pa

(ix)   Average speed of gas molecules is:
   A.   Inversely proportional to the molecular mass of the gas.
   B.   Inversely proportional to the square root of the molecular mass of the gas.
   C.   Inversely proportional to the absolute temperature.
   D.   Inversely proportional to the square root of absolute temperature.

(x)   Liquid crystals are always:
   A.   Isomorphic   B.   Isomeric   C.   Isotropic   D.   Anisotropic

(xi)   Crystalline form of grey tin is:
   A.   Tetragonal   B.   Cubic   C.   Monoclinic   D.   Orthorhombic

(xii)   Equilibrium constant (Kc) can be changed by changing:
   A.   Volume   B.   Pressure
   C.   Temperature   D.   Initial concentrations

(xiii)   If $Q > Kc$, then to acquire equilibrium state:
   A.   System must shift to right side   B.   Reaction must stop
   C.   System must remain unchanged   D.   System must shift to left side

(xiv)   pH of $0.05M$ H_2SO_4 is:
   A.   2.0   B.   1.0   C.   Zero   D.   5.0

(xv)   Hydrogenation of vegetable oil using nickel catalyst is an example of:
   A.   Heterogeneous catalysis   B.   Biocatalysis
   C.   Homogeneous catalysis   D.   Enzyme catalysis

(xvi)   Benzene-water system is an example of:
   A.   Completely miscible liquids   B.   Ideal solutions
   C.   Completely immiscible liquids   D.   Partially miscible liquids

(xvii)   Effect of pressure on the solubility of gases is explained by:
   A.   Graham's law   B.   Henry's law   C.   Raoult's law   D.   Boyle's law

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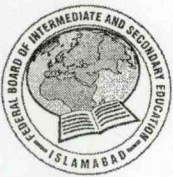
Total Marks: | 17 |

Marks Obtained: | |

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CHEMISTRY HSSC–I
(Revised Syllabus)

Time allowed: 2:35 Hours   **Total Marks Sections B and C: 68**

NOTE: Sections B and C comprise pages 1 – 2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required.   Write your answers neatly and legibly.

SECTION – B (Marks 42)

Q. 2   **Answer any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines.**   (14 x 3 = 42)

(i)   Define the following: 03
    a.   Avogadro's number
    b.   Limiting reactant
    c.   Stoichiometery

(ii)   Write electronic configuration of following elements: 03
    a. $_{25}Mn$ b. $_{20}Ca$ c. $_{30}Zn$

(iii)   What is Hund's rule? Explain with two examples.   03

(iv)   What is dipole moment? How it is calculated? Give its units.   03

(v)   Explain the structure of Methane (CH_4) by using Hybridization concept.   03

(vi)   What is an ideal gas? What are causes of deviation of real gases from ideal behaviour?   03

(vii)   If $50cm^3$ of a gas in a syringe at $15\,^oC$ is heated up to $50\,^oC$. What will be the new volume of the gas if pressure is kept constant.   03

(viii)   Define the additive, constitutive and colligative properties of liquids giving one example of each property.   03

(ix)   Give three differences between Molecular solids and Metallic solids.   03

(x)   Write the relationship between the equilibrium constant Kp with the following equilibrium constants.   03
    a. K_c b. K_n c. K_x

(xi)   Using data given below calculate the value of K_c and its units: 03

$$A_{(g)} + 3B_{(g)} \rightleftharpoons 2AB_{(g)}$$
$$[A] = 0.399M \, , [B] = 1.197M$$
$$[AB] = 0.203M$$

(xii)   What are Buffer solutions? How buffer solutions are prepared? Give an application of buffer solutions.   03

(xiii)   What is chemical Kinetics? Differentiate between average rate and instantaneous rate of a reaction.   03

(xiv)   Calculate the mass of ozone (O_3) in grams if its concentration in atmosphere is 0.5ppb per Kg of air.   03

(xv)   Derive a relationship between lowering of vapour pressure of a solvent and the mole fraction of a non-volatile, non-electrolyte solute using Raoult's law.   03

(xvi) Define the following: **03**
    a.   State function
    b.   Spontaneous process
    c.   Internal energy

(xvii) State and explain the standard Enthalpy of formation. **03**

(xviii) Balance the following Redox equation by using oxidation number method:

$$Na + H_2O \rightarrow NaOH + H_2$$
03

(xix) What is Galvanization? How does sacrificial corrosion take place on a damaged Galvanized sheet? **03**

SECTION – C (Marks 26)

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

Q. 3   **a.**   What is the difference between actual yield and theoretical yield? Calculate the percentage yield of ammonia (NH_3) if 42.0 grams of H_2 produces 120.2 grams of ammonia during the following reaction. $N_{2(g)} + 3H_{2(g)} \rightarrow 2NH_{3(g)}$ [at.masses N=14,H=1]   **05**

    b.   How did James Chadwick discover neutrons? What nuclear reaction takes place when neutrons are bombarded on nitrogen and copper nuclei separately? **05**

    c.   Write down three drawbacks of valence bond theory (VBT). **03**

Q. 4   **a.**   Calculate the value of ideal gas constant (R) using S.I units. Calculate the molar mass of an ideal gas at STP. Density of the gas is $1.29\,kgm^{-3}$. **06**

    b.   State the Lechatelier's principle and discuss how yield of NH_3 can be increased in the Haber's process. **04**

    c.   Prove that: $pKa + pKb = 14$ $at\ 25\,^{o}C$ for a conjugate acid-base pair. **03**

Q. 5   **a.**   What is solubility? Discuss the effect of temperature on the solubility of solid solutes. **03**

    b.   Explain construction and working of a Galvanic cell using its labelled diagram. Also write the oxidation reduction reactions taking place at its electrodes. **06**

    c.   What is Electroplating? How is an iron spoon silver plated? **04**