

CHEMISTRY 2019

Time: 20 minutes

Max, Marks: 17

SECTION 'A'(MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options:

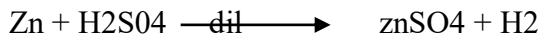
- (i) Capillary action of liquids is due to:
*Surface tension *Density *Viscosity *Fluidity
- (ii) (n+1) value for 5d orbital is:
*4 *5 *6 *7
- (iii) This colour has the shortest wavelength in the visible spectrum of light:
*Red *Violet *Green *Yellow
- (iv) This series of lines is produced when the electron jumps from the 4th orbit to the 2nd orbit:
*Lyman *Balmer *Bracket *Paschen
- (v) The maximum number of electrons can be accommodated in f orbital is:
*7 *10 *14 *15
- (vi) This hydrogen halide has the highest percentage of ionic character
*HF *HCl *HBr *HI
- (vii) This molecule has zero dipole moment:
*NH₃ *C₂O₂ *HCl *H₂O
- (viii) 1 Debye is equal to"
* 3.4 x 10⁻⁴⁰ cm *2.25 x 10⁻³³ cm *3.335 x 10⁻²³ cm *3.335 x 10⁻³⁰ cm
- (ix) One joule is equal to:
* 0.239 cal *0.391 cal *0.398 cal *4.184 cal
- (x) in the following reaction $K_p > K_c$:
* H₂ + I₂ → 2HI *PCl₅ → PCl₃ + Cl₂
*2SO₂ + O₂ → 2SO₃ *2NO₃ → N₂O₄
- (xi) Universal indicator in acid gives:
*Green Colour *Yellow colour *Pink Colour *Red colour
- (xii) The oxidation number Mn in K₂MnO₄ is:
*+2 *+4 *+6 *+7
- (xiii) A powdered solid is more reactive than its chunks due to its:
*Higher temperature *Greater volume *Greater surface area *Higher pressure
- (xiv) This number has five significant figures:
*391.10 *300002 *30000 *10300
- (xv) At S.T.P. the volume of 3.01 x 10²³ molecules H₂ gas is
*22.5 dm³ *22.4dm³ *11.2 dm³ *2.24dm³
- (xvi) An ideal gas obeys gas laws at:
* high temperature *High pressure
* All temperatures and pressures *low temperature
- (xvii) The process of direct conversion solid into vapour is called
* Condensation *Sublimation *Evaporation *Neutralization

CHEMISTRY 2019

SECTION 'B'(SHORT-ANSWER QUESTIONS (40))

NOTE: Attempt any Ten parts questions from this section. All questions carry equal marks.

2. (i) Define the following: (i) Random error. (ii) Exponential notation
(iii) Heat of formation (iv) Rate expression
(ii) Zinc reacts with H₂SO₄ (dil) as given below:



Calculate the mass of ZnSO_4 , the volume of H_2 gas at S.T.P. and the number of molecules of H_2 gas which will be produced by reacting 163.5g of Zn with H_2SO_4 .

(iii) An organic compound contains 40% carbon, 6.67% hydrogen and 53.33% oxygen by mass. The molecular mass of the compound is 180.

Find its empirical and molecular formulae.

(iv) A 500 cm³ vessel contains H_2 gas at 400 torr pressure and another 1 dm³ contains O_2 gas at 600 torr pressure. If these gases are transferred to 2 dm³ empty vessel, calculate the pressure of the mixture of gases.

(v) What is Ideal gas? Derive the ideal equation.

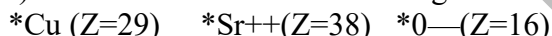
(vi) Give any four scientific reasons of the following:

*Evaporation is a cooling process. * Water has higher B.P. than Hydrogen fluoride although fluorine is more electronegative than Oxygen.

*The order of reaction is zero of photochemical reactions.

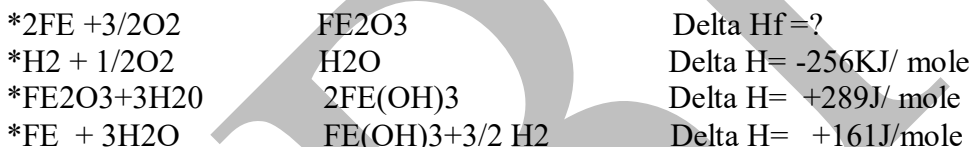
* Na^+ is smaller in size than Na atom.

(vii) State (n+l) rule. Write the electronic configuration of the following:



(viii) What is Covalent Bond? Explain the Ionic character of Covalent bond.

(ix) Calculate the Heat of Formation of Fe_2O_3 at 25°C



(x) State and explain Hess's Law of Constant heat summation with its applications.

(xi) State le-Chatelier's Principle. Give its applications in the manufacture of SO_3 by Contact process.

(xii) The K_c for the reaction $2\text{HI} \rightleftharpoons \text{H}_2 + \text{I}_2$ is 1.3×10^{-2} . If there are 0.5 moles/dm³ of H_2 of 1.5 moles/dm³ of I_2 and 5 moles/dm³ HI ., predict the direction in which the reaction moves so as to achieve the equilibrium.

(xiii) What are the main postulates of Arrhenius theory of ionization?

(xiv) Define Activation energy. Give its relationship with the speed of reactions.

(xv) Determine the order of reaction:

A + B -----> Product From the following data:

S.No.	A moles dm ³	B moles dm ³	Rate MS-1
1	0.1	0.1	1 x 10 ⁻³
2	0.2	0.1	4X 10 ⁻³
3	0.1	0.3	3 X 10 ⁻³

SECTION 'C' (DETAILED- ANSWER QUESTIONS) (28)

Note: Answer 2 Questions from this section. All questions carry equal marks. Draw diagram, where necessary.

3. (a) Starting from $\Delta E = E_2 - E_1$ derive the expression for the wave number for hydrogen atom.

(b) Define Radioactivity. Describe the character of Alpha and beta rays

(c) What is Unit cell? Sketch a unit cell and label the dimensions a, b, c and angle Alpha, beta & Gamma . How do cubic and tetragonal system differ?

4 (a) Define Orbital Hybridization. Explain the shape of Ethene, C₂H₄ on the basis of Hybridization.

(b) Explain the structure of BeCl₂ and NH₃ on the basis of Electro and pair repulsion model and Hybrid orbital model

(c) Differentiate any two of the following

Sigma bond and Pi-bond

Line spectrum and Continuous spectrum

Hydration and Hydrolysis

5. (a) What Standard Electrode potential? How is the electrode of Copper determined? Explain

(b) Balance any One of the following by ion-electron method:



(c) Will Cadmium hydroxide precipitate from 0.02 M solution of

CdCl₂ at pH=10?

K_{sp} of Cd(OH)₂ = 2.5*10⁻¹⁴ mole²/dm⁶

CHEMISTRY 2018

Time: 20 minutes

Max, Marks: 17

SECTION 'A'(MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options:

(i) The volume of 3.01x10²³ molecule of N₂ gas at S.T.P will be:

*3 dm³ ***11.2 dm³** *22.4 dm³ *28 dm³

(ii) The characteristics of 10³ is: *2 ***3** *4 *5

(iii) if a = b not equal c and α = β = γ = 90⁰, the crystal structure is:

*cubic ***Tetragonal** *Orthorhombic *Triclinic

(iv) The rate of diffusion of CO₂ is equal to that of:

*CH₄ *CO ***C₃H₈** *SO₂

(v) The S.I. unit of viscosity is:

*Poise *Millipoise *Centipoise ***N.s.m²**

(vi) The maximum number of electron in a particular energy level is:

***2n²** *n² *(2l+1) *2(2l+1)

(vii) The energy of each quantum of radiation is directly proportional to

*Wavelength ***Frequency** *Wave number *Source of energy

(viii) These radioactive rays are non-material in nature:

*αrays *βrays ***γrays** *Canal rays

(ix) The potential energy of an electron can be denoted by:

*Ze²/r² *Ze/r *Ze²/r ***-ze²/r**

(x) This molecule has the maximum bond angle:

***CS₂** *NH₃ *SO₂ *H₂O

(xi) The energy of this bond is the greatest:

*CH₄ *O₂ *N₂ ***C₁₂**

(xii) The dipole moment of this molecule is zero

*NH₃ ***CO₂** *H₂O *HCl

(xiii) This is not an extensive property:

*internal energy *Enthalpy ***Density** *Entropy

(xiv) The equation for K_{sp} of CaF₂ is: *K_{sp}=[Ca⁺⁺][F⁻]²

***K_{sp} = [Ca²⁺][F⁻]²** *K_{sp}=[Ca⁺⁺][F⁻] * K_{sp} = [Ca][F]

(xv) This ion has the greatest of hydration.

*Na⁺ *Mg²⁺ *Al³⁺ *K⁺

(xvi) The molarity of a solution containing 53g Na₂CO₃ dissolved in 1dm³ solution will be: *0.1
*0.01 *0.02 *0.5

(xvii) The reaction 2N₂O₂ ⇌ 2N₂O + O₂ is Of:

*zero order * order *2nd Order *3rd order

CHEMISTRY 2018

SECTION 'B'(SHORT-ANSWER QUESTIONS)(40)

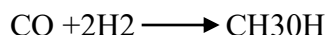
NOTE: Attempt any Ten parts questions from this section. All questions carry equal marks.

2.. (i) Define the following:

*Stoichiometry *Molar volume

*Activation energy *Enthalpy

(ii) Find the mass of CH₃OH produced. When 356 gm Of CO is mixed with 65.0 g of H₂.



(iii) 100 gram of KNO₃ heated to redness. Find volume of oxygen is liberated at 39^o C and 765 torr pressure.



(iv) Give the scientific reasons for any four of the following:

*Viscosity of ethyl alcohol is greater than that of diethyl ether.

*Milk sours rapidly in summer than in winter.

*Evaporation is a cooling process.

*H₂O has higher boiling point than HF.

* CO₂ has zero dipole moment.

(v) Calculate the density of SO₂ in g/dm³ at 25^oC and 300 torr pressure.

(vi) What is Ideal gas? Derive the ideal gas equation.

(vii) State Pauli's exclusion principle and write the electronic configurations of the following:

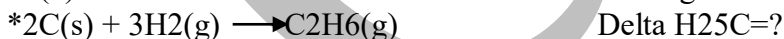
*Ca²⁺ (Z = 20) *Br⁻ (Z=35) *Cr (Z=24)

(viii) Explain Ionic character of Covalent bond.

(ix) State the First Law of thermodynamics and show that:

$$q_v = \Delta E_{qp} = \Delta H$$

(x) Calculate ΔH_{25C} of ethane from the data given below



(xi) State and explain the law of mass action, Derive the expression for the general reversible reaction given below:



(xii) 4.6 gram of ethyl alcohol and 6.0 gram of acetic acid constant were kept at constant temperature until equilibrium was established, 2.0 gram of acetic acid remained unused. Calculate K_c for the reaction.



(xiii) What is Electrolysis? Explain electrolysis in CuCl₂ solution. Also give the chemical reactions on the electrodes,

(xiv) Determine the order of reaction from the data given below:

A+B-----> Product From the following data:

S.No.	A moles dm ³	B moles dm ³	Rate MS-1
1	0.1	0.1	3 x 10 ⁻³
2	0.2	0.1	6.0 x 10 ⁻³
3	0.1	0.3	9.0 x 10 ⁻³

(xv) Make the list of factors which affect the rate of reaction. Discuss the following factors:

*Surface area

*Temperature:

SECTION 'C' (DETAILED- ANSWER QUESTIONS) (28)

Note: Answer 2 Questions from this section. All questions carry equal marks. Draw diagram, where necessary.

3. (a) With the help of the experiment of scattering of a-rays, explain the atomic model and its conclusion.

(b) State the postulates of Bohr's Atomic Theory and derive an expression for the energy of an electron in the nth orbit when

$$r = n^2 h^2 / 4\pi^2 m Z e^2$$

(c) Differentiate between Isomorphism and Polymorphism and explain Ionic crystal.

4 (a) What is Chemical bond? Give its types. Using the example of NaCl, explain the formation and stability of ionic bond.

(b) Give the postulates of electron pair repulsion model and draw the molecular shape of BF₃ and H₂O on the basis of this model.

(c) Should AgCl precipitate form a solution prepared by mixing 400 ml of 0.1 M NaCl and 600 ml of 0.03M AgNO₃? (K_{sp} of AgCl = 1.6 x 10⁻¹⁰ mole²/dm⁶).

5. (a) What is Electrode potential? Determine the electrode potential of Zinc with the help of Cell diagram.

(b) Balance any one of these equation by ion electron method:

* HN03+H2S ->NO+ S+H2O *MNO4 +SO32-+OH-→ Mn+2 +SO42-

(c) 4.0 g NaOH is dissolved in 2.5 dm³ solution. Find its molarity and pH.

CHEMISTRY

Time: 20 minutes

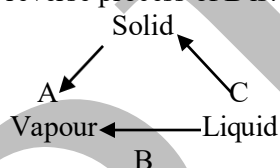
2017

Max. Marks: 17

SECTION 'A' (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options.

(i) In the diagram below, the name of the reverse process of B is:



- a. Sublimation
 - b. Condensation
 - c. Evaporation
 - d. Fusion
- (ii) If $a = b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$ the crystal structure is:
- a. Cubic
 - b. Tetragonal
 - c. Orthohombic
 - d. Triclinic
- (iii) The uncertainty principle is applied to:
- a. Aeroplane
 - b. Cricket ball
 - c. Electron
 - d. Earth
- (iv) This is an intensive property:
- a. Internal Energy
 - b. Enthalpy
 - c. Volume
 - d. Reflective Index
- (v) Quantum number values for 3rd orbital are:
- a. $n = 3, l = 2$
 - b. $n = 3, l = 3$
 - c. $n = 2, l = 2$
 - d. $n = 3, l = 0$
- (vi) This molecule has the maximum bond angle:
- a. $\square\square_3$
 - b. $\square\square_2$
 - c. $\square\square_2$
 - d. $\square_2\square$
- (vii) For a reversible reaction, if the concentrations of the reactants are doubled, then the equilibrium

constant will:

- a. Also be doubled
- b. Be halved
- c. Remain the same
- d. Become one-fourth

(viii) The majority of a solution containing 4gm NaOH dissolved in 10ml solution is:

- a. 0.4M
- b. 0.1M
- c. 10M
- d. 1.0M

CSBF

- (ix) A powdered solid is more reactive than its chunks due to:
- Higher temperature
 - Higher pressure
 - Greater surface area
 - Greater volume
- (x) The number of bonds in N_2O_2 molecules is:
- one σ and two π
 - three σ and one π
 - three σ and two π
 - two σ and two π
- (xi) Most of the radiations coming out from Pithblende were:
- Protons
 - Electrons
 - Positrons
 - Neutrons
- (xii) The number of orbital's in each energy level is given by the formula:
- $2l^2$
 - $(2l + 1)$
 - $2(2l + 1)$
 - l^2
- (xiii) The energy of each quantum of radiation is directly proportional to its:
- Frequency
 - Wavelength
 - Wave number
 - Source of energy
- (xiv) This has five significant figure:
- 0.00215
 - 21500
 - 21.5210
 - 21.521
- (xv) The melting points of those substances which expand on melting increase when the pressure is:
- Decreased
 - Increased
 - Kept Unchanged
 - Atmospheric
- (xvi) While considering the rule of significant figures the simplified result of $3.1 + 14.367$ is:
- 17.467
 - 17.47
 - 17.50
 - 17.5
- (xvii) The atmospheric pressures recorded in different places at the same time are given below:

Nathiagali	Hunza	Murree	Gilgit
700 torr	650 torr	710 torr	600 torr

Water will boil first in:

- Nathiagali
- Hunza
- Murree
- Gilgit

CHEMISTRY

Time: 2 Hours 40 Minutes

2017
Marks: 68

SECTION 'B' (SHORT-ANSWER QUESTIONS)

NOTE: Answer any Ten part questions.

(40)

2. (I) Define the following:

- Limiting reactant
- Internal Energy
- Mole
- Threshold energy

(ii) An organic compound contains 40% C and 6.66% H by mass. Its molecular mass is double that of its empirical formula mass. Find its Molecular formula.

(iii) CaCO_3 Heat $\text{CaO} + \text{CO}_2$ CaCO_3 , is often used to generate CO_2 gas in industry. If 200g of CaCO_3 is strongly heated, what volume of CO_2 gas will be obtained at 30°C and 1200 torr pressure?

(iv) Give the reasons for any four of the following:

- Glycerin is distilled at reduced pressure.
- Milk sours more rapidly in summer than in winter.
- Compounds having hydrogen bond generally have high boiling points.
- The shorter the bond length, the stronger will be the bond.
- Elements give line spectrum.

(v) A gaseous mixture of O_2 and N_2 at 60°C and total pressure of 2.5 atmospheres contains 75 mole % O_2 . What are the partial pressures of both the gases in the mixture?

(vi) State the relevant gas laws which explain the following observations of gases:

- When a balloon filled with air is kept in cold place at constant pressure, its volume is reduced.
- When the pressure on a gas kept in an air light cylinder at constant temperature is doubled, its volume becomes half.

(vii) What is radioactivity? Why is it limited to heavy elements? Write the properties of Alpha particles.

(viii) Calculate to heat of properties of Benzene at 25°C

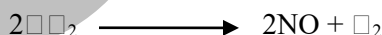
- $6\text{C}_{(s)} + 3\text{O}_{2(g)} \longrightarrow \text{C}_6\text{H}_{6(l)} \quad \Delta H = ?$
- $\text{C}_{(s)} + \text{O}_{2(g)} \longrightarrow \text{CO}_{2(g)} \quad \Delta H = -394 \text{ KJ}$
- $\text{C}_{2(g)} + \frac{1}{2}\text{O}_{2(g)} \longrightarrow \text{C}_2\text{H}_2(g) \quad \Delta H = -286 \text{ KJ}$
- $4\text{C}_{6(l)} + 15/2 \text{O}_{2(g)} \longrightarrow 6\text{CO}_{2(g)} + 3\text{H}_2\text{O}_{(l)} \quad \Delta H = -3267 \text{ KJ}$

(ix) State and explain Hess's Law of constant head of summation with examples.

(x) State Le-Chatelier's principle. Give to application on the manufacture of NH_3 by Contact process.

(xi) Phosphorus pentachloride decomposes in a gas phase reaction at 250°C as follows: $\text{PCl}_5(g) \rightleftharpoons \text{PCl}_3(g) + \text{Cl}_2(g)$. An equilibrium, mixture in a 5.0 Liter container is found to have 3.84 gm PCl_5 , 9.14gm PCl_3 and 2.84 gm of Cl_2 . Evaluate K_p at 250°C .

(xii) Define pH and pOH. Calculate the pH and pOH of a solution of Nitric acid whose concentration of Nitrogen dioxide is $1.8 \times 10^{-3} \text{ mol}^3 \text{ mol}^{-1} \text{ mol}^{-1}$



- Write the rate expression.
- Find the initial rate, when the initial concentration of NO_2 IS 0.75M.
- Find the rate constant k when the initial concentration of NO_2 is doubled.

(xiv) Differentiate between the following (any two)

- Valence Bond Theory (V.B.T) and Molecular Orbital Theory (MOT)
- Azimuthally Quantum number and principal Quantum num.
- Sigma bond and Pi bond.

(xv) Name any three physical methods along with the observed physical properties for determining the rate of reaction. Describe the chemical method for determining the rate of the hydrolysis of ester in acidic medium.

SECTION 'C' (DETAILED-ANSWER QUESTIONS) (28)

NOTE: Answer 2 questions from this section.

3(a) State the postulates of Bohr's atomic model. Derive expression for the frequency when the electron jumps from higher orbit (n_2) to lower orbit (n_1). The energy of the electron = $\frac{-2.18 \times 10^{-18} \text{ J}}{n^2}$

(b) Define Hybridization and write its types. Explain Hybridization in Ethane, C_2H_6 OR Ethene, C_2H_4 molecules.

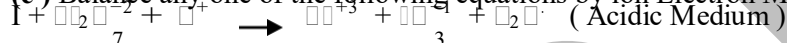
(c) The concentration of Ag^+ ions is $1 \times 10^{-6} \text{ M}$ in AgBr solution. Find the minimum concentration of Br^- ions necessary to cause precipitation of



4(a) What is Electrolysis? Explain by giving the example of CuCl_2 . Give all the necessary electrode reactions.

(b) What is unit cell? Sketch a unit cell and label the dimensions a, b, c and angles α , β , γ . How does cubic and tetragonal system differ?

(c) Balance any one of the following equations by ion Electron Methods.



5.(a) Draw and explain the geometrical shapes of molecules with the following number of electrons pair:

- Two bond pairs
- Three bond pairs and one lone pair
- Two bond pairs and two lone pairs.

(b) State Hund's Rule and write the electronic configurations of the following:

- Cl^{-1} ($Z = 17$)
- Cr ($Z = 24$)
- Co^{+1} ($Z = 37$)

(c) 19.6 gm of Na_2CO_3 is dissolved in 500 cm^3 water to make a solution. What mass of NaOH should be dissolved in 250 cm^3 of water to prepare the solution of the same molarity as that of Na_2CO_3 ?

CHEMISTRY

Time: 20 Minutes

2016

Max. Marks: 17

SECTION 'A' (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options.

(i) The bond angle is the maximum in this molecule:

- a. $\square\square_4$
- b. $\square\square_2$
- c. $\square_2\square$
- d. $\square\square_3$

(ii) Gases behave ideally at these conditions:

- a. High pressures and high temperatures
- b. High pressures and low temperatures
- c. Low pressures and high temperatures
- d. Low pressures and low temperatures

(iii) Glass is a/an:

- a. Crystalline Solid
- b. Amorphous Solid
- c. Covalent Solid
- d. Ionic Solid

(iv) Bond Energy is the greatest for:

- a. $\square\square_4$
- b. \square_2
- c. \square_2
- d. \square_2

(v) The bulk properties of a system, which are easily measurable, are known as:

- a. Microscopic properties
- b. Chemical properties
- c. Macroscopic properties
- d. Physical properties

(vi) The characteristic of 10_3 is:

- a. 2
- b. 3
- c. 4
- d. 5

(vii) This molecule has zero dipole moment:

- a. $\square\square_3$
- b. $\square\square_2$
- c. $\square_2\square$
- d. HCl

(viii) The molarity of a solution containing 20g NaOH dissolved into 1 $\square\square^3$ solution will be:

- a. 0.1
- b. 0.5
- c. 1
- d. 2

(ix) The Octet rule is not valid for this molecule:

- a. \square_2
- b. $\square\square_2$
- c. \square_2
- d. \square_2

- (x) The yield of Ammonia in Haber's process is favored by:
- High pressure and high temperature
 - High pressure and low temperature
 - Low pressure and low temperature
 - Low pressure and high temperature
- (xi) This ion has the greatest degree of hydration:
- M^+
 - M^{2+}
 - M^{3+}
 - M^+
- (xii) This volume of 3.01×10^{23} molecules of O_2 gas at S.T.P. will be:
- 3 dm^3
 - 11.2 dm^3
 - 22.4 dm^3
 - 28 dm^3
- (xiii) Rate = $K[\text{O}_3]^2$. Keeping the other conditions same, if the concentration of O_3 is increased by four times, then the initial rate of reaction X will be:
- 2X
 - 4X
 - 8X
 - 16X
- (xiv) This is not an extensive property:
- Entropy
 - Viscosity
 - Enthalpy
 - Internal Energy
- (xv) The extent of reaction will be maximum for this K_c value:
- 10^{-13}
 - 0.1
 - 10
 - 10^3
- (xvi) This hydrogen halide has the highest percentage of ionic character:
- HF
 - HCl
 - HBr
 - HI
- (xvii) These have low values of activation energy:
- Slow reactions
 - Fast reactions
 - Moderate reactions
 - Ionic reactions

CHEMISTRY

Time: 2 Hours 40 Minutes

2016

Marks: 68

SECTION 'B' (SHORT- ANSWER QUESTIONS)

NOTE: Answer any ten part questions.

(40)

2. (i) Differentiate any Two of the following:°

- Continuous spectrum and Line spectrum
- Isomorphism and Polymorphism
- Polar bond and non-polar bond

(ii) What volume of O_2 measured at 20°C and 720 torque pressure will be produced by reaction between 200 gm of Na_2CO_3 and HCl?



(iii) (a) Simplify the following by using rules of significant figures:

$$\frac{92 \times 751 \times 173}{760 \times 297}$$

(b) Draw the electronic structures of:

- Phosphorus ox chloride
- Nitro methane

(iv) (a) 10 gm Na_2CO_3 has been dissolved in excess of water to dissociate it completely into ions. Calculate the:

- Number of molecule in 10 gm of Na_2CO_3
- Number of positive ions.

(b) Define the following:

- Limiting Reactant
- Random Error

(v) Calculate the heat of formation of MAY at 25°C :

- $2\text{M} + \frac{1}{2}\text{O}_2 \rightarrow \text{M}_2\text{O} \quad (\Delta H = ?)$
- $\text{M} + \text{O}_2 \rightarrow \text{MAY} + \frac{1}{2}\text{O}_2 \quad (\Delta H = -43.2 \text{ KJ / mole})$
- $\text{O}_2 + \frac{1}{2}\text{O}_2 \rightarrow \text{O}_2 \quad (\Delta H = -68.5 \text{ KJ / mole})$
- $\text{O}_2 + \text{O}_2 \rightarrow 2\text{MAY} \quad (\Delta H = -63.2 \text{ KJ / mole})$

(vi) 1100 ml of O_2 at a pressure of 500 torr, 1500 ml O_2 at a pressure of 400 torr and 800 ml of O_2 at a pressure of 600 torr are placed together in a container of 1000 ml capacity. Find the partial pressure of each gas.

(vii) Define solubility. The solubility of $\text{Mg}(\text{OH})_2$ at 25°C is $4.6 \times 10^{-3} \text{ gm / } 100 \text{ cm}^3$. What is the solubility product of $\text{Mg}(\text{OH})_2$?

(viii) For the reaction: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$ the equilibrium mixture contains 0.25 M Nitrogen and 0.15 M Hydrogen gas at 25°C . Calculate the concentration of NH_3 . Given $K_c = 9.6$. The volume of the container is 1 cm^3 .

(ix)(a) If 6 ml of hydrogen diffuse in 30 sec, what volume of O_2 will diffuse in the same time (30 sec). Under similar conditions?

(b) If 1800 cal of heat is added to a system while the system does work equivalent to 2800 cal by expanding against the surrounding, what is the value of ΔE for the system?

(x) Give scientific reasons for the following:

- H_2O Forms concave meniscus while mercury forms convex meniscus.
- Rate of diffusion of O_2 and N_2 gases are same.
- Electron Affinity of noble gases is zero.
- Powdered Zinc reacts more vigorously with HCl than chunks of Zinc.

(xi) Define Hydrogen bonding. State its characteristics and effects on the physical properties of a Δ molecule.

(xiii)(a) Write the electronic configuration of a molecule.

- Cu^+ ($Z = 29$) Δ
- Cu ($Z = 35$)

(b) Using $n + 1$ rule, arrange 4d, 7s and 4f energy levels in ascending order of energy.

(xiii) Enumerate the rules of assigning oxidation number for the elements.

(xiv) The aqueous solution of 0.3M $\text{Mg}(\text{Cl})_2$ is 60% ionized. Calculate its pH.

(xv) (a) Give the relationship between μ_{O} and μ_{H} .

(b) For the reaction: $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$, calculate the rate constant when the initial concentration of N_2O_5 is 10.8g/l while the initial rate is $2.96 \times 10^{-4}\text{mole/l sec}$.

SECTION 'C' (DETAILED – ANSWER QUESTIONS) (28)

NOTE: Answer 2 questions from this section.

3. (A) with the help of diagram of experimental of scattering of α – rays, explain the Atomic model and conclusions.

(b) Derive an expression for the radius of n^{th} orbit for Hydrogen atom using Bohr's atomic model.

(C) Explain the origin of X-rays and describe the relationship between their wavelength and atomic number.

4. (A) Define Electrovalent bond. Explain the formation of NaCl along with the energy changes involved. Also write three characteristics of Ionic compounds.

(b) Explain the shapes of the following molecules on the basis of Electron pair repulsion model and Hybrid orbital model:

i. CO_2

ii. CH_2Cl_2

(c) State Boyle's, Charles and Avogadro's Laws and derive an expression for the equation of state. Calculate the value of Gas constant in two different units.

5. (A) State and explain the first Law of Thermodynamics. Show that $W = P\Delta V$ and $\Delta H = \Delta E + P\Delta V$.

(b) Define standard Electrode potential. How is the electrode-potential of Zn determined?

(c) State the explanation of the law of Mass action. Derive the expression of K_{eq} for a general reversible reaction.

CHEMISTRY

Time: 20 Minutes

2015

Max. Marks: 17

SECTION 'A' (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options.

- (i) This one of the following pairs has the same number of molecules:
- 10O_2 & 10O_4
 - 10O_2 & 50O_4
 - 10O_2 & 80O_4
 - 10O_2 & 16O_4
- (ii) If $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$ then the shape of the crystal is:
- Cubic
 - Tetragonal
 - Hexagonal
 - Orthorhombic
- (iii) The following pair of ions is isoelectronic:
- O^+ & O^{2+}
 - O^- & O^-
 - O^+ & O^+
 - O^{2-} & O^{2-}
- (iv) This one of the following colours has the shortest wavelength:
- Red
 - Blue
 - Violet
 - Orange
- (v) The S.I unit of Dipole moment is:
- dyne/cm
 - poise
 - Debye
 - Coulomb-metre
- (vi) 1 Cal. Is equal to:
- 0.239J
 - 1.98J
 - 4.184J
 - 8.314J
- (vii) When 2 moles of solute are present in 2dm^3 of solution, then the concentration of the solution is:
- 0.5 M
 - 1 M
 - 2 M
 - 3 M
- (viii) With an increase in temperature, a system involving exothermic reaction will:
- Move in the forward direction

- b. Remain at equilibrium
- c. Move in the reverse direction
- d. None of these

(ix) The oxidation number of Sulphur in SO_4^{2-} is:

- a. -2
- b. 0
- c. +4
- d. +6

(x) This is not a primary bond:

- a. Ionic bond
- b. Covalent bond
- c. Dative bond
- d. Hydrogen bond

(xi) For the reaction $2\text{SO}_3 \rightleftharpoons \text{S}_2\text{O}_6^{2-} + 3\text{O}_2$, the relationship between K_p and K_c is:

- a. $K_p = K_c$
- b. $K_p > K_c$
- c. $K_p < K_c$
- d. $K_p \leq K_c$

(xii) Conduction in metals is due to the movement of:

- a. Ions
- b. Electrons
- c. Protons
- d. Atoms

(xiii) The (n+1) value for 5d orbital is:

- a. 4
- b. 5
- c. 6
- d. 7

(xiv) Dipole moment of CO_2 is zero. Hence, the bond angle is:

- a. 90°
- b. 109.5°
- c. 120°
- d. 180°

(xv) The most favorable conditions of temperature and pressure for oxidation of CO_2 into CO_3 are:

- a. Low temperature and high pressure
- b. Low temperature and low pressure
- c. High temperature and high pressure
- d. High temperature and low pressure

(xvi) The volume of 0.2M, H_2SO_4 required for the neutralization of 10^{-3} of 0.1 M NaOH is:

- a. 2.5×10^{-3}
- b. 5×10^{-3}
- c. 10×10^{-3}
- d. 15×10^{-3}

(xvii) Photochemical reactions, which proceed only under the influence of light, are of the order:

- a. Zero
- b. First
- c. Second
- d. Third

CHEMISTRY

Time: 2 Hours 40 Minutes

2015
Marks:68

SECTION 'B' (SHORT-ANSWER QUESTIONS)

NOTE: Answer any Ten part questions:

(40)

2.(i) Define the following:

- Exponential Notation
- Unit Cell
- Common ion effect
- Normal boiling point

(ii) The empirical formula of compound is $\text{C}_2\text{H}_4\text{O}$. 1.8g of this compound in gaseous state occupies 448 cm^3 at S.T.P. Find its molecular formula.

(iii) Differentiate any two of the following:

- Amorphous and Crystalline solids
- Sigma and Pi bond
- Orbit and Orbital

(iv) A gaseous mixture contains 0.2 mole of O_2 and 0.3 mole of CO_2 . If the partial pressure of oxygen is 60 torr, calculate the partial pressure of CO_2 .

(v) Calculate the heat of formation of CO_3^{2-} from the following data:

- $\text{C} + 2\text{O}_2 + \frac{1}{2}\text{O}_2 \rightarrow \text{CO}_3^{2-} \quad \Delta H_f^\circ = ?$
- $\text{C} + \frac{1}{2}\text{O}_2 \rightarrow \text{CO} \quad \Delta H_f^\circ = -111 \text{ KJ/mole}$
- $\text{O}_2 + \frac{1}{2}\text{O}_2 \rightarrow \text{O}_3 \quad \Delta H_f^\circ = -286 \text{ KJ/mole}$
- $\text{CO}_3^{2-} + \text{O}_2 \rightarrow \text{CO} + 2\text{O}_2 \quad \Delta H_f^\circ = -561 \text{ KJ/mole}$

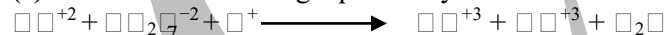
(vi) what is the ionic concentrations of Ca^{2+} and CO_3^{2-} in a saturated solution of CaCO_3 at 25°C ? K_{sp} of CaCO_3 is 1.9×10^{-12} .

(vii) O_2 gas effuses from a 10 cm^3 vessel in 10 sec. Calculate the time for effusion of H_2 gas from 20 cm^3 vessel.

(viii) In the reaction $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$, when equilibrium was attained, the concentration were $[\text{H}_2] = [\text{I}_2] = [\text{HI}] = 4 \text{ moles/dm}^3$. Calculate the equilibrium constant and the initial concentration of H_2 and I_2 .

(ix) State the main postulates of Electron pair repulsion theory & explain shape of BF_3 according to this theory.

(x) Balance the following equation by Ion-electron method:



(xi) Define pH. What is the pH of 0.002M NaOH solution at 25°C ?

(xii)(a) Write the electronic configuration of the following:

- Cu (Z = 29)
- Ag (Z = 47)

(b) Which rule of principle is violated in the following electronic configurations?

- $1s^2 2s^3$
- $2s^2 2p^6 3s^2$
- $1s^2 2s^2 3s^2 2p^6$
- $1s^2 2s^2 2p^2$

(xiii) Give scientific reasons for the following:

- Li^+ ions is more hydrated than Na^+ ions.
- Water expands when cooled below 4°C .
- Surface tension of water is greater than that of Ethyl alcohol.
- Glycerine is distilled at reduced pressure.

(xiv) Write any four postulates of Arrhenius theory of ionization.

(xv) What 4000 J of heat is added to a gaseous system at a constant pressure of $101300 \frac{\text{N}}{\text{m}^2}$ its internal energy increase by 500 J. Calculate the change in the volume of the system.

SECTION 'C' (DETAILED-ANSWER QUESTIONS) (28)

NOTE: Answer 2 questions from this section.

3. (a) Define Orbital Hybridization. Explain sp^2 hybridization with example.

(b) Distinguish between:

- Atomic orbital and Molecular orbital
- Covalent bond and Co-ordinate Covalent bond

(c) Define Thermo chemistry. State and explain Hess's Law of constant heat summation with its applications.

4. (A) how was the presence of electron and proton in the atom discovered in the discharge tube experiment?

(b) Give the defects of Rutherford's Atomic Theory. Write the postulate of Bohr's Atomic Theory.

(c) How did Bohr's theory explain the formation of the line spectrum of hydrogen atom? Write the names and formula of each series.

5. (A) State le-Chatelier's principle. Apply this principle to the manufacture of NH_3 by Haber's process.

(b) What is standard electrode potential? How is the electrode potential of copper determined? Explain.

(c) Write the postulates of Kinetic molecular theory of gases.

OR For the chemical reaction: $\text{N}_2 + 2\text{O}_2 \rightarrow 2\text{NO}_2$

Calculate the:

1. Rate expression
2. Order of reaction
3. Rate constant when the initial concentration of N_2 is 0.1 mole/l , O_2 is 0.01 mole/l and rate of reaction is $1.2 \times 10^{-3} \text{ mole/l}\cdot\text{sec}$.

CHEMISTRY

Time: 20 Minutes

2014

Max. Marks: 17

SECTION 'A' (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options.

- (i) If absolute temperature is doubled and pressure increased to 4 times, the volume:
- Is halved
 - Is doubled
 - Becomes four times
 - Remains unchanged
- (ii) Additions of KCl to AgCl solutions causes:
- Increase in the ionization of AgCl
 - Decreases in the ionization of AgCl
 - No effects on the ionization of AgCl
 - Increases in the concentration of Ag^+ ion
- (iii) Metals placed above hydrogen in the electrochemical series:
- Are reducing agents
 - Are oxidizing agents
 - Serve as cathode in comparison cell
 - Have positive electrode potential
- (iv) During experiment, average of several replicate measurements is taken because:
- It has no negative error
 - It shows positive error
 - It has no systematic error
 - It is more reliable
- (v) The basis of motor oil grading is:
- Viscosity
 - Surface Tension
 - Vapor pressure
 - Boiling point
- (vi) Diamond is very hard because of:
- sp^2 -hybridization
 - Van der Waal's forces
 - Close packing of carbon atoms and large number of covalent bonds
 - Large amount of energy required to break the bonds
- (vii) The colour of the universal indicator in basic solution is:
- Yellow
 - Green
 - Orange
 - Deep blue

- (viii) In Pi-bond, electron density lies:
- Only above the nodal plane
 - Only below the nodal plane
 - Both above and below the nodal plane
 - On the nodal plane
- (ix) When the product of ionic concentrations of sparingly soluble salt is equal to its solubility product (K_{sp}), the solution is said to be a:
- Dilute solution
 - Saturated solution
 - Super saturated solution
 - Very dilute solution
- (x) The presences of Hydrogen bonding in a liquid:
- Decrease the vapour pressure
 - Decreases the boiling point
 - Decreases the viscosity
 - Causes no effects on the physical properties of the liquid
- (xi) The presence of Hydrogen bond is in between:
- 10-20 KJ/mole
 - 20-40 KJ/mole
 - 40-50 KJ/mole
 - 50-60 KJ/mole
- (xii) The oxidation number of Mn in KMnO_4 is:
- +3
 - +5
 - +7
 - +4
- (xiii) When $a \neq b \neq c$, $\alpha = \beta = \gamma = 90^\circ$, the crystal structure is:
- Tetragonal
 - Monoclinic
 - Triclinic
 - Hexagonal
- (xiv) Any real or imaginary line or wall, which separates a system from its surroundings, is called the:
- System
 - Boundary
 - State
 - Surrounding
- (xv) The value of Plank's constant 'h' is:
- 4.803×10^{-10} e.s.u
 - 9.1×10^{-31} kg
 - 6.625×10^{-34} J.S
 - 1.602×10^{-34} kg
- (xvi) The pH of Milk of Magnesia is:
- 10.5
 - 10.0
 - 10.8
 - 11.0

(xvii) The percentage dissociation of P_4O_{10} is:

- 1.2%
- 1.4%
- 1.9%
- 2.1%

CHEMISTRY

Time: 2 Hours 40 Minutes

2014

Marks:68

SECTION 'B' (SHORT-ANSWER QUESTIONS)

NOTE: Answer any Ten part questions.

(40)

2. (i) Define the following:

- Limiting Reactant
- Stoichiometry
- Molar Volume
- Latent heat of fusion

(ii) H_2 is prepared by the reaction $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$. 6.54 gram of Zn reacts with 73 grams of HCl. Find the limiting reactant and the mass of H_2 produced.

(iii) (a) The mass of a substance is 18.8865 grams and its volume is 7.9 cm^3 . What will be its density considering significance figure and rounding off the above obtained?

(b) Calculate the molarity of the solution prepared by dissolving 4.5 gm of NaOH in 500 cm^3 of water.

(iv) Give reasons for the following:

- Ca^{+2} ion is smaller than Mg atom
- H_2O is a polar molecule
- s-s sigma is weaker than s-p sigma bond.
- Some solid change directly to vapours on heating without passing through the liquid phase.

(v) (a). Write the electronic configuration of the following:

- Cr (z = 24)
- Ca^{+2} (z = 24)

(b) Calculate the solubility product of CaSO_4 when the solubility of CaSO_4 is 1.0×10^{-3} grams/ cm^3 .

(vi) Calculate the volume of Nitrogen gas produced by heating 800grams of Ammonia at 21°C and 823 torr pressure:



(vii) Calculate the heat of formation from the following data:

- $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$ $\Delta H_f = ?$
- $\frac{1}{2}\text{O}_2 + \frac{1}{2}\text{H}_2 \rightarrow \text{H}_2\text{O}$ $\Delta H_f = -11.0 \text{ KJ/mole}$
- $\frac{1}{2}\text{O}_2 + \frac{1}{2}\text{H}_2 \rightarrow \text{H}_2\text{O}_2$ $\Delta H = -57.8 \text{ KJ/mole}$
 $\Delta H = +21.6 \text{ KJ/mole}$

(viii) Explain Rutherford's Atomic model with its conclusion.

(ix) Balance the following equations by Ion-electron method:

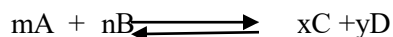
- $\text{Mn}^{2+} + \text{H}_2\text{O}_2 \rightarrow \text{MnO}_4^- + \text{H}^+$
- $\text{NO}_3^- + \text{H}^+ \rightarrow \text{NO} + \text{H}_2\text{O}$

(x) 5.88 moles of Nitrogen and 16.2 moles of Oxygen are mixed and heated at 2000°C until the equilibrium is established, 11.28 moles of Nitric oxide are formed, Calculate the value of equilibrium constant.



(xi) What is an ideal gas? What are the causes of deviations of the real gases from ideal behavior?

(xii) State the law of Equilibrium. Derive the expression of K_p for the following reaction:



- (xiii) (a) Define Activation energy. Give its relation with the speed of reaction.
 (b) For the reaction $A \rightarrow \text{product}$, threshold energy is 40 KJ/mole. The average internal energy of the reactants is 10 KJ/mole. Calculate its activation energy.
 (xiv) How are the nature and surface area of the reactant related to the rate of reaction?
 (xv) State and explain Dalton's Law of Principal pressures with its applications.

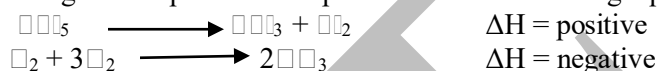
SECTION 'C' (DETAILED-ANSWER QUESTIONS) (28)

NOTE: Answer 2 questions from this section.

3.(a) What is chemical bond? Give its types. Explain the formation of CO_2 by the reaction between C and O_2 using all the energy changes involved.

(b) What is meant by Electrolysis? Explain the electrolysis of CuSO_4 solution giving all the necessary electrode reactions.

(c) Predict the effects of change in temperature and pressure on the following equilibrium:



4. (A) Explain the shapes of BF_3 and H_2O on the basis of:
 Hybrid orbital model and Electron pair repulsion model

(b) State and explain the First Law of Thermodynamics.

Also prove that $\Delta U = \Delta E + P\Delta V = \Delta H$

(c) Combustion of 0.5gm of a Hydrocarbon produced 1.515 gm CO_2 and 0.77 gm of H_2O . If the molecular mass of the compound is 58 a.m.u., determine its Molecular formula.

5.(a) Starting from $\Delta E = E_2 - E_1$, derive the expression for the wave number for the hydrogen atom.

(b) Differentiate between the following:

- Valence Bond theory & Molecular Orbital Theory
- Electro negativity and Electron affinity
- Intensive properties and Extensive properties

(c) The density of a certain gas is 1.43 gram/ dm^3 at 608 and 27°C. Find the molecular mass of the gas.

CHEMISTRY

Time: 20 Minutes

2013

Max.Marks:17

SECTION 'A' (MULTIPLE CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options.

- (i) The number of moles in 58.5 gm of NaCl is:
- 8.5
 - 1
 - 35.5
 - 23
- (ii) The empirical formula of a compound is $\text{C}_2\text{H}_4\text{O}_2$ and molecular formula is:
- $\text{C}_2\text{H}_4\text{O}_2$
 - $\text{C}_4\text{H}_8\text{O}_4$
 - $\text{C}_3\text{H}_6\text{O}_3$
 - $\text{C}_4\text{H}_8\text{O}_4$
- (iii) If $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$, then the crystal structure is:
- Cubic
 - Tetragonal
 - Orthorhombic
 - Triclinic
- (iv) The vapour pressure of water at 100°C is:
- 760 torr
 - 76 torr
 - 14.2 psi
 - None of these
- (v) This colour has the shortest wavelength in the visible spectrum of light:
- Red
 - Violet
 - Green
 - Yellow
- (vi) The $n + 1$ value of 4p orbital is:
- 2
 - 5
 - 7
 - 4

- (vii) The bond formula in fluorine molecule is due to this overlap of orbital:
- s - s
 - s - p
 - p - p
 - none the of these
- (viii) Bond energy of $C \equiv C$ as compared to that $C = C$ is:
- greater
 - lesser
 - same
 - none of these
- (ix) This chemical method is used for determining the rate of reaction:
- Physical method
 - Calorimetric method
 - Polarimetric method
 - Hydrolysis
- (x) A heterogeneous system consists of:
- Only one phase
 - Three phases
 - More than one phase
 - Two phases
- (xi) In this, electric current is produced by an oxidation reduction process:
- Standard cell
 - Voltaic cell
 - Reversible cell
 - Electrolytic cell
- (xii) Among these solutions, this one has the highest pH value:
- 0.01 M NaOH
 - 0.02 M HCl
 - 0.01 M $AlCl_3$
 - 0.10 M Na_2CO_3
- (xiii) This salt will hydrolysis in water:
- NaCl
 - Na_2CO_3
 - KCl
 - $Na_2S_2O_4$
- (xiv) The heat content of a system is called:
- Internal energy
 - Enthalpy
 - Entropy
 - Potential Energy
- (xv) The angle between sp^3 orbital is:
- 127°
 - 109.5°
 - 180°
 - 90°
- (xvi) This series of lines is produced when the electron jumps from the 4th orbit to the 2nd orbit:
- Lyman series
 - Balmer series
 - Paschen series
 - Brackett series

(xvii) Precipitation occurs if the ionic concentration is:

- Less than $\square\square$
- More than $\square\square$
- Equal to $\square\square$
- None of these

CHEMISTRY

Time: 2 Hours 40 Minutes

2013

Marks:68

SECTION 'B' (SHORT-ANSWER QUESTIONS)

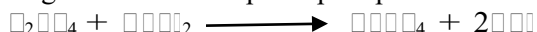
NOTE: Answer any Ten part questions.

(40)

2. (i) Define the following terms:

- Stoichiometry
- Limiting Reactant
- Significant Figures
- Avogadro's Number

(ii) Find the weight of Barium sulphate precipitated on adding a solution containing 82 gram of Potassium chloride.



(iii) State the following laws:

- Avogadro's Law
- Dalton's Law of Partial pressures
- Graham's Law of Diffusion
- Charles Law

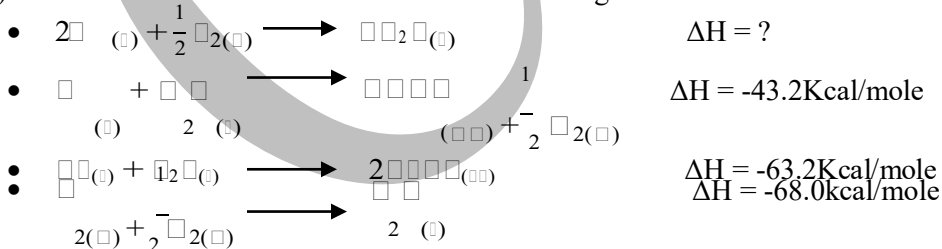
(iv) At 30°C , $500 \square\square^3$ of \square_2 at 400 torr pressure and one $\square\square^3$ of \square_2 at 600 torr pressure are transferred into a $1500 \square\square^3$ flask. Calculate total pressure of the mixture of gases.

(v) Give reasons for any four of the following:

- $\square_2\square$ Forms concave meniscus while Hg forms convex meniscus.
- A drop of ink-spreads over blotting paper.
- I.P of nitrogen is greater than that of oxygen.
- In photochemical reaction, the order of reaction is zero.
- The boiling point of water is greater than that of HF even though Fluorine has greater electro negativity than Oxygen.

(vi) State and explain Hess's Law of constant heat summation with example and give its applications.

(vii) Calculate the heat of formation from the following data:



(viii) Give the postulates of Bohr's atomic theory and derive the formula for the radius of nth orbit of Hydrogen atom.

(ix) (a) What is the shape of the orbital's for the second energy level?

(b) Write the electronic configuration of the following:

- Mo (Z = 42)
- Ag (Z = 47)

(x) (a) What do you mean by the term dative bond? Explain with example.

(b) Differentiate between Sigma and Pi bonds.

(xi) What is electro negativity? Explain the Ionic character of covalent bond with its help.

(xii) (a) Find the oxidation number of:

- CrO_4^{2-}
- Fe_3O_4
- $\text{Fe}_2(\text{SO}_4)_3$
- Fe_3O_4

(b) pH of a solution is 8.4. Calculate the H^+ and OH^- ion concentration

(xiii) (a) Describe the relationship between $\log K_{sp}$ and $\log K_{eq}$

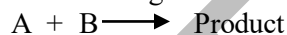
(b) The solubility of AgCl at 25°C is $1.40 \times 10^{-3} \text{ mol/l}$. Its molecular mass is 143.5 Calculate the:

- Molarity of AgCl solution
- Solubility product of AgCl

(xiv) What are the main points of Electron Pair Repulsion Model? Explain the shape of CO_2 molecules on the basis of this model.

(xv) (a) 3.86 gram of NaOH is dissolved in 2.5 dm^3 of solution. Find its molarity.

(b) Determine the order of reaction from the following data:



A	B	Rate
mol/l	mol/l	$\text{mol/l} \cdot \text{sec}$
0.1	0.1	8×10^{-4}
0.2	0.1	16×10^{-4}
0.1	0.2	16×10^{-4}

SECTION 'C' (DETAILED-ANSWER QUESTIONS)(28)

NOTE: Answer 2 questions from this section.

3.(a) What are cathode rays? Describe the experiment of their discovery. Write their properties. What conclusions were drawn from these properties?

(b) State and explain le-Chatelier's Principle. How is it applied in Contact process?

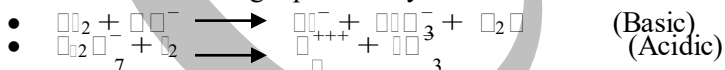
(c) 3 moles of H_2 and 4 moles of I_2 were heated in a sealed tube at a given temperature at which K_c is 50. If the volume of the tube is 1 dm^3 , determine the composition of the equilibrium. $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$

4.(a) When 5400 joules of heat is added to a system of gas at constant pressure, its internal energy increases by 1000 joules. Calculate the change in the volume of the system.

(b) Differentiate between the following:

- Crystalline solid and Amorphous solid.
- Line spectrum and Continuous spectrum.
- Intensive properties and Extensive properties.

(c) Balance the following equations by ion-electron method.



5.(a) What is orbital hybridization? Explain the shape of Ethane and Ethyne molecules on the basis of Hybrid Orbital model.

(b) Define Electrode potential. What is standard electrode potential? How is the electrode potential of Copper determined?

(c) What is meant by the terms Rate of reaction and Rate constant? Explain the effects of surface area of reactants and temperature on the rate of reaction.

CHEMISTRY

Time: 20 Minutes

2012

Max. Marks: 17

SECTION 'A' (MULTIPLE- CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options.

- (i) The colour of Universal indicator in neutral solution is:
- Red
 - Green
 - Blue
 - Pink
- (ii) The process, in which a solid directly changes into vapours without passing through liquid phase, is called:
- Evaporation
 - Condensation
 - Sublimation
 - Neutralization
- (iii) 'No two electrons in an atom can have all the four Quantum exclusion numbers identical' is the statement of:
- Puali's exclusion principle
 - Hund's rule
 - Aufbau principles
 - $(\uparrow + \downarrow)$ rule
- (iv) On Kelvin scale, absolute zero is equal to:
- 273.16°C
 - 0°C
 - 20 K
 - -273.16°C
- (v) The number of Crystal system on the basis of unit cell is:
- 5
 - 6
 - 7
 - 8
- (vi) 3.01×10^{23} molecules of Oxygen gas at S.T.P occupy a volume of:
- 22.4 dm^3
 - 224 dm^3
 - 11.2 dm^3

- d. 2.24×10^3
- (vii) The value of R (Gas constant), when pressure is expressed in N/m^2 (Newton per square metre) is:
- $0.0821 \text{ Atmosphere}^{-1} \text{ dm}^3 \text{ mol}^{-1}$
 - $8.3143 \text{ J} \cdot \text{mol}^{-1} \text{ K}^{-1}$
 - $9.8 \text{ Joule} \cdot \text{mol}^{-1} \text{ K}^{-1}$
 - $8.213 \text{ J} \cdot \text{mol}^{-1} \text{ K}^{-1}$
- (viii) Real gases are nearer to identity at:
- High temperatures and Low pressures
 - High temperatures and High pressures
 - Low temperatures and low pressures
 - Low temperatures and High pressures
- (ix) Capillary action of liquids is due to:
- Viscosity
 - Surface tension
 - Density
 - Fluidity
- (x) Two solids, having the same crystal structure, are called:
- Isomorphous
 - Polymorphous
 - Isotopes
 - Allotropes
- (xi) The particle having a mass 1836 times that of the electrons is:
- Neutron
 - Proton
 - Meson
 - Hyperon
- (xii) On emission of α -particles, ${}_{92}\text{U}^{238}$ changes into:
- ${}_{90}\text{Th}^{234}$
 - ${}_{88}\text{Ra}^{226}$
 - ${}_{84}\text{Po}^{210}$
 - ${}_{91}\text{Pa}^{231}$
- (xiii) The strength of sigma bond is highest for:
- s - s overlap
 - s - p overlap
 - p - p overlap
 - sp^3 - s overlap
- (xiv) For reaction $2\text{N}_2\text{O}_3 \rightleftharpoons \text{N}_2 + 3\text{O}_2$, the relationship between K_p and K_c is:
- $K_p = K_c$
 - $K_p > K_c$
 - $K_p < K_c$
 - $K_p \leq K_c$
- (xv) In electrolytic cell, the anode is the electrode where:
- Oxidation occurs
 - Reduction occurs
 - Both oxidation and reduction occur
 - Neutralization occurs
- (xvi) The dipole moment of CO_2 molecule is:
- 0.00 D
 - 1.03 D
 - 1.85 D

d. 1.67 D

(xvii) The number of gram moles of solute present in 1 dm³ of solution is called:

- a. Normality
- b. Molarity
- c. Mole fraction
- d. Molality

CHEMISTRY

Time: 2 Hours 40 Minutes

2012

Marks: 68

SECTION 'B' (SHORT-ANSWER QUESTIONS)

NOTE: Answer any Ten Part questions.

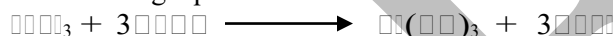
(40)

2.(i) (a) Differentiate between Empirical Formula and Molecular formula.

(b) An organic compound carbon, hydrogen and oxygen has 26.7% C, 2.2% H by weight, Find the Molecular formula of the compound, If molecular mass of the compound is 90 a.m.u.

(ii) (a) Find the mass and number of molecules in 18000 dm³ of O₂ gas at S.T.P.

(b) What is the minimum mass of Al(OH)₃ that can be obtained by the reaction of 13.4g of NaOH with 10g of NaOH according to the following equations:



(iii) Give the reason of any four of the following:

- (a) Ethyl alcohol (C₂H₅OH) has greater viscosity than Diethyl ether (C₂H₅-O-C₂H₅)
- (b) H⁺ ion is smaller in size than Na atom.
- (c) HF forms stronger bond than HI.
- (d) Milk sours more rapidly in summer than in winter.
- (e) A freely falling drop of liquid is spherical.

(iv) (a) Derive General gas equation by combining gas laws.

(b) 1.40 dm³ volume of a gas collected at a temperature of 27°C and pressure of 900 torr was found to have a mass 2.273g. Calculate the Molecular Mass of the gas.

(v) (a) Define Enthalpy and Internal Energy.

(b) Calculate ΔH for the reaction:



Given: (1) $3\text{Mg} + 2\text{O}_3 \longrightarrow \text{O}_3\text{Mg}_2 + 3\text{O}_2$

$$\Delta H = -371 \text{ KJ}$$

(2) $\frac{1}{2}\text{O}_2 + \frac{3}{2}\text{O}_2 \longrightarrow \text{O}_3$

$$\Delta H = -46 \text{ KJ}$$

(vi) Balance the following equations by Ion-electron method:

(a) $\text{I}(\text{OH})_3 + \text{O}_2 \longrightarrow \text{I}_2 + \text{O}_2$ (Basic medium)

(b) $\text{O}_2 + \text{O}_2 \longrightarrow \text{O}_2 + \text{O}_2$ (Acidic medium)

(vii) Derive expression for the frequency & wave number of radiation when the electron jumps from higher orbit (n₂) to lower orbit (n₁). The energy of electron

$$E = \frac{-2n^2 \times 2.18 \times 10^{-18} \text{ J}}{n^2 h^2}$$

(viii) Define Electrovalent bond. Explain the formation of NaCl crystal along with the energies involved.

(ix) (a) Arrange the orbitals in order of ascending energy according to (n + l) rule: 3d, 4s, 4p, 4d, 5s, 6s, 5p.

(b) A system absorbs 2000J of heat from the surroundings and does 1200J of work on the surroundings by expansion. Find the internal energy change (ΔE) of the system.

(x) (a) The equilibrium constant expression for a gaseous equilibrium is: $K_p = \frac{[\text{O}_2]^4 [\text{O}_2]^6}{[\text{O}_3]^4 [\text{O}_2]^5}$ from this,

write the equation for the reaction.

(b) The rate constant for the reaction $2\text{O}_2 \longrightarrow 2\text{NO} + \text{O}_2$ is $1.8 \times 10^{-8} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$. If the initial concentration of O₂ is 2M, what is the rate of reaction?

- (xi) Predict the shape of the following molecules on the basis of electron pair repulsion model:
- (a) CO_3
 (b) CO_2
- (xii) (a) What is the diff. between Balmer & Lyman series?
 (b) Calculate the wave number of the line in Lyman series when an electron jumps from 3rd orbit to the 1st orbit ($R_\infty = 109678 \text{ cm}^{-1}$)
- (xiii) Discuss the effect of increase in temperature and pressure on the following systems at equilibrium:
- (a) $\text{CO}_2 + 3\text{H}_2 \rightleftharpoons 2\text{CO} + \text{H}_2\text{O} + \text{heat}$
 (b) $\text{CO}_2 + \text{C} + \text{Heat} \rightleftharpoons 2\text{CO}$
- (xiv) Define standard electrode potential. How is the standard electrode potential of 'Zinc' determined?
- (xv) Write the electronic configuration of the following and also give the number of protons and electrons in each:
- (a) Cu (Z = 29)
 (b) Mg^{+2} (Z = 12)
 (c) Cl^{-1} (Z = 17)

SECTION 'C' (DETAILED-ANSWER QUESTIONS)

NOTE: Answer 2 questions from this section. (28)

- 3.(a) Give the experimental evidence for the presence of very small positively charged nucleus containing most of the mass of the atom. Write also the weakness of this atomic model.
 (b) Explain the following gas laws with the help of Kinetic theory of gases.
- i. Boyle's Law
 - ii. Charles's Law
 - iii. Dalton's Law of Partial pressures.
- (c) State Pauli's exclusion principle and explain it, giving the example of Helium atom.
- 4.(a) State and explain First Law of thermodynamics. Prove $\Delta Q = \Delta H + W = P\Delta V$
 (b) Define Electrolysis. Write the main postulates of Arrhenius Theory of Ionization.
 (c) The solubility of calcium oxalate (CaC_2O_4) is $0.0016/\text{dm}^3$ at 25°C. Find the Solubility product of calcium oxalate. $K_{sp} = [\text{Ca}^{2+}] [\text{C}_2\text{O}_4^{2-}]$
- 5.(a) Name the physical methods along with the observed physical properties for determining the rate of reaction by physical or chemical means.
 (b) Define Radioactivity. Describe the characteristics of Alpha or Beta particles.
 (c) Using significant figure rules, Simplify: $\frac{0.0000000000}{0.0000000000}$

CHEMISTRY

Time: 20 Minutes

2011

Max. Marks: 17

SECTION 'A' (MULTIPLE- CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options.

- (i) Reactions with high activation energy:
- Are slow
 - Are fast
 - Are moderate
 - Do not occur
- (ii) An ideal gas obeys gas laws under this condition:
- High pressure
 - All temperature and pressure
 - High temperature
 - Low temperature
- (iii) This instrument is used to measure atmospheric pressure:
- Barometer
 - Calorimeter
 - Spectrometer
 - Voltmeter
- (iv) An orbital can have a maximum of:
- Negative
 - Positive
 - Neutral
 - None of these
- (v) In electrolytic cell, cathode is:
- $\frac{\text{kg}}{\text{m}^2}$
 - Kg/ms
 - Kg/m
 - $\frac{\text{kg}}{\text{m}^2 \text{ s}}$
- (vi) In S.I system, the unit of pressure is:
- 0°C
 - 0 K
 - 273 K
 - 273°C
- (vii) The internal resistance of a liquid is called:
- Surface tension
 - Viscosity
 - Resistance
 - All of these
- (ix) The maximum number of unpaired electrons in 3d energy level is:
- 5
 - 6
 - 7
 - 8
- (x) An electron is said to be excited when it:
- Loses energy
 - Jumps to a lower orbit
 - Jumps to a higher orbit
 - Enters the atom

- (xi) The angle between sp^3 orbital is:
- 120°
 - 180°
 - 109.5°
 - 107.5°
- (xii) The single bond in a covalent molecule is called:
- Pi-Bond
 - Sigma Bond
 - Co-ordinate Covalent Bond
 - None of these
- (xiii) This is an intensive property:
- Density
 - Mass
 - Mole
 - Volume
- (xiv) Hess's Law may be used to calculate:
- ΔH
 - ΔS
 - E
 - K
- (xv) If K_c is very small:
- Reverse reaction will occur
 - Forward reaction will take place
 - More products will be formed
 - None of these
- (xvi) The oxidation number of oxygen in hydrogen peroxide is:
- +2
 - 2
 - +1
 - 1
- (xvii) The range of pH of is:
- 1-10
 - 0-20
 - 1-100
 - 0-14

CHEMISTRY

Time: 2 Hours 40 Minutes

SECTION 'B' (SHORT-ANSWER QUESTIONS)

NOTE: Answer any Ten Part questions.

2.(i) Differentiate between any two of the following:

- Isomorphism and Polymorphism
- Exponential Notation and Significant Figures
- Orbit and Orbital

(ii) (a) What rules and principles are violated in the following electronic configurations?

- $1s^2 2s^3$
- $1s^2 2s^2$
- $1s^2 2s^2 2p^6 3s^2 3p^6 3d^4 4s^3$

2011
Marks: 68

(40)

- (iii) Name the factors which affect the rate of reaction and discuss any two.
- (iv) Give reasons for any four of the following:
- A Liquid is less viscous at high temperature.
 - Water has higher B.P than Hydrogen fluoride although Fluorine is more electronegative than Oxygen.
 - Pressure cooker is used for rapid cooking.
 - Evaporation is a cooling process.
 - A freely falling drop of liquid is spherical.

(v) Define orbital Hybridization and discuss sp^3 Hybridization

(vi) (a) What is chemical equilibrium? Illustrate it with the help of graph.

(b) What is neutralization? Give the examples of normal, acidic and basic salts.

(vii) Define the following terms:

- Extensive properties
- Enthalpy
- Molarity
- Common Ion Effect

(viii) (a) 54g of solid dinitrogen pentoxide, N_2O_5 is decomposed on heating as:



Find the volume of NO_2 and O_2 at S.T.P.

(b) Predict the shapes of the following molecules on the basis of electron pair repulsion theory:

- NO_2
- NO_2Cl

(ix) (a) Calculate the wave number of spectral lines of hydrogen gas when the electron jumps from $n=4$ to $n=2$ ($R_H = 109,678^{-1}$)

(b) How is buffer solution prepared?

(x) (a) Find the oxidation number of:

- Cr in $K_2Cr_2O_7$
- S in $K_2S_2O_3$
- P in Ca_3P_4
- Mn in MnO_4^-

(b) A system absorbs 200J of heat from the surroundings and does 120 J of work on the surroundings by expansion. Find the internal energy change of the system.

(xi) (a) Define specific rate constant.

(b) Write the correct sequence of the orbital's for the electronic configuration according to (n+1) rule: 3d 4s 4p 4d 5s 5p

(xii) (a) Find the pH of 0.004 mol/ dm^3 of HCl (fully dissociated) at 25°C.

(b) Simplify the following by using exponential notation: $43100 + 3900 + 2100$

(xiii) (a) What are the assumptions of Bohr's Theory?

(b) * Define Heat of formation * State Hess's Law

(Xiv) (A) What will be the shape of a unit cell if $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$?

(b) In a collection of 24×10^{25} molecules of C_2H_5OH , what is the number of moles? (Atomic mass: C = 12, O = 16, H = 1)

(xv) (a) Define Hydrogen bonding.

(b) Balance the following equation by ion-electron method: $CrO_4^{2-} + CrO_3^{-2} \longrightarrow CrO_4^{+2} + CrO_4^{-2}$ (Basic medium)

SECTION 'C' (DETAILED-ANSWER QUESTIONS)

NOTE: Answer 2 questions from this section.

(28)

3.(a) Explain any one state of matter on the basis of Kinetic Theory.

(b) Explain why the process of diffusion occurs most rapidly in gases, less rapidly in liquids and very slowly in solids.

(c) No liquid ionic compounds are known but many of the known covalent compounds are liquids and some are gases. Account for these differences.

4.(a) Explain the terms: Electrolysis, Electrolyte & Electrode

(b) How is the electrode potential of Zn determined?

(c) The ability of an atom depends upon its charge density. Comment of the statement.

5.(a) Define and explain activation energy.

(b) Write notes on any two of the following:

- Fast reactions
- Slow reactions
- Moderate reactions
- Positive catalyst

(c) Discuss the Effect of light on the rate of reaction.

CBSE

CHEMISTRY

Time: 20 Minutes

2010

Max. Marks: 17

SECTION 'A' (MULTIPLE- CHOICE QUESTIONS)

1. Choose the correct answer for each from the given options.

(i) The solubility product (K_{sp}) of AgCl is 1×10^{-10} . Its precipitation occurs if the product of ionic concentration is:

- a. Less than K_{sp}
- b. Greater than K_{sp}
- c. Equal to K_{sp}
- d. Twice K_{sp}

(ii) In metals conduction is due to the:

- a. Movement of ions
- b. Movement of electrons
- c. Movement of protons
- d. Movement of atoms

(iii) The change in concentration of reacting substance in a unit time called:

- a. Rate of reaction
- b. Rate constant
- c. Rate law
- d. Velocity constant

(iv) The addition of a catalyst to a reaction changes:

- a. Internal energy
- b. Activation energy
- c. Threshold energy
- d. Gibb's free energy

(v) If $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$, then crystal structure is:

- a. Cubic
- b. Tetragonal
- c. Orthorhombic
- d. Triclinic

(vi) The $n+1$ value for 5d orbital is:

- a. 4
- b. 5
- c. 6
- d. 7

(vii) Which bond is non-polar?

- a. Cl – Cl
- b. N – Cl
- c. C – Cl
- d. H – Cl

(viii) The active masses of reacting substances mean:

- a. mole/ cm^3
- b. gm/ cm^3
- c. gm/ m^3
- d. mole/ m^3

(ix) An electrochemical cell is based upon:

- a. Acid-base reaction
 b. Redox reaction
 c. Oxidation reaction
 d. Reduction reaction
- (x) The empirical formula of a compound is C_2H_4 and its molecular mass is 60 its molecular formula is:
 a. C_2H_4
 b. $\text{C}_2\text{H}_4\text{O}_2$
 c. $\text{C}_3\text{H}_6\text{O}_3$
 d. $\text{C}_4\text{H}_8\text{O}_4$
- (xi) Which of the following has the same number of molecules at S.T.P.?
 a. 1 C_2H_6 at C_2 and C_2
 b. 500 C_2H_6 at C_2 and C_2
 c. 100 C_2H_6 at C_2 and C_2
 d. All of them.
- (xii) The total pressure of a mixture of gases is the sum of the partial pressure of each gas present in the mixture. This is stated by:
 a. Dalton
 b. Graham
 c. Charles
 d. Boyle
- (xiii) The sp^2 hybrid orbitals are:
 a. Non-polar
 b. Co-planar
 c. Linear
 d. None of these
- (xiv) The heat content of a system is called:
 a. Internal energy
 b. Enthalpy
 c. Entropy
 d. Potential Energy
- (xv) Which of the of following contains two significant figures?
 a. 0.04
 b. 0.004
 c. 0.0004
 d. 0.042
- (xvi) The vapour pressure of water at 100°C is:
 a. 760 torr
 b. 760 atm
 c. 7 torr
 d. 76 atm
- (xvii) Which of the reactions has the same value of ΔH° ?
 a. $\text{C}_2 + 3\text{C}_2 \rightleftharpoons 2\text{C}_3$
 b. $\text{C}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$
 c. $\text{C}_2\text{H}_5 \rightleftharpoons \text{C}_2\text{H}_3 + \text{H}_2$
 d. $2\text{C}_2 + \text{C}_2 \rightleftharpoons 2\text{C}_3$

CHEMISTRY

Time: 2 Hours 40 Minutes

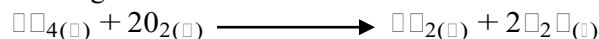
2010
Marks: 68

SECTION 'B' (SHORT-ANSWER QUESTIONS)

NOTE: Answer any Ten Part questions.

(40)

2(i) Complete combustion of C_4H_{10} gives the reaction:



Calculate the mass and volume of CO_2 gas produced at S.T.P. by the combustion of 9.6 gm of C_4H_{10} .

(ii) What is the molecular formula of a compound that contains 80% carbon 20% hydrogen? Its molecular mass is 30.

(iii) A radioactive substance emits three types of radiation. Write their names along with their properties.

(iv) What is an Ionic Bond? Write the formation of NaCl solid from sodium atom and chlorine atom along with energy changes.

(v) Write the electronic configuration of Na (Z = 11) and B (Z = 5) What are the values of n and l for the last sub-shell of each element? What are their shapes?

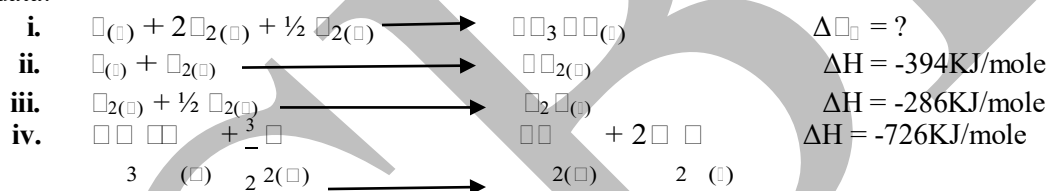
(vi) Define Electrolysis. Name the two parts of Redox reaction that occurs in the electrolysis of molten sodium chloride and state where each part occurs.

(vii) Write notes on any Two of the following:

- Viscosity
- Quantum No.
- Energy of Activation

(viii) (a) Define Standard heat of formation.

(b) Calculate the standard heat of formation of the methyl alcohol from its elements from the following data:



(ix) (a) State & explain Graham's Law of Diffusion of gases.

(b) At certain temperature and pressure CO_3 diffuses 1.48 times more than HCl. If the density of CO_3 is 0.66g/ litre find the density of HCl.

(x) What are the applications of the Law of Equilibrium? Explain with examples.

(xi) Give scientific reason for any Four of the following:

- Milk gets sour sooner in summer than in winter
- The density of ice is less than that of water.
- On heating sublime substances like iodine and camphor they directly change from solid to gas.
- The reactions between ionic compounds are fast.
- A freely falling drop of liquid is spherical.

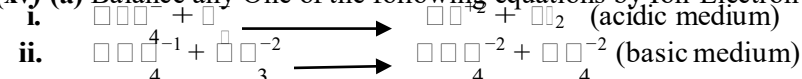
(xii) Differentiate between any Two of the following:

- Hydration and Hydrolysis.
- Endothermic reaction and exothermic reaction.
- Crystalline solid and Amorphous solid

(xiii) What is meant by Common-ion Effect? Discuss its application in the precipitation of the second group of basic radicals in qualitative salt analysis.

(xiv) Derive expressions for frequency (ν) and wave number $\tilde{\nu}$ of energy emitted when an electron jumps from higher energy state (E_2) to lower energy state (E_1).

(xv) (a) Balance any One of the following equations by Ion-Electron method.



(b) The K_c for the reaction $2\text{HI}_{(g)} \rightleftharpoons \text{H}_{2(g)} + \text{I}_{2(g)}$ is 1.3×10^{-2} . If there are 0.5 mole/litre H_2 , 1.5 mole/litre I_2 , and 5 moles/litre HI, predict the direction in which the reaction moves so as to achieve the equilibrium.

SECTION 'C' (DETAILED-ANSWER QUESTIONS)

NOTE: Answer 2 questions from this section. (28)

3. (a) Write the ground state and excited state configuration of carbon atom.

(b) Explain sp^3 hybridization in carbon in detail.

(c) Explain the structure of BF_3 and H_2O on the basis of Electron-pair Repulsion Model.

(d) What are the factors which affect the rate of reaction? Explain any two factors.

4.(a) Define pH and pOH. What is the mathematical relationship between pH and pOH of an aqueous solution?

(b) What is the H^+ and OH^- ion concentration of a solution having pH equal to 7.86?

(c) K_c for the reaction $\text{N}_2\text{O}_3(g) + \text{N}_2\text{O}_5(g) \rightleftharpoons 2\text{N}_2\text{O}_4(g)$ at room temperature is 4, Calculate the equilibrium concentration of N_2O_3 and N_2O_5 when 1.66 moles of N_2O_3 and 2.17 moles of N_2O_5 are allowed to come to equilibrium.

(d) Explain a Buffer solution with an example and write its properties.

(5) Consider the reaction $A + B \longrightarrow C$ and answer the following:

(a) Write the rate expression for the above reaction. What are the units of the rate of reaction?

(b) Will the specific rate constant (K) increase, decrease or remain unchanged if the concentration of A and B is double?

(c) The rate constant for the decomposition of N_2O_2 in the equation $2\text{N}_2\text{O}_2 \longrightarrow 2\text{N}_2 + \text{O}_2$ is $1.8 \times 10^{-3} \text{ l}^3/\text{mole}^3\cdot\text{s}$. What is the initial rate when the initial concentration of N_2O_2 is 0.75M? What is the rate constant when the initial concentration of N_2O_2 is doubled?

(d) Define solubility and Solubility Product. Write the solubility product (K_{sp}) expressions of the following sparingly soluble salts along with their units:

(a) Ag_3PO_4

(b) $\text{Ca}(\text{OH})_2$

CHEMISTRY

Time: 20 Minutes

2009

Max. Marks: 17

SECTION 'A' (MULTIPLE- CHOICE QUESTIONS)**1. Choose the correct answer for each from the given options.**

- (i) At S.T.P. 0.1 mole of a gas occupies the volume.
- 22.4 dm^3
 - 2.24 dm^3
 - 2.24 cm^3
 - 100 cm^3
- (ii) The number of moles in 58.5 gm of NaCl is:
- 58.5 moles
 - 35.5 moles
 - 23 moles
 - 1 moles
- (iii) Which number has five significant figures?
- 302.10
 - 300002
 - 30000
 - 30200
- (iv) A breaker containing 180 gm of water contains:
- 6.02×10^{23} molecules
 - 6.02×10^{24} molecules
 - 10.02×10^{25} molecules
 - 12.01×10^{23} molecules
- (v) A gas at zero Kelvin:
- Is pure cooled
 - Freezes
 - Liquefies
 - Vanishes
- (vi) One dm^3 is equal to:
- 10^{-3} cm^3
 - 100 cm^3
 - 1000 cm^3
 - 10 cm^3
- (vii) The colour of light depends upon its:
- Wavelength
 - Velocity
 - Source
 - None
- (viii) Which atomic orbital is always involved in sigma bonding?
- s orbital

- b. p orbital
 - c. d orbital
 - d. None of these
- (ix) In ethane (C_2H_6) molecules, there are:
- a. Five sigma bonds and one pi bond
 - b. Five sigma bonds
 - c. Four sigma bonds and two pi bond
 - d. None of these
- (x) When gaseous anions and cations are brought closer, the energy involved:
- a. Electron affinity
 - b. Lattice energy
 - c. Electronegativity
 - d. Ionization potential
- (xi) If 200 mL of 1M solution is diluted up to 2000 mL, its molarity would be:
- a. 10M
 - b. 0.2M
 - c. 0.1M
 - d. 1M
- (xii) The oxidation number of S in SO_4^{2-} is:
- a. 6^+
 - b. 2^-
 - c. 4^+
 - d. 2^-
- (xiii) What is the pOH of a solution whose pH is 8?
- a. 6
 - b. 10
 - c. 4
 - d. 2
- (xiv) The unit of viscosity is:
- a. Millipoise
 - b. Milligramme
 - c. Joule
 - d. ampere
- (xv) Which of the compounds has sp^2 hybridization?
- a. CH_3
 - b. C_2H_2
 - c. C_2H_4
 - d. C_2H_6

- (xvi) Which of the following is the example of oxidation?
- a. .
 - b. .
 - c. .
 - d. .

- (xvii) Evaporation is a:
- a. Natural process

- b. Physical process
- c. Cooling process
- d. Chemical process

CHEMISTRY

Time: 2 Hours 40 Minutes

2009

Marks: 68

SECTION 'B' (SHORT-ANSWER QUESTIONS)

NOTE: Answer any 11 Part questions.

(40)

- 2.(i) For the reaction $3\text{Mg} + \text{N}_2 \longrightarrow \text{Mg}_3\text{N}_2$, 1.5 gm of Mg and 1.5 gm of Nitrogen react together. What is the actual amount of Mg_3N_2 formed and which element is the limiting reactant?
- (ii)(a) Calculate the value of R when the pressure is expressed in atmosphere and volume in dm^3 .
- (b) Write down limitations of Rutherford's model of atom.
- (iii) Helium takes 5 seconds to diffuse from a hole of 10 cm^3 in the same container at the same temperature and pressure?
- (iv) Write down the values of all four quantum numbers for each of the two electrons of helium.
- (v) How were positive rays generated from cathode ray tube experiment? Did they depend upon the nature of the gas filled?
- (vi) Write down the postulates of the Arrhenius Theory of ionization.
- (vii)(a) Arrange the following energy levels in ascending order using $n + l$ rules 4d, 7s, 4f
- (b) Write the electronic configuration of Fe^{2+}
- (viii) Draw cross and dot structures of CH_4 and CO_3^{2-}
- (ix) Briefly explain dipole moment and mention its units.
- (x) Derive the equation for the radius of the nth Orbit of a hydrogen atom using Bohr's postulates.
- (xi) Calculate the heat formation of propane (ΔH) from the given reaction
- $$3\text{C}(\text{s}) + 4\text{H}_2(\text{g}) \longrightarrow \text{C}_3\text{H}_8(\text{g})$$
- (a) $\text{C}(\text{s}) + 2\text{H}_2(\text{g}) \longrightarrow \text{CH}_4(\text{g}) \quad \Delta H = -394 \text{ KJ/mole}$
- (b) $\text{C}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \longrightarrow \text{CO}(\text{g}) \quad \Delta H = -286 \text{ KJ/mole}$
- (c) $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \longrightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l}) \quad \Delta H = -2200 \text{ KJ/mole}$
- (xii) When the equilibrium was attained for the reaction $A + B \rightleftharpoons 2C$, the concentration of $[A] = [B]$ was 4 moles / dm^3 and that of $[C]$ was 6 moles / dm^3 , calculate K_c and the initial concentration of $A = B$.
- (xiii) Give reasons for any two of the following:
- (a) The liquids have capillary action.
 - (b) CH_4 is a non polar compound.
 - (c) The energy of activation decreases with the increase of temperature.
- (xiv) Discuss the ionic character of a covalent bond.
- (xv) State the first law of Thermodynamics. Derive the expression $\Delta H = \Delta E + P\Delta V$

SECTION 'C' (DETAILED-ANSWER QUESTIONS)

NOTE: Answer 2 questions from this section.

(28)

- 3.(a) Explain the shape of ethane (C_2H_6) on the basis of hybridization.
- (b) Give a brief account of viscosity and surface tension in liquids.
- (c) The given reaction is $\text{CO}_2 \rightleftharpoons \text{CO}_3^{2-} + 2\text{H}^+$. At 25°C the solubility of $\text{CO}_2 = 0.63 \times 10^{-3} \text{ mole / dm}^3$, find the value of K_a and express its unit.
- 4.(a) State and explain Le Chatelier's Principle and write down its industrial application.
- (b)(i) Find the oxidation number of oxygen in CO_3^{2-}
- (ii) Balance the equation: $\text{Cr}^{2+} + \text{MnO}_4^{1-} + \text{H}^+ \longrightarrow \text{Cr}^{3+} + \text{Mn}^{2+} + \text{H}_2\text{O}$

(c) For the given reaction $A + B \rightarrow$ products, determine the order of reaction from the following data:

S.No	A(mole/l ³)	B(mole/l ³)	Rate mole l ⁻¹
1	0.1	0.1	1×10^{-3}
2	0.2	0.1	4×10^{-3}
3	0.1	0.3	3×10^{-3}

5.(a) Explain the causes of non-ideal behaviour of gases especially at high pressures and low temperatures.

(b) Explain Planck's Quantum Theory of Radiation in detail.

(c) Explain Common-Ion Effect related to K_{sp} value.

CHEMISTRY

Time: 3 Hours

2008

Max. Marks: 75

NOTE: Attempt Five questions in all. All parts of a question must be solved together in sequence.

1.(a) Choose the correct answer for each from the given options.

(i) If PH of a solution is zero, the nature of solution will be: (03)

- (a) Acidic
- (b) Basic
- (c) amphoteric

(ii) The integer part of logarithm is called:

- (a) characteristics
- (b) mantissa
- (c) base

(iii) Bohr's model of atom is contradicted by:

- (a) Heisenberg's Uncertainty Principle
- (b) Pauli's Exclusion Principle
- (c) Planck's Quantum Theory

(b) An organic compound producing air pollution contains 8.73% carbon, 77.45% chlorine and 13.82% fluorine: find the molecular formula of the compound if its molecular mass is 137.5 (Atomic masses: C = 12, Cl = 35.5, F = 19) (04)

(c) Define any two of the following: (02)

- Significant figure
- Limiting reactant
- Bond energy

(d)(i) Simplify $\frac{2.417 \times 8.123}{4.956}$ according to the rules of significant figures (02)

(ii) Zn reacts with H_2SO_4 (dilute) as given: (04)



Calculate the mass of ZnSO_4 the volume of H_2 and the number of molecules of H_2 which will be produced by reacting 163.5 gm of Zn with H_2SO_4 at S.T.P. (Atomic masses: Zn = 65.4, S = 32, O = 16, H=1)

2.(a) (i) Give the unit cell of a cubic or orthorhombic system.

(ii) Write a short note on any One of the following: (02+3)

- Viscosity
- Ionization Potential

(b) Give reasons for any Two of the following: (03)

(i) 100 l^3 of O_2 and 100 l^3 of O_3 contain the same number of molecules at S:T.P.

(ii) The rates of diffusion of O_2 & O_3 gases are same.

(iii) C_4H_{10} & C_4H_8 are isomorphism.

(c) What is an ideal Gas? What are the causes of deviation of the real gases from the ideal behavior? (04)

(d) A 500 cm^3 vessel contains 2 gm of He and 8gm of CO_2 . What is the total pressure of the mixture of these gases at -3°C (Atomic masses: He = 4, C = 12, H = 1) (03)

3.(a) What are the defects in Rutherford's Atomic Model? Write the postulates of Bohr's Atomic Theory. (04)

(b)(i) Calculate the wave number of an electron when it jumps from an orbit $n=5$ to an orbit $n=1$ ($R_\infty = 109678 \text{ cm}^{-1}$).

(ii) Distinguish between any One of the following: (02+03)

- Continuous spectrum and Line Spectrum
- Electro negativity and Electron affinity

(c) (i) Which principle is violated in the following configurations? (01)

- $1s^2 2s^1 2p^5$
- $1s^2 2s^3 2p^5$

(ii) Write the values of all quantum numbers for both the electrons of He atom. (02)

(d) In the following parts one item is different from the others in each line. Locate the item in any two of these parts and give the reason for it:

- Carbon black, graphite, coke, charcoal
- O_2 , O_3 , O
- Aufbau, Thomson, Rutherford, Bohr

4.(a) What is Hybridization? Discuss sp^3 hybridization in CH_4 . (04)

(b) Do as directed in the following: (04)

- Covalent bonds in ethyne (C_2H_2) [Draw the lewis structure]
- Co-ordinate covalent bond in ammonium ion [Draw the Lewis structure]
- Association of water molecules through hydrogen bond [Draw the diagram only.]
- Metallic bonds in the atomic crystals of metals [Draw the diagram only.]

(c) (i) Predict the geometrical shape of CO_2 & SO_3 on the basis of Electron-pair Repulsion Theory. (03)

(ii) Which of the following compounds have dipole moments? CO_2 , H_2O , CH_4 , NH_3 (01)

(d) Choose the correct answer for each from the given options:

(i) _____ bonds are present in one molecular of ethane (C_2H_6):

- Four sigma two pi
- Two sigma four pi
- Five sigma one pi

(ii) The bond distance between carbon-carbon single bond (C-C) is _____

- 1.54 \AA
- 1.34 \AA
- 1.20 \AA

(iii) In hydrogen halides _____ possesses the largest ionic character:

- HF
- HCl
- HBr

5.(a) State and explain Hess's Law of Constant Heat Summation. Give its application. (04)

(b) Calculate the heat of formation of CO_2 from the following data:

- $2\text{CO}(\text{g}) \longrightarrow \text{C}_2\text{O}_4$ $\Delta H = ?$
- $\frac{1}{2} 2\text{O}_2(\text{g}) + \text{C}(\text{s}) \longrightarrow \text{CO}_2(\text{g})$ $\Delta H = +33.95 \text{ KJ/mole}$
- $\text{C}(\text{s}) + 2\text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$ $\Delta H = +9.3 \text{ KJ/mole}$

(c) (i) Write True or False for the following: (02+03)

- 1 joule = 4.184 calories (F)
- Work is a state function. (F)

(ii) Give scientific reasons for any three of the following:

- Graphite is very soft whereas diamond is very hard.
- Phosphorus combines with chlorine to form PCl_5 but it does not form PI_5 with iodine.
- The boiling point of a liquid remains constant although heat is continuously supplied to the liquid.
- A negative catalyst decreases the rate of reaction.

(d) Which one is more concentrated-1 Molar NaOH or 1 molal NaOH aqueous solution? Explain it. (03)

6.(a) State the Law of Mass Action and derive the equilibrium constant for $aA + bB \rightleftharpoons cC + dD$ (04)

(b) State Le Chatelier's Principle. For the gaseous equilibrium $2\text{CO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{CO}_2(\text{g})$
 $\Delta H = -ve$. (04)

Predict only the directions in which the reaction will proceed after the following changes are brought about at equilibrium:

- Increasing the concentration of NO
- Decreasing the concentration of O_2
- Increasing the temperature.
- Increasing the pressure.

(c) In a reaction $A + B \rightleftharpoons 2C$, 7 moles / dm^3 of A and 7 moles / dm^3 of B, were mixed and allowed to attain equilibrium. If $K_c = 2.25$, find out the concentration of A, B and C at equilibrium state. (04)

(d) What is solubility product (K_{sp})? The solubility of AgCl at 25°C is $1.4 \times 10^{-3} \text{ gm/dm}^3$. What is the solubility product? (Atomic masses: Ag = 108, Cl = 35.5) (03)

7.(a) Choose the correct answer for each from the given options: (03)

- KCl is a/an _____ salt. (normal, acidic, basic)
- The total no. of neutrons in ${}^{24}_{12}\text{Mg}^{2+}$ is _____. (10,12,24)
- The colour of the universal indicator in a neutral solution is _____ (green, purple, red)

(b) Differentiate between any ONE of the following: (03)

- Hydration and Hydrolysis
- Sigma bond and pi bond

(c) Write a short note on any ONE of the following: (03)

- pH.
- Arrhenius Theory of Ionization

(d) For the reaction $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$, point out acid, conjugate base and conjugate acid, according to Bronsted Lowry Theory and give reasons. (03)

(e) What is Electrode Potential? How is electrode potential of Zn determined experimentally? (03)

8.(a) (i) What is rate of reaction? Describe how the rate of the following chemical reaction is determined experimentally:



(ii) How is rate of reaction influenced by the surface area of the reactant? (01)

(b) (i) Write the rate expressions for (01)



(ii) For the chemical reaction $\text{O}_2 + 2\text{CO} \rightleftharpoons 2\text{CO}_2$, 0.1 mole / dm^3 , of CO_2 in 0.01 dm^3 / dm^3 . (03)

(c) Write the postulates of Kinetic Molecular Theory of gases. (4)

(d) (i) Find the oxidation number of H in H_2 and C in CO_2 . (1)

(ii) Balance the following equation by Ion-electron method. $\text{MnO}_4^- + \text{Fe}^{2+} \longrightarrow \text{Mn}^{2+} + \text{Fe}^{3+}$
 (Acidic medium) (02)