



Roll No. \_\_\_\_\_ to be filled in by the candidate.

**(NEW PATTERN)**

Paper Code 6 4 8 3

**Sessions; 2012-2014, 2013-2015 & 2014-2016****Chemistry** (Objective Type)

Time: 20 Minutes

Marks: 17

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A,B,C & D to each question are given. Which answer you consider correct, fill the corresponding circle A,B,C or D given in front of each question with Marker or pen ink on the answer sheet provided.

- 1.1. The cathodic reaction in the electrolysis of dil  $H_2SO_4$  with Pt electrode is:
- (A) reduction (B) oxidation  
(C) both oxidation and reduction (D) neither oxidation nor reduction
2. The rate of reaction:
- (A) increases as the reaction proceeds (B) decreases as the reaction proceeds  
(C) remains the same (D) may decrease or increase as the reaction proceeds
3. Isotopes differ in:
- (A) properties which depend upon mass (B) arrangement of electrons in orbitals  
(C) chemical properties  
(D) The extent to which they may be affected in electromagnetic field.
4. The mass of one mole of electron is:
- (A) 1.008mg (B) 0.55mg (C) 0.184mg (D) 1.673mg
5. Solvent extraction is an equilibrium process and it is controlled by:
- (A) Law of mass action (B) The amount of solvent used (C) Distribution law (D) The amount of solute used
6. Pressure remaining constant, at which temperature the volume of a gas will become twice of what is at  $0^\circ C$ ?
- (A)  $546^\circ C$  (B)  $200^\circ C$  (C) 546 K (D) 273 K
7. The molar volume of  $CO_2$  is maximum at:
- (A) S.T.P (B)  $127^\circ C$  and 1 atm (C)  $0^\circ C$  and 2 atm (D)  $273^\circ C$  and 2 atm
8. Acetone and chloroform are soluble in each other due to:
- (A) Intermolecular H-bonding (B) Ion-Dipole interaction  
(C) Instantaneous Dipole (D) all of the above
9. Ionic solids are characterized by:
- (A) low melting points (B) good conductivity in solid state  
(C) high vapour pressures (D) solubility in polar solvents
10. Quantum number values for 2P orbitals are:
- (A)  $n = 2, \ell = 1$  (B)  $n = 1, \ell = 2$  (C)  $n = 1, \ell = 0$  (D)  $n = 2, \ell = 0$
11. When 6d orbital is complete, the entering electron goes into:
- (A) 7f (B) 7s (C) 7p (D) 7d
12. The number of bonds in nitrogen molecule is:
- (A) One  $\sigma$  and one  $\pi$  (B) One  $\sigma$  and two  $\pi$  (C) Three sigma only (D) Two  $\sigma$  and one  $\pi$
13. Which of the following molecules has zero dipole-moment?
- (A)  $NH_3$  (B)  $CHCl_3$  (C)  $H_2O$  (D)  $BF_3$
14. Calorie is equivalent to:
- (A) 0.4184 J (B) 41.84 J (C) 4.184 J (D) 418.4 J
15. The pH of  $10^{-3} \text{ mol dm}^{-3}$  of an aqueous solution of  $H_2SO_4$  is:
- (A) 3.0 (B) 2.7 (C) 2.0 (D) 1.5
16. For which system does the equilibrium constant,  $K_c$  has units of  $(\text{Concentration})^{-1}$ :
- (A)  $N_2 + 3H_2 \rightleftharpoons 2NH_3$  (B)  $H_2 + I_2 \rightleftharpoons 2HI$   
(C)  $2NO_2 \rightleftharpoons N_2O_4$  (D)  $2HF \rightleftharpoons H_2 + F_2$
17. Molarity of pure water is:
- (A) 1 (B) 18 (C) 55.5 (D) 6

Roll No. \_\_\_\_\_ امیدوار خود پر کرے

(NEW PATTERN)

Subject Code 6 0 4 8

Sessions; 2012-2014, 2013-2015 &amp; 2014-2016

**Chemistry** (Essay Type)

Time: 3:10 Hours

Marks: 83

**Section - I****2- Write short answers of any eight parts from the following.**

2 x 8 =16

- Molecular formula is a multiple of empirical formula, explain with example.
- Write four characteristics of a solvent selected for crystallization of a compound.
- Write down the postulates of kinetic molecular theory responsible for the deviation of gases from ideal behaviour.
- How does the change of pressure shift the equilibrium position in the synthesis of ammonia?
- Calculate the number of atoms in 0.1g of sodium.
- Differentiate between actual yield and theoretical yield.
- What is solvent extraction? Give its importance.
- Write down the quantitative definition of Charles law.
- Define state function and give two examples.
- Draw a labelled diagram of bomb calorimeter.
- Define pH and give the pH of milk and eggs.
- How buffer solutions are prepared?

**3- Write short answers of any eight parts from the following.**

2 x 8 =16

- The radius of an atom cannot be determined precisely. Give reasons.,
- Differentiate between polar and non-polar covalent bonds with examples.
- What are dipole-induced dipole forces?
- What do you mean by cleavage and cleavage planes?
- What is transition temperature? Give examples.
- What is vacuum distillation? Give its advantages.
- State Heisenberg's uncertainty principle.
- State Pauli's exclusion principle.
- What is Stark effect?
- What happens when a neutron decays?
- How does electron affinity vary in periodic table?
- Why second I.P. of an element is always greater than First I.P.?

**4- Write short answers of any six parts from the following.**

2 x 6 =12

- How do you justify that freezing points are depressed due to the presence of solutes?
- Calculate oxidation number of chromium in (a)  $K_2Cr_2O_7$  (b)  $K_2CrO_4$
- Differentiate between instantaneous rate and average rate of a reaction.
- What is meant by critical solution temperature?
- Define molarity of a solution. Give its equation.
- What is meant by standard hydrogen electrode?
- A salt bridge maintains the electrical neutrality in cell. Justify.
- What do you mean by half life period?
- Define homogeneous catalysis and give an example.

**Section - II****NOTE: Answer any three questions from the following.**

8x3=24

- (a) What are ionic solids? Give their properties. 4  
(b) Calculate the number of grams of  $K_2SO_4$  and water produced when 14g KOH are reacted with excess of  $H_2SO_4$ . Also calculate the number of molecules of water produced. (At mass K=39, S=32) 4
- (a) What is Graham's law of diffusion? Also give its experimental verification. 4  
(b) Write the postulates of Bohr's atomic model. 4
- (a) Give salient features of VSEPR theory. 4  
(b) State and explain the first law of thermodynamics? 4
- (a) Define the order of a reaction and give one example of first, second and third order reaction each. 4  
(b) Calculate the pH of a buffer solution in which 0.11 molar  $CH_3COONa$  and 0.09 molar acetic acid solutions are present.  $K_a$  for  $CH_3COOH$  is  $1.85 \times 10^{-5}$ . 4
- (a) What is molal boiling point constant? How we can determine the molar mass of an unknown solid by elevation in boiling point method? 4  
(b) What is a galvanic cell? Give composition and working of galvanic cell. 4

**Section -III (Practical Section)****NOTE: Answer any three parts from the following.**

5x3=15

- Purify the given sample of common salt obtained from Khewra mines by passing HCl gas through common ion effect. 05
- Separate and identify  $Pb^{+2}$  and  $Cd^{+2}$  ions in a mixture by paper chromatography and also calculate  $R_f$  values. 05
- The given solution contains 5g NaOH dissolved per  $dm^3$ . Find out the percentage purity of the sample. (Molar mass of NaOH=40) 05
- The given mixture contains 35g  $FeSO_4$  and  $(NH_4)_2SO_4$  dissolved per  $dm^3$ . Calculate the percentage composition of the mixture. (Molar mass of  $FeSO_4 \cdot 7H_2O=278$ ) 05
- The given solution contains 24.8g  $Na_2S_2O_3 \cdot xH_2O$  dissolved per  $dm^3$ . Find out the value of x. (Molar mass of  $Na_2S_2O_3 \cdot xH_2O=158+18x$ ) 05



Roll No. \_\_\_\_\_ to be filled in by the candidate.

**(OLD PATTERN)**Paper Code 

2	4	8	3
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**Chemistry** (Objective Type)**Session; 2011-2013****Time: 20 Minutes****Marks: 17**

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A,B,C & D to each question are given. Which answer you consider correct, fill the corresponding circle A,B,C or D given in front of each question with Marker or pen ink on the answer sheet provided.

- 1.1. If a salt bridge is not used between two half cells then the voltage:
- (A) decreases rapidly (B) decreases slowly  
(C) does not change (D) drops to zero
2. If rate equation of a reaction  $2A + B \longrightarrow$  products is  $rate = K[A]^2[B]$ , and A is present in large excess, then order of reaction is:
- (A) 1 (B) 2 (C) 3 (D) zero
3. Isotopes differ in:
- (A) properties which depend upon mass (B) arrangement of electrons in orbitals  
(C) chemical properties  
(D) The extent to which they may be affected in electromagnetic field.
4. 27g of Al will react completely with how much mass of  $O_2$  to produce  $Al_2O_3$ ?
- (A) 8g of oxygen (B) 16g of oxygen (C) 32g of oxygen (D) 24g of oxygen
5. Pressure remaining constant, at which temperature the volume of a gas will become twice of which it is at  $0^\circ C$ ?
- (A)  $546^\circ C$  (B)  $200^\circ C$  (C) 546K (D) 273K
6. The order of rate of diffusion of gases  $NH_3$ ,  $SO_2$ ,  $Cl_2$  and  $CO_2$  is:
- (A)  $NH_3 > SO_2 > Cl_2 > CO_2$  (B)  $NH_3 > CO_2 > SO_2 > Cl_2$  (C)  $Cl_2 > SO_2 > CO_2 > NH_3$  (D)  $NH_3 > CO_2 > Cl_2 > SO_2$
7. When water freezes at  $0^\circ C$ , its density decreases due to:
- (A) cubic structure of ice (B) empty spaces present in the structure of ice  
(C) change of bond length (D) change of bond angles
8. Which of the following is a pseudo solid?
- (A)  $CaF_2$  (B) Glass (C) NaCl (D) Sand
9. The wave number of light emitted by a certain source is  $2 \times 10^6 m^{-1}$ . The wave length of this light will be:
- (A) 500nm (B) 500m (C) 200nm (D)  $5 \times 10^7 m$
10. Quantum number values for 2P orbitals are:
- (A)  $n = 2, l = 1$  (B)  $n = 1, l = 2$  (C)  $n = 1, l = 0$  (D)  $n = 2, l = 0$
11. Which of the following hydrogen halides has the highest percentage of ionic character?
- (A) HCl (B) HBr (C) HF (D) HI
12. Which of the following species has unpaired electrons in antibonding molecular orbitals?
- (A)  $O_2^{2+}$  (B)  $N_2^{2-}$  (C)  $B_2$  (D)  $F_2$
13. A solution of glucose is 10% W/V. The volume in which 1g mole of it is dissolved will be:
- (A)  $1 dm^3$  (B)  $1.8 dm^3$  (C)  $200 cm^3$  (D)  $900 cm^3$
14. The molal boiling point constant is the ratio of the elevation in boiling point to:
- (A) molarity (B) molality (C) mole fraction of solvent (D) mole fraction of solute
15. Solvent extraction is an equilibrium process and it is controlled by:
- (A) Law of mass action (B) The amount of solvent used (C) Distribution law (D) The amount of solute
16. If an endothermic reaction is allowed to take place very rapidly in the air, the temperature of the surrounding air:
- (A) remains constant (B) increases (C) decreases (D) remains unchanged
17. The pH of  $10^{-3} mol dm^{-3}$  of an aqueous solution of  $H_2SO_4$  is:
- (A) 3.0 (B) 2.7 (C) 2.0 (D) 1.5

Roll No. \_\_\_\_\_ (To be filled in by the candidate)

**(OLD PATTERN)**

Subject Code 2 4 8

**Chemistry** (Essay Type)

Session; 2011-2013

Time: 2:40 Hours

Marks: 68

**Section - I****2- Write short answers of any eight parts from the following.**

2 x 8 =16

- Define molecular ion, how it is formed?
- What is chromatography? Define its types.
- Derive the numerical value of "R" in S.I units.
- Define Charle's law, derive its mathematical expression.
- Derive Graham's law of diffusion from kinetic equation.
- What is polarizability? Give its applications.
- Earthen-Ware vessel keeps the water cool. Explain it.
- What are crystallographic elements? Give an example.
- What is mass spectrometer? Give the mathematical expression used in mass spectrometer.
- Write four qualities of good solvent for the process of crystallization.
- Write the Van-der waal's equation used for real gas when gas is n moles and when gas is one mole.
- Sodium is softer than copper, but both are very good electrical conductor. Explain.

**3- Write short answers of any eight parts from the following.**

2 x 8 =16

- Why is it necessary to decrease the pressure in the discharge tube to get the cathode rays?
- How the distinction between covalent bond and co-ordinate covalent bond vanishes after bond formation in  $NH_4^+$  and  $H_3O^+$ ?
- Write four properties of positive rays.
- What particles are formed by the decay of free neutrons?
- Define standard enthalpy of formation with one example.
- $\pi$ -bonds are more diffused than  $\sigma$ -bonds. Give reason.
- Define state and state function.
- What is dipole moment? Give its mathematical form and units.
- What is the pH of  $10^{-4}$  mol  $dm^{-3}$  of HCl?
- Differentiate between internal energy and enthalpy.
- Write down four uses of buffers.
- What is Henderson's equation? Give mathematical forms.

**4- Write short answers of any six parts from the following.**

2 x 6 =12

- Justify that in summer, the antifreeze solutions protect the radiator from boiling-over.
- Rate of chemical reaction is an ever changing parameter under the given conditions. Discuss.
- A Catalyst is specific in action. Define with suitable example.
- Define upper consolute temperature with example.
- Define water of crystallization with example.
- Define molarity of a solution.
- Write down the reactions in alkaline battery. What is its voltage?
- Define colligative properties of solution.
- Differentiate between rate and rate constant of a reaction.

**Section - II****NOTE: Answer any three questions from the following.**

8x3=24

- (a) Define stoichiometry. Give its assumptions. Define two relevant laws, which govern the stoichiometry. 4  
(b) Derive an equation representing ionic-product constant of water ( $K_w$ ). How it enables us to derive relationship between pH and pOH? 4
- (a) Define and describe the Raoult's law with mathematical derivations in two different ways? 4  
(b) Calculate the mass of  $1dm^3$  of  $NH_3$  gas at  $30^\circ C$  and 1000mm Hg pressure, considering that  $NH_3$  is behaving ideally. 4
- (a) What are molecular crystals? Give their properties. 4  
(b) When 2.0 moles of  $H_2$  and 1.00 mole of  $O_2$  at  $100^\circ C$  and 1 torr pressure react to produce 2.00 moles of gaseous water, 484.5 KJ of energy are evolved. What are the values of (a)  $\Delta H$  (b)  $\Delta E$  for the production of one mole of  $H_2O_{(g)}$ ? 4
- (a) What are cathode rays? Give their properties. 4  
(b) Define: (i) Half life period (ii) Energy of activation (iii) Inhibitors (iv) Rate determining step 4
- (a) Prove with the help of molecular orbital diagram that  $O_2$  is paramagnetic molecule. 4  
(b) What is SHE? Explain its structure. 4

Roll No. \_\_\_\_\_ to be filled in by the candidate.

Paper Code	2	4	8	1
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Session; 2015-2017

# Chemistry (Objective Type)

Time: 20 Minutes

Marks: 17

NOTE: Write answers to the questions on objective answer sheet provided. Four possible answers A,B,C & D to each question are given. Which answer you consider correct, fill the corresponding circle A,B,C or D given in front of each question with Marker or pen ink on the answer sheet provided.

1.1. The volume occupied by 1.4g of  $N_2$  at STP is:

- (A) 2.24 dm<sup>3</sup>                      (B) 22.4 dm<sup>3</sup>                      (C) 1.12 dm<sup>3</sup>                      (D) 112 cm<sup>3</sup>

2. 27g of Al will react completely with how much mass of  $O_2$  to produce  $Al_2O_3$ .

- (A) 8g of oxygen                      (B) 16g of oxygen                      (C) 32g of oxygen                      (D) 24g of oxygen

3. The comparative rates at which the solute move in paper chromatography depends on:

- (A) the size of paper                      (B)  $R_f$  values of solutes  
(C) Temperature of the experiment                      (D) size of the chromatographic tank

4. The number of molecules in one dm<sup>3</sup> of water is close to:

- (A)  $\frac{6.02}{22.4} \times 10^{23}$                       (B)  $\frac{12.04}{22.4} \times 10^{23}$                       (C)  $\frac{18}{22.4} \times 10^{23}$                       (D)  $55.6 \times 6.02 \times 10^{23}$

5. A real gas obeying Vanderwaal's equation will resemble ideal gas if:

- (A) both 'a' and 'b' are large                      (B) both 'a' and 'b' are small  
(C) 'a' is small 'b' is large                      (D) 'a' is large 'b' is small

6. Acetone and chloroform are soluble into each other due to:

- (A) Intermolecular hydrogen bonding                      (B) Ion-dipole interaction  
(C) Instantaneous dipole                      (D) Debye forces

7. The molecules of  $CO_2$  in dry ice form the:

- (A) Ionic crystals                      (B) covalent crystals                      (C) molecular crystals                      (D) any type of crystal

8. Splitting of spectral lines when atoms are subjected to strong electric field is called:

- (A) Zeeman effect                      (B) Stark effect                      (C) photoelectric effect                      (D) Compton effect

9. Quantum number values for 2P orbitals are

- (A)  $n = 2, \ell = 1$                       (B)  $n = 1, \ell = 2$                       (C)  $n = 1, \ell = 0$                       (D)  $n = 2, \ell = 0$

10. Which of the following species has unpaired electrons in antibonding molecular orbitals?

- (A)  $O_2^{2+}$                       (B)  $N_2^{2-}$                       (C)  $B_2$                       (D)  $F_2$

11. Which of the following hydrogen halides has the highest percentage of ionic character?

- (A) HCl                      (B) HBr                      (C) HF                      (D) HI

12. Calorie is equivalent to:

- (A) 0.4184 J                      (B) 41.84 J                      (C) 4.184 J                      (D) 418.4 J

13. The solubility product of AgCl is  $2.0 \times 10^{-10} \text{ mole}^2 \text{ dm}^{-6}$ . The maximum concentration of  $Ag^+$  ions in the solution is:

- (A)  $2.0 \times 10^{-10} \text{ mole dm}^{-3}$                       (B)  $1.41 \times 10^{-5} \text{ mole dm}^{-3}$                       (C)  $1.0 \times 10^{-10} \text{ mole dm}^{-3}$                       (D)  $4.0 \times 10^{-24} \text{ mole dm}^{-3}$

14. The pH of  $10^{-3} \text{ mol dm}^{-3}$  of an aqueous solution of  $H_2SO_4$  is:

- (A) 3.0                      (B) 2.7                      (C) 2.0                      (D) 1.5

15. Molarity of pure water is:

- (A) 1                      (B) 18                      (C) 55.5                      (D) 6

16. The oxidation number of 'O' atom in  $OF_2$  is:

- (A) +2                      (B) -2                      (C) +1                      (D) -1

17. In Zero order reaction, the rate is independent of:

- (A) temperature of reaction                      (B) concentration of reactants  
(C) concentration of products                      (D) pressure of reactants

Roll No. \_\_\_\_\_

Subject Code 2 4 8

**Chemistry** (Essay Type)

Session; 2015-2017

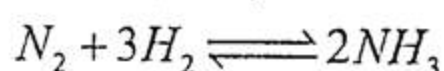
Time: 2:40 Hours

Marks: 68

**Section - I****2- Write short answers of any eight parts from the following.**

2 x 8 = 16

- Define stoichiometry and give two assumptions for stoichiometric calculations.
- Differentiate between adsorption and partition chromatography.
- What is meant by the term critical solution temperature? Also give value of critical solution temperature and composition of phenol water system at critical temperature.
- State Lechatlier's principle. What is the effect of change in pressure on the following reaction?



- Calculate mass in Kg of  $2.6 \times 10^{20}$  molecules of  $SO_2$ .
- Why actual yield is usually less than the theoretical yield?
- How crystals are decolourised?
- Convert  $-40^\circ C$  into Fahrenheit.
- Define mole fraction and give its mathematical form.
- Why deep sea divers take oxygen mixed with an inert gas?
- Define hydrates and give its two examples.
- Derive formula to determine density from an ideal gas equation.

**3- Write short answers of any eight parts from the following.**

2 x 8 = 16

- Define hydrogen bonding. Show hydrogen bonding in ammonia molecule.
- In summer the antifreeze solutions protect the radiators from boiling over. How?
- Write down the reaction at anode and cathode of silver oxide battery in a basic electrolyte.
- Define crystalline solids and crystallites.
- Define transition temperature. Give two examples.
- Define crystallographic elements.
- Narrate four properties of cathode rays.
- Define slow neutrons and fast neutrons.
- State Mosely's law and write down its equation.
- Write the electronic configuration of Si=14 and Cr=24.
- Define electrolytic cell.
- Define standard electrode potential.

**4- Write short answers of any six parts from the following.**

2 x 6 = 12

- Define ionization potential. Give two factors on which it depends.
- $CO_2$  molecules have linear structure while  $H_2O$  have angular structure. Explain.
- Under what conditions activated complex is formed?
- Define Octet rule.
- $\pi$ -bonds are diffused than sigma bonds. Explain.
- Define state function with an example.
- State with one example enthalpy of combustion.
- Define order of reaction with an example.
- What is auto-catalysis? Give an example.

**Section - II****NOTE: Answer any three questions from the following.**

8x3=24

- (a) The combustion analysis of an organic compound shows it to contain 65.44% carbon, 5.50% hydrogen and 29.06% of oxygen. What is the empirical formula of the compound? If the molecular mass of this compound is  $110.15 \text{ g mol}^{-1}$ . Calculate the molecular formula of the compound. 4  
(b) What are liquid crystals? Give their three uses in daily life. 1+3=4
- (a) State Graham's law of diffusion and demonstrate this law with diagram. 4  
(b) Write the main postulates of Bohr's theory. 4
- (a) Describe  $sp^2$  hybridization giving example of Ethene. 4  
(b) Write a note on Hess's law of constant heat summation with one example. 4
- (a) Describe the method to determine the rate of reaction by a chemical method. 4  
(b) The solubility of  $CaF_2$  in water at  $25^\circ C$  is found to be  $2.05 \times 10^{-4} \text{ mol dm}^{-3}$ . What is the value of  $K_{sp}$  at this temperature. Atomic mass of Ca=40, F=19. 4
- (a) What are azeotropic mixtures. Discuss positive deviation from Raoult's law. 4  
(b) Write a note on Nickel Cadmium cell. 4



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Paper Code 6 4 8 1

Sessions; 2012-2014, 2013-2015 &amp; 2014-2016

**Chemistry** (Objective Type)

Time: 20 Minutes

Marks: 17

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A,B,C & D to each question are given. Which answer you consider correct, fill the corresponding circle A,B,C or D given in front of each question with Marker or pen ink on the answer sheet provided.

- 1.1. In largest number of molecules are present in:
- (A) 3.6g of H<sub>2</sub>O      (B) 4.8g of C<sub>2</sub>H<sub>5</sub>OH      (C) 8.4g of CO      (D) 5.4 of N<sub>2</sub>O<sub>5</sub>
2. The number of moles of CO<sub>2</sub> which contain 8.0g of oxygen:
- (A) 0.25      (B) 0.50      (C) 1.0      (D) 1.50
3. Which one of the following substances is not a drying agent?
- (A) NaCl      (B) CaCl<sub>2</sub>      (C) Silica gel      (D) Phosphorous pentaoxide
4. The number of molecules in one dm<sup>3</sup> of water is close to:
- (A)  $\frac{6.02}{22.4} \times 10^{23}$       (B)  $\frac{12.04}{22.4} \times 10^{23}$       (C)  $\frac{18}{22.4} \times 10^{23}$       (D)  $55.6 \times 6.02 \times 10^{23}$
5. The molar volume of CO<sub>2</sub> is maximum at:
- (A) STP      (B) 200°C and 1 atm      (C) 0°C and 2 atm      (D) 273°C and 2 atm
6. The molar heat of vaporization of water is:
- (A) 50.4 KJ mole<sup>-1</sup>      (B) 40.6 KJ mole<sup>-1</sup>      (C) 46.6 KJ mole<sup>-1</sup>      (D) 45.8 KJ mole<sup>-1</sup>
7. The transition temperature of Tin is:
- (A) 15.6°C      (B) 13.2°C      (C) 50°C      (D) 23.2°C
8. Quantum number values for 3d orbitals are:
- (A)  $n=3, \ell=1$       (B)  $n=3, \ell=2$       (C)  $n=3, \ell=0$       (D)  $n=2, \ell=2$
9. The formula used to find out the number of electrons in a sub-shell is:
- (A)  $2(2\ell+1)$       (B)  $(2\ell+1)$       (C)  $3(2\ell+1)$       (D)  $(2\ell+2)$
10. Which one of the following molecules has zero dipole moment?
- (A) NH<sub>3</sub>      (B) CHCl<sub>3</sub>      (C) H<sub>2</sub>O      (D) BCl<sub>3</sub>
11. Which of the following species has unpaired electron in antibonding molecular orbitals?
- (A) O<sub>2</sub><sup>2+</sup>      (B) N<sub>2</sub><sup>2-</sup>      (C) B<sub>2</sub>      (D) F<sub>2</sub>
12. One calorie is equivalent to:
- (A) 0.4184 J      (B) 41.84 J      (C) 4.184 J      (D) 418.4 J
13. The pH of 10<sup>-2</sup> moles dm<sup>-3</sup> of an aqueous solution of HCl is:
- (A) 2.0      (B) 2.7      (C) 3.0      (D) 1.5
14. The solubility product of AgCl is 2.0 × 10<sup>-10</sup> mole<sup>2</sup> dm<sup>-6</sup>. The maximum concentration of Ag<sup>+</sup> ions in the solution is:
- (A) 2.0 × 10<sup>-10</sup> mol dm<sup>-3</sup>      (B) 1.41 × 10<sup>-5</sup> mol dm<sup>-3</sup>      (C) 1.0 × 10<sup>-10</sup> mol dm<sup>-3</sup>      (D) 4.0 × 10<sup>-20</sup> mol dm<sup>-3</sup>
15. 18g of glucose is dissolved in 90g of water, the relative lowering of vapour pressure is equal to:
- (A) 1/5      (B) 5.1      (C) 1/51      (D) 6
16. The stronger the oxidizing agent the greater is:
- (A) reduction potential      (B) oxidation potential      (C) Redox potential      (D) E.M.F of cell
17. If the rate equation of a reaction  $2A + B \longrightarrow$  products is rate =  $K[A]^2[B]$  and A is present in large excess, the order of reaction is:
- (A) 1      (B) 2      (C) 3      (D) none of these

Roll No. \_\_\_\_\_

Subject Code 6 0 4 8

**Chemistry** (Essay Type)

Sessions; 2012-2014, 2013-2015 &amp; 2014-2016

Time: 3:10 Hours

Marks: 83

**Section - I****2- Write short answers of any eight parts from the following.**

2 x 8 = 16

- Why in an experimental work, one or more reactants is/are deliberately used in excess?
- How does a mass spectrograph show the relative abundance of the isotopes of an element?
- Write down four features of solvent selected for crystallization.
- How do you justify from the general gas equation that increase in temperature and decrease of pressure, decreases the density of a gas?
- Write down two postulates of kinetic molecular theory which are responsible for deviation of real gases from ideal behaviour.
- What are spontaneous and non-spontaneous processes? Give an example for each.
- What will be the effect of increase of temperature on the solubility of  $\text{Li}_2\text{CO}_3$ ?
- How the efficiency of a reaction is expressed? ix. How a crude substance is decolourized during crystallization?
- What is meant by the state of chemical equilibrium? xi. Define standard enthalpy of formation and give an example.
- Why do we need buffer solutions in daily life?

**3- Write short answers of any eight parts from the following.**

2 x 8 = 16

- At room temperature  $\text{I}_2$  is solid whereas  $\text{Cl}_2$  is a gas. Explain with reason.
- Neutrons can be used as projectile in nuclear reactions. Give two examples.
- Give equations relating the energy of a photon with (a) Wave length (b) Wave number.
- Discuss the geometry of  $\text{H}_2\text{O}$  molecule on the basis of VSEPR theory.
- Evaporation causes cooling. Explain. vi.  $\text{I}_2$  dissolves readily in  $\text{CCl}_4$ . Why?
- Ionic crystals are highly brittle. Explain with reason. viii. Give the electronic configuration of  $\text{K}_{10}^{39}$  and  $\text{Br}_{35}^{80}$ .
- What is the origin of line spectra? x. What is dipole moment? Give its two units.
- The oxygen molecule is paramagnetic. Give reason. xii. What is ionization energy? Give an example.

**4- Write short answers of any six parts from the following.**

2 x 6 = 12

- The concentration in terms of molality is independent of temperature but Molarity depends upon temperature. Why?
- What is molality? Calculate the molality of solution having 49 grams of  $\text{H}_2\text{SO}_4$  dissolved in 250 grams of water.
- In summer, the anti-freeze solution protects the radiator from boiling over. Why?
- $\text{Na}$  and  $\text{K}$  can displace hydrogen from acid but  $\text{Pt}$ ,  $\text{Pd}$  and  $\text{Cu}$  can not. Why?
- Calculate the oxidation number of underlined element in  $\text{Ca}(\underline{\text{ClO}}_3)_2$  and  $\text{Cr}_2(\underline{\text{SO}}_4)_3$ .
- The sum of co-efficients of a balanced chemical equation is not necessarily important to give the order of reaction. Justify.
- Differentiate between homogeneous and heterogeneous catalysis.
- Write down the chemistry of alkaline battery. What is its voltage?
- Why photochemical reactions have generally zero order reaction?

**Section - II****NOTE: Answer any three questions from the following.**

8x3=24

- (a) What is vapor pressure? How is it measured by manometric method? 4  
(b) Calculate the number of grams of  $\text{K}_2\text{SO}_4$  and water produced when 14 gm of  $\text{KOH}$  are reacted with excess of  $\text{H}_2\text{SO}_4$ . (At mass of  $\text{K}=39/\text{mol}$ ,  $\text{O}=16\text{gm}/\text{mol}$ ,  $\text{S}=32\text{gm}/\text{mol}$ ,  $\text{H}=1\text{gm}/\text{mol}$ ) 4
- (a) Derive Charles law and Graham's law from kinetic theory of gases. 4  
(b) What are quantum numbers? Explain azimuthal quantum number. 4
- (a) Write main postulates of VSEPR theory. 4  
(b) Explain Hess's law with suitable examples. 4
- (a) Discuss characteristics of enzyme catalysis. 4  
(b) Calculate the pH of a buffer solution in which 0.11 molar  $\text{CH}_3\text{COONa}$  and 0.09 molar acetic acid solutions are present.  $K_a$  for  $\text{CH}_3\text{COOH}$  is  $1.85 \times 10^{-5}$ . 4
- (a) What is Raoult's law. Give its three statements. 4  
(b) Describe a galvanic cell explaining the function of electrodes. 4

**Section -III (Practical Section)****NOTE: Answer any three parts from the following.**

5x3=15

- A. Prepare pure sample of benzoic acid by crystallization. 05  
B. Separate the mixture of three inks by chromatography. 05  
C. The given solution contains a mixture of 6.0 grams of  $\text{NaOH}$  and  $\text{NaCl}$  dissolved per  $\text{dm}^3$ . Find out the percentage of each component volumetrically. 05  
D. 27.8 grams of sample of  $\text{FeSO}_4 \cdot \text{XH}_2\text{O}$  are dissolved per  $\text{dm}^3$  of solution. Determine the value of "X" volumetrically. 05  
E. The given solution contains 4.0g of Iodine dissolved per  $250\text{cm}^3$ . Determine the percentage purity of the sample. 05





Roll No. \_\_\_\_\_ to be filled in by the candidate.

13

Paper Code 2 4 8 1

Sessions; 2015-2017 &amp; 2016-2018

**Chemistry** (Objective Type)

Group-I

Time: 20 Minutes

Marks: 17

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A, B, C & D to each question are given. Which answer you consider correct, fill the corresponding circle A, B, C or D given in front of each question with Marker or pen ink on the answer sheet provided.

1.1. The mass of one mole of electron is:

- (A) 1.008 mg                      (B) 0.55 mg                      (C) 0.184 mg                      (D) 1.673 mg

2. The largest number of molecules are present in:

- (A) 3.6 g of H<sub>2</sub>O                      (B) 4.8 g of C<sub>2</sub>H<sub>5</sub>OH                      (C) 2.8 g of CO                      (D) 5.4 g of N<sub>2</sub>O<sub>5</sub>

3. The comparative rates at which the solutes move in paper chromatography depend on:

- (A) Size of paper                      (B) R<sub>f</sub> values of solutes  
(C) Temperature of the experiment                      (D) size of the chromatographic tank used

4. The molar volume of CO<sub>2</sub> is maximum at:

- (A) S.T.P                      (B) 127°C and 1 atm                      (C) 0°C and 2 atm                      (D) 273°C and 2 atm

5. The deviation of a gas from ideal behaviour is maximum at:

- (A) -10°C and 5.0 atm                      (B) -10°C and 2.0 atm                      (C) 100°C and 2.0 atm                      (D) 0°C and 2.0 atm

6. NH<sub>3</sub> shows a maximum boiling point among the hydrides of vth group elements due to:

- (A) very small size of nitrogen                      (B) lone pair of electrons present on nitrogen  
(C) enhance electronegative character of nitrogen                      (D) pyramidal structure of NH<sub>3</sub>

7. Ionic solids are characterized by:

- (A) low melting points                      (B) good conductivity in solid state  
(C) high vapour pressure                      (D) solubility in polar solvents

8. The nature of positive rays depend on:

- (A) the nature of electrode                      (B) the nature of discharge tube  
(C) the nature of residual gas                      (D) the nature of voltage supplied

9. When 6d orbital is complete, the entering electron goes into:

- (A) 7f                      (B) 7s                      (C) 7p                      (D) 7d

10. Which of the hydrogen halides has the highest percentage of ionic character?

- (A) HCl                      (B) HBr                      (C) HF                      (D) HI

11. Which of the following species has unpaired electrons in the antibonding orbitals?

- (A) O<sub>2</sub><sup>2+</sup>                      (B) N<sub>2</sub><sup>2-</sup>                      (C) B<sub>2</sub>                      (D) F<sub>2</sub>

12. If an endothermic reaction is allowed to take place very rapidly in the air the temperature of the surrounding air:

- (A) remains constant                      (B) increases                      (C) decreases                      (D) remains unchanged

13. The solubility product of AgCl is 2 × 10<sup>-10</sup> mole<sup>2</sup>dm<sup>-6</sup>. The maximum concentration of Ag<sup>+</sup> ions in the solution is:

- (A) 2.0 × 10<sup>-10</sup> mole dm<sup>-3</sup>                      (B) 1.41 × 10<sup>-5</sup> mole dm<sup>-3</sup>                      (C) 1.0 × 10<sup>-10</sup> mole dm<sup>-3</sup>                      (D) 4.0 × 10<sup>-24</sup> mole dm<sup>-3</sup>

14. An excess of aqueous silver nitrate is added to aqueous barium chloride and precipitate is removed by filtration. What are the main ions in the filtrate?

- (A) Ag<sup>+</sup> and NO<sub>3</sub><sup>-</sup> only                      (B) Ag<sup>+</sup>, Ba<sup>2+</sup> and NO<sub>3</sub><sup>-</sup>                      (C) Ba<sup>2+</sup> and NO<sub>3</sub><sup>-</sup> only                      (D) Ba<sup>2+</sup>, NO<sub>3</sub><sup>-</sup> and Cl<sup>-</sup>

15. A solution of glucose is 10% w/v. The volume in which 1g mol of it is dissolved will be:

- (A) 1 dm<sup>3</sup>                      (B) 1.8 dm<sup>3</sup>                      (C) 200 cm<sup>3</sup>                      (D) 900 cm<sup>3</sup>

16. Stronger the oxidizing agent, greater is the:

- (A) Oxidation potential                      (B) reduction potential                      (C) redox potential                      (D) E.M.F of cell

17. If the rate equation of a reaction 2A + B → products is, rate = k[A]<sup>2</sup>[B]<sup>1</sup>, and A is present in large excess then order of reaction is:

- (A) 1                      (B) 2                      (C) 3                      (D) 4

(14)

Inter (Part-I)-A-2017

Roll No. \_\_\_\_\_ امیدوار خود پر کرے

Sessions; 2015-2017 &amp; 2016-2018

Chemistry (Essay Type)

Group-I

Time: 2:40 Hours

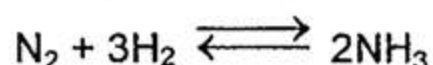
Marks: 68

## Section - I

2- Write short answers of any eight parts from the following.

2 x 8 = 16

- What is function of magnetic field in mass spectrometer?
- Derive Boyle's law from kinetic molecular theory of gases.
- Define molarity and write the formula for the determination of molarity.
- State law of Mass Action. Give equilibrium constant expression  $K_c$  for the following reaction.



- Define filtration and crystallization.
- Define mole with two examples.
- Write down the four properties of a good solvent.
- Define atmospheric pressure. Give its two units.
- Why actual yield is usually less than the theoretical yield?
- Why lighter gases diffuse more rapidly than heavier gases?
- Calculate pH of  $10^{-4}$  mole  $dm^{-3}$  of  $Ba(OH)_2$  solution.
- Why aqueous solution of  $CuSO_4$  is acidic in nature?

3- Write short answers of any eight parts from the following.

2 x 8 = 16

- Which type of particles are formed by the decay of free neutrons?
- Sodium is softer than copper but both are very good electrical conductor.
- Which ever gas is used in discharge tube, the nature of cathode rays remains the same, why?
- Define hydrogen bonding and give one example.
- Ionic crystals are highly brittle. Explain.
- What is Mosely law?
- What is Anodized Aluminium?
- Calculate the oxidation number of Cl in the following compound  $Ca(ClO_3)_2$ .
- Evaporation takes place at all temperatures. Explain.
- What are the defects of Rutherford's atomic model?
- Aqueous solution of  $Na_2CO_3$  is alkaline in nature, Why?
- Impure Cu can be purified by electrolytic process, Explain.

4- Write short answers of any six parts from the following.

2 x 6 = 12

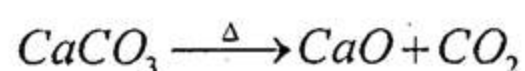
- The radioactive decay is always a first order reaction. Justify it.
- State first law of thermodynamics. Give its mathematical formula.
- What is difference between the bonding and antibonding molecular orbitals?
- Define dipole moment. Give its mathematical formula.
- Define Electronegativity. Give its trend in periodic table.
- Define standard enthalpy of combustion with example.
- Define Covalent bond. Give two examples.
- What is enzyme catalysis. Give an example.

## Section - II

NOTE: Answer any three questions from the following.

8x3=24

5. (a) When lime stone ( $CaCO_3$ ) is roasted,  $CaO$  is produced according to following equation. The actual yield of  $CaO$  is 2.5 Kg, When 4.5 Kg of limestone is roasted. What is percentage yield of this reaction?



Atomic mass of Ca=40
Atomic mass of O=16
Atomic mass of C=12

- Define vapour pressure of a liquid. How vapour pressure of a liquid can be measured by manometric method? 4
- (a) Explain Linde's method for the liquification of Gases. 4  
(b) Derive the equation for the radius of  $n$ th orbit of Hydrogen atom using Bohr's model. 4
- (a) State co-ordinate covalent bond with the help of two examples. 4  
(b) State first law of thermodynamics. How does it explain that  $q_p = \Delta H$ . 4
- (a) The solubility of  $CaF_2$  in water at  $25^\circ C$  is found to be  $2.05 \times 10^{-4}$  mole  $dm^{-3}$ . What is the value of  $K_{sp}$  at this temperature? 4  
(b) Explain effect of concentration of reactant on rate of reaction. 4
- (a) Define colligative properties and discuss freezing point depression by Beckman apparatus. 4  
(b) Give any four applications of electrolysis. 4

834-011-A-11000

## Chemistry (Objective Type)

## Group-II

Time: 20 Minutes

Marks: 17

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A,B,C & D to each question are given. Which answer you consider correct, fill the corresponding circle A,B,C or D given in front of each question with Marker or pen ink on the answer sheet provided.

- 1.1. 27 g of Al will react completely with how much mass of  $O_2$  to produce  $Al_2O_3$  ?  
 (A) 8 g of oxygen (B) 16 g of oxygen (C) 32 g of oxygen (D) 24 g of oxygen
2. The volume occupied by 1.4 g of  $N_2$  at STP is  
 (A)  $2.24 \text{ dm}^3$  (B)  $22.4 \text{ dm}^3$  (C)  $1.12 \text{ dm}^3$  (D)  $112 \text{ cm}^3$
3. Solvent extraction is an equilibrium process and is controlled by:  
 (A) Law of Mass Action (B) The amount of solvent used  
 (C) Distribution Law (D) The amount of solute
4. Pressure remaining constant, at which temperature the volume of a gas will become twice of what it is at  $0^\circ\text{C}$   
 (A)  $546^\circ\text{C}$  (B)  $200^\circ\text{C}$  (C) 546 K (D) 273 K
5. The molar volume of  $CO_2$  is maximum at:  
 (A) STP (B)  $127^\circ\text{C}$  and 1 atm (C)  $0^\circ\text{C}$  and 1 atm (D)  $273^\circ\text{C}$  and 2 atm
6. In order to maintain the boiling point of water at  $110^\circ\text{C}$ , the external pressure should be  
 (A) between 760 torr and 1200 torr (B) between 200 torr and 760 torr  
 (C) 765 torr (D) any value of pressure
7. The molecules of  $CO_2$  in dry ice form the:  
 (A) ionic crystals (B) covalent crystals (C) molecular crystals (D) Metallic crystals
8. In ground state of an atom, the electron is present  
 (A) in the nucleus (B) in the second shell (C) nearest to the nucleus (D) farthest from the nucleus
9. Velocity of Photon is:  
 (A) independent of its wavelength (B) depends on its wavelength  
 (C) equal to square of its amplitude (D) depends on its source
10. Which of the following species has unpaired electrons in the antibonding molecular orbitals  
 (A)  $O_2^{+2}$  (B)  $N_2^{-2}$  (C)  $B_2$  (D)  $F_2$
11. The number of bonds in nitrogen molecule is:  
 (A) one sigma and one Pi (B) one sigma and two Pi  
 (C) three sigma only (D) two sigma and one Pi
12. For a given process, the heat changes at constant pressure ( $q_p$ ) and at constant volume ( $q_v$ ) are related to each other as:  
 (A)  $q_p = q_v$  (B)  $q_p < q_v$  (C)  $q_p > q_v$  (D)  $q_p = \frac{q_v}{2}$
13. The solubility product of  $AgCl$  is  $2.0 \times 10^{-10} \text{ mol}^2 \text{ dm}^{-6}$ . The maximum concentration of  $Ag^+$  ions in the solution is:  
 (A)  $2.0 \times 10^{-10} \text{ mole dm}^{-3}$  (B)  $1.41 \times 10^{-5} \text{ mole dm}^{-3}$  (C)  $1.0 \times 10^{-10} \text{ mole dm}^{-3}$  (D)  $4.0 \times 10^{-20} \text{ mole dm}^{-3}$
14. Which statement about the following is correct  $2SO_2 + O_2 \rightleftharpoons 2SO_3 \Delta H = -188.3 \text{ kJ mole}^{-1}$   
 (A) the value of  $K_p$  falls with rise in Temp. (B) the value of  $k_p$  falls with increasing pressure  
 (C) Adding  $V_2O_5$  catalyst increases the equilibrium yield of Sulphur trioxide  
 (D) the value of  $K_p$  is equal to  $K_c$
15. The molal boiling point-constant is the ratio of the elevation in the boiling point to  
 (A) molarity (B) molality (C) mole fraction of solvent (D) mole fraction of solute
16. Stronger the oxidizing agent, greater is the:  
 (A) oxidation potential (B) reduction potential (C) redox potential (D) E.M.F of cell
17. If rate equation of a reaction  $2A + B \rightarrow \text{products}$  is  $\text{rate} = k[A]^2[B]$  and A is present in large excess, then order of reaction is:  
 (A) 1 (B) 2 (C) 3 (D) 4

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# Chemistry (Essay Type)

## Group-II

Time: 2:40 Hours

Sessions; 2015-2017&2016-2018

Marks: 68

### Section - I

2- Write short answers of any eight parts from the following.

2 x 8 =16

- i. Justify that 23 gm of sodium and 238 gm of uranium have Equal number of atoms in them.
- ii. Calculate %age of Nitrogen in  $NH_2CO NH_2$  (at mass of N=14, C=12, H=1, O=16).
- iii. How limiting reactant is Identified during chemical reaction?
- iv. Boiling points of the solvents increase due to the presence of solutes. Justify it.
- v. Throw some light on the factor  $\frac{1}{273}$  in Charles law.
- vi. Why  $SO_2$  is comparatively non-Ideal at 237K but behaves Ideally at 327°C.
- vii. Define sublimation with one example.
- viii. Define Diffusion of gases with one example.
- ix. Calculate PH of  $10^{-3} \text{ mol dm}^{-3}$  HCl
- x. Define common Ion effect with one example.
- xi. Define water of crystallization with one example.
- xii. Why there is a need to crystallize a crude product?

3- Write short answers of any eight parts from the following.

2 x 8 =16

- i. Differentiate between intermolecular and intramolecular forces.
- ii. Ionic solids do not conduct electricity in solid state. Give reason.
- iii. Write down nuclear reactions involved in the conversion of Cu into Zn.
- iv. Evaporation causes cooling . Give reason.
- v. What are crystallographic elements? Explain with diagram.
- vi. Define Zeeman effect and Stark effect.
- vii. Why the positive rays are also called canal rays?
- viii. Define Pauli's exclusion principle and Hund's rule.
- ix. What are hydrates? Give two examples.
- x. Differentiate between primary and secondary cell giving one example each.
- xi. A salt bridge maintains electrical neutrality in the cell. Give reason.
- xii. Define oxidizing agent and reducing agent.

4- Write short answers of any six parts from the following.

2 x 6 =12

- i. Both  $NH_3$  and  $BF_3$  are tetra atomic but different geometries, why?
- ii. What is meant by heterogeneous catalysis? Give its two examples.
- iii. Why  $CO_2$  has zero dipole moment and that of water has value of dipole moment 1.85 D ?
- iv. Bond distance is the compromise distance between two atoms, Justify.
- v. Differentiate between spontaneous and non-spontaneous process.
- vi. Define standard enthalpy of formation with two examples.
- vii. Define rate of reaction and give its units.
- viii. Why the radius of an atom can not be determined precisely?
- ix. What is pseudo first order reaction?

### Section - II

NOTE: Answer any three questions from the following.

8x3=24

- 5. (a) When lime stone is roasted, quick lime (CaO) is produced according to the following equation.  
The actual yield of CaO is 2.5 kg, when 4.5 kg of lime stone is roasted. What is the percentage yield of this reaction?  $CaCO_3 \rightarrow CaO + CO_2 (g)$  4
- (b) Define vapour pressure. Describe the manometric method to measure the vapour pressure of a liquid. 1+3=4
- 6. (a) Describe Dalton's law of partial pressures and write its two applications. 4
- (b) Derive the formula for calculating the radius of nth orbit in Bohr's model. 4
- 7. (a) What is dipole moment ? Give its units. How does it explain the geometry of  $CO_2$  and  $BF_3$  Molecules? 4
- (b) State Hess's law of constant Heat summation and explain with an example. 1+3=4
- 8. (a) Write four characteristics of a catalyst. 4
- (b)  $Ca(OH)_2$  is a sparingly soluble compound. Its solubility product is  $6.5 \times 10^{-6}$ .  
Calculate the solubility of  $Ca(OH)_2$
- 9. (a) Define and describe Raoult's Law and derive its three different forms? 4
- (b) Write a note on fuel cells? 4



Roll No. \_\_\_\_\_ to be filled in by the candidate.

Paper Code 6 4 8 1

**Chemistry** (Objective Type)

Sessions; 2013-2015 &amp; 2014-2016

Group-I

Time: 20 Minutes

Marks: 17

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A, B, C & D to each question are given. Which answer you consider correct, fill the corresponding circle A, B, C or D given in front of each question with Marker or pen ink on the answer sheet provided.

1.1. The mass of one mole of electrons is:

- (A) 1.008 mg                      (B) 0.55 mg                      (C) 0.184 mg                      (D) 1.673 mg

2. 1 mole of water contains:

- (A)  $6.02 \times 10^{23}$  atoms of oxygen                      (B)  $12.04 \times 10^{23}$  molecules of water  
(C)  $6.02 \times 10^{23}$  atoms of hydrogen                      (D) 18 gram atoms of water

3. When an organic compound formed in water is volatile or thermally unstable, it is separated by:

- (A) Crystallization                      (B) Sublimation                      (C) Solvent extraction                      (D) Chromatography

4. Partial Pressure of a gas is the mole fraction of that gas multiplied by:

- (A) the total number of moles of the mixture                      (B) the total pressure of the mixture  
(C) Volume of the mixture                      (D) the number of moles of that gas

5. The molar volume of  $\text{CO}_2$  is maximum at:

- (A) STP                      (B)  $127^\circ\text{C}$  and 1 atm                      (C)  $0^\circ\text{C}$  and 2 atm                      (D)  $273^\circ\text{C}$  and 2 atm

6. H-bonding is present among the:

- (A) Atoms of He gas                      (B) Molecules of  $\text{CCl}_4$   
(C) Molecule of solid iodine                      (D) molecule of  $\text{NH}_3$

7. In orthorhombic crystal, the unit cell dimensions are:

- (A)  $a = b \neq c$ ,  $\alpha = \beta = \gamma = 90^\circ$                       (B)  $a \neq b \neq c$ ,  $\alpha = \beta = \gamma = 90^\circ$   
(C)  $a \neq b \neq c$ ,  $\alpha = \beta \neq \gamma = 90^\circ$                       (D)  $a \neq b \neq c$ ,  $\alpha \neq \beta \neq \gamma \neq 90^\circ$

8. Orbitals having same energy are called:

- (A) hybrid orbitals                      (B) valence orbitals                      (C) degenerate orbitals                      (D) d-orbitals

9. Various lines in Lyman series of H-spectrum lie in:

- (A) I.R region                      (B) Far I.R region                      (C) U.V region                      (D) Visible region

10. In  $sp^2$  hybridization, the orbitals are oriented at an angle of:

- (A)  $109.5^\circ$                       (B)  $120^\circ$                       (C)  $180^\circ$                       (D)  $60^\circ$

11. The geometry of  $\text{BeCl}_2$  is:

- (A) Linear                      (B) Trigonal planer                      (C) Tetrahedral                      (D) Trigonal pyramidal

12. For the reaction  $2\text{NaOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$ , the change in enthalpy is called:

- (A) Heat of reaction                      (B) Heat of formation                      (C) Heat of neutralization                      (D) Heat of combustion

13. Reaction of  $\text{BiCl}_3$  with  $\text{H}_2\text{O}$  gives white precipitate of  $\text{BiOCl}$  and  $\text{HCl}$ . The white precipitate disappears by:

- (A) adding more  $\text{BiCl}_3$                       (B) adding more  $\text{HCl}$   
(C) By increasing temperature                      (D) by decreasing temperature

14. pH of pure water at  $25^\circ\text{C}$  is:

- (A) 6.6                      (B) 7                      (C) 14                      (D) 0

15. An azeotropic mixture of two liquids boils at a lower temperature than either of them when:

- (A) it is saturated                      (B) it shows +ve deviation from Raoult's law  
(C) it shows -ve deviation from Raoult's law                      (D) it is metastable

16. When aqueous solution of  $\text{NaCl}$  is electrolyzed, which of the following ions gets discharged at anode?

- (A)  $\text{Cl}^-$                       (B)  $\text{OH}^-$                       (C)  $\text{Na}^+$                       (D)  $\text{H}^+$

17. The rate of reaction:

- (A) increases as the reaction proceeds                      (B) decreases as the reaction proceeds  
(C) remains the same as the reaction proceeds                      (D) may decrease or increase as the reaction proceed

Roll No. \_\_\_\_\_ امیدوار خود پر کرے

**Chemistry** (Essay Type)Sessions; 2013-2015 & 2014-2016  
Group-I

Time: 3:10 Hours

Marks: 83

**Section - I****2- Write short answers of any eight parts from the following.**

2 x 8 = 16

- |   |  |
|---|--|
| i. Define mole and Avogadro's number.                                     | ii. Give four properties of choice of solvent for Crystallization. |
| iii. What are the basic assumptions of stoichiometry?                     | iv. State distribution law.  |
| v. Define effusion and diffusion.   | vi. Give two applications of Dalton's law of partial pressure.     |
| vii. What is Plasma? How is plasma formed?                                | viii. Give four properties of molecular solids.                    |
| ix. Metals are malleable and ductile. Why?                                | x. Define hydrogen bond.   |
| xi. Calculate the number of moles of Cl atoms in 0.822g of $C_4H_4Cl_2$ . |  |
| xii. Ionic crystals are highly brittle. Give reason.                      |  |

**3- Write short answers of any eight parts from the following.**

2 x 8 = 16

- |   |  |
|---|--|
| i. Distribute the electrons in orbitals (i) $_{29}Cu$ (ii) $_{11}Na$ .                    | ii. Write down four properties of Cathode rays or electrons.   |
| iii. State "Hunds rule" with example.   | iv. Dipole moments of $CO_2$ and $CS_2$ are zero. Give reason. |
| v. Write down four postulates of Bohr's atomic model.                                     | vi. Define polar and non polar molecules with examples.        |
| vii. State "Le-Chatelier's principle".  | viii. Define pH and pOH.                                       |
| ix. Write down the Lewis structures for the following compounds (i) $CCl_4$ (ii) $N_2O_5$ |  |
| x. $\pi$ -bonds are more diffused than $\sigma$ -bond. Justify it.                        |  |
| xi. Justify that heat of formation of compound is the sum of all the other enthalpies.    |  |
| xii. State "first law of thermodynamics". Give its mathematical relationship.             |  |

**4- Write short answers of any six parts from the following.**

2 x 6 = 12

- One molal solution of Urea is dilute than one molar solution. Justify.
- Why boiling points of the solvent increase due to the presence of solutes?
- Why  $NaCl$  and  $KNO_3$  are used to lower the melting point of the ice?
- Differentiate between electrolytic and voltaic cell.
- What are primary and secondary cells?
- Calculate oxidation state of Oxygen in  $OF_2$  and Oxidation state of Manganese in  $KMnO_4$ .
- A finely divided catalyst may prove more effective. Give reasons.
- Define activation energy and activated complex.
- Write two examples of enzyme catalysed reactions.

**Section - II****NOTE: Answer any three questions from the following.**

8x3=24

- (a) What is vapour pressure. How is it measured by manometric method? 4  
(b) A mixture of two liquids Hydrazine  $N_2H_4$  and  $N_2O_4$  are used in rockets. They produce  $N_2$  and water vapours. How many grams of  $N_2$  gas will be formed by reacting 100g of  $N_2H_4$  and 200g of  $N_2O_4$ . 4  
Equation:  $N_2H_4 + N_2O_4 \longrightarrow 3N_2 + 4H_2O$
- (a) Discuss four applications of Dalton's law of partial pressure. 4  
(b) Derive radius of nth orbit of H-atom by Bohr's atomic model. 4
- (a) State and explain Hess's law of constant heat summation with some suitable examples. 4  
(b) The solubility product constant ( $K_{sp}$ ) of  $Ag_2CrO_4$  is  $2.6 \times 10^{-2}$  at  $25^\circ C$ . Calculate the solubility of compound. 4
- (a) Explain sp-hybridization with example of ethyne. 4  
(b) Explain electrolysis of fused salts of  $PbCl_2$  and  $NaCl$ . 4
- (a) Describe four qualities to distinguish between ideal and non-ideal solutions. 4  
(b) Define half-life period of a decomposition reaction. Derive an expression to calculate fractional bond order of a reaction based on half life. 4

**Section -III (Practical)****NOTE: Answer any three parts from the following.**

5x3=15

- How will you prepare pure crystals of benzoic acid from water? 05
- Separate a mixture of three inks by paper chromatography. 05
- The given solution contains 10 grams of  $NaHCO_3$  dissolved per  $dm^3$ . Find out the percentage purity of the sample. 05
- 27.8 g of  $FeSO_4 \cdot xH_2O$  are dissolved per  $dm^3$  of solution. Find out the value of X. 05
- 10 grams of iodine are dissolved in  $500cm^3$  of solution. Calculate percentage purity of the sample. 05



Roll No. \_\_\_\_\_ to be filled in by the candidate.

Paper Code 6 4 8 2

Session; 2013-2015 &amp; 2014-2016

**Chemistry** (Objective Type)**Group-II**

-Time: 20 Minutes

Marks: 17

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A,B,C & D to each question are given. Which answer you consider correct, fill the corresponding circle A,B,C or D given in front of each question with Marker or pen ink on the answer sheet provided.

1.1. Which is not molecular ion.

- (A)
- $\text{CH}_4^+$
- (B)
- $\text{CO}^+$
- (C)
- $\text{N}_2^+$
- (D)
- $\text{NH}_4^+$

2. The Avogadro's constant is the number of

- (A) Atoms in 1 g of He (B) Molecules in 35.5g
- $\text{Cl}_2$
- (C) 6g graphite (D) 24g Mg

3. When some KI is added to  $\text{I}_2$  it becomes soluble due to formation of

- (A)
- $\text{I}^-$
- ions (B)
- $\text{I}_2^-$
- ions (C)
- $\text{I}_3^-$
- ions (D)
- $\text{I}_4^-$
- ions

4. Which gas has lesser rate of diffusion?

- (A)
- $\text{H}_2$
- (B) He (C)
- $\text{N}_2$
- (D)
- $\text{CO}_2$

5. A real gas obeying Van der Waal's equation will resemble ideal gas if.

- (A) Both "a" and "b" are large (B) Both "a" and "b" are small
- 
- (C) "a" is large "b" is small (D) "a" is small and "b" is large

6. In which crystal system, all three axes are of unequal length and all are at right angle to each other.

- (A) Orthorhombic (B) hexagonal (C) tetragonal (D) Cubic

7. At Murree hills boiling point of water is  $98^\circ\text{C}$ , the atmospheric pressure at Murree is

- (A) 100 torr (B) 323 torr (C) 700 torr (D) 1489 torr

8. Which fundamental particle of an atom was discovered by Chadwick?

- (A) Electron (B) Proton (C) Neutron (D) Neutrino

9. A sub-shell has principal quantum number value 3 and Azimuthal quantum number value 1, the sub-shell will be.

- (A) 3p (B) 3s (C) 3d (D) 4s

10. The geometrical shape of  $\text{NH}_3$  molecule is

- (A) Linear (B) Trigonal pyramidal (C) Angular (D) Tetrahedral

11. In which molecule central atom carbon is sp hybridized ?

- (A)
- $\text{CH}_4$
- (B)
- $\text{C}_2\text{H}_6$
- (C)
- $\text{C}_2\text{H}_4$
- (D)
- $\text{C}_2\text{H}_2$

12. Calorie is equivalent to

- (A) 0.4184 J (B) 4.184 J (C) 41.84 J (D) 418.4 J

13. In which chemical reaction, equilibrium constant value has no units?

- (A)
- $\text{PCl}_5 \rightleftharpoons \text{PCl}_3 + \text{Cl}_2$
- (B)
- $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
- (C)
- $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$
- (D)
- $\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$

14. What will be the PH of 0.1M NaOH solution.

- (A) 0 (B) 1 (C) 11 (D) 13

15. Aqueous solution of  $\text{Na}_2\text{CO}_3$  is:

- (A) Basic (B) Acidic (C) Neutral (D) Neither acidic nor basic

16. Standard reduction potential value of standard hydrogen electrode is

- (A) 0.0v (B) 2.0v (C) 100v (D) 220v

17. In some chemical reactions, the product formed acts as catalyst. This substance is known as:

- (A) Negative Catalyst (B) Homogeneous Catalyst (C) Activator (D) Autocatalyst

**Chemistry** (Essay Type)**Group-II**

Time: 2:40 Hours

Session; 2013-2015 &amp; 2014-2016

Marks: 68

**Section - I****2- Write short answers of any eight parts from the following.**

2 x 8 =16

- N<sub>2</sub> and CO have the same no. of electrons, protons and neutrons. Explain the reason.
- Define with one example each term. (a). Gram atom (b). Molar volume
- 23g of sodium and 238g of uranium have equal no. of atoms in them. Why?
- Write down any four properties of ideal solvent for crystallization.
- How decolourization of undesirable colours, is done for crystals.
- How does kinetic molecular theory of gases explain Avogadro's Law.
- Heat of sublimation of iodine is very high. Why?
- Define Joule Thomson effect? How does it cause cooling?
- Earthenware vessels keep water cool. How?
- Diamond is hard and an electrical insulator. Why?
- Define anisotropy with an example .
- Water vapours do not behave ideally at 273K. Why?

**3- Write short answers of any eight parts from the following.**

2 x 8 =16

- Give two defects of Bohr's atomic model.
- Write two postulates of Bohr's atomic model.
- What is Hund's Rule?
- Define non polar covalent bond with an example.
- CO<sub>2</sub> is non polar molecule although its bonds are polar. Why?
- What is state and state function?
- What do you mean by active mass of a substance?
- What is Lyman series? In which region it lies?
- An ionic radius is larger than parent atom. Justify.
- Define bond order. What is the bond order of He?
- What are endothermic reactions? Give examples.
- What is meant by state of chemical equilibrium.

**4- Write short answers of any six parts from the following.**

2 x 6 =12

- Define mole fraction and ppm?
- Why freezing point of the solvent is depressed due to the presence of solutes?
- A porous plate or salt bridge is not required in lead storage cell. Give reason.
- Differentiate between zeotropic and azeotropic mixture.
- What are the formulae of Bauxite and cryolite?
- What are functions of salt bridge?
- A catalyst is specific in its action. Justify
- The radio active decay is always a first order reaction. Justify.
- Define catalytic poisoning and enzyme catalysis.

**Section -II****NOTE: Answer any three questions from the following.**

8x3=24

- (a) When lime stone is roasted quick lime is produced. The actual yield of CaO is 2.5kg .  
When 4.5kg of lime stone is roasted. What is % yield of this reaction ? 4
- (b) Write down four properties of each of the following crystalline solids. (i) Habit of a crystal (ii) Anisotropy 4
- (a) State and explain Graham's law of diffusion. Give its experimental verification. 4
- (b) Explain Millikan's Oil Drop Method for determining the charge on electron. 4
- (a) Define enthalpy and prove that  $\Delta H = q_p$  4
- (b) What is the percentage ionization of acetic acid in solution in which 0.1 moles of it has been dissolved per dm<sup>3</sup> of the solution ( $K_a = 1.85 \times 10^{-5}$ ). 4
- (a) What is meant by first and higher ionization energies of elements ? Represent them with thermochemical equations . Why magnitude of higher ionization energies is greater than that of first ionization energy? 4
- (b) Balance the following REDOX equations: 4
  - $NaCl + MnO_2 + H_2SO_4 \rightarrow Na_2SO_4 + MnSO_4 + Cl_2$  (by oxidation number method)
  - $C\bar{N} + Mn\bar{O}_4 \rightarrow CN\bar{O} + MnO_2$  ( by ion-electron method in basic medium).
- (a) What are colligative properties? why are they called so? 4+4
- (b) Explain two methods to find the order of reaction.

**Section -III(Practical)****Note: Answer any three parts from the following.**

- Write down material required, diagram and procedure for part A and B.
  - Write down standard solution, chemical equation with mole ratio, indicator and end point, procedure and supposed reading with calculations for part C,D and E.
- Purify the given sample of benzoic acid by crystallization method using water as solvent. 05
  - Separate the mixture of inks by paper chromatography. 05
  - 6.3g of H<sub>2</sub>C<sub>2</sub>O<sub>4</sub> . xH<sub>2</sub>O have been dissolved per dm<sup>3</sup> of solution. Find value of "x" by volumetric method. 05
  - 15g mixture of oxalic acid and sulphuric acid have been dissolved per dm<sup>3</sup> of solution. Find percentage composition by volumetric method. 05
  - 30g of Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> and Na<sub>2</sub>SO<sub>4</sub> have been dissolved per dm<sup>3</sup> of solution. Find percentage of each by volumetric method. 05





Roll No. \_\_\_\_\_ to be filled in by the candidate.

Paper Code 2 4 8 5

Sessions: 2015-2017, 2016-2018 &amp; 2017-2019

**Chemistry** (Objective Type)

Time: 20 Minutes

Marks: 17

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A, B, C & D to each question are given. Which answer you consider correct, fill the corresponding circle A, B, C or D given in front of each question with Marker or pen ink on the answer sheet provided.

- 1.1. The number of bonds in nitrogen molecule is:  
(A) one  $\sigma$  and one  $\pi$  (B) one  $\sigma$  and two  $\pi$  (C) three  $\sigma$  only (D) two  $\sigma$  and one  $\pi$
2. Which of the following has zero dipole moment?  
(A)  $\text{NH}_3$  (B)  $\text{CHCl}_3$  (C)  $\text{H}_2\text{O}$  (D)  $\text{BF}_3$
3. The change in heat energy of a chemical reaction at constant temperature and pressure is called:  
(A) enthalpy change (B) heat of sublimation (C) bond energy (D) internal energy change
4. For which system does the equilibrium constant,  $K_c$  has units of (concentration)<sup>-1</sup>?  
(A)  $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$  (B)  $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$  (C)  $2\text{NO}_2 \rightleftharpoons \text{N}_2\text{O}_4$  (D)  $2\text{HF} \rightleftharpoons \text{H}_2 + \text{F}_2$
5. The pH of  $10^{-3}$  mol  $\text{dm}^{-3}$  of an aqueous solution of  $\text{H}_2\text{SO}_4$  is:  
(A) 3.0 (B) 2.7 (C) 2.0 (D) 1.5
6. Molarity of pure water is:  
(A) 1 (B) 18 (C) 55.5 (D) 6
7. Stronger is the oxidizing agent, greater is the:  
(A) Oxidation potential (B) Reduction potential (C) Redox potential (D) E.M.F of the cell
8. The unit of the rate constant is the same as that of the rate of reaction in:  
(A) first order reaction (B) second order reaction (C) zero order reaction (D) third order reaction
9. The mass of one mole of electrons is:  
(A) 1.008 mg (B) 0.55 mg (C) 0.184 mg (D) 1.673 mg
10. The atomicity of  $\text{C}_6\text{H}_{12}\text{O}_6$  is:  
(A) 6 (B) 12 (C) 3 (D) 24
11. The comparative rate at which the solute moves in paper chromatography depends on:  
(A) the size of paper (B)  $R_f$  value of solutes  
(C) Temperature of the experiment (D) Size of chromatographic tank used
12. The order of the rate of diffusion of gases  $\text{NH}_3$ ,  $\text{SO}_2$ ,  $\text{Cl}_2$  and  $\text{CO}_2$  is:  
(A)  $\text{NH}_3 > \text{SO}_2 > \text{Cl}_2 > \text{CO}_2$  (B)  $\text{NH}_3 > \text{CO}_2 > \text{SO}_2 > \text{Cl}_2$  (C)  $\text{SO}_2 > \text{NH}_3 > \text{CO}_2 > \text{Cl}_2$  (D)  $\text{CO}_2 > \text{SO}_2 > \text{Cl}_2 > \text{NH}_3$
13. The number of molecules in one  $\text{dm}^3$  of water is close to:  
(A)  $\frac{6.02}{22.4} \times 10^{23}$  (B)  $\frac{12.04}{22.4} \times 10^{23}$  (C)  $\frac{18}{22.4} \times 10^{23}$  (D)  $55.6 \times 6.02 \times 10^{23}$
14. In order to mention the boiling point of water at  $110^\circ\text{C}$ , the external pressure should be:  
(A) between 760 torr and 1200 torr (B) between 200 torr and 760 torr  
(C) 765 torr (D) 620 torr
15. The molecules of  $\text{CO}_2$  in dry ice form the:  
(A) Ionic crystals (B) Covalent crystals  
(C) Molecular crystals (D) Metallic crystals
16. The nature of the positive rays depends on:  
(A) nature of the electrode (B) nature of the discharge tube  
(C) nature of the residual gas (D) all these
17. When 6d orbital is complete, the entering electron goes into:  
(A) 7 f (B) 7 s (C) 7 p (D) 7 d

Roll No. \_\_\_\_\_ to be filled in by the candidate.

Sessions: 2015-2017, 2016-2018 & 2017-2019

## Chemistry (Essay Type)

Time: 2:40 Hours

Marks: 68

### Section - I

2- Write short answers of any eight parts from the following.

2 x 8 = 16

- Write the names of any four methods employed for the separation of isotopes.
- Law of conservation of mass has to be obeyed during stoichiometric calculations. Justify it.
- What is the difference between adsorption and partition chromatography.
- Hydrogen and helium are ideal at room temperature, but  $\text{SO}_2$  and  $\text{Cl}_2$  are non ideal. How do you explain it?
- Justify that the volume of given mass of a gas becomes theoretically zero at  $273^\circ\text{C}$ .
- What is buffer solution? Give types of buffer solution with their composition.
- What do you know about gram atom?
- Define solvent extraction and partition law.
- Write any two methods for drying the crystals.
- Why pilots feel uncomfortable breathing at high altitude?
- How do buffers act? Give example of acidic buffer.
- Prove that  $\text{P}K_a + \text{P}K_b = 14$ . at  $25^\circ\text{C}$ .

3- Write short answers of any eight parts from the following.

2 x 8 = 16

- How is dynamic equilibrium established during evaporation of a liquid in a closed vessel at constant temperature?
- Why is boiling point of water different in Murree and Mount Everest?
- Justify that one molal solution of urea in  $\text{H}_2\text{O}$  is dilute as compared to one molar solution of urea but the number of particles of solute is same?
- Why the concentration term of molality is independent of temperature but molarity depends upon temperature?
- Differentiate between Continuous spectrum and Line spectrum?
- Calculate mass of electron by using its value of charge and  $e/m$  value.
- How was neutron discovered by James Chadwick? Prove it by a nuclear reaction.
- How is caustic soda obtained by electrolysis of aqueous solution of  $\text{NaCl}$ ? Write only the chemical reactions occurring at different electrodes.
- Define oxidation number and calculate oxidation number of chromium in  $\text{K}_2\text{CrO}_4$ .
- Why do earthenware vessels keep water cool?
- Define isomorphism and give one example.
- What is Bohr's atomic model? Give its two postulates.

4- Write short answers of any six parts from the following.

2 x 6 = 12

- Why Cationic radius is smaller than atomic radius of atom?
- Differentiate between polar and non-polar covalent bond.
- Differentiate between endothermic and exothermic reactions.
- Why does  $\text{O}_2$  show paramagnetic character?
- Why is Pi-bond weaker than Sigma bond?
- Define Thermochemical equation.
- How can half life be used to determine order of reaction?
- Discuss a reaction to explain specification of Catalyst.
- Discuss two characteristics of enzyme.

### Section - II

NOTE: Answer any three questions from the following.

8x3=24

- (a) Ascorbic acid (vitamin C) contains 40.92% carbon, 4.58% hydrogen and 54.5% of oxygen by mass. What is the empirical formula of ascorbic acid? 4
- (b) Write down any four properties of Ionic solids. 4
- (a) Give the statement of Dalton's Law of partial pressure. How does this law help to find out the partial pressure in the mixture of gases? 4
- (b) Explain Millikan's oil drop experiment to determine the charge on electron. 4
- (a) Describe measurement of enthalpy of a reaction with bomb calorimeter. 4
- (b) Explain paramagnetic behaviour of oxygen molecule on the basis of Molecular Orbital Theory. 4
- (a)  $\text{N}_2(\text{g})$  and  $\text{H}_2(\text{g})$  combine to give  $\text{NH}_3(\text{g})$ . The value of  $K_c$  in this reaction at  $500^\circ\text{C}$  is  $6.0 \times 10^{-2}$ . Calculate the value of  $K_p$  for this reaction. 4
- (b) Describe four uses of electrolysis process in industries. 4
- (a) Discuss Raoult's law for the solution in which both components are volatile. 4
- (b) What is catalysis? Explain its types with one example of each. 4



Roll No. \_\_\_\_\_ to be filled in by the candidate.

Paper Code 6 4 8 5

Session: 2014-2016

## Chemistry (Objective Type)

Time: 20 Minutes

Marks: 17

NOTE: Write answers to the questions on objective answer sheet provided. Four possible answers A, B, C & D to each question are given. Which answer you consider correct, fill the corresponding circle A, B, C or D given in front of each question with Marker or pen ink on the answer sheet provided.

- The number of bonds in nitrogen molecule is:  
(A) one  $\sigma$  and one  $\pi$  (B) one  $\sigma$  and two  $\pi$  (C) three sigma only (D) three  $\pi$  only
- Which of the following molecules has zero dipole moment?  
(A)  $\text{NH}_3$  (B)  $\text{CHCl}_3$  (C)  $\text{H}_2\text{O}$  (D)  $\text{BF}_3$
- 1 Calorie is equivalent to:  
(A) 0.4184 J (B) 41.84 J (C) 1.184 J (D) 418.4 J
- The pH of  $10^{-3}$  mole  $\text{dm}^{-3}$  of an aqueous solution of  $\text{H}_2\text{SO}_4$  is:  
(A) 3 (B) 2.7 (C) 2 (D) 1.5
- For which system does the equilibrium constant  $K_c$  has units of (concentration) $^{-1}$ ?  
(A)  $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$  (B)  $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$  (C)  $2\text{NO}_2 \rightleftharpoons \text{N}_2\text{O}_4$  (D)  $2\text{HF} \rightleftharpoons \text{H}_2 + \text{F}_2$
- Molarity of pure water is:  
(A) 1 (B) 18 (C) 55.5 (D) 6
- Stronger the oxidizing agent greater is the:  
(A) oxidation potential (B) reduction potential (C) redox potential (D) EMF of the cell
- In zero order reaction, the rate is independent of:  
(A) Temperature of reaction (B) Concentration of reactants  
(C) Concentration of products (D) none of these
- The mass of one mole of electrons is:  
(A) 1.008 g (B) 0.55 mg (C) 0.184 mg (D) 1.673 mg
- One mole of  $\text{SO}_2$  contains:  
(A)  $6.02 \times 10^{23}$  atoms of oxygen (B)  $18.1 \times 10^{23}$  molecules of  $\text{SO}_2$   
(C)  $6.02 \times 10^{23}$  atoms of sulphur (D) 4 g atoms of  $\text{SO}_2$
- Solvent Extraction is an equilibrium process and it is controlled by:  
(A) Law of Mass Action (B) The amount of solvent used  
(C) Distribution Law (D) The amount of solute
- Number of molecules in one  $\text{dm}^3$  of water is close to:  
(A)  $\frac{6.02}{22.4} \times 10^{23}$  (B)  $\frac{12.04}{22.4} \times 10^{23}$  (C)  $\frac{18}{22.4} \times 10^{23}$  (D)  $55.6 \times 6.02 \times 10^{23}$
- The molar volume of  $\text{CO}_2$  is maximum at:  
(A) STP (B)  $127^\circ\text{C}$  and 1atm (C)  $273^\circ\text{C}$  and 2atm (D)  $0^\circ\text{C}$  and 2atm
- Which of the following is a Pseudo solid?  
(A)  $\text{CaF}_2$  (B) Glass (C)  $\text{NaCl}$  (D) All
- The molecules of  $\text{CO}_2$  in the dry ice form:  
(A) Ionic crystal (B) Covalent crystal (C) Molecular crystal (D) All type of crystal
- The wave number of light emitted by a certain source is  $2 \times 10^6 \text{ m}^{-1}$ . The wave length of this light will be:  
(A) 500 nm (B) 200 nm (C) 500 m (D)  $5 \times 10^7 \text{ m}$
- Orbitals having same energy are called:  
(A) Hybrid orbitals (B) Valence orbitals (C) Degenerate orbitals (D) d-orbitals

Roll No. \_\_\_\_\_ to be filled in by the candidate.

Session: 2014-2016

**Chemistry** (Essay Type)

Time: 3:10 Hours

Marks: 83

**Section - I****2- Write short answers of any eight parts from the following.**

2 x 8 = 16

- Molecular formula is an integral multiple of empirical formula of same substance. Explain with two examples.
- Why concentrated HCl and  $\text{KMnO}_4$  solutions cannot be filtered through Gooch crucible?
- What is shape of graph when PV is plotted against pressure for ideal gas at constant temperature? Draw the graph also.
- Calculate pOH and pH of  $10^{-4}$  M aqueous solution of  $\text{Ba}(\text{OH})_2$ , assume complete ionization.
- Define solubility product constant. Write an expression for solubility product constant for partially soluble  $\text{PbCl}_2$ .
- Define atomic mass unit (amu). What is its value?
- Why is actual yield less than that of theoretical yield?
- How are crystals dried by a reliable method?
- Define Avogadro's Law with two examples.
- Give uses of Chromatography.
- Why water vapours do not behave ideally at 273 K?
- Give two good reasons for need of Buffer Solutions.

**3- Write short answers of any eight parts from the following.**

2 x 8 = 16

- Diamond is hard and electrical insulator. Why?
- Why are ionic crystals highly brittle?
- Write electronic configuration of Cr-24 and Cu-29.
- Write down the importance of Mosley's law.
- Define percentage weight / volume and give example.
- Lead accumulator is chargeable battery. How?
- Evaporation occurs at all temperatures. Why?
- What are dipole-dipole forces? Give example.
- Define magnetic quantum number. Give its significance.
- Write two defects of Rutherford's Atomic Model.
- What is water of crystallization? Give two examples.
- What are fuel cells? Give their advantage.

**4- Write short answers of any six parts from the following.**

2 x 6 = 12

- Give two reasons due to which radius of an atom cannot be determined precisely.
- Differentiate between spontaneous and non-spontaneous reactions.
- Differentiate between Rate and Rate Constant of a reaction.
- Define Electronegativity.
- Define dipole moment. Give its formula.
- Define Homogeneous Catalysis with example.
- Define coordinate covalent bond with example.
- State First Law of Thermodynamics.
- Define energy of activation.

**Section - II****NOTE: Answer any three questions from the following.**

8x3=24

- (a) Define Yield. How do we calculate the percentage yield of a chemical reaction? 4  
(b) Describe the effect of external pressure on boiling point of a liquid. Give example. 4
- (a) 250  $\text{cm}^3$  of sample of hydrogen effuses four times as rapidly as 250  $\text{cm}^3$  of an unknown gas. Calculate molar mass of unknown gas. 4  
(b) Discuss Principal and Azimuthal quantum numbers in detail. 4
- (a) Define Ionization Potential. Give its trends in periodic table. 4  
(b) How is heat of combustion determined by bomb calorimeter? 4
- (a) The solubility of  $\text{CaF}_2$  in water at  $25^\circ\text{C}$  is found to be  $2.05 \times 10^{-4}$  mole/ $\text{dm}^3$ . What is value of  $K_{sp}$  at this temperature? 4  
(b) What is Enzyme Catalysis? Give its example. Also give two characteristics of Enzyme Catalysis. 4
- (a) What is elevation of boiling point? How can it be measured by Landsberger's method. 4  
(b) Describe the construction and working of standard hydrogen electrode. 4

**Section -III (Practical)****NOTE: Answer any three parts from the following.**

5x3=15

- A. Prepare a pure sample of Benzoic acid by crystallization. 5  
B. Separate mixture of three inks by chromatography. 5  
C. The given solution contains 10.0g of impure NaOH dissolved per  $\text{dm}^3$ . Find percentage purity of NaOH volumetrically. 5  
D. Determine value of 'x' in  $\text{C}_2\text{O}_4\text{H}_2 \cdot x\text{H}_2\text{O}$ , 6.3g of which has been dissolved per 1  $\text{dm}^3$ . 5  
E. The solution contains 4.0g of a sample of  $\text{I}_2$  dissolved in 250  $\text{cm}^3$ . Find percentage purity of the sample. 5



Roll No. \_\_\_\_\_ to be filled in by the candidate.

(For all Sessions)

Paper Code 6 4 8 1

# Chemistry (Objective Type)

Time: 20 Minutes

Marks: 17

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A, B, C & D to each question are given. Which answer you consider correct, fill the corresponding circle A, B, C or D given in front of each question with Marker or pen ink on the answer sheet provided.

- 27g of 'Al' will react completely with how much mass of  $O_2$  to produce  $Al_2O_3$ .  
(A) 8g of oxygen (B) 16g of oxygen (C) 32g of oxygen (D) 24g of oxygen
- The number of moles of  $CO_2$  which contain 8.0g of oxygen is:  
(A) 0.25 (B) 0.50 (C) 1.0 (D) 1.50
- Solvent extraction method is a particularly useful technique for separation when product to be separated:  
(A) non-volatile or thermally unstable (B) volatile or thermally unstable  
(C) non volatile or thermally stable (D) volatile or thermally stable
- Pressure remaining constant, at which temperature the volume of a gas will become twice of what it is at  $0^\circ C$ ?  
(A)  $546^\circ C$  (B)  $200^\circ C$  (C) 546 K (D) 273 K
- Amorphous solids:  
(A) have sharp melting point (B) Undergo clean cleavage when cut with knife  
(C) have perfect arrangement of atoms (D) can possess small regions of orderly arrangement of atoms
- London dispersion forces are the only forces present among the:  
(A) Molecules of water in liquid state (B) Atoms of helium in gaseous state at high temperature  
(C) Molecules of solid iodine (D) Molecules of hydrogen chloride gas
- The nature of the positive rays depends on:  
(A) the nature of the electrode (B) the nature of the discharge tube  
(C) the nature of the residual gas (D) all these
- The wave number of the light emitted by a certain source is  $2 \times 10^6 m^{-1}$ . The wavelength of this light will be:  
(A) 500 nm (B) 500 m (C) 200 nm (D)  $5 \times 10^7 m$
- Which of the following molecules have zero dipole moment?  
(A)  $NH_3$  (B)  $CHCl_3$  (C)  $H_2O$  (D)  $BF_3$
- Which of the hydrogen halides has the highest percentage of ionic character?  
(A) HCl (B) HBr (C) HF (D) HI
- In endothermic reaction, the heat content of the:  
(A) Product is more than that of reactants (B) Reactant is more than that of products  
(C) Both A and B (D) Reactant and product are equal
- The solubility product of AgCl is  $2 \times 10^{-10} mole\ dm^{-3}$ . The maximum concentration of  $Ag^+$  ion in the solution is:  
(A)  $2 \times 10^{-10} mole\ dm^{-3}$  (B)  $1.41 \times 10^{-5} mole\ dm^{-3}$  (C)  $1.0 \times 10^{-10} mole\ dm^{-3}$  (D)  $4.0 \times 10^{-20} mole\ dm^{-3}$
- The relationship between  $K_p$  and  $K_c$  is given by:  
(A)  $K_c = K_p(P)^{\Delta n}$  (B)  $K_c = K_p\left(\frac{P}{N}\right)^{\Delta n}$  (C)  $K_p = K_c(RT)^{\Delta n}$  (D)  $K_p = K_c(RT)^{-\Delta n}$
- An aqueous solution of ethanol in water have vapour pressure:  
(A) equal to that of water (B) equal to that of ethanol  
(C) more than that of water (D) less than that of water
- The sum of mole fraction of gas in a mixture of gases is:  
(A) always more than one (B) always less than one  
(C) always one (D) may be less or more than one
- Stronger the oxidizing agent greater is the:  
(A) Oxidation potential (B) Reduction potential (C) Redox potential (D) E.M.F of cell
- The rate of reaction:  
(A) Increases as the reaction proceeds (B) decreases as the reaction proceeds  
(C) remains the same as the reaction proceeds (D) may decrease or increase as the reaction proceeds

Roll No. \_\_\_\_\_ to be filled in by the candidate.

(For all Sessions)

**Chemistry** (Essay Type)

Time: 2:40 Hours

Marks: 68

**Section - I****2- Write short answers of any eight parts from the following.**

2 x 8 = 16

- Discuss purification of sodium chloride by common ion effect.
- Write down the role of magnetic separator in mass spectrometer.
- Define molecular formula and empirical formula. Give relationship between them.
- Write down  $K_c$  for the following reaction. Suppose the volume of reaction mixture is "V" dm<sup>3</sup> at equilibrium stage.  
$$PCl_5 \rightleftharpoons PCl_3 + Cl_2$$
- How do you justify that the greater quantity of CH<sub>3</sub>COONa in acetic acid decreases the dissociation power of acetic acid so the pH increases.
- Explain respiration process in the light of Dalton's Law of partial pressure.
- Convert -40°C into Fahrenheit scale.
- Derive Charles's law from kinetic theory of gases.
- Define pH and pOH. What is the sum of pH and pOH?
- What are molecular ions? How are they produced?
- How is undesirable colour removed from the crystals?
- Define sublimation with examples.

**3- Write short answers of any eight parts from the following.**

2 x 8 = 16

- Justify that one molal solution of urea in water is more dilute than its molar solution.
- What is meant by symmetry? Give elements of symmetry.
- Define colligative properties. Name some important colligative properties.
- What is octet rule? Give two examples of compounds which deviate from it.
- A fresh cut metal has a shiny look. Justify it.
- What factors influence the electron affinity?
- No bond in chemistry is 100% ionic. Justify it.
- Why the molecule of BF<sub>3</sub> is trigonal planar?
- What is meant by state function? Give examples.
- Differentiate between internal energy and enthalpy.
- Define crystal and crystallite.
- What is habit of a crystal? Give one example.

**4- Write short answers of any six parts from the following.**

2 x 6 = 12

- State Moseley's law.
- What is Hund's rule?
- How atomic emission spectrum is obtained?
- Why the positive rays are also called as canal rays?
- What is Electrochemistry?
- Give advantages of Fuel Cell.
- What is zero-order reaction? Give an example.
- Write two characteristics of a catalyst.
- Calculate oxidation state of Cr in (a) Cr<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub> (b) K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.

**Section - II****NOTE: Answer any three questions from the following.**

8x3=24

- (a) The combustion analysis of an organic compound shows it to contain 65.44% carbon, 5.50% hydrogen and 29.6% of oxygen. What is the empirical formula of the compound if the molar mass of this compound is 110.15 g mol<sup>-1</sup>? Calculate the molecular formula of the compound. 4  
(b) Discuss manometric method for the measurement of vapour pressure of a liquid. 4
- (a) State and explain Graham's Law of diffusion. 4  
(b) State and explain Planck's quantum theory. 4
- (a) Describe the structure of NH<sub>3</sub> and H<sub>2</sub>O with the help of atomic orbital hybridization. 4  
(b) Describe Hess's law of constant heat summation with two examples. 4
- (a) Derive Henderson's equation for acidic and basic buffer. 4  
(b) What is electrolysis? Discuss the electrolysis of fused salt PbBr<sub>2</sub>. 4
- (a) The vapour pressure of water at 30°C is 28.4 torr. Calculate the vapour pressure of solution containing 70.0g of cane sugar (C<sub>12</sub>H<sub>22</sub>O<sub>11</sub>) in 1000.0 g of water at same temperature. Also calculate the lowering of vapour pressure. 4  
(b) How does Arrhenius equation help us to calculate the energy of activation of a reaction? 4

Roll No. \_\_\_\_\_ to be filled in by the candidate.

(For all sessions)

Paper Code	6	4	8	7
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**Chemistry** (Objective Type)

Time: 20 Minutes

Marks: 17

**NOTE:** Write answers to the questions on objective answer sheet provided. Four possible answers A,B,C & D to each question are given. Which answer you consider correct, fill the corresponding circle A,B,C or D given in front of each question with Marker or pen ink on the answer sheet provided.

- When water Freezes at 0°C, its density decreases due to:
  - Cubic structure of ice
  - Empty spaces present in the structure of ice
  - Change of bond lengths
  - Change of bond angle
- Which one of the following is an example of cubic system?
  - Diamond
  - Borax
  - Iodine
  - Graphite
- Brackett series lie in the region:
  - U.V
  - I.R
  - Visible
  - X-Ray
- Bohr model of atom is contradicted by:
  - Plank's quantum theory
  - dual nature of matter
  - Heisenberg's uncertainty principle
  - Newton theory
- The number of bonds in nitrogen molecule is:
  - one  $\sigma$  and one  $\pi$
  - one  $\sigma$  and two  $\pi$
  - three  $\sigma$  (sigma) only
  - two  $\sigma$  and one  $\pi$
- The covalent radius of Cl-atom is:
  - 99.4 pm
  - 80 pm
  - 70 pm
  - 66.4 pm
- One calorie is equivalent to:
  - 0.4184J
  - 4.184J
  - 41.84J
  - 418.4J
- pH value of vinegar is:
  - 1.1
  - 2.0
  - 2.8
  - 3.5
- For which system does the equilibrium constant,  $K_c$  has units of (concentration)<sup>-1</sup>?
  - $N_2 + 3H_2 \rightleftharpoons 2NH_3$
  - $H_2 + I_2 \rightleftharpoons 2HI$
  - $2NO_2 \rightleftharpoons N_2O_4$
  - $2HF \rightleftharpoons H_2 + F_2$
- 18g of glucose is dissolved in 90g of water. The relative lowering of vapour pressure is equal to:
  - 1/5
  - 5.1
  - 1/51
  - 6.0
- Stronger the oxidizing agent, greater is the:
  - Oxidation potential
  - Reduction potential
  - Redox potential
  - E.M.F of cell
- If the rate equation of a reaction:  $2A+B \longrightarrow$  Products is,  $\text{rate}=K[A]^2[B]$ , and A is present in large excess, then order of reaction is:
  - 1
  - 2
  - 3
  - 4
- Isotopes differ in:
  - properties which depend upon mass
  - arrangement of electrons in orbitals
  - chemical properties
  - their behaviour in electromagnetic field.
- Number of isotopes of Tin is/are:
  - one
  - eleven
  - fifteen
  - eighteen
- Solvent extraction method is a particularly useful technique for separation when the product to be separated is:
  - non-volatile or thermally unstable
  - volatile or thermally stable
  - non-volatile or thermally stable
  - volatile or thermally unstable
- Pressure remaining constant, at which temperature the volume of a gas will become twice of what it is at 0°C.
  - 546 °C
  - 200 °C
  - 546 K
  - 273 K
- The partial pressure of oxygen in the lungs is:
  - 100 torr
  - 116 torr
  - 150 torr
  - 159 torr

Roll No. \_\_\_\_\_ to be filled in by the candidate.

(For all sessions)

**Chemistry** (Essay Type)

Time: 2:40 Hours

**Section - I**

Marks: 68

2 x 8 = 16

**2- Write short answers of any eight parts from the following.**

- Why is actual yield less than theoretical yield?
- Define Fractional crystallization with example.
- Magnesium atom is twice heavier than that of carbon.
- Define (i) Stationary phase (ii) Distribution co-efficient
- Give uses of Chromatography.
- Why absolute zero is unattainable?
- What is (i) Isotherm (ii) Partial Pressure
- What are the Faulty points of Kinetic theory of Gas?
- Give quantitatively statement of Charles law.
- Give any two differences between Ideal and Non Ideal solution.
- Colligative properties are obeyed when solute is non-volatile and solution is dilute. Justify it.
- 23 gram sodium and 238 gram Uranium have equal number of atoms.

2 x 8 = 16

**3- Write short answers of any eight parts from the following.**

- Distinguish between Isomorphism and polymorphism.
- Differentiate between continuous and line spectrum.
- How does polarizability effect the strength of London Forces?
- What are the favourable conditions for ammonia synthesis on Industrial scale?
- Why is it necessary to decrease the pressure in a discharge tube?
- Justify with examples that some reactions occur at higher rate and some may occur at moderate rate.
- Why positive rays are called canal rays?
- Why do crystals change their habit?
- How does the buffer solution act?
- Radioactive decay is always a First order reaction.
- Define the terms (i) helix (ii) Debye Forces
- What is electromagnetic spectrum?

2 x 6 = 12

**4- Write short answers of any six parts from the following.**

- Why atomic radii cannot be determined precisely?
- Define electrode potential.
- Name factors affecting ionization energy.
- Calculate Bond order of Helium molecule(He<sub>2</sub>).
- Define enthalpy of atomization and give an example.
- Define heat and give its units.
- Differentiate between galvanic and electrolytic cell.
- How is copper purified by electrolysis?
- Why cationic radii are smaller than its parent atom?

**Section - II****NOTE: Answer any three questions from the following.**

8x3=24

- (a) NH<sub>3</sub> gas can be prepared by heating two solids NH<sub>4</sub>Cl and Ca(OH)<sub>2</sub>, the mixture containing 100g of each. Calculate no. of grams of NH<sub>3</sub> produced. 4
- (b) Define and explain Hydrogen bondings by giving any two suitable examples. 4
- (a) Define plasma and explain its four applications. 4
- (b) Explain the concept of orientation of orbitals by using magnetic quantum number. 4
- (a) How ionization energy varies in periodic table? 4
- (b) What is internal energy? Discuss first law of thermodynamics. 4
- (a) N<sub>2</sub>(g) and H<sub>2</sub>(g) combine to give NH<sub>3</sub>(g). The value of K<sub>c</sub> in this reaction at 500°C is 6.0x10<sup>-2</sup>. Calculate the value of K<sub>p</sub> for this reaction. 4
- (b) Explain half life method for measurement of the order of a reaction can help us to measure the order of even those reactions which have fractional order. 4
- (a) Explain elevation of boiling point with a graph. 4
- (b) Explain electrolysis of aqueous solution of salts. 4

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