FEDERAL PUBLIC SERVICE COMMISSION

COMPETITIVE EXAMINATION FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT, 2011

Roll Number

CHEMISTRY, PAPER-I

TIME ALLOWED: THREE HOURS	**(PART-I MCQs)**	**30 MINUTES**	**MAXIMUM MARKS: 20**
	(PART-II)	**2 HOURS & 30 MINUTES**	**MAXIMUM MARKS: 80**

NOTE: (i) **First** attempt **PART-I (MCQs)** on separate Answer Sheet which shall be taken back after 30 minutes.
(ii) **Use of simple calculator is allowed.**
(iii) **Overwriting/cutting of the options/answers will not be given credit.**

(PART-I MCQs) (COMPULSORY)

Q.1. Select the best option/answer and fill in the **appropriate box** on the **Answer Sheet**. **(1 x 20=20)**

(i) The geometry associated with sp^3d^2 hybridization is:

(a) Octahedral (b) Tetrahedral (c) Trigonal planar (d) Trigonal biplanar

(ii) Which of the following molecules has a dipole movement?

(a) CH_4 (b) CO_2 (c) H_2O (d) CCl_4

(iii) Which of the following represents the shape of NH_3 molecule?

(a) Trigonal planar (b) Angular (c) Trigonal Pyramidal (d) Tetrahedral

(iv) Which of the following is the largest ion?

(a) Li^+ (b) Cs^+ (c) Rb^+ (d) Na^+

(v) Which of the following represent different isotopes of the same element?

1. 12 protons, 11 neutrons, 12 electrons
2. 11 protons, 12 neutrons, 11 electrons
3. 10 protons, 12 neutrons, 12 electrons
4. 11 protons, 12 neutrons, 10 electrons
5. 12 protons, 12 neutrons, 12 electrons

(a) 1 and 5 (b) 2 and 4 (c) 2, 3, 4 and 5 (d) None of these

(vi) Which of the following represents the correct number of particles in $^{79}_{34}Se^{2-}$?

(a) 34 protons, 79 neutrons, 2 electrons (b) 34 protons, 45 neutrons, 32 electrons
(c) 34 protons, 45 neutrons, 2 electrons (d) 34 protons, 45 neutrons, 36 electrons

(vii) Which one of the following is correct equation for the reaction of chlorine with water?

(a) $2Cl + H_2O \rightarrow 2HCl + \frac{1}{2}O_2$ (b) $Cl_2 + 2H_2O \rightarrow 2HCl + H_2O_2$

(c) $Cl_2 + 3H_2O \rightarrow HClO_3 + 5HCl$ (d) $Cl_2 + H_2O \rightarrow HCl + HOCl$

(viii) Faraday's laws of electrolysis are related to the:

(a) Atomic number and speed of the cation (b) Atomic number and speed of the anion
(c) Quantity of electricity and equivalent weight of the electrolyte (d) None of these

(ix) When Pt and Co are electrically connected, which one is corroded:

(a) Pt (b) Co (c) Both of these (d) None of these

(x) For the reaction ($Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$), which of the following statements is correct?

(a) Zn is dissolved and Cu is deposited (b) Cu is reduced and Zn is exidized

(c) Cu is the cathode and Zn the anode (d) All statements are correct

(xi) What is the pH of 0.0001 M NaOH solution?

(a) 4 (b) 10 (c) 5 (d) 14

(xii) What is the pH of 1.0×10^{-3} M HCl solution?

(a) 10 (b) 30 (c) 3 (d) 0.3

(xiii) Which of the following is the correct equilibrium expression for the reaction $[N_2(g) + 3H_2(g) \quad 2NH_3(g)]$?

(a) $[2NH_3][N_2 + 3H_2]$ (b) $[2NH_3] / [N_2][3H_2]$

(c) $[NH_3]^2 / [N_2][H_2]^3$ (d) $[NH_3]^2 / [N_2] + [H_2]^3$

(xiv) Which of the following best describes how a catalyst works?

(a) It changes the potential energies of the reactants and products.

(b) It decreases the temperature of the reaction which leads to a faster rate.

(c) It lowers the activation energy for the reaction by providing a different reaction mechanism.

(d) It raises the activation energy for the reaction which produces a faster rate.

(xv) Which of the following will not act as Lewis acid;

(a) $AlCl_3$ (b) BF_3 (c) $FeBr_3$ (d) CCl_4

(xvi) Which of the following is the strongest acid?

(a) HF (b) HCl (c) HBr (d) HI

(xvii) Which of the following could be used for cathodic protection:

(a) Al (b) Cd (c) Cu (d) None of these

(xviii) Hybridization of XeF_4 is:

(a) sp^3d (b) sp^2d^2 (c) sp^3d^2 (d) sp^3

(xix) Which of the following will increase the rate of the reaction?

(a) Decreased temperature and increased concentration of reactants

(b) Decreased temperature and decreased concentration of reactants

(c) Increased temperature and decreased concentration of reactants

(d) Increased temperature and increased concentration of reactants

(xx) Silicones are polymeric substances with linkage:

(a) Si – S – Si (b) Si – O – Si (c) $Si(CH_3)_4$ (d) O = Si = O

CHEMISTRY, PAPER-I

PART-II

NOTE:	**(i)**	**PART-II** is to be attempted on separate Answer Book.
	(ii)	**Attempt ONLY FOUR questions from PART-II. All questions carry EQUAL marks.**
	(iii)	**Periodic Table is attached.**
	(iv)	**Extra attempt of any question or any part of the attempted question will not be considered.**

Q.2. (a) Explain with suitable examples the difference between electrochemical cell and electrolytic cell? **(07)**

For the cell, Ni(s)/Ni^{+}(aq)//Ag^{+}(aq)/Ag(s), write half cell reactions at each electrode and balanced redox reaction that occurs in the cell.

(b) For the given reaction, $Fe_2O_{3(S)} + 2Al_{(S)} \rightarrow Al_2O_{3(S)} + 2Fe_{(S)}$ the heat of formation of $Fe_2O_{3(S)}$ and $Al_2O_{3(S)}$ are -822.25 and -1669.84 kJ at 298 K, calculate the change in enthalpy. **(03)**

(c) Write comprehensive note on Fuel cells. **(10)**

Q.3. (a) How do buffers resist changes in pH? Write any two applications of buffers in Chemistry? **(05)**

(b) Calculate pH of 0.1 N solution of NaOH. **(02)**

(c) Give a brief account of Debye-Hükel theory of strong electrolytes? **(05)**

(d) What is hydrogen over voltage, how it is related to corrosion rate? **(08)**

Q.4. (a) Explain the terms Gibbs free energy, enthalpy and entropy of a reaction. What is the relationship between these terms? **(08)**

(b) The heat of reaction for the following reaction at 298K is – 92.466 kJ. **(04)**

$$\tfrac{1}{2}H_2(g) + \tfrac{1}{2}Cl_2 \rightarrow HCl(g)$$

Calculate the heat of this reaction at 323 K.

(c) Define heat of combustion. How it is measured experimentally?. **(08)**

Q.5. (a) Explain the terms spontaneous and non-spontaneous reactions with suitable examples. **(05)**

(b) Describe moving boundary method for the determination of transference number. **(10)**

(c) Write a note on concentration cells. **(05)**

Q.6. (a) Describe main features of crystal field theory, How this theory explains colour of coordination complexes? **(10)**

(b) Write the electronic configuration for each of the following: **(04)**

Ni^{2+}, Cu, Mn^{2+}, Cr^{3+}

(c) Write coordination and oxidation numbers for the transition metal atom in each of the following coordination compounds. **(06)**

	$K[Ag(CN)_2]$	$K[CuCl_2]$	$[MnO_4]^-$
Coordination No			
Oxidation No			

Q.7. (a) State the method by which NaOH is manufactured industrially using NaCl as raw material? **(06)**

(b) Describe different allotropic forms of carbon? Discuss structure and chemical properties of each. **(08)**

(c) Discuss chemistry of Hard and Soft water. **(06)**

Q.8. (a) Write an essay on the Oxides of Nitrogen and Environmental Pollution. **(08)**

(b) Write structure and chemical properties of Interhalogen compounds. **(07)**

(c) With the help of equations, outline the manufacture of glass. **(06)**

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