FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION FOR
RECRUITMENT TO POSTS IN BPS-17 UNDER
THE FEDERAL GOVERNMENT, 2010

Roll Number

CHEMISTRY, PAPER-I

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

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

PART – I (MCQ)
(COMPULSORY)

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

(i) When an electron is brought from infinite distance close to the nucleus of the atom, the energy of Electron-nucleus system?
(a) increases to a smaller negative value (b) decreases to a greater negative value
(c) decreases to a smaller positive value (d) increases to a greater positive value

(ii) The probability of finding the electron in the nucleus is:
(a) 100% due to forces of attraction (b) finite for all orbitals
(c) Zero for all orbitals (d) Zero for some orbitals and finite for others

(iii) When Zn metal is kept in $CuSO_4$ solution, copper is precipitated and $ZnSO_4$ is formed because:
(a) Atomic number of Zinc is smaller than copper
(b) Atomic number of Zinc is larger than copper
(c) Standard reduction potential of Zinc is more than that of copper
(d) Standard reduction potential of Zinc is less than that of copper

(iv) Electrolytes when dissolved in water, dissociate into their constituent ions, the degree of dissociation of an electrolyte increases with the:
(a) Presence of a substance yielding common ion
(b) Decreasing temperature
(c) Decreasing concentration of electrolyte
(d) Increasing concentration of electrolyte

(v) There is a large positive entropy change for an exothermic reaction. It means that the reaction will be:
(a) possible at high temperatures only (b) impossible at all temperatures
(c) possible at low temperatures only (d) possible at all temperatures

(vi) Which of the following statement is false?
(a) the temperature of the system will fall if an exothermic reaction is isolated from its surroundings
(b) Energy is absorbed when one compound is converted into another with higher heat content
(c) the temperature of the system is likely to fall if heat is absorbed during the course of a reaction
(d) None of these

(vii) The H_____ bond is strongest in:
(a) S–H ……O (b) O–H …….S (c) F–H ……..O (d) F–H ……..S

(viii) Heavy water contains:
(a) Large amount of salts (b) Deuterium (c) O^{18} (d) O^{16}

(ix) pH + pOH of a solution is:
(a) 7 (b) Zero (c) 14 (d) -14

(x) The compound that is not Lewis acid:
(a) BF_3 (b) $BaCl_2$ (c) $SnCl_4$ (d) $AlCl_3$

(xi) Strongest acid having K_a:
(a) 10^4 (b) 10^{-4} (c) 1 (d) 10^{-2}

(xii) Ore of Aluminium:
(a) Calamine (b) Dolomite (c) Bauxite (d) Limestone

(xiii) Oxidation number of S in sulphuric acid:
(a) Four (b) Six (c) Two (d) Eight

(xiv) d-block elements form coordination compounds because of:
(a) Small Cationic size (b) Large ionic Charge
(c) Unfilled d-orbitals (d) Filled d-orbitals

(xv) Brass is an alloy of:
(a) Cu and Zn (b) Cu, Ni, Zn (c) Cu and Ni (d) Cu, Al, Zn

(xvi) Urea is a high quality nitrogenous fertilizer with:
(a) 76% nitrogen (b) 46% nitrogen (c) 66% nitrogen (d) 26% nitrogen

(xvii) Diamond is:
(a) Good conductor of electricity (b) Bad conductor of electricity
(c) Bad conductor on heating (d) Good conductor on heating

(xviii) Carbon monoxide is poisonous gas because it:
(a) replaces oxygen from lungs (b) forms carboxy haemoglobin
(c) Forms carbon dioxide with oxygen (d) has a sweet smell

(xix) Rust is:
(a) $FeO + Fe(OH)_2$ (b) $Fe_2O_3 + Fe(OH)_2$ (c) Fe_2O_3 (d) $Fe_2O_3 + Fe(OH)_3$

(xx) Calcium Carbide reacts with water to give:
(a) Methane (b) Ethylene (c) Acetylene (d) Ethane

PART – II

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

Q.2. (a) Derive the Principal Quantum number from schrodinger wave equation and justify that if the orbit of hydrogen atom is spherically symmetrical then expression for energy of electron is the same as deduced by Bohr. **(12)**

(b) An atom of Helium is moving in one Dimensional box of width 10^{-2} m. Calculate the energy difference between second and third energy level. **(8)**

Q.3. (a) How do you measure the pH of a solution by potentiometric method using: **(15)**
(i) Hydrogen Electrode (ii) Glass Electrode

(b) Calculate the pH of a buffer solution containing 0.2M acetic acid and 0.02 M sodium acetate. pK_a of acetic acid is 4.73. **(5)**

Q.4. (a) Define following types of processes: **(8)**
(i) Isothermal (ii) Adiabatic (iii) Isochoric (iv) Isobaric

(b) How the pressure, temperature and volume of a gas are related to each other in adiabatic process: **(8)**

(c) 1 mole of an ideal gas at 25^oc is allowed to expand reversibly at constant temperature from $15dm^3$ to $30dm^3$ calculate the work done by gas: **(4)**

Q.5. (a) What is acid rain? How is it produced? Give in detail its chemistry. **(8)**
(b) Discuss the harmful effects of acid rain on environment and human health. **(8)**
(c) Enlist major sources for air pollution. **(4)**

Q.6. (a) Describe the composition of Portland cement. **(6)**
(b) Which raw materials are used to manufacture glass on industrial scale? **(6)**
(c) What is fibre glass? Describe its uses. **(4)**
(d) Which compounds are added to impart different colours to glass? **(4)**

Q.7. (a) How is urea manufactured in Pakistan, explain with flow sheet diagram? **(10)**
(b) Name at least four nigtrogenous fertilizers. **(4)**
(c) 5.35 gm NH_4Cl is heated with excess of quick lime. What is the weight of ammonia obtained? If this ammonia is dissolved in 1 litre of water, Calculate the normality of this solution. **(6)**

Q.8. (a) What are transition metals? Discuss their characteristic features. **(12)**
(b) Why AgCl is soluble in NH_3? **(4)**
(c) What are alloy steels, give some examples? **(4)**

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CHEMISTRY, PAPER-II

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

NOTE: (i) First attempt **PART-I (MCQ)** on separate **Answer Sheet** which shall be taken back after **30 minutes.**
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PART – I (MCQ)
(COMPULSORY)

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

(i) Which of the following substituent deactivates benzene ring and is o, p-directing?
(a) __ NH_2 (b) __ Cl (c) __ OCH_3 (d) __ OH

(ii) Which of the following is most readily nitrated?
(a) Toluene (b) Benzaldehyde (c) Nitrobenzene (d) Benzoic Acid

(iii) Ketones can be prepared by reaction of Grignard reagent with:
(a) Acid Amides (b) Acid Chloride (c) Carboxylic Acid (d) Epoxides

(iv) Which of the following statements about the order of reaction is true?
(a) The order of a reaction can only be determined by experiment.
(b) A second order reaction is also bimolecular
(c) The order of reaction must be a positive integer
(d) The order of reaction increases with increasing temperature.

(v) Polysaccharides yield many monosaccharides on:
(a) Hydration (b) Oxidation (c) Reduction (d) Hydrolysis

(vi) Which of the following is not aromatic?
(a) Benzene (b) cyclooctatetraene (c) Pyridine (d) Phenol

(vii) Which of the following is most basic?
(a) H_2O (b) NH_3 (c) CH_3 NH2 (d) CH_3OH

(viii) Which of the following has lowest pH?
(a) CH_3COOH (b) CF_3COOH (c) $ClCH_2COOH$ (d) Cl_3C COOH

(ix) The equilibrium of two readily interconvertible isomers is called:
(a) Stereoisomerism (b) Metamerism (c) Tautomerism (d) Polymorphism

(x) Which of the following compounds exhibit geometrical isomerism?
(a) 1-Pentene (b) 2-Pentene (c) 2-methyl –2-Pentene (d) 2-methyl –2-Butene

(xi) Which of the following gives a tertiary alcohol when treated with Grignard reagent:
(a) HCHO (b) CH_3CHO (c) C_3H_5CHO (d) CH_3COCH_3

(xii) Which of the following tests is not used to identify aldehydes?
(a) Tollen's test (b) Benedict solution test (c) Fehling solution test (d) Ammonia test

(xiii) Which is incorrect about alkaloids?
(a) Naturally Occuring (b) Possess a hetrocyclic ring
(c) Exhibit biological action (d) acidic in nature

(xiv) Which of the followings will not give iodoform test:
(a) Acetone (b) Ethylacohol (c) Benzaldehyde (d) Acetaldehyde

(xv) The reaction of aniline with bromine water gives:
(a) o-bromoaniline (b) p-bromoaniline (c) 2,4-dibromoaniline (d) 2,4,6-tribromoaniline

(xvi) The reaction of tripalmitin, with sodium hydroxide is called:
(a) Hydrolysis (b) Saponification (c) Esterification (d) Combustion

(xvii) Which one is not Petrochemical?
(a) Napthalene (b) Mineral Oil (c) Wax (d) Table Salt

(xviii) Chemical adsorption:
(a) is exothermic (b) is irreversible (c) takes place at high temp. (d) All of these

(xix) The most commonly used absorbent for chromatographic separation of organic compound is:
(a) Activated charcoal (b) Fuller's Earth (c) Alumina (d) Silica gel

(xx) Grignard reagent is:
(a) Organo Zinc halide (b) Organo cadmium bromide
(c) n-Butyl Lithium (d) Organo Magnesium halide

PART – II

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

Q.2. (a) What is mesomerism? Give the conditions necessary for mesomerism. **(10)**
(b) What is intramolecular and intermolecular hydrogen bonding? Illustrate with examples. **(6)**
(c) Indicate the type of hybridization of carbon atom in the following: **(4)**
(i) Formaldehyde (ii) Dimethylether (iii) Hydrogen Cyanide (iv) Acetylene

Q.3. (a) What is Diazotisation reaction? How will you prepare following via Diazotisation reaction? **(14)**
(i) Phenol (ii) Chlorobenzene (iii) Phenyl ethyl ether (iv) any dye
(b) Discuss the action of nitrous acid on secondary and tertiary amines. **(6)**

Q.4. (a) How will you synthesize following? Give reaction conditions and mechanism. **(16)**
(i) Acetaldehyde from Ethanol (ii) Benzaldelyde from Benzene
(iii) Cyanohydrin from acetaldehyde (iv) Salicyldehyde from Phenol
(b) What is the difference between clemmensen and wolff-kishner reduction? **(4)**

Q.5. (a) Discuss the structure of Grignard Reagent. **(4)**
(b) How these compounds can be prepared via Grignard Reagent? **(16)**
(i) 2-Butanol (ii) Ethane (iii) Acetic Acid (iv) Ethyl thiol

Q.6. (a) Explain the difference between**:** **(16)**
(i) Homopolymer and Copolymer
(ii) Addition Polymerization and Condensation Polymerization
(iii) Monosaccharide and Polysaccharide
(iv) α-D-glucose and β-D-glucose
(b) Write the structure of monomers from which each of the following would be formed: **(4)**
(i) PVC (ii) Teflon (iii) Nylon 6 (iv) PAN

Q.7. (a) Hydrolysis of Ethylacetate by sodium hydroxide is done by taking different initial concentration. What will be the rate of this reaction? **(6)**
(b) A second order reaction has equal concentrations of reactants and is 25% completed in 20 minutes. How much time is required to complete the reaction by 75%? **(10)**
(c) Express the rate of reversible decomposition of Phosphorus pentachloride into Phosphorous trichloride and chlorine in terms of reactants and products. **(4)**

Q.8. How would you prapre the following compounds from benzene? Name each reaction as well. **(20)**
(i) Acetophenone (ii) Bromobenzene (iii) Maleic anhydride (iv) Toluene
(v) Benzaldehyde

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