# FEDERAL PUBLIC SERVICE COMMI[illegible]

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## COMPETITIVE EXAMINATION FOR RECRUITMENT TO POSTS IN BS-17 UNDER THE FEDERAL GOVERNMENT, 2013

## CHEMISTRY, PAPER-I

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

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

## PART-I ((MCQs) (COMPULSORY)

**Q.1. (i)** Select the best option/answer and fill in the appropriate Circle◯ on the **OMR Answer Sheet. (20x1=20)**
**(ii)** Answers given anywhere, other than OMR Answer Sheet, shall not be considered.

**1.** What happens when Al dissolves in aqueous NaOH?
**(a)** Forms soluble $NaAl(OH)_4$ **(b)** Forms $Al_2O_3$ **(c)** Precipitates of $Al(OH)_3$
**(d)** Precipitates $[Al(OH_2)_6]^{3+}$ forms which then loses $H^+$ **(e)** None of these

**2.** The magnetic moment of the fluoride complex is expected to be:
**(a)** The same as the magnetic moment of the cyanide complex.
**(b)** Larger than the magnetic moment of the cyanide complex because there are more unpaired electrons in the fluoride complex.
**(c)** Smaller than the magnetic moment of the cyanide complex because there are more unpaired electrons in the fluoride complex.
**(d)** Larger than the magnetic moment of the cyanide complex because there are fewer unpaired electrons in the fluoride complex. **(e)** None of these

**3.** When solid $CoCl_2$ is dissolved in water, a pink solution results and the following equilibrium is established:

$$Co(H_2O)_6^{2+}{}_{(aq)} + 4\ Cl^-{}_{(aq)} <=> CoCl_4^{2-}{}_{(aq)} + 6\ H_2O_{(l)}$$

Which one of the following best describes what will happen when a concentrated HCl is added to the $CoCl_2$ solution without changing the volume significantly?
**(a)** Because a solution of HCl is colorless, the color of the $CoCl_2$ solution will not change.
**(b)** Because HCl is a strong acid, the number of unpaired electrons in $[Co(H_2O)_6]^{2+}$, but not $[CoCl_4]^{2+}$, will change.
**(c)** The concentration of $[Co(H_2O)_6]^{2+}$ will decrease and the concentration of $[CoCl_4]^{2-}$ will increase; the color of the solution will become more blue.
**(d)** The concentration of $[Co(H_2O)_6]^{2+}$ will increase and the concentration of $[CoCl_4]^{2-}$ will decrease; the color of the solution will become more pink. **(e)** None of these

**4.** Passage of electric current through the metals is due to:
**(a)** Oxidation reaction **(b)** Reduction reaction **(c)** Electrolysis
**(d)** Free movement of electrons **(e)** None of these

**5.** VBT is unable to explain the nature of some of the complexes of:
**(a)** Cobalt **(b)** Copper **(c)** Nickel **(d)** Manganese **(e)** None of these

**6.** Energy available to do work at constant_____ and _____ is known as Gibb's free energy.
**(a)** Pressure, temperature **(b)** Pressure, volume **(c)** Temperature, volume
**(d)** All of these **(e)** None of these

**7.** A spontaneous reaction is not possible if:
**(a)** $\Delta H$ and $T\Delta S$ are both negative **(b)** $\Delta H$ and $T\Delta S$ are Positive
**(c)** $\Delta H$ is positive and $T\Delta S$ is negative **(d)** $\Delta H$ is negative and $T\Delta S$ is Positive **(e)** None of these

**8.** Which is not true about thermodynamics?
**(a)** It ignores the internal structure of atoms and molecule. **(b)** It involves the matter in bulk.
**(c)** It is concerned only with the initial and final states of the system.
**(d)** It is not applicable to macroscopic system. **(e)** None of these

**9.** The zero point energy of a particle is 1-D box of dimension $6A^0$ is:
**(a)** $10^{-22}J$ **(b)** $10^{-2}J$ **(c)** $16.22 \times 10^{-20}J$ **(d)** $10^{22}J$ **(e)** None of these

**10.** The salt bridge in the electrochemical cell serves to:
**(a)** Increase the rate at which equilibrium is attained. **(b)** Increase the voltage of the cell.
**(c)** Maintain electrical neutrality **(d)** Increase the oxidation/reduction rate.
**(e)** None of these

**11.** The equation $\frac{dP}{dT} = \frac{\Delta H}{T(V_2 - V_1)}$ is called:

**(a)** Gibbs's Helmohtz equation **(b)** Kirchoff's equation **(c)** Clapeyron equation
**(d)** Clausius Clapeyron equation **(e)** None of these

**12.** The hydrogen molecule may be represented by two wave functions, Ψcovalent and Ψionic and $C_1$ and $C_2$ coefficient indicating the weight of each function. The real wave function may be written as (N is normalization constant)

**(a)** $\Psi$= N [$\Psi$covalent + $\Psi$ionic] **(b)** $\Psi$= N [$C_1$ $\Psi$covalent + $C_2$ $\Psi$ionic]
**(c)** $\Psi$= N [$C_1$ $\Psi$covalent x $C_2$ $\Psi$ionic] **(d)** $\Psi$= ($C_1 + C_2$) N [$\Psi$covalent x $C_2$ $\Psi$ionic]
**(e)** None of these

**13.** Copper metal will replace silver ions in solution, resulting in the production of silver metal and copper ions. This indicates that:

**(a)** Silver has a higher oxidation potential than copper. **(b)** A combustion reaction is occurring.
**(c)** Copper has a higher oxidation potential than silver. **(d)** Silver is much less soluble than copper.
**(e)** None of these

**14.** According to Debye-Huckel theory of strong electrolytes, and ion moving in an atmosphere of oppositely charged ions experiences a drag. This effect is known as the:

**(a)** Asymmetric effect **(b)** Electrophoretic effect **(c)** Inter-ionic effect
**(d)**Concentration effect **(e)** None of these

**15.** The electrical conductivity of an electrolyte depends upon:

**(a)** The number of molecules in the electrolyte. **(b)** The number of ions present in the electrolyte.
**(c)** The number of ions present in the solution . **(d)** The number of molecules of the solvent.
**(e)** None of these

**16.** Brass is an alloy of:

**(a)** Cu and Zn **(b)** Cu, Ni, Zn **(c)** Cu and Ni **(d)** Cu, Al, Zn **(e)** None of these

**17.** Urea is a high quality nitrogenous fertilizer with:

**(a)** 76% nitrogen **(b)** 46% nitrogen **(c)** 66% nitrogen **(d)** 26% nitrogen **(e)** None of these

**18.** 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. **(e)** None of these

**19.** The most important ore of aluminium is:

**(a)** Bauxite **(b)** Magnetite **(c)** Haematite **(d)** Monazite **(e)** None of these

**20.** The inexpensive and commonly used variety of glass is called soda glass. It is called so because:

**(a)** Was used initially for making bottles of soda (carbonated drink). **(b)** Is made using soda (sodium carbonate)
**(c)** Was initially used for storing sodium carbonate. **(d)** Is made using soda lime. **(e)** None of these

## PART-II

**NOTE**: **(i) Part-II** is to be attempted on the separate **Answer Book.**
**(ii)** Candidate must write **Q. No.** in the **Answer Book** in accordance with **Q. No.** in the **Q. Paper.**
**(iii)** Attempt **ONLY FOUR** questions from **PART-II. ALL questions carry EQUAL marks.**
**(iv)** Extra attempt of any question or any part of the attempted question will not be considered.
**(v) Periodic Table of Elements is available on page-4.**
**(vi) Use of calculator is allowed.**

**Q.2.** **(a).** What is engineering ceramics? Describe the raw materials used in making classic ceramic products. **(08)**

**(b).** How urea is manufactured on commercial scale, support with a schematic diagram. **(08)**

**(c).** In what respect does inner orbital complexes differ from an outer orbital complexes? **(04)**

**Q.3.** **(a).** Describe the oxyacids of chlorine. **(06)**

**(b).** Describe what is meant by *silane* and *silanol.* What is their role in preparation of *Silicons.* **(08)**

**(c).** Define the following types of Processes: **(06)**
**(i)** Isothermal **(ii)** Adiabatic **(iii)** Isochoric **(iv)** Isobaric

**Q.4.** **(a).** How CFT and MOT account for the fact that $[CoF_6]^{3-}$ is paramagnetic while $[Co(NH_3)_6]^{3+}$ is diamagnetic? **(06)**

**(b).** Discuss crystal field splitting in complexes having different geometries?

**(c).** What are the raw materials for the production of calcium superphosphate and cement?

**Q.5.** **(a).** Derive Schrodinger wave equation and calculate the energy of the particle in one dimensional box having length α. **(14)**

**(b).** What are the hazardous effects of acid rain and global warming on plants? **(06)**

**Q.6.** **(a).** How Debye-Huckel theory is applied to determine activity and activity coefficients for strong electrolytes? Derive its mathematical form. **(12)**

**(b).** How standard electrode potential is measured? **(06)**

**(c).** What is de Broglie hypothesis? **(02)**

**Q.7.** **(a).** How chorine is produced on industrial scale? **(08)**

**(b).** How Werner's Theory explains the structure of coordination compounds? **(08)**

**(c).** Why the Ozone Layer exists at a certain altitude in Stratosphere? **(04)**

**Q.8.** **(a).** Give the applications of chelates in biological and analytical systems. **(04)**

**(b).** What are the advantages of semiconductive devices? **(04)**

**(c).** Derive mathematical form of Clausius-Clapeyron equation. **(12)**

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