FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2018
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT

Roll Number

CHEMISTRY, PAPER-I

TIME ALLOWED: THREE HOURS	**PART-I (MCQS) MAXIMUM MARKS = 20**
PART-I(MCQS): MAXIMUM 30 MINUTES	**PART-II MAXIMUM MARKS = 80**

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) All the parts (if any) of each Question must be attempted at one place instead of at different places.
(iv) Candidate must write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
(v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
(vi) Extra attempt of any question or any part of the attempted question will not be considered.
(vii) **Use of Calculator is allowed**.

PART-II

Q. No. 2. **(a).** Explain de Broglie's hypothesis and derive its equation. How Davisson and Germer proved the dual nature of electron? **(10)**

(b). Explain transport number. How it can be determined by Hittorf 's method for Ag^+ ions in $AgNO_3$ solution? **(10)**

Q. No. 3. **(a).** Explain the working of quinhydrone electrode. **(5)**

(b). Calculate the standard heat of formation of propane (C_3H_8) if its heat of combustion is –2220.2 kJ mol^{-1}. The heats of formation of $CO_2(g)$ and $H_2O(l)$ are –393.5 and –285.8 kJ mol^{-1} respectively. **(5)**

(c). Describe the criteria of spontaneity of a chemical process. Explain in terms of change in entropy, enthalpy and free energy with derivation of necessary equations. **(10)**

Q. No. 4. **(a).** Discussthe factors which can affect the rate of a chemical reaction. **(5)**

(b). Explain Arrhenius equation. Discuss Arrhenius concept of activation energy and explain it by graphical representation. **(8)**

(c). Explain enzyme catalysis with examples. Also give some characteristics of this catalysis. **(7)**

Q. No. 5. **(a).** What are colloids? How are they classified? Describe how colloidal solution of sulphur can be prepared? **(8)**

(b). What is meant by confidence limits? Seven replicate analysis for mercury in natural gas condensate gave following results in ng/mL: **(7)**
21.9 21.5 19.9 21.3 21.7 23.8 24.7
Calculate the 95% and 99% confidence limits for these measurements.

(c). Explain R_f value. Suppose that components of a mixture are separated by paper chromatography using a non-polar solvent like hexane. Describe and explain how the polarity of a compound in the mixture will affect its R_f value? **(5)**

Q. No. 6. **(a).** What is electrophoresis? Explain its working principle and describe its different applications as a separation and characterization technique. **(7)**

(b). Explain the paramagnetic behavior of O_2 molecule on the basis of molecular orbital theory. Explain why the existence of He_2 molecule is not possible on the basis of MOT? **(6)**

(c). Explain the molecular shape of $[Ni(CN)_4]^{2-}$ with the help of valence bond theory. Also discuss its magnetic behaviour. **(7)**

CHEMISTRY, PAPER-I

Q. No. 7. **(a).** Using VSEPR theory, identify the type of hybridization and draw the structure of OF_2. What are oxidation states of O and F? **(5)**

(b). A buffer of pH 9.26 is made by dissolving x moles of ammonium sulphate and 0.1 mole of ammonia into 100 mL solution. If pK_b of ammonia is 4.74, calculate the value of x. **(5)**

(c). Explain soft and hard acids and bases (SHAB) concept with examples. How is it able to explain the stability of complexes and reaction rates? **(10)**

Q. No. 8. **(a).** Explain crystal field theory. How it differs from valence bond theory? Also explain crystal field splitting. How crystal field stabilization energy of a complex is calculated? **(10)**

(b). Write systemic names of following compounds. **(5)**

$K_4[NiF_6]$, $K_3[Fe(CN)_6]$, $[Co(NH_3)_4Cl_2]Cl$, $K_2[PtCl_6]$, $K_2[Cu(CN)_4]$

(c). Write the coordination number and oxidation state of the metal ion in each of the above stated complexes. **(5)**

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Roll Number

CHEMISTRY, PAPER-II

TIME ALLOWED: THREE HOURS	**PART-I (MCQS) MAXIMUM MARKS = 20**
PART-I(MCQS): MAXIMUM 30 MINUTES	**PART-II MAXIMUM MARKS = 80**

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) All the parts (if any) of each Question must be attempted at one place instead of at different places.
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PART-II

Q.No. 2. (a) Define Resonance and Resonance effect. (10)

(b) Write Short note on followings. (5+5) **(20)**
(i) Tautomerism (ii) Hyperconjugation.

Q.No. 3. (a) Complete the following reactions. (8×2=16)

(i) $CH_3\text{-}CH{=}CH_2 + KMnO_4 \xrightarrow{H_2O} ?$

(ii) $CH_3\text{-}CH{=}CH_2 + \underset{\text{Pressure}}{\overset{Ni\ \triangle}{\longrightarrow}}$

(iii) $CH_3\text{-}CH{=}CH_2 + \text{dil. } H_2SO_4 \longrightarrow$

(iv) $CH_3\text{-}CH{=}CH_2 + CH_3 - \overset{O}{\overset{\|}{C}}\text{-}H \longrightarrow$

(v) $CH_3\text{-}CH{=}CH_2 + Br_2 \xrightarrow{CCl_4}$

(vi) $CH_3 - C \equiv CH_3 + Na / \text{lig } NH_3 \longrightarrow$

(vii) $CH \equiv CH + NaNH_2 \longrightarrow$

(viii) $CH \equiv CH + H_2O \xrightarrow{H_2SO_4 / HgSO_4}$

(b) 1-Butyne forms a precipitate with an ammonical solution of silver nitrate where 2-Butyne does not. Why? (4) **(20)**

Q.No. 4. Explain electrophilic substitution reaction mechanism with the help of:
(i) Nitration (ii) Sulphonation. **(20)**

Q.No. 5. (a) Distinguish between: (4×3=12)
(i) Configuration and conformation
(ii) Enantiomer and Diastreomers
(iii) R. Convention and S. Convention

(b) Define specific rotation. How do you measure using polarimeter? (8) **(20)**

Q.No. 6. (a) What do you mean by the setting of cement. (10)
(b) Discuss future of cement industry in Pakistan. (10) **(20)**

Q.No. 7. (a) Explain Aldol condensation reaction with examples. (10)
(b) What are proteins? (5)
(c) Explain Bio synthesis of cholesterol. (5)

Q.No. 8. Explain the following: (4 marks each) **(20)**
(a) Beers Lamberts Law. (b) Wood Wards Fieser Rule
(c) Hooks Law (d) Basic principle of NMR?
(e) Chemical Shift.

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