



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

Roll Number

**CHEMISTRY, PAPER-I**

<b>TIME ALLOWED: THREE HOURS</b>	<b>PART-I (MCQS)</b>	<b>MAXIMUM MARKS = 20</b>
<b>PART-I(MCQS): MAXIMUM 30 MINUTES</b>	<b>PART-II</b>	<b>MAXIMUM MARKS = 80</b>
<b>NOTE: (i) Part-II is to be attempted on the separate Answer Book.</b> <b>(ii) Attempt ONLY FOUR questions from PART-II. ALL questions carry EQUAL marks.</b> <b>(iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.</b> <b>(iv) Candidate must write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.</b> <b>(v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.</b> <b>(vi) Extra attempt of any question or any part of the attempted question will not be considered.</b> <b>(vii) Use of Calculator is allowed.</b>		

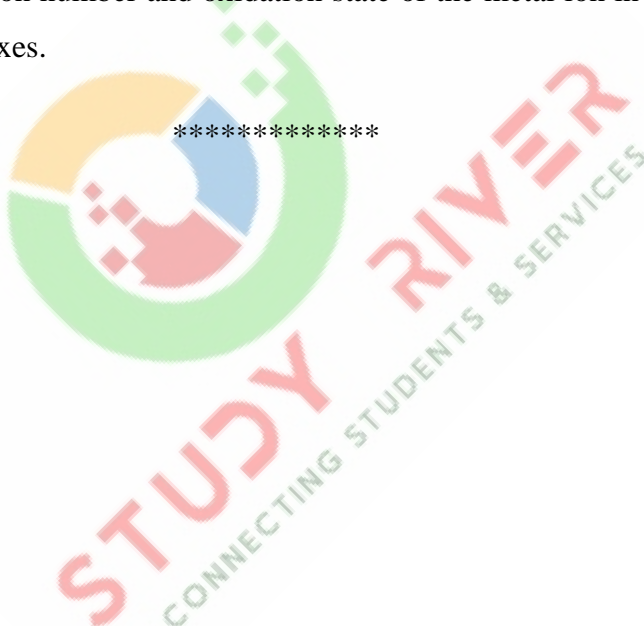
**PART-II**

- 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  $\text{Ag}^+$  ions in  $\text{AgNO}_3$  solution? (10)
- Q. No. 3.** (a). Explain the working of quinhydrone electrode. (5)
- (b). Calculate the standard heat of formation of propane ( $\text{C}_3\text{H}_8$ ) if its heat of combustion is  $-2220.2 \text{ kJ mol}^{-1}$ . The heats of formation of  $\text{CO}_2(\text{g})$  and  $\text{H}_2\text{O}(\text{l})$  are  $-393.5$  and  $-285.8 \text{ kJ mol}^{-1}$  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). Discuss the 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:  
21.9 21.5 19.9 21.3 21.7 23.8 24.7  
Calculate the 95% and 99% confidence limits for these measurements. (7)
- (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  $\text{O}_2$  molecule on the basis of molecular orbital theory. Explain why the existence of  $\text{He}_2$  molecule is not possible on the basis of MOT? (6)
- (c). Explain the molecular shape of  $[\text{Ni}(\text{CN})_4]^{2-}$  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  $\text{OF}_2$ . 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  $\text{pK}_b$  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)
- $\text{K}_4[\text{NiF}_6]$ ,  $\text{K}_3[\text{Fe}(\text{CN})_6]$ ,  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$ ,  $\text{K}_2[\text{PtCl}_6]$ ,  $\text{K}_2[\text{Cu}(\text{CN})_4]$
- (c). Write the coordination number and oxidation state of the metal ion in each of the above stated complexes. (5)





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**CHEMISTRY, PAPER-II**

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<b>PART-I(MCQS): MAXIMUM 30 MINUTES</b>	<b>PART-II</b>	<b>MAXIMUM MARKS = 80</b>
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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)  $\text{CH}_3\text{-CH=CH}_2 + \text{KMnO}_4 \xrightarrow{\text{H}_2\text{O}} ?$   
(ii)  $\text{CH}_3\text{-CH=CH}_2 + \xrightarrow[\text{Pressure}]{\text{Ni}\Delta}$   
(iii)  $\text{CH}_3\text{-CH=CH}_2 + \text{dil. H}_2\text{SO}_4 \longrightarrow$   
(iv)  $\text{CH}_3\text{-CH=CH}_2 + \text{CH}_3\text{-}\overset{\text{O}}{\parallel}\text{C-H} \longrightarrow$   
(v)  $\text{CH}_3\text{-CH=CH}_2 + \text{Br}_2 \xrightarrow{\text{CCl}_4}$   
(vi)  $\text{CH}_3\text{-C}\equiv\text{CH}_3 + \text{Na / lig NH}_3 \longrightarrow$   
(vii)  $\text{CH}\equiv\text{CH} + \text{NaNH}_2 \longrightarrow$   
(viii)  $\text{CH}\equiv\text{CH} + \text{H}_2\text{O} \xrightarrow{\text{H}_2\text{SO}_4 / \text{HgSO}_4}$   
(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 Diastereomers  
(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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