



**FEDERAL PUBLIC SERVICE COMMISSION**  
**COMPETITIVE EXAMINATION-2020**  
**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) 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 question will not be considered.</b> <b>(vii) Use of calculator is allowed.</b>		

**PART-II**

- Q. 2.** (a) Write two equations of state for real gases and compare them highlighting their important features. (10)
- (b) (i) Explain Heisenberg's uncertainty principle. (05)  
(ii) Discuss Born's interpretation of wave function. (05) (10) **(20)**
- Q. 3.** (a) Explain the Kohlrausch law. Why do the real solution should deviate from the law? (10)
- (b) Compare Langmuir's and Freundlich's adsorption isotherms. (10) **(20)**
- Q. 4.** (a) Explain the Arrhenius equation. Also highlight its applications and limitations. (10)
- (b) Explain various acid-base theories. What are hard and soft acids and bases? (10) **(20)**
- Q. 5.** (a) Make a comparison of column chromatography and thin layer chromatography (TLC) by highlighting merits and demerits of the both. (10)
- (b) Explain Werner's theory of coordination complexes. Give examples from d-block transition metals. (10) **(20)**
- Q. 6.** (a) Give a comprehensive classification of various chromatographic techniques. Also mention potential application of each. (10)
- (b) (i) What is Hydrogen bonding. Explain. (05)  
(ii) Describe Hybridization in p-block elements. (05) (10) **(20)**
- Q. 7.** (a) Explain crystal Field Theory (CFT) for d-block elements. (10)
- (b) Write an extensive essay on types of chemical bonding giving examples. (10) **(20)**
- Q. 8.** Write short notes on the following: (5 each) **(20)**
- (i) Liquid junction potential  
(ii) Potentiometry  
(iii) Collision theory of Chemical reactions.  
(iv) Transition state theory.

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**CHEMISTRY, PAPER-II**

Roll Number

<b>TIME ALLOWED: THREE HOURS</b>	<b>PART-I (MCQS)</b>	<b>MAXIMUM MARKS = 20</b>
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<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>		

**PART-II**

- Q.No. 2.** Explain the difference between: **(5 each) (20)**
- Inductive and Field effects
  - Inductive and Resonance effects
  - Localized and Delocalized bonding
  - Conjugation and Hyperconjugation
- Q.No. 3. (a)** “The resonance effect has an appreciable influence on physical characteristics and the chemical reactivity of organic molecules”. Elaborate the statement with the help of examples. **(10)**
- (b)** Outline the EAS mechanism (Electrophilic Aromatic Substitution) through which aromatic compounds react with electrophiles. **(5)**
- (c)** Discuss factors which favour an elimination reaction occurring over a substitution reaction. **(5) (20)**
- Q.No. 4.** How would you carry out the following conversions? Account for your answer with mechanism in each case. **(4 each) (20)**
- $(\text{CH}_3)_3\text{CCH}=\text{CH}_2 \rightarrow (\text{CH}_3)_2\text{C}(\text{OH})\text{CH}(\text{CH}_3)_2$
  - $(\text{CH}_3)_3\text{CCH}=\text{CH}_2 \rightarrow (\text{CH}_3)_3\text{CCH}(\text{OH})\text{CH}_3$
  - $(\text{CH}_3)_3\text{CCH}=\text{CH}_2 \rightarrow (\text{CH}_3)_3\text{CCH}_2\text{CH}_2\text{OH}$
  - $(\text{CH}_3)_3\text{CC}\equiv\text{CH} \rightarrow (\text{CH}_3)_3\text{CCOCH}_3$
  - $(\text{CH}_3)_3\text{CC}\equiv\text{CH} \rightarrow (\text{CH}_3)_3\text{CCH}_2\text{CHO}$
- Q.No. 5.** The following reactions can be used for the preparation of alkanes or cycloalkanes. Elaborate them with the help of reaction mechanisms. **(5 each) (20)**
- Corey House reaction
  - Wurtz reaction
  - Kolbe reaction
  - Simmons - Smith Reaction
- Q.No. 6.** How would you convert cyclohexanone into the following compounds? Write down the mechanisms of the reactions. **(4 each) (20)**
- Caprolactone
  - Caprolactam
  - Cycloheptanone
  - Cyclohexa-1,2-dione
  - Cyclohexane
- Q.No. 7. (a)** How can a racemic mixture be separated into its components? Describe different methods. **(16)**
- (b)** (-)-Lactic acid has a specific rotation of  $-3.8^\circ$ . What will be the specific rotation of a solution containing 7.5g of (-)-lactic acid and 2.5 g of (+)-lactic acid? **(4) (20)**
- Q.No. 8. (a)** Starch, glycogen and cellulose are polymers of glucose. How will you differentiate among these three both structurally and functionally. **(12)**
- (b)** Explain precisely the following terms. **(8) (20)**
- Glycolysis
  - Glycogenolysis
  - Glycogenesis
  - gluconeogenesis

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