



PUNJAB PUBLIC SERVICE COMMISSION
COMBINED COMPETITIVE EXAMINATION
FOR RECRUITMENT TO THE POSTS OF
PROVINCIAL MANAGEMENT SERVICE, ETC -2021
CASE NO. 3C2022

SUBJECT: CHEMISTRY (PAPER-I)

TIME ALLOWED: THREE HOURS

MAXIMUM MARKS: 100

NOTE:

- i. All the parts (if any) of each Question must be attempted at one place instead of at different places.
- ii. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
- iii. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
- iv. Extra attempt of any question or any part of the question will not be considered.

NOTE: **Attempt Any Five Questions. All Questions Carry Equal Marks. Attempt in English or Urdu.**

Q No. 1: a). Define entropy. Describe entropy changes and conclusions for reversible and irreversible process. **(2+4+4=10 Marks)**

b). Explain the significance of Gibbs free energy as useful work. **(10 Marks)**

Q No. 2: a). What is hybridization of orbitals? Give comparison of Sigma and Pi bonds. Explain sp^3 hybridization. **(2+4+4=10 Marks)**

b). Write down the main points of Molecular Orbital Theory (MOT) and explain the structure of HF molecule. **(5+5=10 Marks)**

Q No. 3: a). What is molar conductance? How are the conductance / resistance measured? **(2+8=10 Marks)**

b). Define electrode potential. Explain standard hydrogen electrode. **(2+8=10 Marks)**

Q No. 4: a). What is Pauli Exclusion Principle? How does it helps and effect in distribution of electrons in an atom? **(3+7=10 Marks)**

b). Derive Schrodinger wave equation for calculating the *Laplacian operator*. **(10 Marks)**

Q No. 5: a). What are the main postulates of Werner's theory and explain structure of $CoCl_3.6NH_3$. **(7+3=10 Marks)**

b). What are chelates and give classification? Give examples of the formation of chelates. **(2+2+6=10 Marks)**

Q No. 6: a). What is radioactive decay? Describe the decay of Beta (β^+ , β^-) particles. **(2+8=10 Marks)**

b). Differentiate nuclear fission and nuclear fusion process. **(10 Marks)**

Q No. 7: a). What is the composition of cement? Describe the Wet process for the manufacture of Cement. **(10 Marks)**

b). Define fertilizers and explain the classification of fertilizers. **(2+8=10 Marks)**

Q No. 8: a). What are pollutants? How air pollution can be controlled? **(10 Marks)**

b). Write a note of any one: **(10 Marks)**

(i) Green house effect

(ii) Water pollution



PUNJAB PUBLIC SERVICE COMMISSION
COMBINED COMPETITIVE EXAMINATION
FOR RECRUITMENT TO THE POSTS OF
PROVINCIAL MANAGEMENT SERVICE, ETC -2021
CASE NO. 3C2022

SUBJECT: CHEMISTRY (PAPER-II)

TIME ALLOWED: THREE HOURS

MAXIMUM MARKS: 100

NOTE:

- I. All the parts (if any) of each Question must be attempted at one place instead of at different places.
- II. Write Q. No. in the Answer Book in accordance with Q. No. in the Q. Paper.
- III. No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
- IV. Extra attempt of any question or any part of the question will not be considered.

NOTE: Attempt any FIVE Questions in all. Attempt in Urdu or English.

- Q.No.1** A. What are the necessary conditions for the absorption of IR radiation by the compounds? Which of the following molecules do not absorb in the IR region and why? **(15 Marks)**
- (i) H_2 (ii) HCl (iii) ICl (iv) N_2 (v) H_2O
- B. Discuss the applications of Ultraviolet/Visible spectroscopy. **(5 Marks)**
- Q.No.2** A. Discuss the effect of Hydrogen bonding on the boiling points and water solubility of organic compounds. **(8 Marks)**
- B. What is the essential difference between:
- (i) Inductive effect and Mesomeric effect
(ii) Resonance and Tautomerism
(iii) Conjugation and Hyperconjugation **(12 Marks)**
- Q.No.3** A. Describe the general mechanism by which benzene undergoes substitution reaction. **(5 Marks)**
- B. Show the product formed (if any), by action of each of the following on benzene. **(15 Marks)**
- (i) Conc. HCl (ii) Bromine Water (iii) Con. $NaOH$
(iv) Bromine water (v) Fuming H_2SO_4
- Q.No.4** A. Write the structure of the following compounds. **(10 Marks)**
- (i) 2-methylcyclobutanol (ii) t-amylalcohol (iii) o-nitrophenol
(iv) 2-iso-propyl-6-methylphenol (v) neo pentyl alcohol
- B. Define and explain the following reactions: **(10 Marks)**
- (i) Haloform reactions (ii) Cannizzaro reactions
- Q.No.5** A. What is optical isomerism? Discuss necessary conditions for it. How it can be determined? **(10 Marks)**
- B. Write the resonance structure of: **(10 Marks)**
- (i) Benzene (ii) Anthracene (iii) Naphthalene (iv) Phenanthrene
- Q.No.6** A. Discuss the digestion, absorption and transport of proteins. **(12 Marks)**
- B. Discuss structure and biological significance of nucleic acids. **(8 Marks)**
- Q.No.7** A. What is Chromatography? How Column chromatography is used as an analytical technique? **(10 Marks)**
- B. What is polymerization? Discuss and compare condensation polymerization with addition polymerization. **(10 Marks)**