PUNJAB PUBLIC SERVICE COMMISSION

COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE-2019

SUBJECT: CHEMISTRY (PAPER-I)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE: Attempt Five Questions in All. Attempt in Urdu or English.

Q No. 1: **a)** What is meant by corrosion? How it can be explained electrochemically? Also list methods to avoid them. **(10 Marks)**

b) Define Gibbs free energy. How it can be related to equilibrium constant? Derive the relationship. **(10 Marks)**

Q No. 2: **a) Define the following:** **(5X2=10 Marks)**

i. Millimole ii. Equivalent iii. Tunneling effect

iv. Potential v. Entropy

b) Derive the equation of wave function for a particle moving in one dimension. **(10 Marks)**

Q No. 3: **a)** Differentiate between $K_4[Fe(CN)_6]$ and $[Fe(H_2O)_6]SO_4$ on the basis of CFT. Also explain the distortion present in copper complexes. **(4+6=10 Marks)**

b) Write down postulates of VBT in case of transition metal compounds. Also comment, why ClO_4^{-1} and H_2SO_4 has the same geometry, **(7+3=10 Marks)**

Q No. 4: **a)** Define pollutant. How it produces adverse effect on living organisms and imbalance in the environment? **(10 Marks)**

b) Explain briefly the advantage and disadvantage of supplying sewage and sludge to the agriculture soil. **(10 Marks)**

Q No. 5: **a)** How will you prove "$H\psi = E\psi$" by the Schrodinger wave equation? **(10 Marks)**

b) Briefly, explain the followings: **(5 + 5=10 Marks)**

(i) Principal Quantum Number (ii) Azimuthal Quantum Number

Q No. 6: **a)** Define thermodynamics and enthalpy. Prove First law of thermodynamics by mathematical formulation. **(10 Marks)**

b) Explain the followings, **(5 + 5=10 Marks)**

(i) Gibbs free energy and its applications in different process

(ii) Change in enthalpy (ΔH) and relationship with change in energy (ΔE)

P.T.O

Q No. 7: **a)** Define hybridization and give examples. Write down the rules of hybridization and explain SP hybridization and SP^3 hybridization. **(10 Marks)**

b) Describe the main postulates of Molecular Orbital Theory. Give its application in heteronuclear diatomic molecules with two examples. **(10 Marks)**

Q No. 8: **a)** Discuss the nature of Alpha (α) rays and Gamma rays (γ). Describe the kinetic study of radioactive decay. Give example. **(10 Marks)**

b) Define pollution, pollutants and contaminants. Describe the source, effects and control of carbon monoxide as pollutant. **(10 Marks)**

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COMBINED COMPETITIVE EXAMINATION FOR RECRUITMENT TO THE POSTS OF PROVINCIAL MANAGEMENT SERVICE-2019

SUBJECT: CHEMISTRY (PAPER-II)

TIME ALLOWED: THREE HOURS **MAXIMUM MARKS: 100**

NOTE: Attempt Five Questions in All. Attempt in Urdu or English.

Q No. 1: **(i) Draw the structures of the following compounds: (5 Marks)**

a) Spiro [2.4]heptane
b) Bicyclo [2.2.2] cyclo octane
c) Hexane dioic acid
d) 4-oxobutanoic acid
e) Ethanoic anhydride

(ii) Justify the following statement: (2x5=10 Marks)

a) Dimethyl amine is stronger base than methyl amine which is stronger than ammonia
b) Phenol is stronger than ethanol
c) *m* – chloro-benzoic acid is a stronger acid than *p* – chloro-benzoic acid
d) Pyrrole is a weaker base than Pyridine

iii) Draw the resonance structures of the following compounds: (5 Marks)

(a) CH2=CH-CH3 (b) CH3=CH-O-CH3 (c) CH3-N=N=N

(d) CH2=CH-C=N (e) CH_3-C-CH2-C-OC2H5

Q No. 2:

(i) Methanol is a good solvent for UV but not for IR Spectroscopy. Explain the fact. **(5 Marks)**

(ii) Briefly describe the basic difference between Beer's and Lamber's laws of absorption of light. **(5 Marks)**

(iii) Explain the working of double beam IR instrument with special discussion on the formation of a solution and recording of absorbance. **(10 Marks)**

Q No. 3: **(a) Illustrate the difference between the following with examples: (3 + 5 + 4+5=17)**

i. Conjugation and Hyperconjugation.
ii. Mesomeric Effect and Inductive Effect.
iii. Chromophore and Auxochrome.
iv. Electromeric Effect and Resonance Effect.

(b) Why esters have low boiling points than their corresponding acids? **(3 Marks)**

Q No. 4:

(a) Explain the principle of UV and IR Spectroscopy. **(3.5+3.5=7 Marks)**

(b) How would you distinguish between ethane ethylene and acetylene by IR spectroscopy? **(6 Marks)**

(c) Differentiate between Bathochromic Shift and Hypsochromic Shift. **(5 Marks)**

(d) What is the formula for absorbance of a substance in Electronic Spectroscopy? **(2 Marks)**

P.T.O

Q No. 5: (i) Explain the steps involved in the phenomenon of "Walden Inversion". **(5 Marks)**

(ii) Discuss the role of Nicol Prism for plane of polarized light. **(5 Marks)**

(iii) Sketch the energy profile diagram and shapes of boat, twist boat, half chair and chair conformations of cyclohexane. **(10 Marks)**

Q No. 6: (i) Differentiate between the following terms with the help of appropriate examples.

(a) Fats and oils (b) Soap and detergents (c) Lipids and wax

(d) Iso-electronic point and flash- point. **(2x4=8 Marks)**

(ii) Proteins exhibit a variety of coloured reactions, describe any four of these. **(8 Marks)**

(iii) Hydrogen bonding plays an important role in protein structure, prove it. **(4 Marks)**

Q No. 7: **(a) What are Carbohydrates? Discuss their classification. (2+6=8 Marks)**

(b) How do you differentiate between paper partition and adsorption paper chromatography? **(6 Marks)**

(c) Define Detergent. What are its types and how it is different from soap? **(2+2+2=6 Marks)**

Q No. 8: **(a)** Explain the difference between chain growth and step growth polymerization? **(6 Marks)**

(b) Write a brief note on the following: (3.5x4=14 Marks)

i. TLC

ii. Functions of Lipids

iii. PTFE and its applications

iv. P-type and N-type Semiconductors