(3 Hours) **[Total Marks: 100]**

Please check whether you have got the right question paper.

N.B. : 1. All Questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of log-table/nonprogrammable calculator is allowed.
4. Answers for the same question as far as possible should be written together.

1. (A) Select the correct option and complete the following sentences. (any **twelve**) **12**

(i) There are _____ crystal system and _____ Bravais lattices.
(a) 7 ,14 (b) 14,7 (c) 7,7

(ii) The total number of effective atoms in body centered cubic system is ____.
(a) 4 (b) 2 (c) 3

(iii) A _____ accelerates a reaction by decreasing the energy of activation of the reaction.
(a) catalyst (b) inhibitor (c) pressure

(iv) The enzyme which can catalyse the conversion of _____ into glucose is maltase.
(a) maltose (b) invertase (c) zymase

(v) The _____ equation for diffraction of X-rays is $n\lambda = 2d\sin\theta$.
(a) Bragg's (b) Plank's (c) de-Broglie

(vi) The total number of effective atoms in _____ system is 2.
(a) face centred cubic (b) body centred cubic (c) simple cubic.

(vii) pKa range for strongly acidic cation is in between _____.
(a) 1 to 6 (b) 6 to 11.5 (c) -4 to 1

(viii) The cation is strongly acidic if z^2/r is in between _____.
(a) 0.1 to 0.16 (b) 0.01 to 0.04 (c) 0.04 to 0.1

(ix) Pure phosphoric acid is _____ crystalline solid.
(a) yellowish (b) greyish (c) white

(x) _____ acid is responsible for acid rain.
(a) H_2SO_4 (b) HCl (c) CH_3COOH

(xi) pKa values are greater than 14 for _____ cation.
(a) non acidic (b) weakly acidic (c) feebly acidic

(xii) _____ is called king of chemicals.
(a) HNO_3 (b) H_2SO_4 (c) H_3PO_4

(xiii) Two moles of _____ diketone are required in Hantzsch synthesis of pyridine.
(a) 1,3- (b) 1,4- (c) 1,5-

(xiv) Electrophilic substitution reaction in furan takes place at position _____ .
(a) 2 and 5 (b) 3 and 5 (c) 3

(xv) Sulphonation of furan can be carried out by action of ____ .
(a) H_2SO_4 (b) SO_3 and pyridine (c) oleum

(xvi) Benzene diazonium chloride when reduced with $NaHSO_3$ gives _____.
(a) phenyl hydrazine (b) phenyl hydrazone (c) hydrazobenzene

(xvii) Nitration of aniline mainly gives _____ as major products.
(a) o- and p-nitroaniline (b) m- and o-nitroaniline (c) p- and m-nitroaniline

(xviii) Reaction of aniline with bromine water at room temperature gives ____.
(a) 2- bromoaniline (b) 4-bromoaniline (c) 2,4,6-tribromoaniline

(B) State whether the following statements are true or false. (any **three**) **3**

(i) As temperature increases the rate of reaction decreases and the energy of activation increases.
(ii) Sodium chloride crystallises in the face centred cubic lattice form.
(iii) Hydrolysis of hydrated cation renders the solution basic.
(iv) Phosphoric acid is a mineral acid.
(v) Friedel - Crafts reaction of the furan can be carried out by using $AlCl_3$.
(vi) Pyrrolidine is a stronger base than pyrrole.

(C) Match the column. (any **five**) **5**

(i)	Inhibitor	(a)	Zn^{2+}
(ii)	Promoter	(b)	Al^{3+}
(iii)	Weakly acidic cation	(c)	$K_b = 54 \times 10^{-5}$
(iv)	Moderately acidic cation	(d)	Increases activity of catalyst
(v)	Dimethyl amine	(e)	Ba^{2+}
(vi)	Aniline	(f)	Face centred cubic
		(g)	$K_b = 3.8 \times 10^{-10}$
		(h)	$K_b = 37 \times 10^{-5}$
		(i)	Retards rate of reaction

2. Attempt any **four** of the following. **20**

(A) What are (100), (110) and (111) planes for the body-centred cube?
(B) How are X-rays used to determine the interplanar distances in cubic crystals?
(C) Derive Michalis-Menten equation for enzyme catalysis.
(D) Explain characteristic features of a catalysis.
(E) An inorganic salt of molecular weight 74.36 and density 1.874×10^3 $Kg.m^{-3}$ crystallises in a form like NaCl. Calculate the length of the edge of the unit cell if Avogadro's number is 6.023×10^{23} molecules mol^{-1}.
(F) Explain the kinetics of acid-base catalysis.

3. Attempt any **four** of the following. **20**

(A) Explain the process of hydration of cation with suitable diagram. How can cation render acidity to the solution?
(B) Explain the relationship between pK_a, acidity and Z^2/r ratio of monoatomic cations by means of graphical presentation.
(C) With the help of predominance diagrams explain non acidic cations and feebly acidic cations with suitable examples.

(D) Write Latimer equation to calculate hydration energy of anion and explain the terms involved in it. Using this equation, calculate ΔH_{hyd} for F^- ion. (Given radius of F^- ion is 119pm.)
(E) Write physical properties of sulphuric acid.
(F) Write a note on uses of phosphoric acid.

4. Attempt any **four** of the following.

(A)	(i) Give the preparation of a) 2-chlorothiophene, b) 2-nitrothiophene and c) thiophene-2-sulphonic acid from thiophene.	**3**
	(ii) Discuss aromaticity of furan.	**2**
(B)	(i) Explain Chichibabin reaction of pyridine.	**3**
	(ii) Give the carbylamine reaction of primary amines.	**2**
(C)	(i) 'Pyridine gives nucleophilic substitution at 2,4 and 6 positions'. Explain.	**3**
	(ii) How is primary amine obtained by reductive amination of aldehyde and ketone?	**2**
(D)	(i) Write a note on Hofmann exhaustive methylation (HEM).	**3**
	(ii) Give Paal-Knorr synthesis for the preparation of pyrrole.	**2**
(E)	(i) How will you distinguish between ethyl amine, diethyl amine and triethyl amine using nitrous acid?	**3**
	(ii) Explain Vilsmeier-Haack reaction of pyrrole.	**2**
(F)	(i) Give azo-coupling reaction of benzene diazonium chloride with a) Phenol and b) N,N-dimethyl aniline.	**3**
	(ii) How is hydrazobenzene prepared from nitrobenzene?	**2**

5. Attempt any **four** of the following.

(A)	Sodium chloride has a face centred cubic lattice and the length of the cube edge is 6.56 A°. Calculate d_{110} and d_{111}.	**5**
(B)	Write a note on activity of nanoparticles as a catalyst.	**5**
(C)	With the help of suitable predominance diagram, explain the behaviour of F^- and S^{2-} in aqueous solution.	**5**
(D)	Write a note on acid rain.	**5**
(E)	(i) Describe Hofmannn degradation of amides.	**3**
	(ii) How is chlorobenzene obtained by Sandmeyer reaction?	**2**
(F)	(i) Explain Diel's-Alder reaction of furan.	**3**
	(ii) Why is pyridine more basic than pyrrole?	**2**