

BANKIM SARDAR COLLEGE

Part – I (1+1+1) Examination 2020

B.Sc. (Honours)

Subject: CHEMISTRY

Paper: I+II

Group: (1+2)

Time: 2 Hours

Full Marks: 25 +25=50

(Answer each group in separate Answer-Sheets)

Group: 1

Paper -I (F.M-25)

Paper: IA (F.M-12.5)

(Answer in separate answer-sheets)

Answer any TWO Questions from Question 1 to 4. Question 5 is compulsory.

1. (a) Draw the Fischer projection formulae of all the possible stereoisomers of 2,3,4-trihydroxy glutaric acid. 3
(b) Represent Fischer projection formula of *meso*-tartaric acid in Newman and Sawhorse projection formulae. 2

2. (a) Draw the Fischer projection formula of all the possible stereoisomers of $\text{CH}_3\text{CH}(\text{OH})\text{CH}=\text{CH}-\text{COOH}$ 3
(b) Draw the Fischer projection formula of (2*S*, 3*R*)-3-chlorobutan-2-ol. 2

3. (a) Draw the orbital picture of allene and $\text{CH}_2=\text{CH}-\text{CN}$ indicating the state of the hybridization of all the carbon atoms. 3
(b) Arrange the following compounds in increasing order of acid strength and explain.
(i) 4-nitro phenol (ii) 2,6-dimethyl-4-nitro phenol and (iii) 3,5 di-methyl-4-nitrophenol. 2

4. (a) Label the following compounds as aromatic, non-aromatic or anti-aromatic with justification (any three). 3
(i) cyclopropyl anion, (ii) di-trans-[10] annulene (iii) cyclohepta tri-enyl cation, (iv) cyclo-octa tetra-ene.
(b) Explain the following terms with examples (any one) 2
(i) Conglomerate (ii) Racemate.

5. **Compulsory Question** 2.5 × 1 = 2.5
D) (a) Write the minimum and sufficient condition for a compound for being optically active

- (b) Give one example of an antiaromatic compound
 (c) How many tautomers can you draw for $\text{CH}_3\text{COCH}_2\text{COCO}_2\text{Et}$?

OR

- II. (a) Show the mechanism of S_N^1 reaction
 (b) Indicate its Rate determining step
 (c) What do you mean by rate determining step?

Paper: IB (F.M-12.5)

(Answer in separate answer-sheets)

Answer any TWO Questions from Question 6 to 9. Question 10 is compulsory.

6. For a vander Waal's gas find the reduced pressure and the pressure exerted by one mole of the gas taken in a 0.0804L vessel at 37.5°C . Given $P_c = 48.2 \text{ atm}$, $T_c = 305.4\text{K}$, $V_c = 0.148\text{L/mol}$
 Define Boyle temperature. How is it related to the second virial coefficient? [3+2]

7. One mole of an ideal monoatomic gas at 25°C and 5atmospheric pressure is expanded to a final pressure of 1 atmosphere (a) isothermally against a constant pressure of 1 atmosphere (b) adiabatically reversibly. Calculate in each case (i) the final temperature (ii) the heat absorbed (iii) the increase in internal energy and (iv) the increase in enthalpy of the gas. [5]

8. Draw the graph of concentration vs time for three species A, B, C undergoing the first order consecutive reaction $\text{A} \longrightarrow \text{B} \longrightarrow \text{C}$

For the reaction $\text{A} \longrightarrow \text{B}$, the rate law is

$$-d[\text{A}]/dt = k [\text{A}]^{1/2}$$

(i) integrate the rate equation

(ii) derive an expression for the half life period in terms of k and [A]

What is the unit of k

[2+3]

9. Derive an expression for $\left(\frac{\partial H}{\partial P}\right)_T$ using the relation $\mu = [(2a/RT) - b]/C_p$

Under what circumstances will ΔA equal ΔG .

[3+2]

10. **Compulsory Question** [2.5x1=2.5]

- I. In the equation $PV = 1/3 mnc^2$ what velocity does 'c' refer to? If 'c' in the equation $PV = 1/3 mnc^2$ was replaced by average velocity, calculate percentage of error.

OR

- II. With the help of an indicator diagram show that irreversible work of compression is greater than reversible work of compression.

Paper: IIA (F.M-12.5)

(Answer in separate answer-sheets)

Answer any TWO Questions from Question 11 to 14. Question 15 is compulsory.

11. (a) Why CO_2 is linear but H_2O is angular ? 3
(b) Why does bond angles in NH_3 and NF_3 differ? 2
- 12.(a) SiCl_4 can be hydrolysed but CCl_4 not ---- explain 3
(b) NaCl is ionic while LiCl is covalent ----- explain 2
13. (a) Write short note on π bond and σ bond 3
(b) What is Bent's rule? 2
14. (a) Explain the following order of acid strengths
 $\text{H}_3\text{PO}_2 > \text{H}_3\text{PO}_3 > \text{H}_3\text{PO}_4$ 3
(b) Which among the following bases is the weakest and why?
 $\text{Cl}^- , \text{I}^- , \text{Br}^- , \text{F}^-$ 2
15. **Compulsory Question** 2^{1/2}
Find out the ground term symbol of Cobalt (II) ion

OR

Write down the Born- Lande equation for lattice energy and explain each of the terms in it.

Paper: IIB (F.M-12.5)

(Answer in separate answer-sheets)

Answer any TWO Questions from Question 16 to 19. Question 20 is compulsory.

16. (a) Write down the confirmatory test of Fe^{3+} with reactions 3
(b) Which one of the following salts is water soluble? 2
 $\text{CuSO}_4 , \text{Cu}_3(\text{PO}_4)_2 , \text{CuS}$

17. (a) Write down the reactions related to Borax bead test 3
(b) Why concentrated HCl is used in flame test ? 2
18. (a) What happens when conc. H_2SO_4 and ethanol is added to the borate salt and the mixture is heated and the evolved gas ignited? Write down the relevant reactions 3
(b) What happens when $\text{K}_2\text{Cr}_2\text{O}_7$ and conc H_2SO_4 are added to the chloride salt and heated ? 2
19. (a) Write down the confirmatory reaction of sulphide ion in a sample 3
(b) Among the following salts which is insoluble in water? 2
 BaSO_4 , FeSO_4 , MnSO_4 , NiSO_4
20. **Compulsory Question** 2^{1/2}
How do you confirm the presence of Ni^{+2} ion in a solution?

OR

How do you confirm presence of PO_4^{3-} in a solution?