



Register Number:

Date: 28-11-2020

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27

B. Sc. CHEMISTRY - III SEMESTER

SEMESTER EXAMINATION: NOVEMBER 2020

CH 318 : CHEMISTRY

Time- 2 ½ hrs

Max Marks-70

NOTE: This paper contains four printed pages and three parts (twenty one questions).

Wherever reactions are required, structures must be given.

PART A

Answer any 6 out of 8 questions. Each question carries 2 marks. 6 x 2 = 12

- 1) Name the two factors on which the frequency of a given stretching vibration in an IR spectrum depends.
- 2) What is photoelectric effect? Elements from which group would exhibit this effect.
- 3) Mention any two structural features of graphite.
- 4) What is a plane of symmetry? Give an example of a molecule that does not possess a plane of symmetry.
- 5) Why does nitrogen show a catenation tendency lesser than that of phosphorus?
- 6) Give any two characteristics of a catalyst.
- 7) How are acids and bases defined in terms of Lowry-Bronsted concept? Give an example for each
- 8) Methanol is soluble in water, while decanol is insoluble in water. Why?

PART B

Answer any 8 out of 10 questions. Each question carries 6 marks. 8 x 6 = 48

- 9) (a) What are ionic or salt-like hydrides? How are they prepared?
(b) With a proper explanation, arrange BF_3 , BCl_3 and BBr_3 in the increasing order of Lewis acid strength?

(3+3)

- 10) (a) What is meant by diagonal relationship in the periodic table? Mention the reason for the diagonal relationship between Li and Mg. Give an example of another two elements that exhibit this relationship.

- (b) Explain how the conductance of alkali metal ions in aqueous solutions vary down the group. (3+3)
- 11) Draw the bond-line formula of atleast six constitutional isomers with the molecular formula $C_4H_{10}O$. Classify each compound according to its functional group.
- 12) (a) Compare the ring stability between cyclobutane and cyclopentane?
(b) Explain briefly the diastereomeric method of resolution of a racemic mixture. (3+3)
- 13) (a) Give the general electronic configuration of group 15 elements. With relevant examples give an account for the oxidation states exhibited by the Nitrogen and phosphorus of this group.
(b) At 0°C and 1 atm pressure, the volume of nitrogen gas required to cover a sample of silica gel, assuming Langmuir monolayer adsorption, is found to be $130\text{cm}^3\text{g}^{-1}$ of the gel. Calculate the surface area per gram of silica gel. Given that the area occupied by a nitrogen molecule is 0.162 (nm)^2 . ($V_m = 22.144\text{dm}^3\text{mol}^{-1}$) (3+3)
- 14) Explain with the help of a potential energy diagram, the rotation about the C_2-C_3 bond of butane, through 360° , starting with the least stable conformer?
- 15) (a) What are silicates? Draw the structure of a basic silicate unit of an orthosilicate and a pyrosilicate.
(b) Oxygen exhibits anomalous behavior in its group. Give any three unique characteristics exhibited by oxygen. (3+3)
- 16) (a) Give the structure of all possible stereoisomers of 2,3 – dibromopentane.
(b) Derive the rate expression for general acid catalyzed reactions. (3+3)
- 17) (a) Draw the two chair conformations of methylcyclohexane. Which form is more stable and why?
(b) Give the IUPAC nomenclature of the following compounds



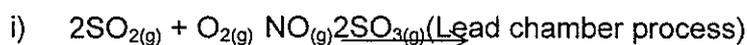
- (3+3)
- 18) (a) Draw and explain the orbital overlap picture of acetylene (Ethyne).
(b) Write the contributing resonance structures and resonance hybrid for the following:



PART C

Answer any 2 out of 3 questions. Each question carries 5 marks (2 x 5 = 10)

19) (a) Which of the following is not an example of homogeneous catalysis, and why?



(b) Justify the following in a sentence or two:

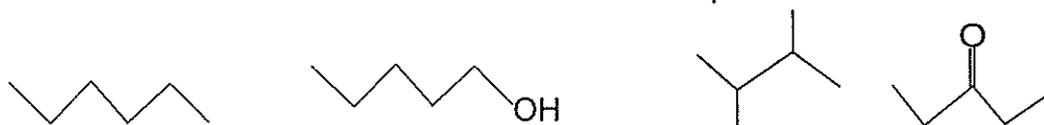
i) $\text{B}(\text{OH})_3$ is acidic while $\text{Tl}(\text{OH})_3$ is basic

ii) While Al, Ga, In and Tl form both covalent and electrovalent compounds, boron mostly forms covalent compounds.

(2+3)

20) (a) Account for the larger dipole moment of NH_3 (1.46D) as compared to that of NF_3 (0.24D)?

(b) Arrange the following compounds in order of increasing boiling points. Explain your answer in terms of intermolecular forces in each compound.

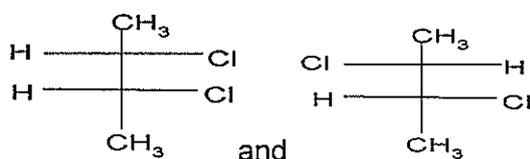


(c) Give the conjugate bases of the following compounds: CH_4 , NH_3 , H_2O , HF . Arrange these conjugate bases in the order of increasing basicity.

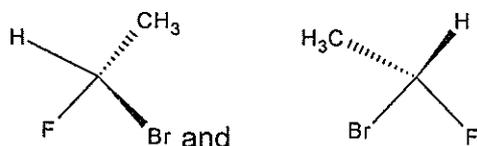
(1.5+1.5+2)

21) (a) Designate each chirality centre as (R) or (S). Identify the relationship between the following pairs, by describing them as enantiomers, diastereomers or two molecules of the same compound?

i)



ii)



(b) The flavor enhancer (S)—(+)— Monosodium glutamate (MSG) is used in many Chinese foods. It has a specific rotation of $+24^\circ$.

i) What is the specific rotation of (R)—(—)-monosodium glutamate?

ii) What is the specific rotation of a racemic mixture of MSG?

(3+2)

.....THE END.....

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