



Register Number:

Date: /10/2019

St. JOSEPH'S COLLEGE (AUTONOMOUS) BANGALORE-27

B. Sc, CHEMISTRY- III SEMESTER

SEMESTER EXAMINATION: OCTOBER - 2019

CH 318: CHEMISTRY

Instruction: This question paper has four printed pages and three parts (21 questions). A sheet with IR absorption frequencies is attached at the end of the question paper.

Time: 2.5 hours

Max. Marks: 70

PART- A

Answer **any six** questions.

2 x 6 = 12

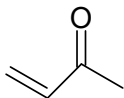
1. Classify the following objects as chiral or achiral: Hammer, screw driver, an ear, baseball bat.
2. Why are alkaline earth metals denser and harder than the alkali metals?
3. Why is the ionization energy of carbon in group 14 high, compared to silicon?
4. Write the following condensed structural formula as bond line representation.
(i) $\text{CH}_2=\text{CHC}(\text{CH}_3)_2\text{CH}_3$ (ii) $(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{OH}$
5. How does the physical state of group 15 elements vary down the group?
6. Name two allotropes of oxygen and sulphur.
7. Give two differences between physisorption and chemisorption.
8. Define homogeneous catalysis with an example.

PART B

Answer **any eight** of the following questions.

6 x 8 = 48

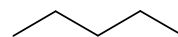
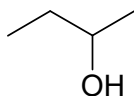
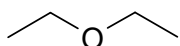
9. (a) Draw the resonance structures for the following molecule using curved arrow and the resonance hybrid. Which structure contributes more to the resonance hybrid and why?



- (b) Explain the structure of ethene, based on hybridisation of C atom.

(3+3)

10. (a) The following compounds have similar molecular weights. Arrange them in the order of increasing boiling points. Explain your answer.



- (b) Indicate the bond vectors in the following compounds. Which of the following

is/are polar? I) $\text{Br}_2\text{C}=\text{CCl}_2$ ii) SO_2 ii) CO_2 (3+3)

11. (a) Which would you expect to be the stronger acid, $\text{CH}_2\text{FCO}_2\text{H}$ or $\text{CH}_2\text{FCH}_2\text{CO}_2\text{H}$? Explain your choice.

(b) Classify as electrophiles and nucleophiles : NH_3 , H_2O^+ , BF_3 , Br^+ , NO_2^+ , OH^- . (3+3)

12. (a) Draw the structures of the following compound: i) 3-ethylcyclopentene ii) 5,5-dimethyl-2-hexene iii) 3-ethyl-1-pentyne.

(b) Discuss ring strain in cyclobutane. (3+3)

13. (a) Perform conformational analysis of ethane. Represent the most stable and the least stable conformations in Newman projection formula.

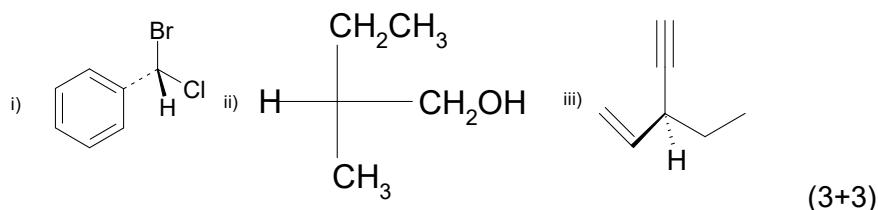
(b) Draw the chair conformations of axial and equatorial tert-butyl cyclohexane. Which is more stable and why? (3+3)

14. (a) List the following substituents in decreasing order of priority.

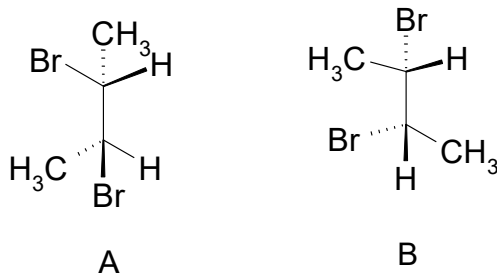
i) $-\text{Cl}$, $-\text{OH}$, $-\text{SH}$, $-\text{H}$ ii) $-\text{CH}(\text{CH}_3)_2$, $-\text{C}(\text{CH}_3)_3$, $-\text{H}$, $-\text{CH}=\text{CH}_2$

iii) $-\text{CH}_3$, $-\text{CH}_2\text{Br}$, $-\text{CH}_2\text{Cl}$, $-\text{CH}_2\text{OH}$

(b) Assign R, S configurations to the following structures.



15. (a) What is a meso compound? Which of the two A or B, is a meso compound? Why?



(b) Can compounds without chirality centre exhibit enantiomerism? Give an example of a compound to support your answer. (3+3)

16. (a) Give three salient points to show the resemblance of hydrogen with alkali metals and halogens.

(b) Briefly explain the hydration of alkali metal ions and its effect on their ionic conduction. (3+3)

17. (a) Arrange the following in the increasing order of their Lewis acid strength: BBr_3 , BF_3 , BCl_3 . Give reasons for the trend.

- (b) What are silicates? Draw the structure of the basic silicate unit of an orthosilicate and a pyrosilicate. (3+3)
18. (a) Give 3 differences that show the anomalous behaviour of oxygen compared to the other elements in the group.
(b) Derive rate expression for a general homogeneous acid-catalysed reaction. (3+3)

PART-C

Answer **any two** of the following questions.

5 X 2 = 10

19. (a) Draw the structures of possible constitutional isomers with molecular formula C_4H_{10} . Label primary, secondary and tertiary hydrogens in each structure.
(b) "The bond length is in between that of a double and triple bond" Discuss the above statement with reference to the electronic structure of Nitric oxide. (3+2)
20. (a) An organic compound with molecular formula $C_3H_6O_2$, gives IR absorption in $2800-3000\text{cm}^{-1}$ region, a strong peak in the $1710-1780\text{cm}^{-1}$ region and also a strong broad absorbance in the $2500-3500\text{cm}^{-1}$ region. Interpret the IR signals and propose a possible structure for the compound.
(b) State true or false "except in special cases, chemisorption must be exothermic". Justify your answer. (4+1)
21. (a) Give reasons for the following: (i) BeO and MgO are insoluble in water. (ii) The +1 oxidation state becomes more and more stable as we move down the group from boron to thallium. (1+3)
(b) Show how you can use BET equation to determine surface area. (1)

PTO for IR frequency data

TABLE 17.17.1

<i>Functional Group</i>	<i>Characteristic Absorption(s)</i> (cm^{-1})
Alkyl C-H Stretch	2950 - 2850 (m or s)
Alkenyl C-H Stretch Alkenyl C=C Stretch	3100 - 3010 (m) 1680 - 1620 (v)
Alkynyl C-H Stretch Alkynyl $\text{C}\equiv\text{C}$ Stretch	~ 3300 (s) 2260 - 2100 (v)
Aromatic C-H Stretch Aromatic C-H Bending Aromatic C=C Bending	~ 3030 (v) 860 - 680 (s) 1700 - 1500 (m,m)
Alcohol/Phenol O-H Stretch	3550 - 3200 (broad, s)
Carboxylic Acid O-H Stretch	3000 - 2500 (broad, v)
Amine N-H Stretch	3500 - 3300 (m)
Nitrile $\text{C}\equiv\text{N}$ Stretch	2260 - 2220 (m)
Aldehyde C=O Stretch Ketone C=O Stretch Ester C=O Stretch Carboxylic Acid C=O Stretch Amide C=O Stretch	1740 - 1690 (s) 1750 - 1680 (s) 1750 - 1735 (s) 1780 - 1710 (s) 1690 - 1630 (s)
Amide N-H Stretch	3700 - 3500 (m)

All figures are for the typical case only -- signal positions and intensities