

- iii) What is the major difference between electron affinity and electronegativity?
- iv) What is the basis of Mulliken scale of electronegativity?
- v) What do you mean by partial ionic character of a covalent molecule?
- vi) What is an ionic radius?
5. What do you mean by covalent radii and how it is related to the electronegativity of constituent atoms? Compare covalent radii and van der Waals radii and how these two are related to the bond distance? 1+2+2
6. What is electron affinity? Discuss the stability of O^{2-}/S^{2-} in the context of electron affinity. Why the noble gases have very high positive value of electron affinity? What does it signify? 1+2+1+1
7. Between Copper and Silver, which one has greater ionization potential and why? What are the anomalies observed in the case of Ga and Tl from the usual periodic trend of ionization potential of Group-13 elements? Discuss with reasons. $2\frac{1}{2}+2\frac{1}{2}$

FIRST B. SC. EXAMINATION, 2019

(1st Semester, Old Syllabus)

CHEMISTRY (HONOURS)**PAPER - II**

Time : Two hours

Full Marks : 50

Use a separate answer script for each group.

GROUP - A

1. Answer **any three** questions : 3×3
- a) Define 'Z' vs 'P' plot for a fixed mass of methane gas at a particular temperature which is lesser than its Boyle temperature. How will you explain this experimental finding?
- b) Define critical state of non-ideal gas. What will be the value of 'Z' of a non-ideal van der Waals gas? Use the expressions of its critical constants.
- c) A *van der Waals* gas cannot be liquefied above $32.3^{\circ}C$ by increasing pressure and minimum pressure required to liquefy the gas at that temperature is 48.2 atm . Find the radius of the gas molecule.
- d) What is *limiting density*? How will you determine molar mass of non-ideal gas using it?

[Turn over

[2]

2. a) Define *saturated vapor pressure* of a liquid ? Why the boiling point of liquid rises with increase of pressure ? 3
- b) What are *cohesion* and *adhesion* force ? Under What condition, the work of adhesion between solid and liquid is equal to the work of cohesion of the liquid ? 3
- c) "Highly viscous liquids are less volatile" –justify or criticize, 3

Or

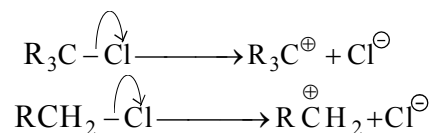
Find the change in surface energy when two identical Hg droplets of diameter 2 mm each are merged isothermally to form 1 drop (surface tension of Hg=49mN.m⁻¹). 2

GROUP - B

3. a) Justify the following statements :
- i) Phenyl cation is extremely unstable. 2
- ii) Intramolecular hydrogen bonding is preferred rather than intermolecular hydrogen bonding in 1,2 diols. 2
- b) What do you mean by molecularity of a reaction ? Explain your answer with an example. 2
- c) Predict the sign of ΔG^0 for an exothermic reaction where entropy is increased and comment on its spontaneity. 1

[3]

- d) **A** and **B** can react at a certain temperature to give the major product **C** (the kinetically controlled product). At a higher temperature they give the predominant product **D** which is the thermodynamically controlled product. Use standard free energy diagram to explain this behaviour. 3
- e) Assuming that R₃CCl and RCH₂Cl have comparable free energies, which one of the two reactions below will occur more rapidly ? Use an energy profile diagram to explain your answer. Predict a structure for the transition state in each reaction. 4



- f) With the help of π -MO picture of allyl anion, explain that its end carbons will react with electrophiles. 3

GROUP - C

Answer question no. 4 and *any two* from the rest.

1×6

4. i) What is lanthanide contraction ?
- ii) Why noble gases show very high ionization potential value ?

[Turn over