First B. Sc. Examination, 2018

(1st Semester, Old Syllabus)

Chemistry (Subsidiary)

Paper - IIS

Time : Two hours   Full Marks : 50

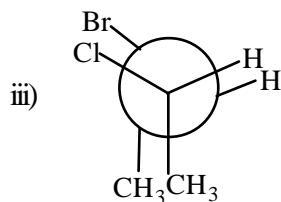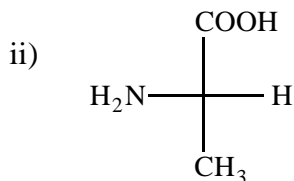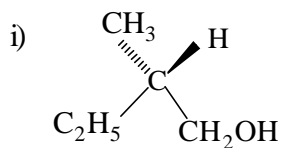Use a separate answerscript for each group.

GROUP - A

1. a) Explain the term 'contact angle' denoting the factors which govern its value when a liquid comes in contact with a solid in a gaseous atmosphere.   3

   b) To calm large waves, the sailors in ancient times used to pour oil over the sea – explain.   2

   c) By how much will the surface of a liquid be depressed in a glass tube of radius 0·02 cm if the angle of contact of the liquid is 135° and its surface tension 547 dynes / cm ? Density of the liquid = 13·5 g / c.c.   3

2. a) Write down Poiseuille's equation to measure the viscosity of a liquid. What is the condition to be satisfied for the above equation ?   3

   b) How does the viscosity of a liquid vary with temperature? Is this nature of a liquid different from gas ?   3

3. a) State Hauy's law with reference to crystallography.   1

   b) Draw the pictures of face centred and body centred cubic systems of a crystal.   2

[Turn over

GROUP - B

4. a) Draw the Fischer and Sawhorse projection of *threo*-3-bromo-2-butanol. 3

b) 3 gms of an enantiomer is dissolved in ethanol to make 100 ml of solution. Find out the specific rotation at $25^\circ C$ for sodium light (the O-line) if the solution has an observed rotation of $+2 \cdot 10^\circ$ in 10 cm polarimeter tube. 2

c) Designate the chiral center(s) of the following compounds with $\underline{R}/\underline{S}$ notations. *(any two)* 2

i)

$$CH_3 \quad H$$
$$C$$
$$C_2H_5 \quad CH_2OH$$

ii)

$$COOH$$
$$H_2N \rule[0.5ex]{2em}{0.4pt} H$$
$$CH_3$$

iii)

$$Br$$
$$Cl$$
$$H$$
$$H$$
$$CH_3 CH_3$$

d) Assign $\underline{E}/\underline{Z}$ configuration to the following compounds. 2

i)

$$CH_3 \quad Cl$$
$$H \quad C_2H_5$$

ii)

$$HOOC \quad COOH$$
$$C = C$$
$$H \quad H$$
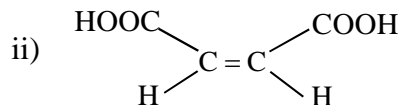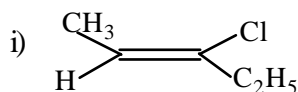
b) The dissociation energies of H-Br, 3·79 eV ; H-H, 4·52 eV; Br-Br 2·00 eV are noted. Hence, calculate the difference in Pauling electronegativity between hydrogen and bromine.

c) Calculate the Allred-Rochow electronegativity of Zn taking its covalent radius $1 \cdot 25$ Å (Z_{eff} (Zn) = 4·00).

d) Explain the trend of first ionization energy of the following elements (Ionization energy is noted in braces, kJ/mole) ; Li (520·3), Be(899·5), B(800·6), C(1086·4), N(1402·3), O(1314·0), F(1681·0).
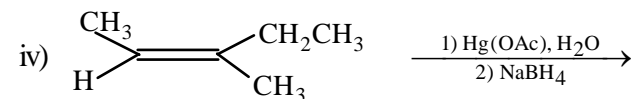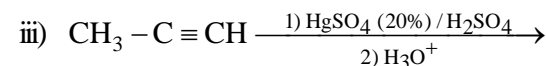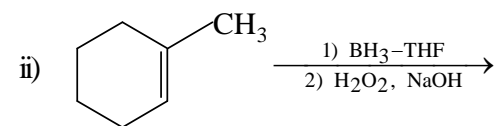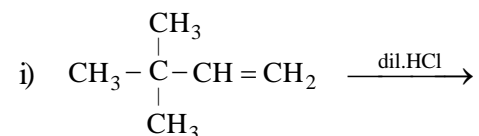
GROUP - C

6. Attempt *any five* questions :   2×5

a) On the Pauling scale, the electronegativities of Oxygen and Sulphur are 3·5 and 2·5 respectively. Why is sulphur less electronegative than oxygen ?

b) Why is Cl (0·99 Å) is smaller than Cl^- (1·81 Å), while reverse is true for Na (1·91 Å) and Na^+ (1·02 Å) ?

c) Calculate the univalent radii of Na^+ and F^- ions, if the internuclear distance between the ions in the crystal is 2·31 Å . (Shielding effect of $Na^+/F^- = 4·5$).

d) Although the second electron affinity of metals are negative, yet stable oxide ($O^=$) compounds are formed. – Explain.

e) How do atomic radii change within a Group and Period of the Periodic Table ?

f) Why C radius vary as follows :

$C(C_2H_6)$, 0·77 Å; $C(C_2H_4)$, 0·67 Å; $C(C_2H_2)$, 0·59 Å ?

7. Attempt *any two* questions :   3×2

a) How can electronegativity be used to determine the type of bond ? Predict the nature of bonds in NaCl and CCl_4 (Given, Electronegativity of C, 2·5 ; Cl, 3·0 ; Na, 0·9)

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5. a) Predict the product(s) of the following reactions with plausible mechanism *(any three)* $1\frac{1}{2}×3$

i)
$$CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH = CH_2 \xrightarrow{\text{dil.HCl}}$$

ii)
$$\xrightarrow[\text{2) } H_2O_2, \text{ NaOH}]{\text{1) } BH_3-THF}$$

iii) $CH_3 - C \equiv CH \xrightarrow[\text{2) } H_3O^+]{\text{1) } HgSO_4 \text{ (20\%) } / H_2SO_4}$

iv)
$$\xrightarrow[\text{2) NaBH}_4]{\text{1) Hg(OAc), H}_2O}$$

b) i) What is 'SBR' ? How it can be formed ? $\frac{1}{2}+1$

ii) What is biodegradable polymer ? Give an example.

                       $1\frac{1}{2}+\frac{1}{2}$