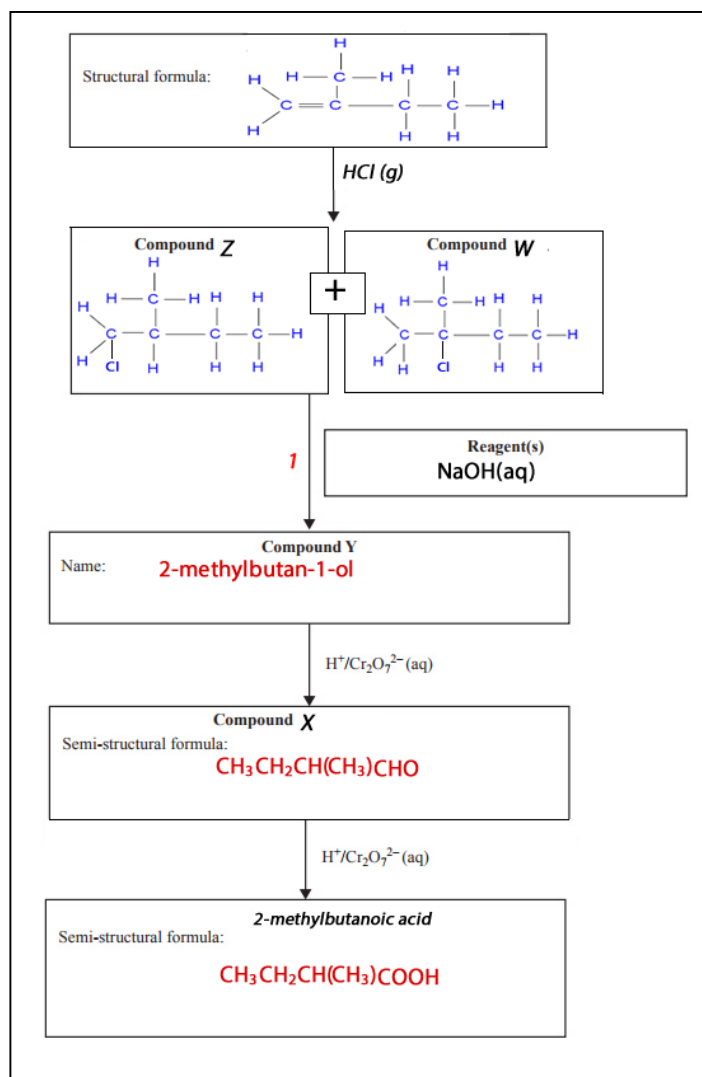Friday worksheet 11

Organic – pathways, reactions

1) Consider the image on the right.
   a) In the box provided on the right:
   i.   Draw the structural formula of 2-methylbut-1-ene

   ii. Draw the structural formula of compound Z.

   iii. Draw the structural formula of compound W

   iv. Write the name of compound Y

   v.   Write the semi-structural formula of compound X

   vi. Write the semi-structural formula of 2-methylbutanoic acid

   vii. Write the reagents for reaction labelled (1)

Structural formula:

HCl (g)

Compound Z   +   Compound W

Reagent(s)
NaOH(aq)

Compound Y
Name: 2-methylbutan-1-ol

$H^+/Cr_2O_7^{2-}$ (aq)

Compound X
Semi-structural formula:
$CH_3CH_2CH(CH_3)CHO$

$H^+/Cr_2O_7^{2-}$ (aq)

2-methylbutanoic acid
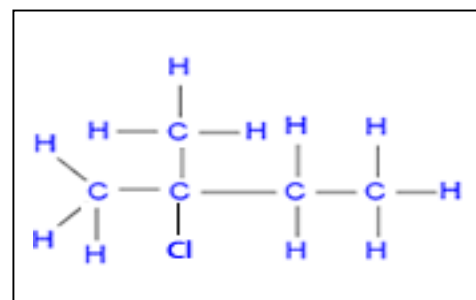Semi-structural formula:
$CH_3CH_2CH(CH_3)COOH$

b) Do compounds Z and W have isomers that will rotate plane-polarized light? Explain

Compound Z has one chiral centre so it will have two optical isomers.
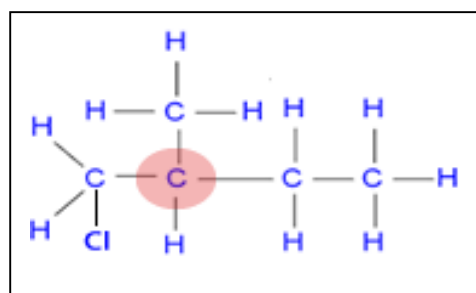
Compound W has no chiral centres, hence, has no optical isomers.

2) Consider the reaction $CH_3CHCH_2 + Cl_2 \rightarrow CH_3CHCl\ CH_2Cl$.

   a) Is this a redox reaction? Justify your answer.

   Yes

   *Cl_2 has an oxidation state of 0 and is reduced to an oxidation state of -1.*

   The carbon in CH_3CHCH_2 has an oxidation sate of -2 and in $CH_3CHClCH_2Cl$ has an oxidation state of -1.33 so it is oxidised.

   b) In the space provided on the right draw the repeating unit of the polymer formed by an addition reaction between 2-methylbut-1-ene monomers.
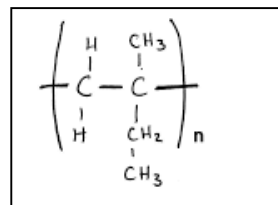
   c) In the space provided on the right draw the structural formula of the molecules stated in each box.

propan-1,3-diol
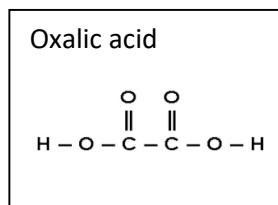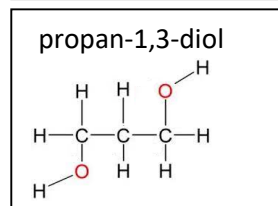
Oxalic acid

   d) In the space provided on the right draw the structural formula of the repeating unit of a polymer formed by the polymerisation of propan-1,3-diol and oxalic acid (HOOCCOOH) .
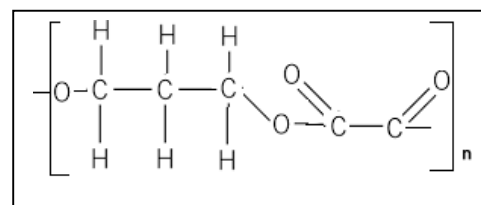
   i.   State the type of reaction that takes place to form the polymer.
        Condensation polymerisation

   ii. Calculate the molecular mass (g/mol) of a small unit composed of four monomers.
        Molecular mass of oxalic acid is 100 g/mol while 1,3-propandiol is 76 g/mol.
        => since two of each molecule is needed the combined mass of the four monomers is 352 g/mol.
   *=> 4 monomers will form four linkages*
        eg X-Y-X-Y
        => Since a water molecule is removed at every linkage formed we must now remove the mass of three water molecules
        => 352 – 54 = 298 g/mol

e) Consider a small section of a copolymer shown on the right formed by two different monomers.

   i. In the diagram on the right circle the functional group present in the copolymer
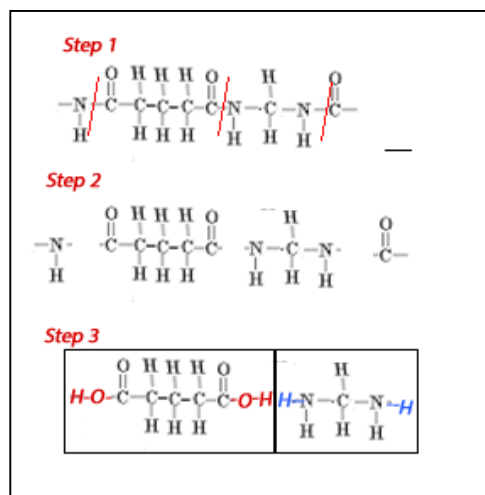
   ii. Name the functional group you circled.
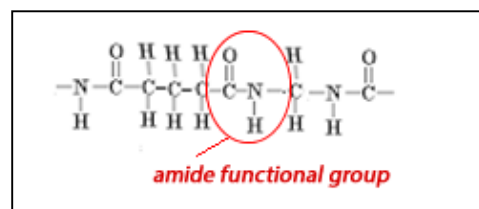
   iii. In the two boxes below draw the structural formula of each monomer.

   In order to decipher which monomers took part in the polymerisation reaction follow the steps below.
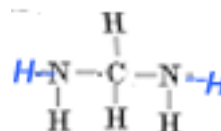
   Step 1 identify the amide links. Place a line through the N-C bond as shown on the right and split the polymer.

   Step 2 Separate the parts.

   Step 3 Add O-H to the ends with C=O and a H to the ends with N-H.

amide functional group

Step 1

Step 2

Step 3

methandiamine

pentanedioic acid