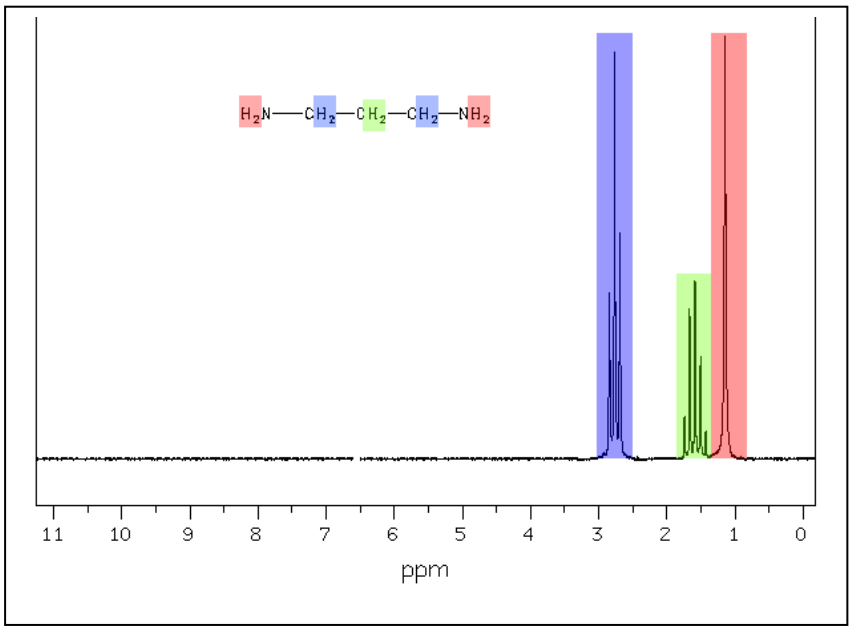
Revision for Organic Chemistry **Name: ……**

1) The following two reactions are part of an organic pathway .

1) Prop-1,2-diene $\xrightarrow{HCl}$ B

2) B $\xrightarrow{2NH_3}$ C + 2HCl

Below is the HNMR spectrum of compound C which has the molecular formula $C_3H_{10}N_2$

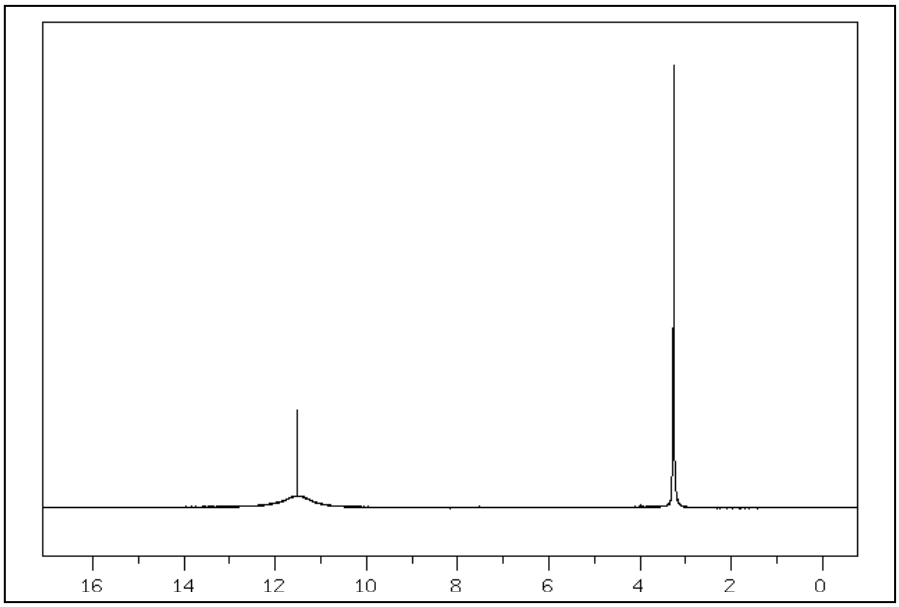


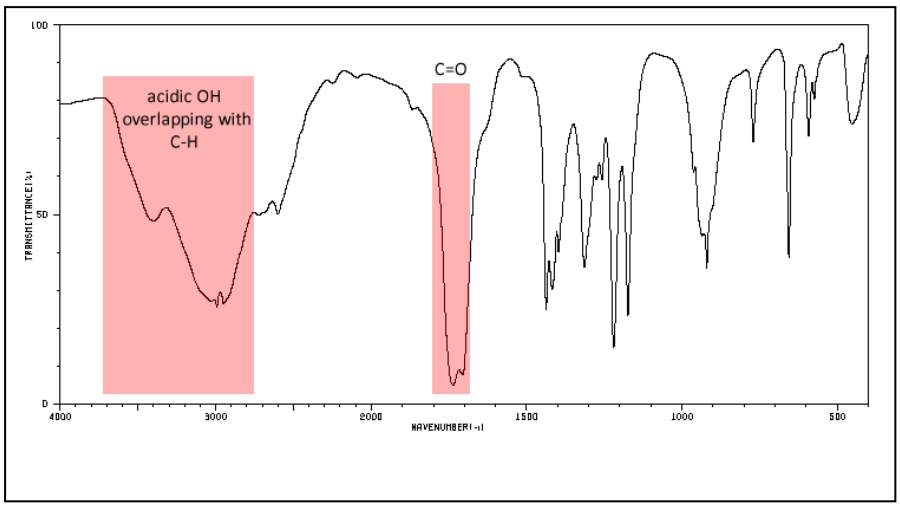
a) Identify compound C. Name and draw its structure.
The HNMR peak for Hs on an R-NH_2 is between 1-5 ppm, according to the data sheet.
propan-1,3-diamine

b) Name two other possible products of reaction 1 above.
Any of
2,2-dichloropropane
1,2-dichloropropane
1,1-dichloropropane
-

c) What type of reaction is reaction:
1 - *addition*
2 - *substitution*

d) Compound E has the molecular formula $C_3H_4O_4$ its HNMR and IR spectra are shown below.

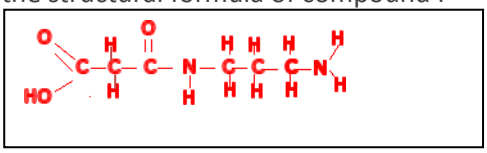




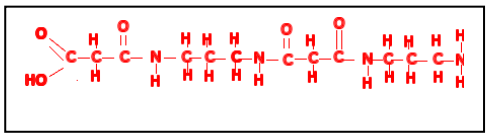
i. If 20.00 mL of a 1.00 M solution of compound E reacts with exactly 40.00 mL of a 1.00 M NaOH draw the structural formula and name compound E.
The IR indicates that COOH groups exist so the molecule is a carboxylic acid. The information given that for every 0.02 mol of acid 0.04 mol of NaOH reacts indicates that it may have two COOH groups.

ii. Compound E and compound C react according to the equation below.
$C + E \rightarrow H_2O + F$
According to the HNMR and the IR spectra compound E is most likely $HOOCCH_2COOH$

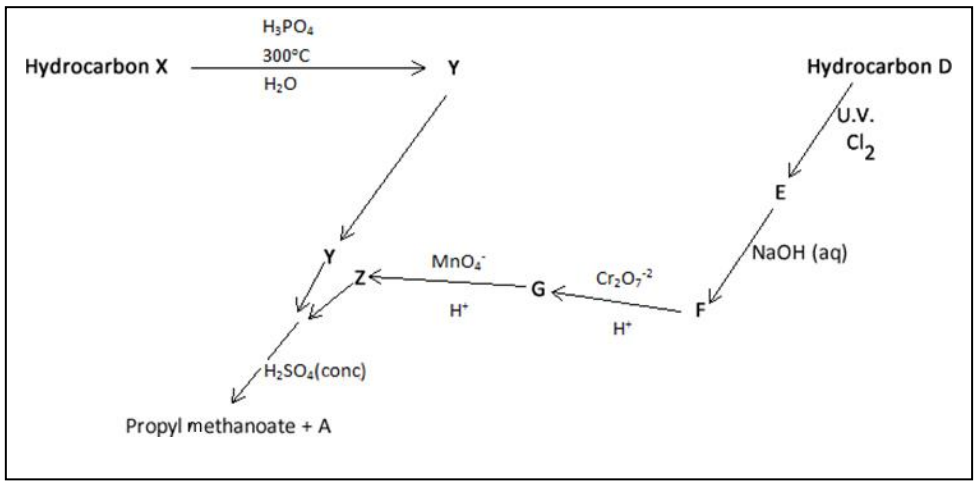
Draw the structural formula of compound F



iii. When more than one molecule of C and E react a long polymer is produced. Draw the structural formula of the polymer when two molecules of each compound react together.

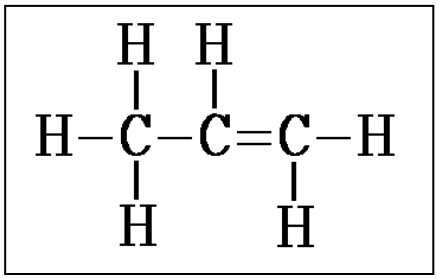


2) Below is the reaction pathway to synthesising propyl methanoate.

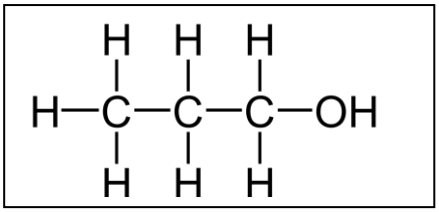


a) Draw the structural formulae of each of the substances below.

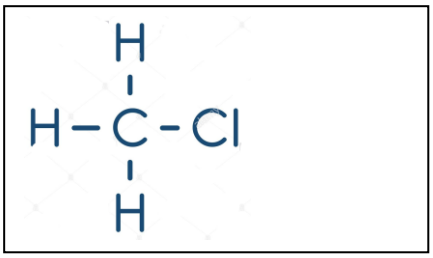
X



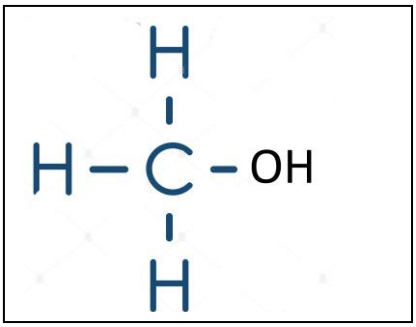
Y



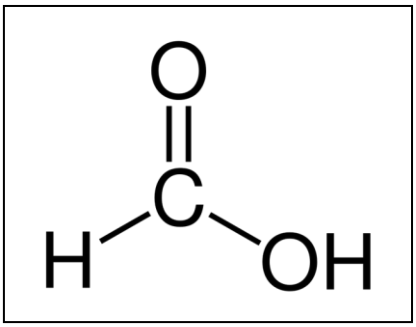
E



F



Z



b) What type of reaction forms each of the compounds, listed below.
Y -*Addition*
E - *Substitution*
F - *Substitution*
Z – *Oxidation*
Propyl ethanoate - *Condensation*

c) The reaction that forms G is a redox reaction where $Cr_2O_7^{-2}$ is converted to Cr^{3+}. This reaction is used in an experimental fuel cell.

i. Write the balanced equation for the half reaction that occurs at the:
Anode – $CH_4O \rightarrow CH_2O + 2H^+ + 2e$
Catode – $6e + 14H^+ + Cr_2O_7^{-2} \rightarrow 2\ Cr^{3+} + 7H_2O$

d) Identify substance A. H_2O

e) Consider the reaction that forms substance Y.

i. If 4.200 grams of substance X reacts completely to form 2.9 grams of substance Y calculate the percentage yield?

=> Percentage yield = (actual mass of product/Theoretical mass of product) X 100

Step 1 find the mol of prop-1-ene

=> 4.200/42.0 = 0.100

Step 2 find the mol of propan-1-ol

=> It is also 0.100 mol as it forms in a 1:1 mol ratio with prop-1-ene

Step 3 Find the mass of propan-1-ol

=> 0.100 X 60.0 =6.00 grams

Step 4 Find the % yield

=> 2.9/6.00 = 48% (2 sig figs)

ii. What is the percentage atom economy for the reaction?

% percentage atom economy = (Mass of desired product / mass of total reactants) X 100

Step 1 Write an equation

=> $C_3H_6 + H_2O \rightarrow C_3H_8O$

Step 2 Calculate % atom economy

=> (42 + 18) / 60) X100 = 100%

f) Consider substance Y

i. How many isomers exist for substance Y?

2

propan-2-ol , propan-1-ol

ii. How many of these isomers, if any, are optically active?

neither have chiral centres