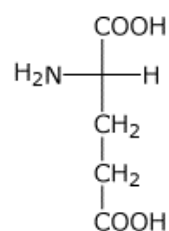Revision –organic pathways, naming organic compounds, analytical and food chemistry.

1. Consider glutamic acid, shown on the right.
   a. Give the IUPAC name for this amino acid

$$\begin{array}{c} COOH \\ | \\ H_2N - \!\!\!-\!\!\!- H \\ | \\ CH_2 \\ | \\ CH_2 \\ | \\ COOH \end{array}$$

b. Given that glutamic acid has an isoelectric point of pH 3.2, draw the dominant structure of the molecule in the solution of the given pH in the space provided on the right.

pH = 1	pH = 3.2	pH =10

c. A 4.23 g tablet, claiming to contain 53 %m/m glutamic acid ($C_5H_9NO_4$), is dissolved in a 200 mL volumetric flask and made to the mark with distilled water. A 20.00 mL aliquot was transferred from the volumetric flask to a conical flask and titrated against a 0.152 M NaOH. An average titre of 22.15 mL was obtained.
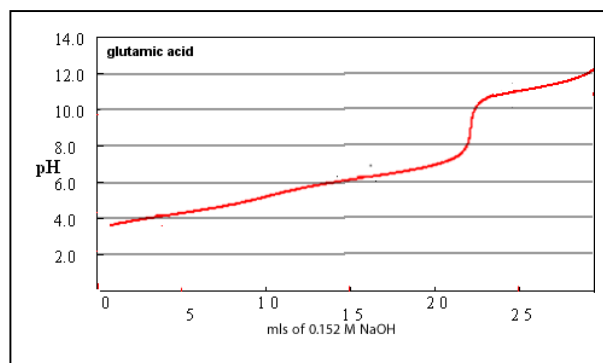
   i. Write a balanced chemical equation, with states, for the reaction that occurs in the conical flask between glutamic acid and NaOH.

   ii. Calculate the amount, in mol, of NaOH present in the average titre.

   iii. Calculate the amount, in mol, found in the volumetric flask.

   iv. Calculate the content of glutamic acid in the tablet in %m/m to the right number of significant figures.

d. The pH curve of the titration is shown on the right.

   i.   From the data booklet select an indicator that is best to use in this titration.

   ii. What is the colour change expected from the selected indicator in I. above?

e. Suggest how your answer to the %m/m of glutamic acid in the tablet would change if the following took place. Justify your suggestion. **Greater than, less than**, or **no change**

   i.   Phenol red was used as the indicator

   ii. The volumetric flask was rinsed with distilled water

   iii. Distilled water was used to rinse the 20 mL pipette used to deliver the sample from the volumetric flask to the conical flask.

   iv. A volume of 0.152 M NaOH was used to rinse out the burette prior to the titration.

   v.   Distilled water was used to rinse the conical flask prior to transferring the 20.00 mL sample into the flask.

2. Consider the organic pathway shown below.
a. Given that substance Q has the empirical formula C_2H_4O and it's ^{1}HNMR, IR and MS are shown on the next page, identify the following
i.   Q

ii. W

iii. Z

iv. J

v.   L

vi. X

vii. *Reagent 1*

viii. Reagent 2

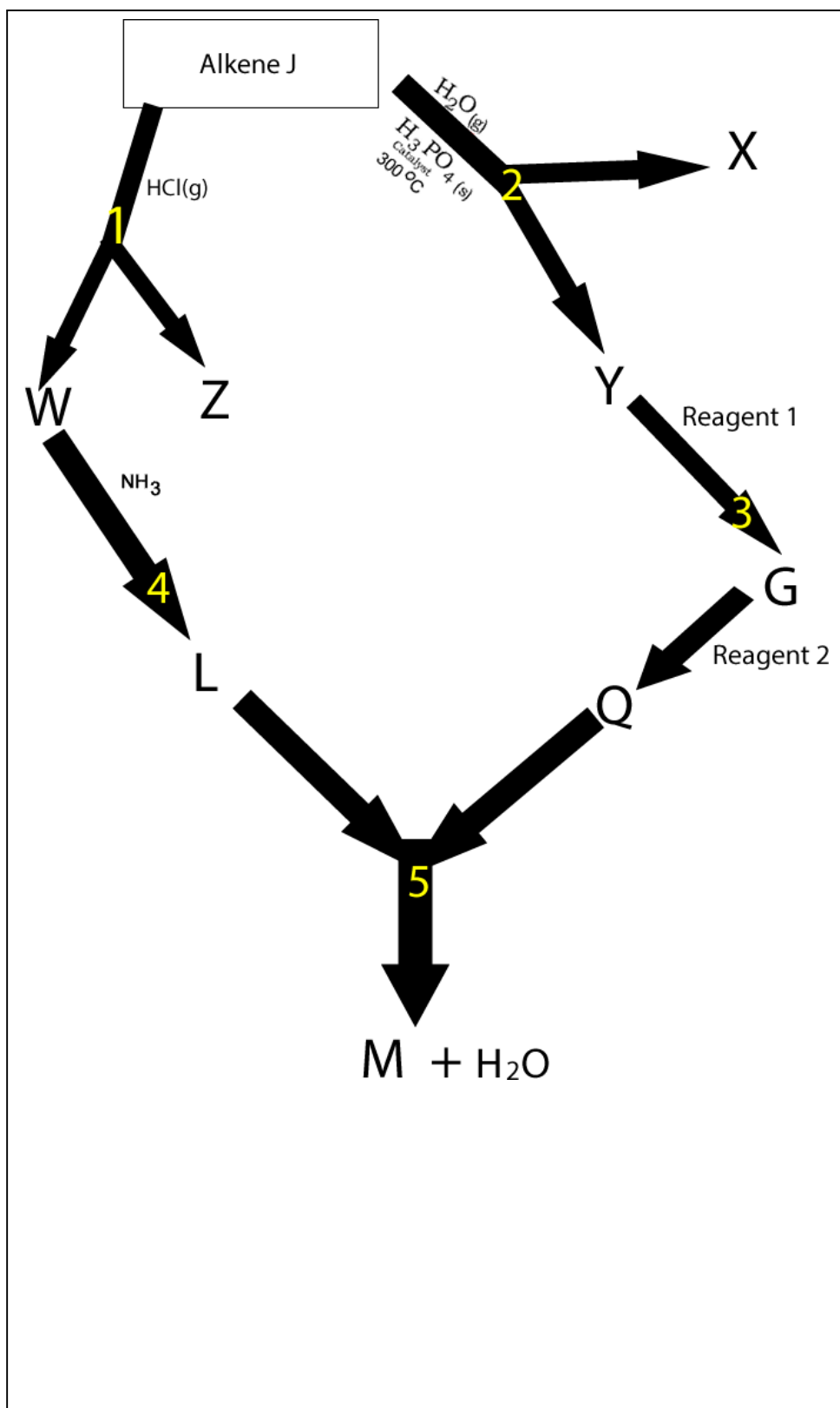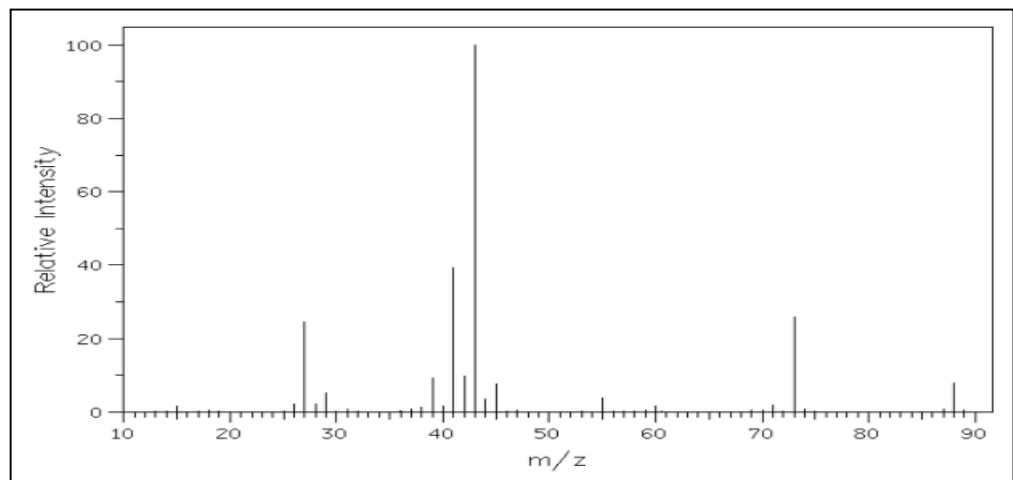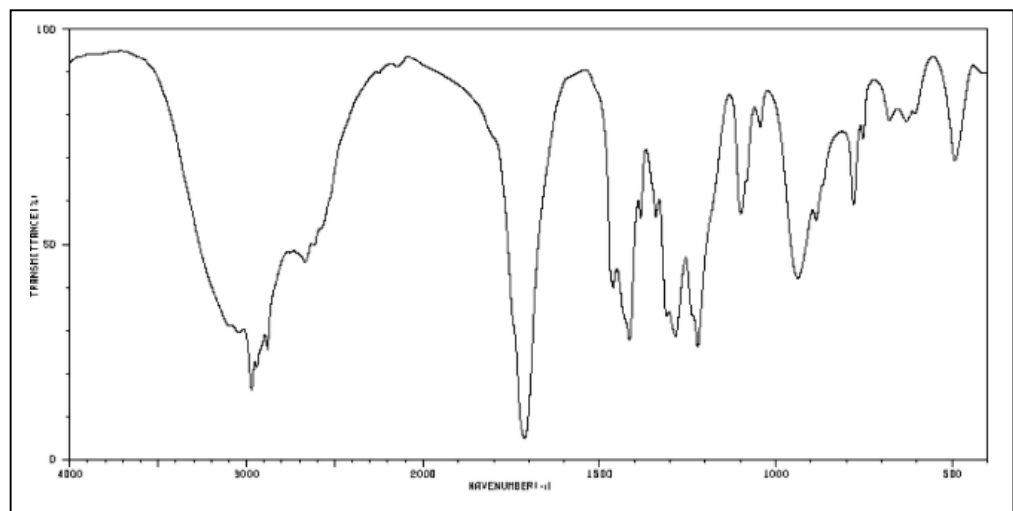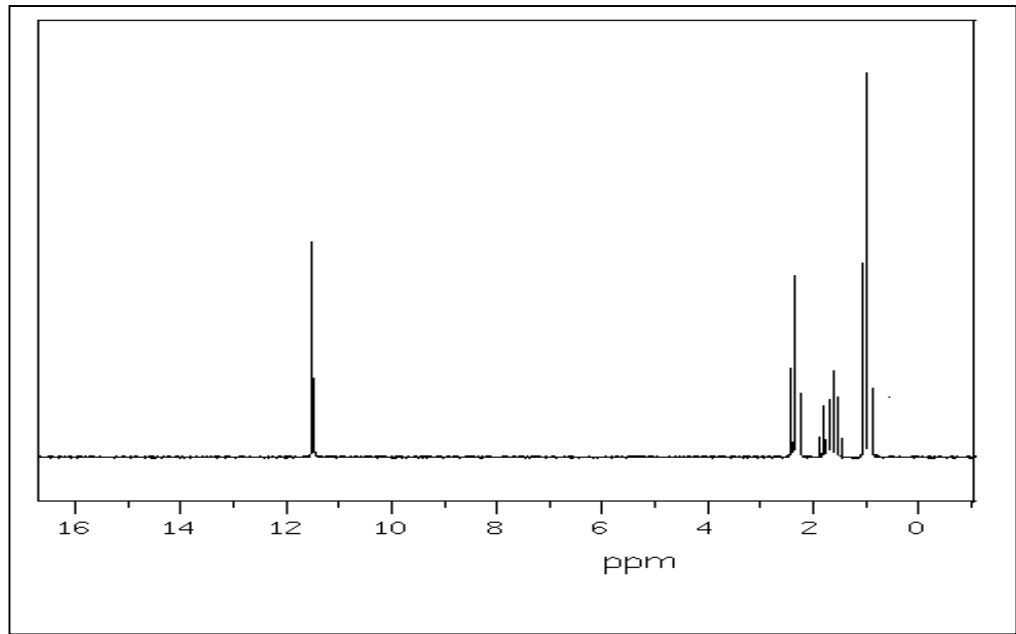b. Identify the type of reactions represented by:

i.   1

ii. 2

iii. 3

iv. 4

v.   5

Alkene J

HCl(g)

$H_2O_{(g)}$
$H_3PO_{4 (s)}$
Catalyst
300 °C

1

2

X

W   Z

Y

Reagent 1

NH3

3

4

G

L

Reagent 2

Q

5

M + H₂O

3. Consider the information given by the 3 spectra of compound Q.

   i.   What information can be derived from the parent ion peak of the mass spectrum of compound Q?

   ii.   Give the molecular formula of Q

   iii.   Give a possible fragment that caused the base peak.

   iv.   What information can be derived from the IR spectrum as to the class of compounds that Q belongs to?

   v.   How many hydrogen environments exist in compound Q?

   vi.   Draw the structural formula of compound Q

   vii.   Give the semi-structural formula of compound L

   viii. Give the semi-structural formula of compound M, circle and name one functional group present in the molecule.