

F324 Synoptic HW1

Compounds A to F are all isomers of $C_6H_{10}O_4$

- (a) Isomer A ($HOOC(CH_2)_4COOH$) is used to make nylon 6,6

Name A and draw the repeating unit of nylon 6,6

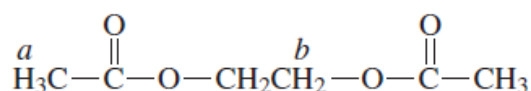
Draw the structure of the anhydride formed when one molecule of water is lost by one molecule of A (4 marks)

- (b) Draw the structure of Isomer B ($C_6H_{10}O_4$), a dicarboxylic acid which contains two chiral centres. (1 mark)

- (c) Isomer C is a propyl ester which also contains a carboxylic acid group.

Draw the structure of C (1 mark)

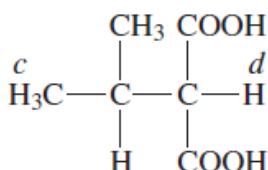
- (d) Isomer D is the diester shown below. Some of the protons have been labelled.



Deduce the number of peaks in the proton n.m.r. spectrum of D

Use Table 1 of the Data Sheet to predict the δ range of the peaks produced by the protons labelled *a* and *b*. (3 marks)

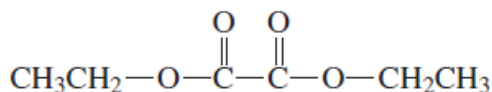
- (e) Isomer E is the dicarboxylic acid shown below. Some of the protons have been labelled.



The protons labelled *c* and *d* each produce a peak in the proton n.m.r. spectrum.

Name the splitting pattern of the peak due to the protons labelled *c* and name the splitting pattern of the peak due to the proton labelled *d*. (2 marks)

- (f) Isomer F is shown below.



The mass spectrum of Isomer F contains major peaks at $m/z = 45$ and $m/z = 29$

Draw the structure of the fragment which causes the peak at $m/z = 45$

Write an equation for the fragmentation of the molecular ion to produce the fragment which causes the peak at $m/z = 29$ (3 marks)

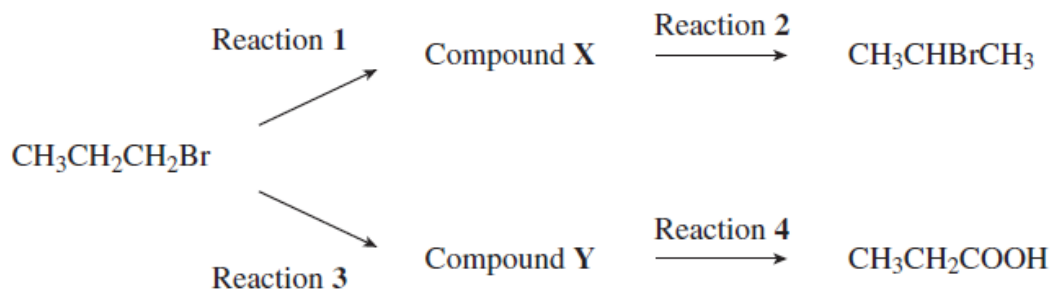
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Part 2

Consider the reaction sequences shown below.

Reaction 1 is an elimination.

Reaction 3 is a substitution.



Identify compounds X and Y.

Give reagents and conditions for each of Reactions 1, 2, 3 and 4.

(9 marks)