18. Carboxylic acids and derivatives

18.2 Esters

Paper 2

Question Paper

1 **(c)** Biodiesel **T** is a fuel made from vegetable oil **R**. Fig. 5.1 shows the production of **T** from **R** in a two-step process.

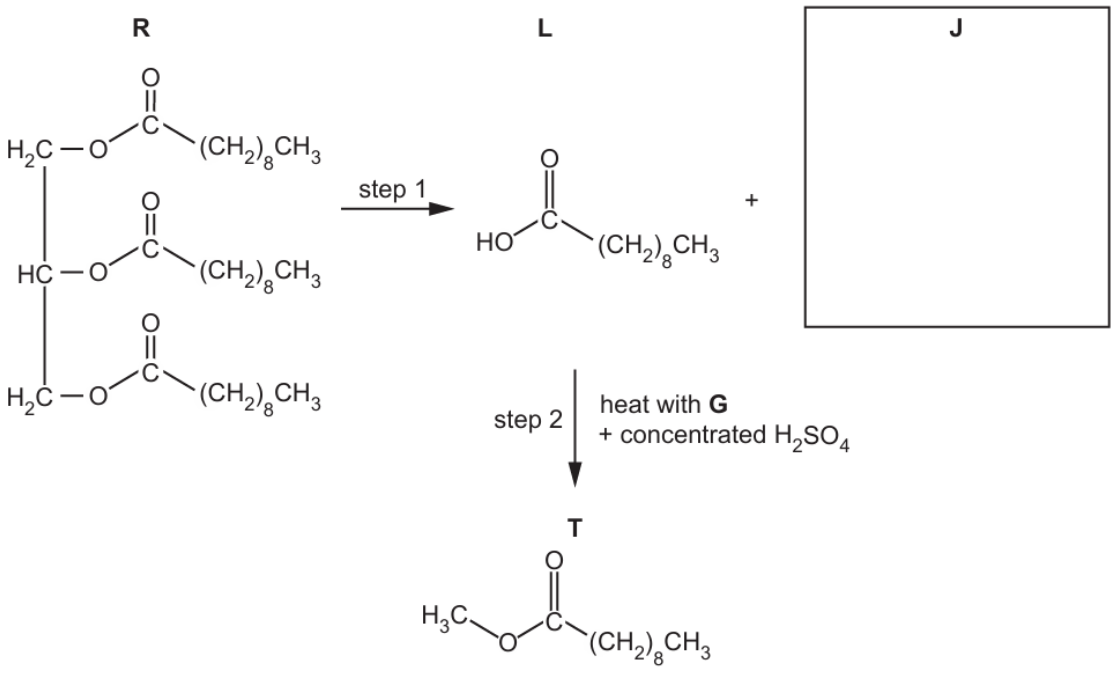


Fig. 5.1

(i) In step 1 all three ester groups in **R** react. Suggest a suitable reagent and conditions for step 1.

..... [1]

(ii) Draw the structural formula of **J** in the box in Fig. 5.1. [1]

(iii) Name the type of reaction that occurs in step 2.

..... [1]

(iv) Name organic reagent **G** used in step 2.

..... [1]

(v) **L** is called decanoic acid. Use systematic nomenclature to deduce the name of **T**.

..... [1]

2 **(d)** **D** reacts in the presence of a sulfuric acid catalyst to form **E** and water.

The structure of **E** is shown in Fig. 5.1.

E

Fig. 5.1

(i) Name the functional group present in **E**.

..... [1]

(ii) Identify the type of reaction that occurs when **D** reacts to form **E**.

..... [1]

(iii) Draw the structure of **D** in the box.

D

[1]

3 Phosphoric(V) acid, H_3PO_4, is used in both inorganic and organic reactions.

(c) Fig. 3.1 shows a reaction scheme that involves H_3PO_4 in several reactions.

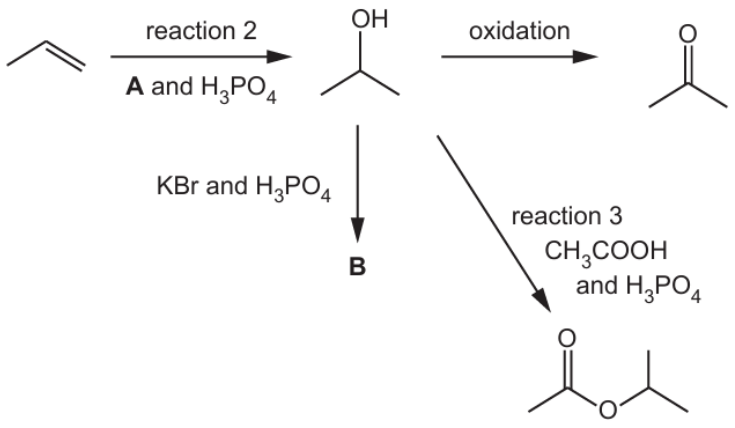


Fig. 3.1

(i) Identify **A**, which reacts with propene in the presence of H_3PO_4 in reaction 2.

..... [1]

(ii) Draw the structure of **B**.

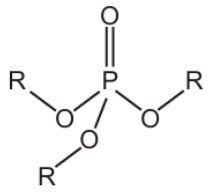
[1]

(iii) Name the type of reaction that occurs in reaction 3.

..... [1]

(d) H_3PO_4 also reacts with alcohols to form organophosphates.

Organophosphates are compounds similar to esters. They have the general structure shown in Fig. 3.2.



R = alkyl group

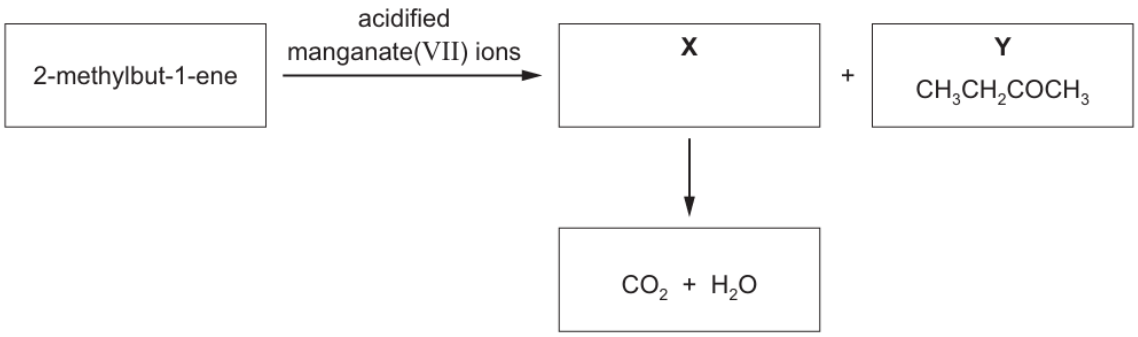
Fig. 3.2

(i) Complete the equation to suggest the products of the reaction of H_3PO_4 with methanol, CH_3OH.

$H_3PO_4 + 3CH_3OH \rightarrow$ ..... [1]

4 2-methylbut-1-ene reacts with acidified manganate(VII) ions, under specific conditions, to produce two organic compounds **X** and **Y**.

X immediately reacts with the acidified manganate(VII) ions to form carbon dioxide and water. **Y** has the structural formula $CH_3CH_2COCH_3$.



(g) Organic compound **W** is an ester which is a structural isomer of propanoic acid.

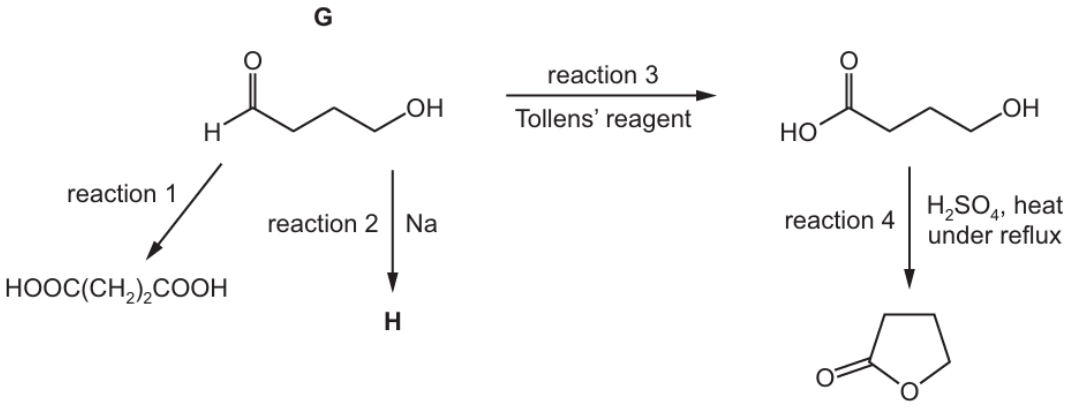
(i) State the molecular formula of **W**.

..... [1]

(ii) Draw a possible structure of **W**.

[1]

5 Some reactions of compound **G** are shown.



(a) (i) State the type of reaction that occurs in reaction 1.

..... [1]

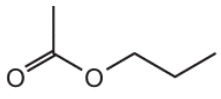
(ii) Suggest the reagent(s) and conditions required for reaction 1.

.....

..... [2]

6 Many naturally occurring esters are used as flavourings in food.

(a) The structure of ester **V** is shown.



V

V reacts with a reagent to form a salt of a carboxylic acid and an alcohol.

(ii) Identify a reagent that could be used in this reaction.

..... [1]

(iii) Draw the displayed formula of the alcohol made during this reaction.

[1]

(iv) State one other possible use for **V**, apart from as a food flavouring.

..... [1]