Chemistry 3.5, 2004

90698 Describe the structure and reactions of organic compounds containing selected organic groups

Credits: Four

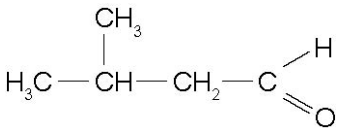
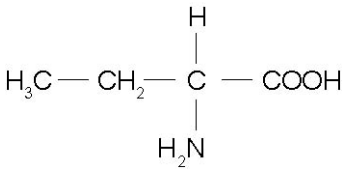
You should answer ALL the questions in this booklet.

Achievement Criteria	*For Assessor's use only*	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe the structure and reactions of organic compounds containing selected functional groups.	Apply principles of the organic chemistry of selected functional groups.	Analyse information and apply principles of organic chemistry to problems that require integration of ideas.
Overall Level of Performance		

You are advised to spend 40 minutes answering the questions in this booklet.

Question One: Organic compounds

a Complete the following table to show the systematic (IUPAC) name and structural formula for each of the four organic compounds.

(i) Structural formula: 	(ii) Structural formula:
Name:	Name: pentan–2–one
(iii) Structural formula: 	(iv) Structural formula:
Name:	Name: ethanoyl chloride

b Name the functional groups present in compounds (i) and (iii) in the table above.

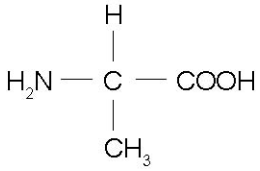
Compound (i)

Compound (iii)

c Compound (iii) can exist as two optical isomers (enantiomers). Draw 3-dimensional structures that clearly show the relationship between the two enantiomers.

d Describe similarities and differences in the chemical and physical properties of the enantiomers in part **c**.

e Compound (iii) in part **a** undergoes a condensation reaction with the following molecule (commonly referred to as alanine). It forms two different organic products referred to as dipeptides.



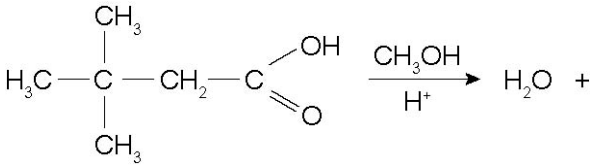
i Draw the structural formulae for the two possible dipeptides.

ii Explain why the formation of dipeptides is referred to as a '**condensation reaction**'.

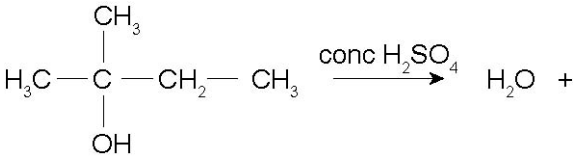
Question Two: Loss of water

a The following reactions involve the loss of water. Clearly show the **structure** of one major organic product of each of these reactions.

i



ii



b Identify the type of reaction that is occurring in each case above:

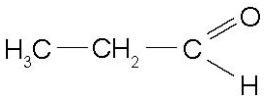
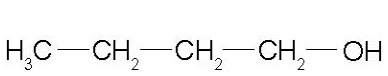
Reaction **a i** =

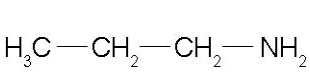
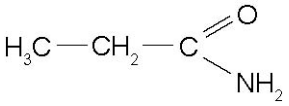
Reaction **a ii** =

Question Three: Practical identification

Describe chemical tests that could be used to distinguish between the compounds in each of the pairs of substances below. For each test description:
- include reagents used, and
- link the observed results to the reactions occurring at the functional groups present in the organic molecules.

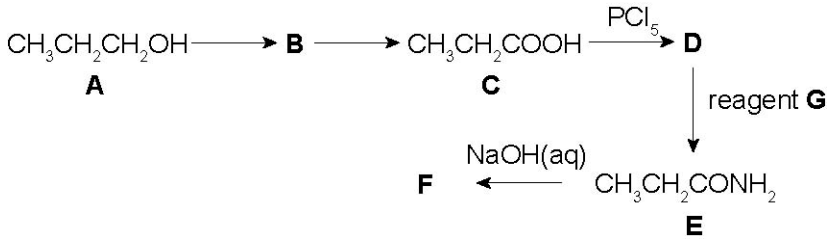
Do **NOT** use the same test more than once.

a  and 

b  and 

Question Four: Preparing an organic compound

The sequence below summarises, in part, the reactions for the preparation of an organic compound, F.



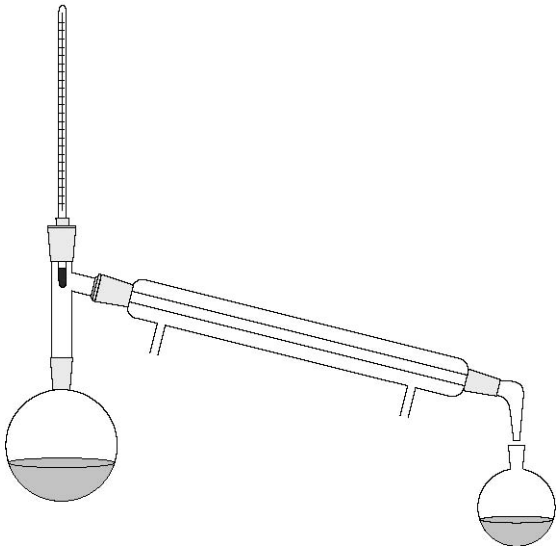
a Draw and name the structure of an **ester** molecule that is a structural isomer of compound C above.

Structure:

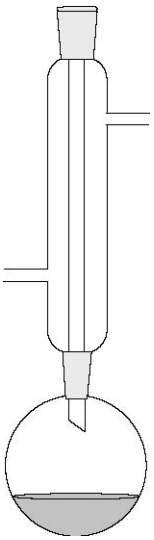
Name:

b Compound **A** can be directly converted to compound **C** by adding an oxidising agent and heating the mixture under reflux.

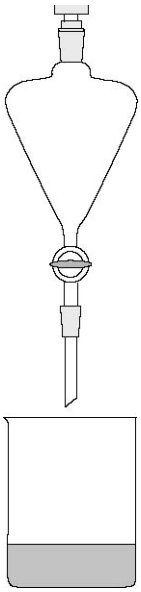
- Identify an appropriate oxidising agent, and
- select one of the diagrams below and use it to explain (in the space below) how the process of reflux works, and why the reaction is carried out this way.



(i)



(ii)



(iii)

Appropriate oxidising agent:

Diagram selected:

Explanation:

c The conversion of compound **A** into compound **C** initially involves formation of compound **B**.

i Draw the structural formula of compound **B** and name it.

Structure:

Name:

ii Describe how the conditions in part (b) could be modified to produce compound **B** rather than compound **C** as the major product. Give reasons for these modifications.

d Compound **C** is reacted with PCl_5 under anhydrous conditions to form compound **D**.

i Draw the structural formula of compound **D** and name it**.**

Structure:

Name:

ii What is meant by 'anhydrous conditions' and explain why such conditions are necessary for this reaction.

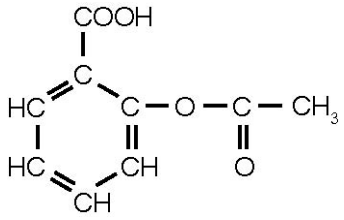
e **i** Name compound **E**.

ii Identify reagent **G**.

f Compound **E** can be hydrolysed by reaction with aqueous sodium hydroxide. Name the products of this hydrolysis reaction and draw the structural formula for each.

Question Five: Aspirin

Tablets for treating headaches and other pains often contain aspirin. The structural formula of aspirin is:



Packets of aspirin tablets often have an expiry date, or use-by date, after which their effectiveness is decreased. The decrease in effectiveness is more evident in warm, humid locations, especially when the bottle has been left open. A vinegary smell may be apparent.

Explain why hot, humid weather conditions will result in deterioration of the aspirin tablets. Include formulae and equations where appropriate.