

CHEMISTRY 3.5 Paper 2

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

Credits: Five

INSTRUCTIONS

Answer **ALL** questions

You are advised to spend about 50 minutes answering these questions.

Question One (Bursary 2001 Question 2: modified)

Vinyl chloride, $\text{H}_2\text{C}=\text{CHCl}$, is a toxic chlorinated hydrocarbon. It is the monomer from which the widely used polymer polyvinyl chloride (PVC) is made.

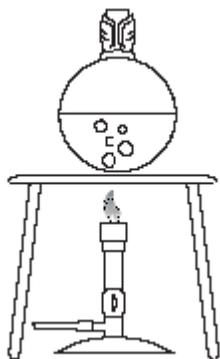
a Give the systematic name for vinyl chloride. **A** _____

The **first step** in the production of vinyl chloride is the reaction of ethene with chlorine gas.

b Write the equation, using **structural formulae**, for the reaction of chlorine gas with ethene. **A**

A pure compound can be separated from a reaction mixture by **distillation**.

c Complete the diagram below by sketching the apparatus that would be added to the flask to allow distillation to take place.

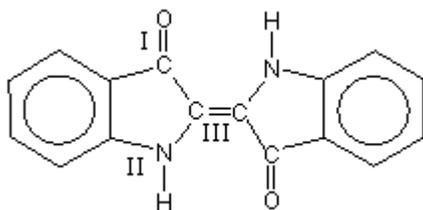


A M

Question Two (Bursary 2001 Question 3: modified)

From early times, people have used natural substances to colour themselves and their possessions. Many early dyes came from plants, among these being **indigo**, the blue dye used to colour denim jeans.

The structure of indigo is shown below.



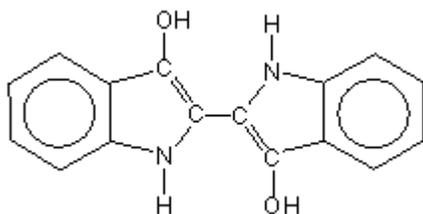
a Name the THREE functional groups labelled I, II and III in this molecule. **A M**

I _____

II _____

III _____

A reduced form of indigo is pale yellow and is soluble in water. It has the following structure.

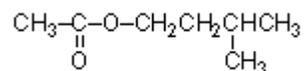


b What feature of this molecule makes it water soluble? **A**

Explain your answer. **M**

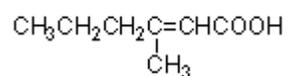
Question Three (Bursary 2001 Question 4: modified)

The odours of some fruits are due to a blend of esters. Banana oil contains the following ester.



- a** Draw the structure of another ester with the same molecular formula as the ester above. Name it. **A**

Scientists have identified the following compound as being responsible for underarm odour.

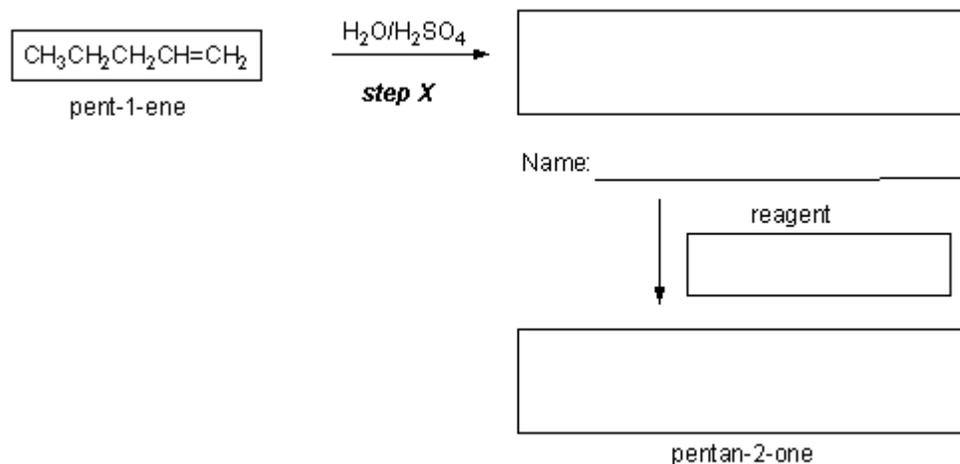


- b i** Complete the systematic name for this molecule (otherwise known as MHA). **A**
____-methyl____-2-enoic acid

In the laboratory, MHA can be synthesised from pent-1-ene.

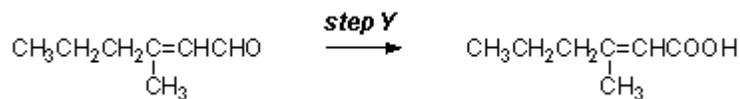
- ii** Draw the structure of a pentene molecule that has geometrical isomers. **A**

- c Complete the reaction scheme below for the conversion of pent-1-ene to pentan-2-one. **A M E**



Write the structural formula for the other possible organic product that could result from the reaction at **step X** and name it.

- d To make MHA, pentan-2-one is converted to an aldehyde. The aldehyde is then reacted further to give the acid.

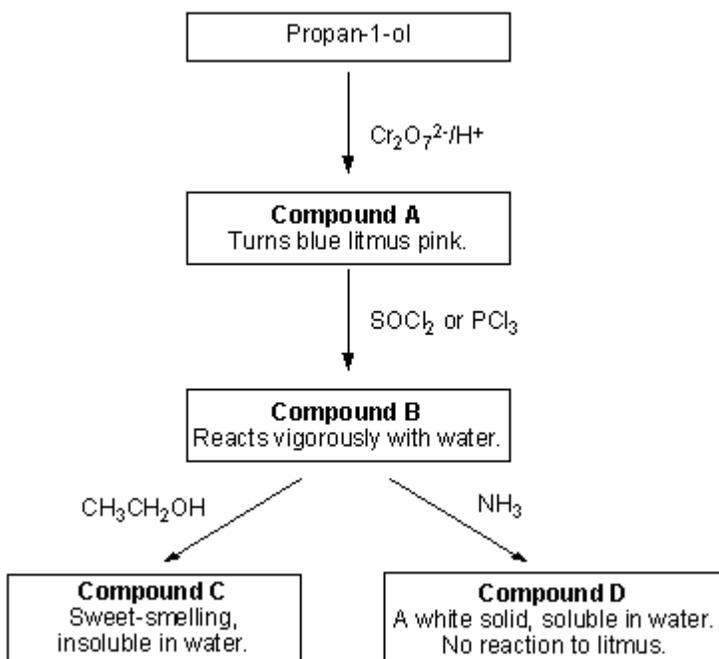


- i Give the name for the type of reaction occurring at **step Y**. **A**

- ii Identify the reagent(s) and condition(s) that could be used in the laboratory to identify an aldehyde. Discuss the expected observations. **A M E**

Question Four (Bursary 2001 Question 9: modified)

The following is a chart for a series of organic reactions.



a i Circle the classification from the list below which best describes the alcohol propan-1-ol. **A**

Primary

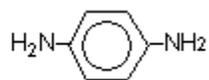
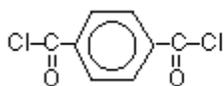
Secondary

Tertiary

ii Draw structural formulae for each of the compounds A – D given in the chart. **A M**

Compound	Structural Formula
A	
B	
C	
D	

Nomex is a polymer similar to nylon but with a much higher melting point. It is made from the monomers:



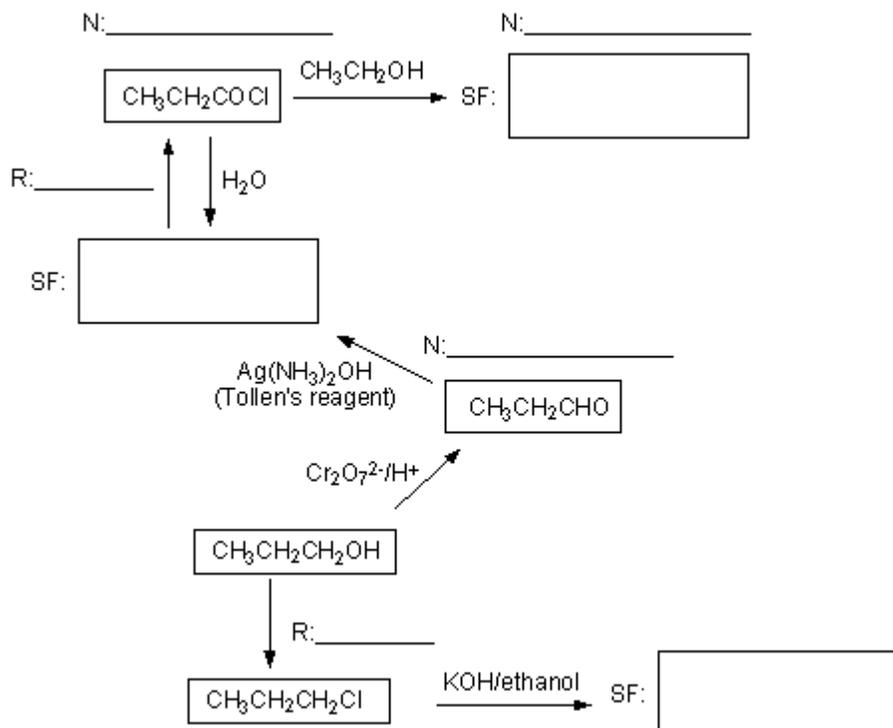
b i Draw the repeating unit of the Nomex polymer. **A**

ii Explain why this polymer is a condensation polymer. **M**

Question Five (Bursary 2000 Question 4: modified)

Complete the diagram below by entering:

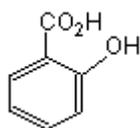
- a structural formula in the boxes labelled **SF**
- a reagent name or formula on the lines labelled **R**
- the names of the organic compounds on the lines labelled **N**



AME

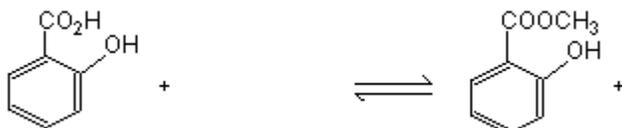
Question Six (Bursary 2000 Question 12: modified)

Salicylic acid can be prepared from the bark of willow trees. The structure of salicylic acid is shown below.



Salicylic acid can be converted to methyl salicylate (oil of wintergreen) which is used to treat minor muscle injuries.

- a i** Complete the equation for the reaction forming methyl salicylate by adding the **missing reactant** and the **missing product**. **A**

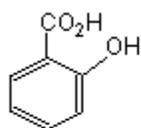


A catalyst is used in the reaction above to increase the rate. The usual catalyst is also a dehydrating agent that increases the yield of the methyl salicylate.

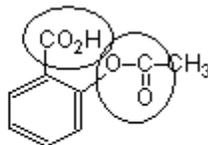
- ii** Name the substance commonly used as the catalyst. **A**

- iii** Explain how this substance also improves the yield of methyl salicylate. **M**

Salicylic acid can also be converted into the common painkiller called aspirin. The structures of salicylic acid and aspirin are shown below.



salicylic acid



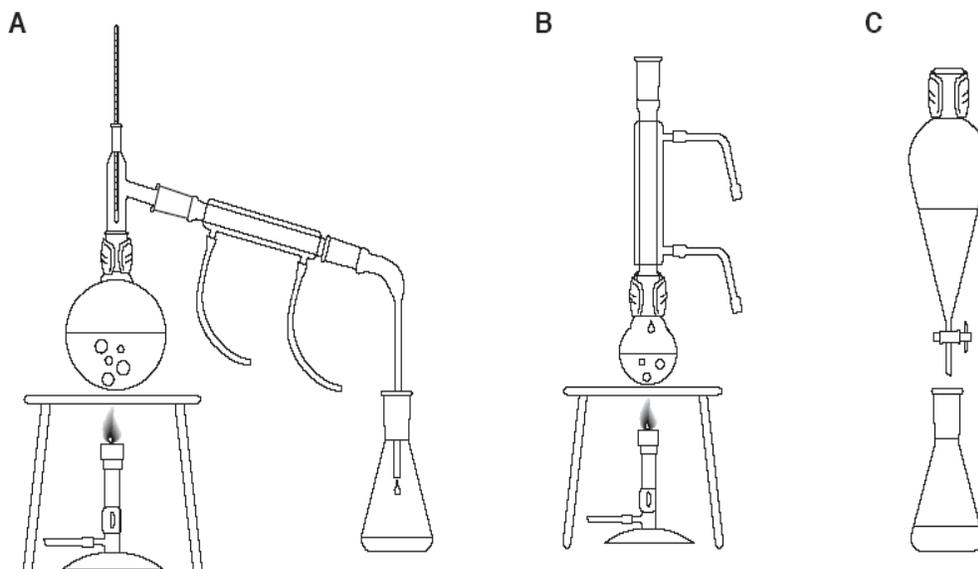
aspirin

- b i** Name the TWO functional groups circled on the structure of aspirin shown above. **A**

- ii Explain why both aspirin and salicylic acid are more soluble in aqueous sodium hydroxide than they are in water? M

Aspirin can be converted to salicylic acid by refluxing with dilute aqueous sodium hydroxide, followed by addition of acid.

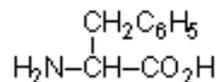
- c i Circle the letter of the equipment shown below that would be used to carry out the refluxing process. A



- ii Discuss why refluxing is preferable to boiling the reagents together in an open beaker. A M E

Question Seven (Bursary 2000 Question 13: modified)

Phenylketonuria (PKU) is a potentially lethal inherited disease. Babies suffering from PKU lack the ability to break down phenylalanine, an amino acid present in their diet. The structural formula of phenylalanine is shown below.



Phenylalanine exists as two enantiomers (optical isomers).

a i What structural feature must molecules have to exist as enantiomers? **A**

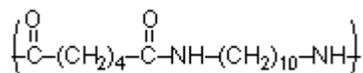
ii Give ONE physical property that is different for the two enantiomers of phenylalanine. **A**

b i Give the common name of the amino acid given below. **A**

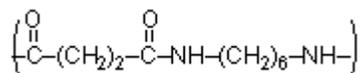


ii Draw structural formulae for the two dipeptides that form when phenylalanine combines with the amino acid shown in part **b i** above. **A M**

Nylons, like proteins, are polyamides. Nylon 6,10 is the name given to the polymer with the repeat unit shown below.



c i Complete the name given to the polymer that has the following repeat unit. **A**



Nylon _____ , _____

ii Circle the amide group in the structure shown in **i** above. **A**

iii When acid is splashed on nylon clothing, the fabric rapidly disintegrates. Explain why this happens. **A M**
