

2011 PRELIM ELUCIDATION

- 5 (c) **A** ($C_5H_9OC\ell$), an optically inactive chlorine-containing compound, is an intermediate used in the production of the drug chloroquine phosphate. Chloroquine phosphate is prescribed by doctors for preventing and treating malaria.

A gives a positive test with both 2,4-dinitrophenylhydrazine and aqueous alkaline iodine.

A reacts with sodium borohydride ($NaBH_4$) to produce **B** ($C_5H_{11}OC\ell$).

B reacts with concentrated sulfuric acid to produce **C** and **D**. **C** does not have any stereoisomers while **D** exists as a pair of geometric isomers.

E ($C_6H_{12}O_3$) is produced when **B** is warmed with potassium cyanide in ethanol, followed by warming with dilute sulfuric acid. On further heating with concentrated sulfuric acid, **E** produces a sweet smelling liquid **F** ($C_6H_{10}O_2$).

Deduce the structural formulae of **A** to **F**, stating the *type* of **each** reaction described above.
[9]

2011 PRELIM ELUCIDATION

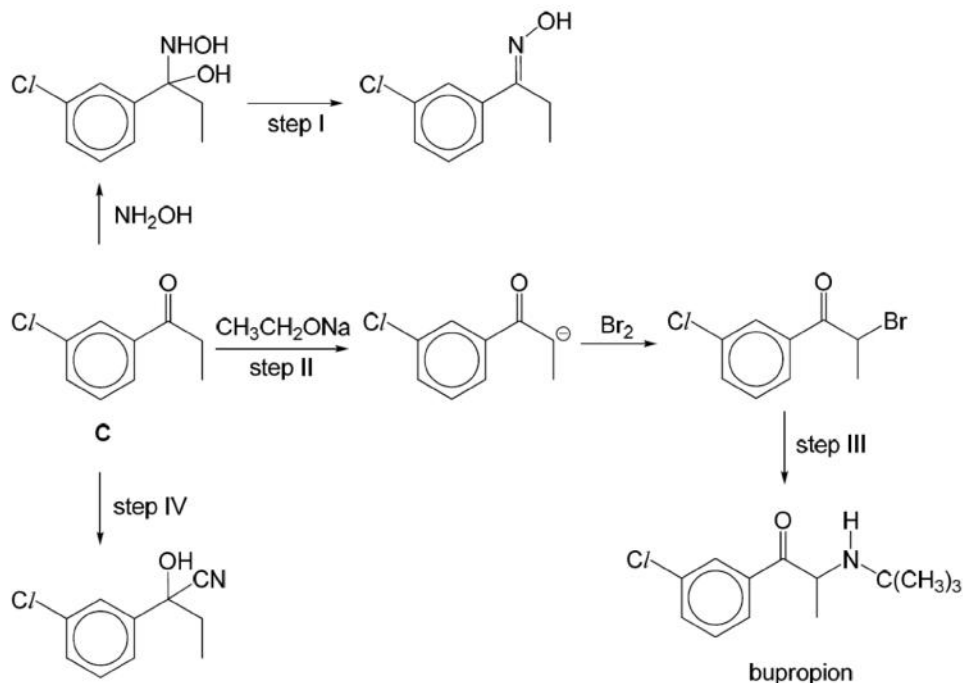
- (c) An organic compound **A**, $C_5H_8O_2$, gives a weakly acidic solution in water. When hydrogen bromide gas was reacted with **A**, a chiral compound **B**, $C_5H_9O_2Br$ was produced. On heating **B** with aqueous NaOH followed by concentrated H_2SO_4 , a sweet smelling neutral liquid **C** yielded. Compound **C** has the same molecular formula as **A**. When 1 mol of **A** was heated with $KMnO_4$ in dilute H_2SO_4 , 1 mol of an acidic gas was produced.

Deduce the structural formula of **A**, **B**, and **C**.

[6]

- 2 (a) This question is related to the chemistry of carbonyl compounds to form nitrogen-containing compounds.

Bupropion is an anti-depressant that was subsequently found to be useful as a smoking cessation aid. It reduces the severity of nicotine cravings and withdrawal symptoms. It can be synthesised from compound **C**, from which many derivatives of bupropion can also be synthesised.

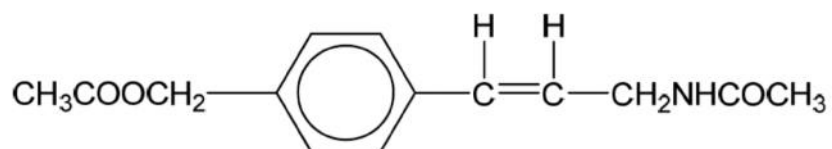


- Suggest the type of reaction occurring in step I.
- Name the type of reaction in step III and state the reagent(s) and condition(s) involved.
- Given that bupropion is basic, without using fractional distillation, suggest a reagent and a suitable separation technique that you will use to isolate the product bupropion from the reaction mixture. Describe what you will observe in the process.
- Suggest the reagents and conditions required in step IV and state and describe the mechanism of this step.
- Based on your answer in **a(iv)**, suggest and explain whether the product of step IV is optically active or optically inactive.

[12]

2011 PRELIM ELUCIDATION

- (e) Compound **E**, $C_{10}H_7NO$ can exhibit geometric isomerism. **E** can react with silver diamine but not Fehling's solution. On reacting **E** with lithium aluminium hydride, **F**, $C_{10}H_{13}NO$ is formed. **F** is readily soluble in acid. 1 mole of **F** reacts with 2 moles of ethanoyl chloride to give the compound below:



When **E** is heated with dilute sodium hydroxide, the dried product is a white crystalline solid, **G**, $C_{10}H_7O_3Na$.

Deduce the structural formula of **E**, **F** and **G**, explaining your reasoning.

[7]