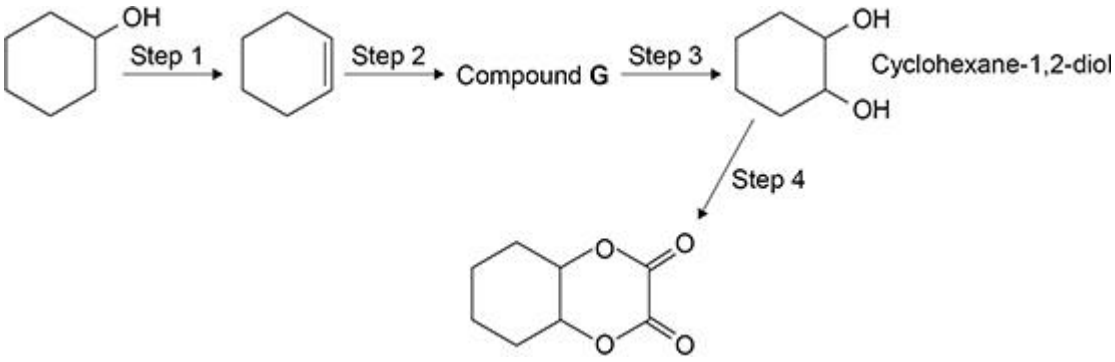
Q1.

This question is about making a diester from cyclohexanol.



(a) State the type of reaction in step **1**.

Give the name of the reagent needed for step **1**.

Type of reaction _____

Reagent _____

(2)

(b) State the reagents needed and give equations for step **2** and step **3**.

Show the structure of Compound **G** in your equations.

Step 2 reagent _____

Step 2 equation

_____

Step 3 reagent _____

Step 3 equation

_____

(4)

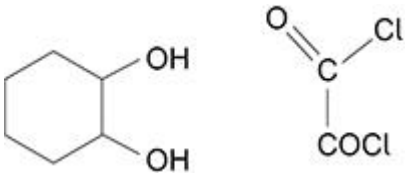
(c) Cyclohexane-1,2-diol reacts with ethanedioyl dichloride.

Give the name of the mechanism for this reaction.

Complete the mechanism to show the formation of **one** ester link in the first step of this reaction.

Mechanism name _____

Mechanism



(5)

(d) Suggest why chemists usually aim to design production methods
- with fewer steps
- with a high percentage atom economy.

Fewer steps _____

_____

_____

High percentage atom economy _____

_____

_____

(2)

(Total 13 marks)

Q2.

A two-step preparation of propylamine is shown.

bromoethane → **X** → propylamine

What is **X**?

A $CH_3CH_2CH_2NH_2$ ⬭

B CH_3CH_2CN ⬭

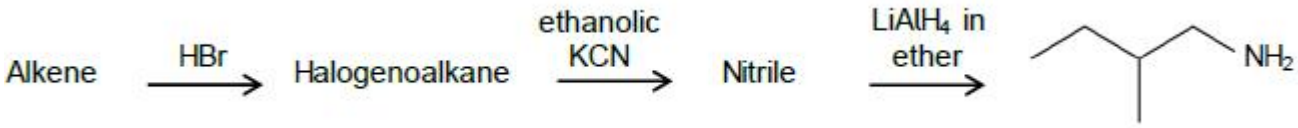
C $CH_3CH_2CH_2Br$ ⬭

D $CH_3CH_2NH_2$ ⬭

(Total 1 mark)

Q3.

2-Methylbutylamine can be synthesised from an alkene.



What is the identity of the alkene?

A But-2-ene ⬭

B Methylpropene ⬭

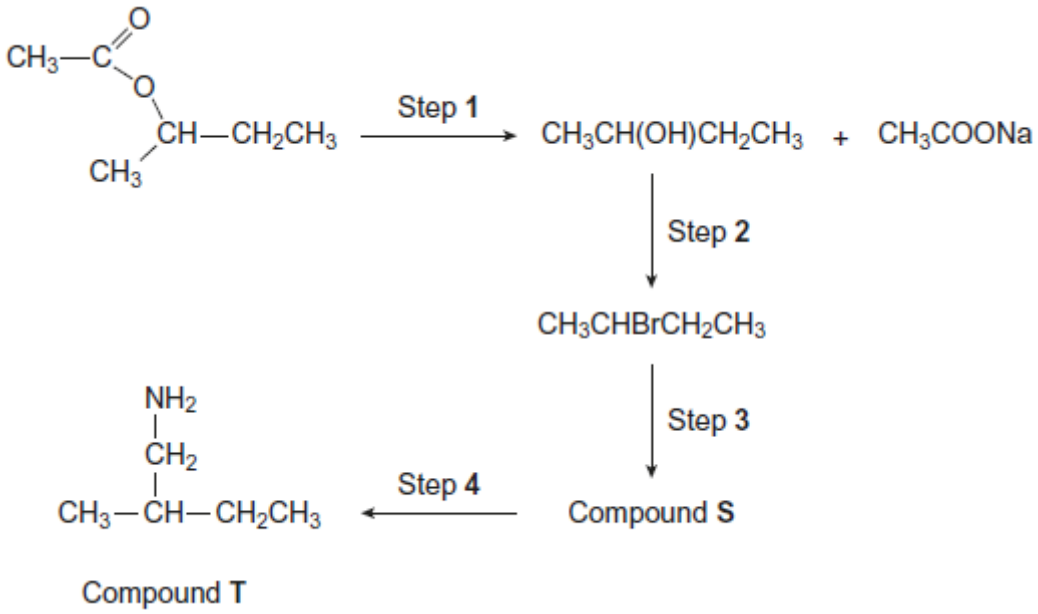
C 2-Methylbut-1-ene ⬭

D 2-Methylbut-2-ene ⬭

(Total 1 mark)

Q4.

A four-step synthesis of compound **T** is shown.



(a) Give the reagent and conditions for Step **1**.
State how you could obtain a sample of the alcohol from the reaction mixture formed in Step **1**.

_____

_____

_____

_____

_____

(3)

(b) Draw the structure of compound **S**.
For each of Steps **3** and **4**, give a reagent and one condition, other than heat.

(5)