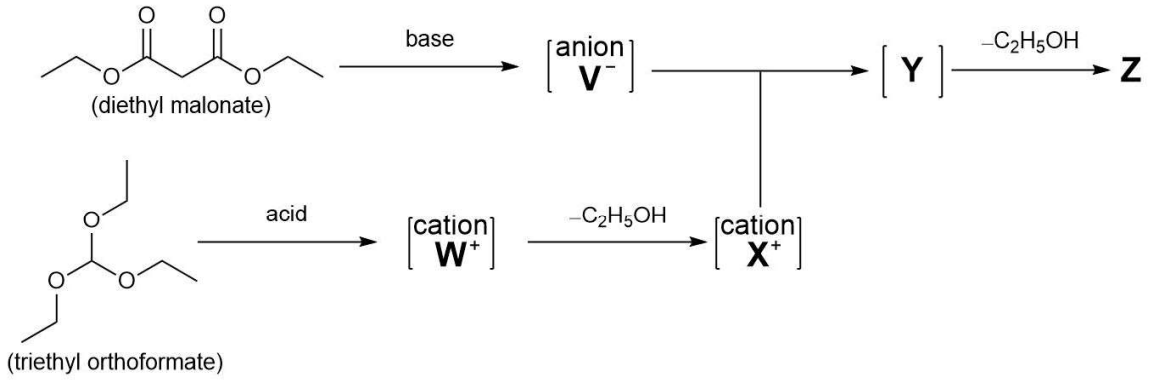
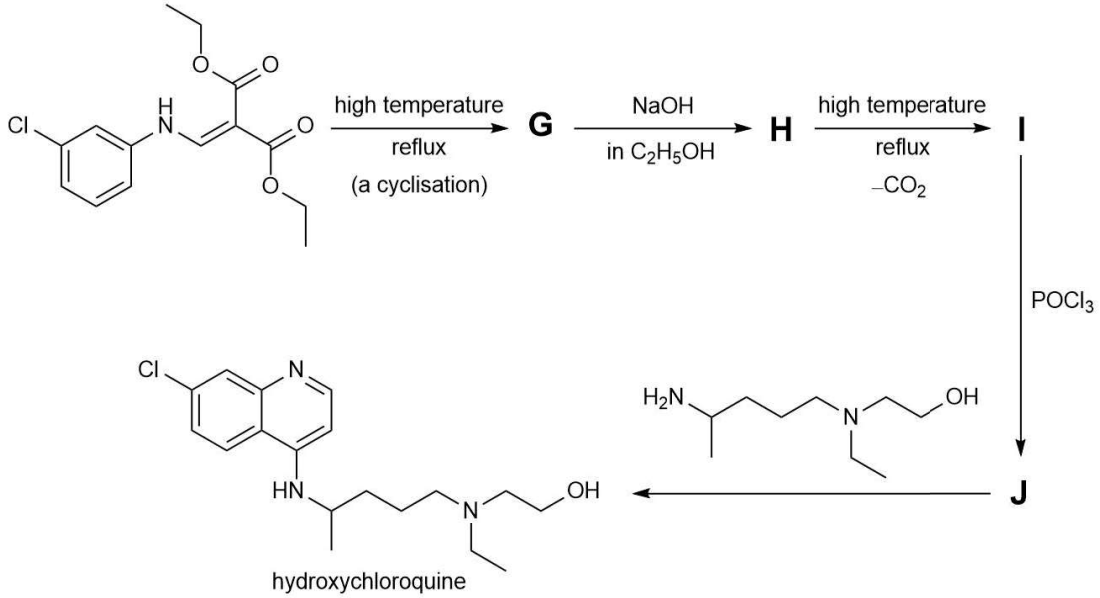
Reagent **Z** is synthesised as shown below. When treated with a base diethyl malonate forms anion $\mathbf{V^-}$. When treated with an acid triethyl orthoformate forms cation $\mathbf{W^+}$. Cation $\mathbf{W^+}$ fragments, losing ethanol to give cation $\mathbf{X^+}$. Anion $\mathbf{V^-}$ and cation $\mathbf{X^+}$ then combine to form intermediate **Y**, which loses a further molecule of ethanol to form **Z**.




**(e)** Draw the structures of anion $\mathbf{V^-}$, cation $\mathbf{W^+}$, cation $\mathbf{X^+}$, intermediate **Y**, and reagent **Z**.

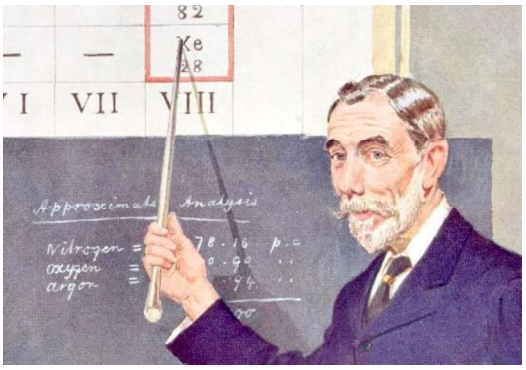
The final part of the synthesis is shown below.




**(f)** Draw the structures of **G**, **H**, **I**, and **J**.

**6. This question is about fluorides of xenon**

At the time of its discovery by Scottish chemist Sir William Ramsay, the noble gas xenon was considered to be inert. It has since been discovered that xenon will react with strong oxidants. For example, xenon reacts with fluorine gas, forming a series of fluorides, $XeF_2$, $XeF_4$ and $XeF_6$.




**(a)** Write an equation for the formation of xenon tetrafluoride.

The structure of xenon tetrafluoride has six electron pairs on xenon and therefore the structure is based on an octahedral configuration.

**(b)** Draw a dot-and-cross structure of xenon tetrafluoride.

**(c)** Draw the two possible three-dimensional arrangements of the electron pairs on xenon in xenon tetrafluoride and tick the one adopted.

**(d)** Draw the possible three-dimensional arrangements of the five electron pairs on xenon in xenon difluoride and tick the one adopted.

The kinetics of the formation of xenon difluoride from xenon and fluorine has been studied under various conditions. The following table shows the instantaneous reaction rates at 120 °C for different initial concentrations of the reagents. Assume the volume of the reaction vessel is constant.

| $n_{Xe}$ / mol | $n_{F_2}$ / mol | $10^5 \times$ rate / mol dm$^{-3}$ s$^{-1}$ |
|---|---|---|
| 1.0 | 5.0 | 3.6 |
| 1.0 | 10.0 | 3.6 |
| 2.0 | 10.0 | 7.2 |

**(e)** What is the rate equation for the formation of xenon difluoride?