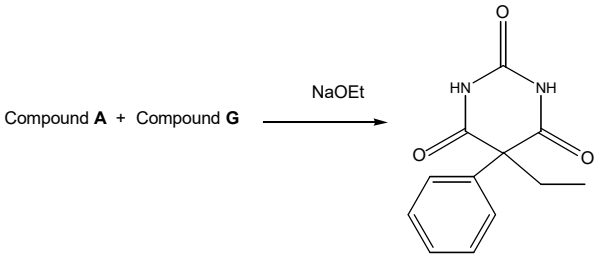
5. This question is about the synthesis of phenobarbital

Barbiturates are derivatives of *barbituric acid* which act as central nervous system depressants. Barbiturates are used in the treatment of seizure disorders. One example of a barbiturate that has been used as an anti-convulsive for many years is phenobarbital.

Phenobarbital can be synthesised from two compounds, **A** and **G**:



Phenobarbital

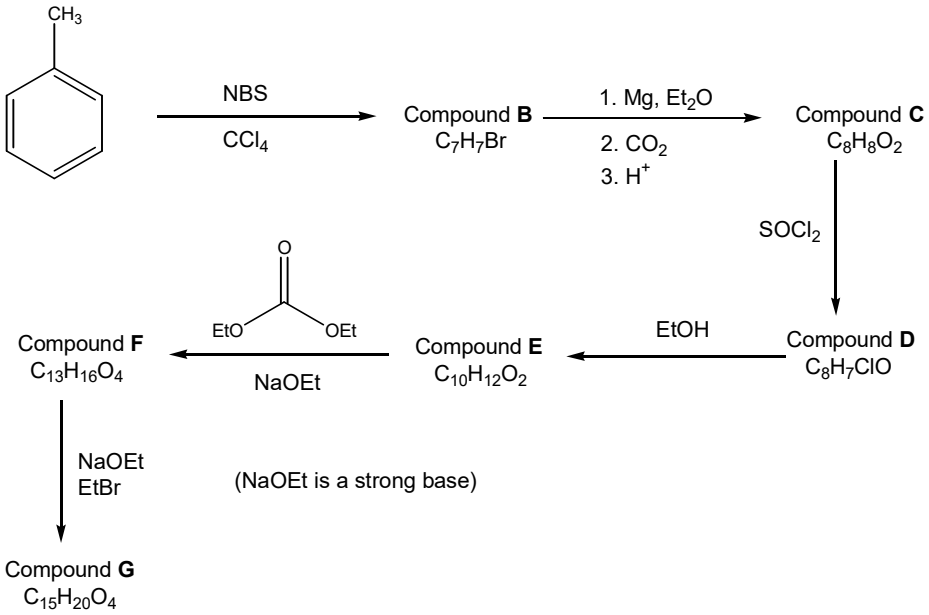
a) Compound **A** can be found as a metabolite in human urine.

Use the information below and in the introduction above to determine the molecular formula of compound **A**. Show clearly the important steps in your working. [4]

- Combustion of a 0.250g sample of compound **A** produces 0.178g of CO_2 and 0.146g of H_2O.
- A further 0.250g sample of compound **A**, when boiled with an excess of alkali, liberates all the nitrogen as ammonia, NH_3. The ammonia generated in this reaction is sufficient to neutralise 40.8cm^3 of 0.200 mol dm^{-3} aqueous hydrochloric acid.
- Mass spectrometry shows that compound **A** has a relative molecular mass of 60.

Compound **G** can be synthesised as follows:

[Note: NBS is *N*-bromosuccinimide - a source of bromine radicals and Et = ethyl]



b) In your answer booklet, draw the structural formulae of compounds **A** – **G**. [7]