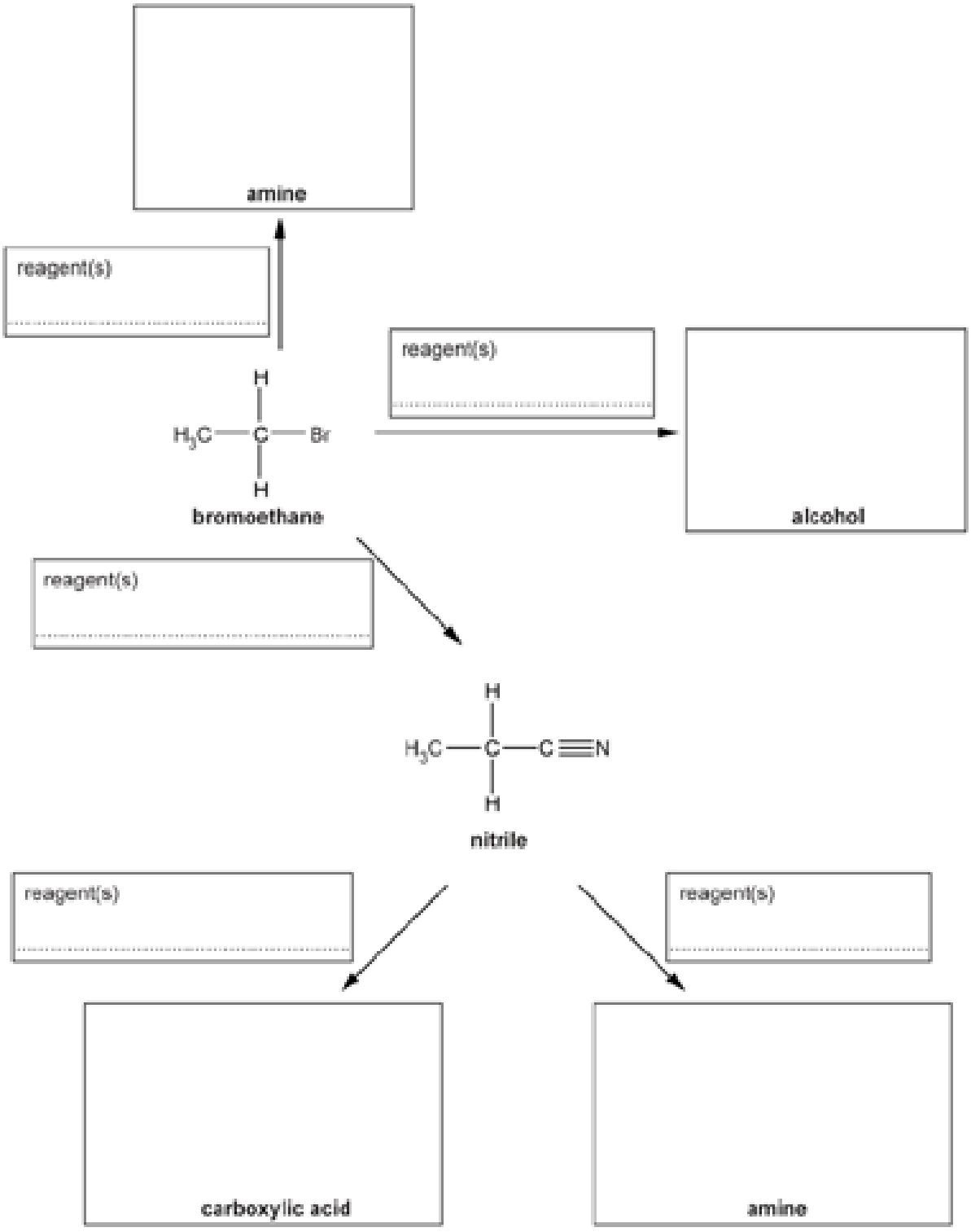
1. Complete the flowchart by filling in each box.



[9]

2. 1.35 g of ethylamine gas, $CH_3CH_2NH_2$ (M_r = 45.0), is reacted with 20 cm^3 of 2.0 mol dm^{-3} hydrochloric acid forming a solution of ethylammonium chloride.

$CH_3CH_2NH_2(g) + HCl(aq) \rightarrow CH_3CH_2NH_3^+(aq) + Cl^-(aq)$

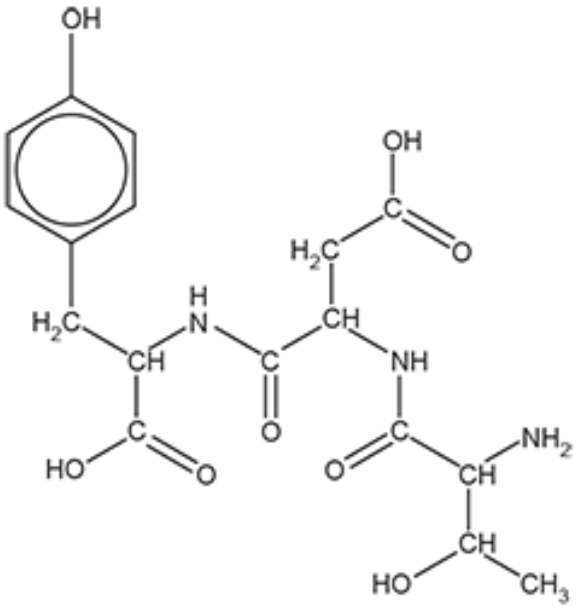
What is the concentration of ethylammonium chloride in mol dm^{-3}?

A 0.03
B 0.67
C 1.50
D 2.00

Your answer ☐ **[1]**

3. This question is about α-amino acids.

Three α-amino acids can react together to form compound **E**, shown below.



Compound E

i. How many optical isomers are possible for compound **E**?

---

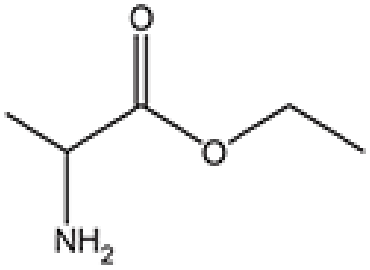
[1]

ii. A student hydrolyses compound **E** with dilute hydrochloric acid, HCl (aq).

Draw the structures of the organic products formed by this hydrolysis.

[4]

4. *A student intends to synthesise compound **I**.



Compound I

Plan a synthesis to prepare 9.36 g of compound **I** starting from 2-chloropropanoic acid, $CH_3CHCICOOH$. The overall percentage yield of compound **I** from 2-chloropropanoic acid is 64%.

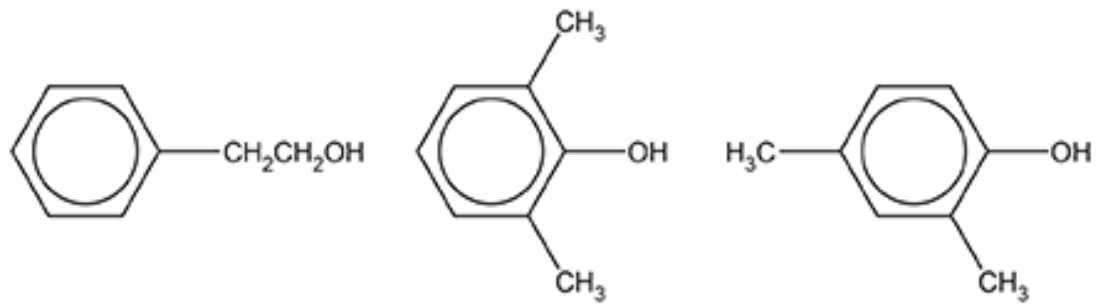
In your answer, include starting mass of 2-chloropropanoic acid, reagents, conditions and equations where appropriate.

Additional answer space if required.

[6]

5. This question is about the chemistry of aromatic compounds.

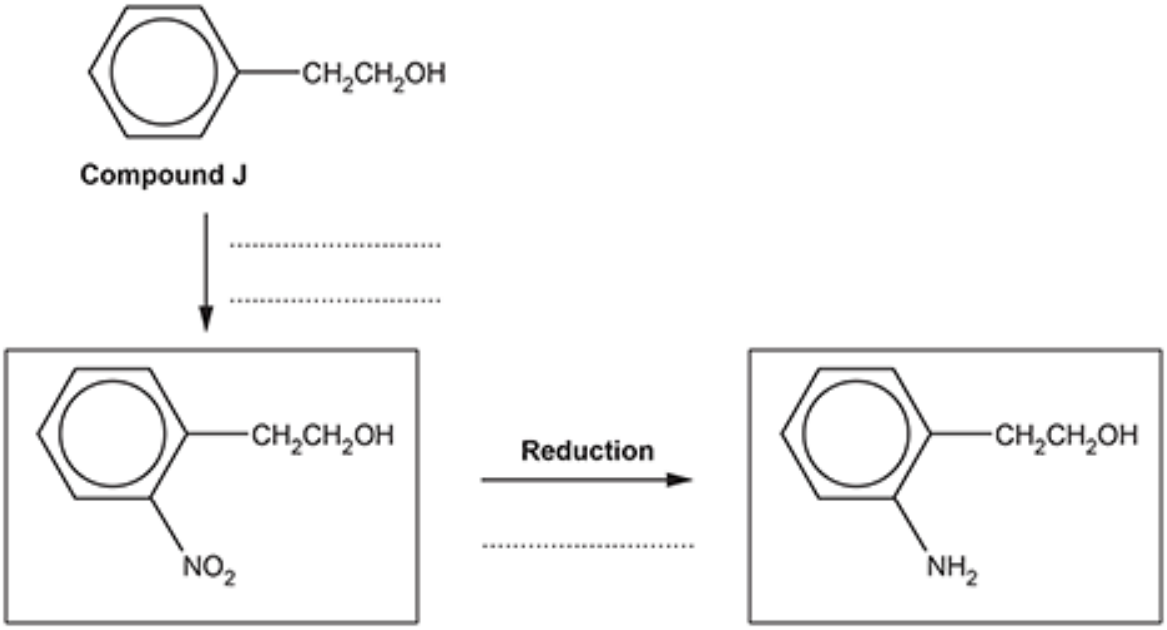
Compounds **J**, **K** and **L**, shown below, are structural isomers.



Compound J **Compound K** **Compound L**

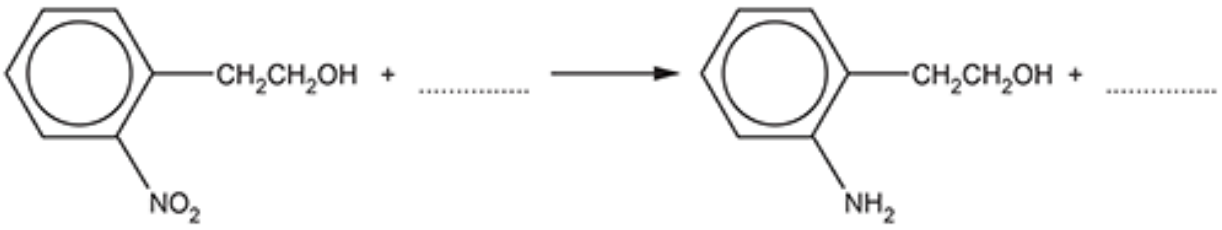
A two-stage synthesis of an amine from compound **J** is shown below.

i. Add the reagents for each stage of this synthesis.



[2]

ii. Fill in the equation for the reduction stage of this synthesis.



[1]

END OF QUESTION PAPER