

**A Level Chemistry A**  
**H432/03** Unified chemistry

**Question Set 13**

**1** Benzoic acid,  $C_6H_5COOH$ , is added to some foods as a preservative. A student prepares benzoic acid as outlined below.

**Step 1** The student mixes  $4.00\text{ cm}^3$  of phenylmethanol,  $C_6H_5CH_2OH$ , (density =  $1.04\text{ g cm}^{-3}$ ) with sodium carbonate and aqueous potassium manganate(VII), as an oxidising agent.  
The mixture is heated under reflux.

**Step 2** The resulting mixture is cooled and then acidified with concentrated  $HCl$ .  
Impure crystals of benzoic acid appear.

**Step 3** The student recrystallises the impure crystals to obtain  $1.59\text{ g}$  of pure benzoic acid.

**(a)** In **Step 1**, sodium carbonate,  $Na_2CO_3$ , makes the reaction mixture alkaline.

Write an ionic equation to show how carbonate ions form an alkaline solution in water. **[1]**

**(b)** In **Step 2**, explain why the mixture must be acidified so that crystals of benzoic acid appear. **[1]**

**(c)** Write the overall equation for the preparation of benzoic acid from phenylmethanol.  
Use  $[O]$  for the oxidising agent. **[1]**

**(d)** Calculate the percentage yield of benzoic acid.  
Give your answer to **3** significant figures. **[3]**

**(e)** In **Step 3**, describe how the student can recrystallise the impure crystals to obtain pure benzoic acid. **[2]**

**Total Marks for Question Set 13: 8**

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