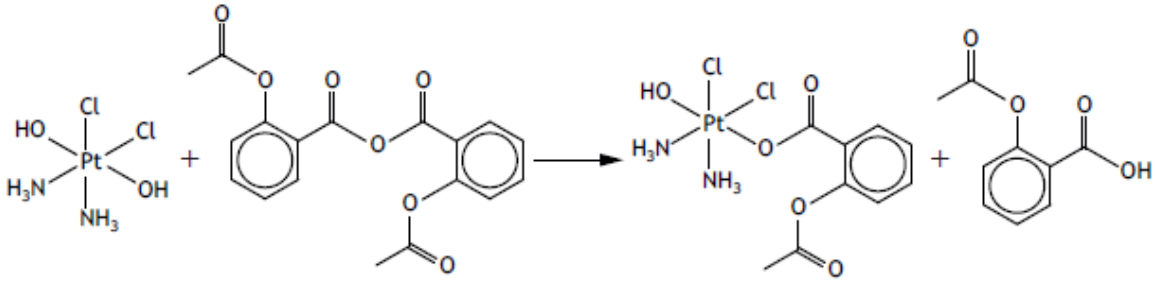
**1.** A new drug being trialled, asplatin, may be capable of overcoming drug resistance in cancer cells. Asplatin is synthesised by reacting oxoplatin with acetylsalicylic anhydride.



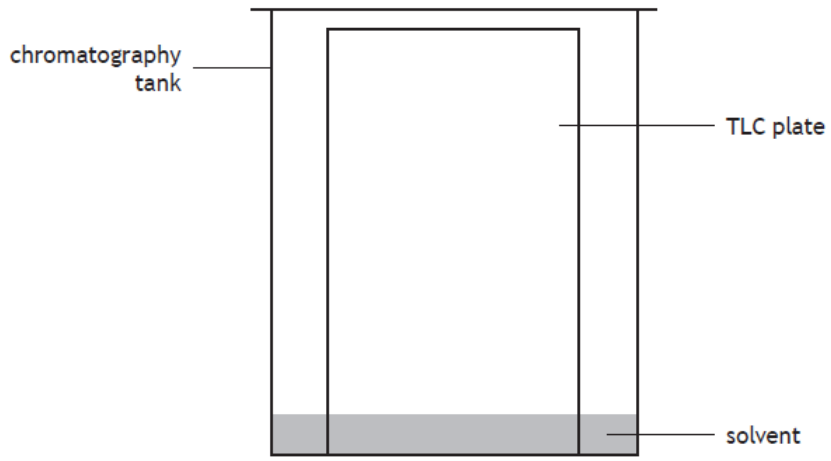
| oxoplatin | acetylsalicylic anhydride | asplatin | aspirin |
|---|---|---|---|
| GFM = 334·1 g | GFM = 342 g | GFM = 496·1 g | GFM = 180 g |

a) During a trial synthesis, 4·98 g of oxoplatin was reacted with 5.00g acetylsalicylic anhydride. In an experimental procedure, the percentage yield of asplatin was 64%. Calculate the mass of asplatin produced. **3 marks**

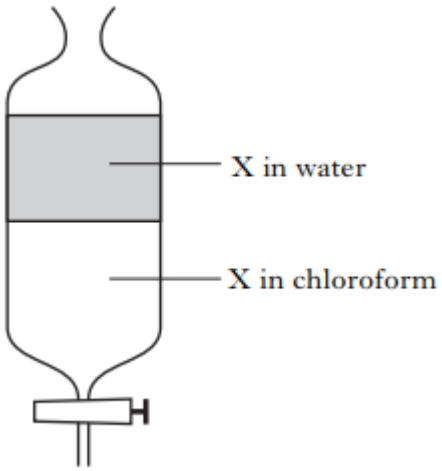
b) The purity of the aspirin produced was checked by carrying out a melting point analysis. The literature value for the melting point of pure aspirin is 138°C-140°C. It was concluded that the aspirin was impure as it gave a melting point of 128°C-132°C. It was then recrystallised in an attempt to purify it.

i) Explain why the impure aspirin has a lower and broader melting point range than pure aspirin. **1 mark**
ii) Explain why water was used to recrystallise the impure aspirin. **1 mark**
iii) Outline the key steps involved in recrystallisation. **2 marks**

c) After recrystallisation, the purity of the aspirin was checked using tlc. Use the diagram below to explain and illustrate how a tlc analysis would be set up and also used to show that the aspirin was now pure. **3 marks**



2. A pupil was investigating the best solvent to use for extracting an organic acid X. They used chloroform and set up the apparatus in the following way. The organic acid X distributed itself between both layers.




a) Explain which solvent, water or chloroform, is denser. **1 mark**
b) Outline the criteria which the student would consider when choosing a solvent for this experiment. **1 mark**
c) Write an equilibrium expression in terms of x. **2 marks**

3. A student added 50 $cm^3$ of an aqueous iodine solution to 50 $cm^3$ of cyclohexane in a separating funnel. After shaking thoroughly, the funnel was left until the following equilibrium was established.

$I_2(aqueous) \rightleftharpoons I_2(cyclohexane)$

Two layers were formed, each containing dissolved iodine. 10.0$cm^3$ of each layer was titrated with sodium thiosulfate solution until the end point was reached. The cyclohexane layer required 18.8$cm^3$ of 0.025 mol $l^{-1}$ sodium thiosulfate. The aqueous layer required 10.5 $cm^3$ of 0.050 mol $l^{-1}$ sodium thiosulfate. (The mole ratio of sodium thiosulfate to iodine is 2:1).

a) Calculate the number of moles of iodine
   (i) in the 10$cm^3$ cyclohexane layer **1 mark**
   (ii) in the 10$cm^3$ aqueous layer. **1 mark**

b) Calculate the partition coefficient for iodine between the two solvents (in this instance it is the number of moles of iodine in the cyclohexane layer divided by the number of moles of iodine in the aqueous layer). **1 mark**

c) Suggest an improvement to the solvent extraction procedure. **1 mark**

**Total marks 18**