

Some insecticides contain dieldrin,  $C_{12}H_8Cl_6O$  ( $M = 381\text{g/mol}$ ), as the active ingredient. When burnt in oxygen, the only products of combustion of dieldrin are carbon dioxide, hydrogen chloride and water. If the products of combustion are bubbled through a solution of silver nitrate, then a white precipitate is formed.

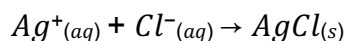
In a typical experiment, 2.26g of the insecticide was burnt in oxygen. The white solid was collected, washed, and dried. It was found to weigh 3.28g.

- Write balanced chemical equations for the combustion of dieldrin and for the reaction of the combustion products with the solution of silver nitrate. (3 marks)
- Calculate the percentage purity of the insecticide. (5 marks)
- If the precipitate was not washed thoroughly before it was dried, what effect would this have on the calculated percentage? Explain your answer. (2 marks)

a)



- b) The chloride ions from hydrochloric acid and silver ions from silver nitrate form a precipitate:



$$n(Cl^-) = n(HCl) = 6 \times n(C_{12}H_8Cl_6O) = 0.03559\dots mol$$

$$n(AgCl) = m/MM = 3.28/143.32 = 0.02289 mol$$

$$n(Cl) = n(AgCl) = 0.02289 mol$$

$$n(C_{12}H_8Cl_6O) = n(Cl)/6 = 0.02289/6 = 3.81 \times 10^{-3} mol$$

$$m(C_{12}H_8Cl_6O) = nMM = 381 \times 3.81 \times 10^{-3} = 1.45g$$

$$\therefore \text{percentage purity} = 1.45/2.26 \times 100 = 64.3\%$$

- c) If the precipitate was not washed thoroughly, there could still be some remaining impurities or chemicals left on the surface of the precipitate. This would lead to a higher mass being recorded for the precipitate and hence an overestimation of the calculated percentage purity.

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