

1. Answer the following questions relating to the solubility of the chlorides of silver and lead.

(a) At  $10^{\circ}\text{C}$ ,  $8.9 \times 10^{-5}$  g of  $\text{AgCl}(s)$  will dissolve in 100. mL of water.

(i) Write the equation for the dissociation of  $\text{AgCl}(s)$  in water.

(ii) Calculate the solubility, in  $\text{mol L}^{-1}$ , of  $\text{AgCl}(s)$  in water at  $10^{\circ}\text{C}$ .

(iii) Calculate the value of the solubility-product constant,  $K_{sp}$ , for  $\text{AgCl}(s)$  at  $10^{\circ}\text{C}$ .

(b) At  $25^{\circ}\text{C}$ , the value of  $K_{sp}$  for  $\text{PbCl}_2(s)$  is  $1.6 \times 10^{-5}$  and the value of  $K_{sp}$  for  $\text{AgCl}(s)$  is  $1.8 \times 10^{-10}$ .

(i) If 60.0 mL of  $0.0400\text{ M NaCl}(aq)$  is added to 60.0 mL of  $0.0300\text{ M Pb}(\text{NO}_3)_2(aq)$ , will a precipitate form? Assume that volumes are additive. Show calculations to support your answer.

(ii) Calculate the equilibrium value of  $[\text{Pb}^{2+}(aq)]$  in 1.00 L of saturated  $\text{PbCl}_2$  solution to which 0.250 mole of  $\text{NaCl}(s)$  has been added. Assume that no volume change occurs.

(iii) If  $0.100\text{ M NaCl}(aq)$  is added slowly to a beaker containing both  $0.120\text{ M AgNO}_3(aq)$  and  $0.150\text{ M Pb}(\text{NO}_3)_2(aq)$  at  $25^{\circ}\text{C}$ , which will precipitate first,  $\text{AgCl}(s)$  or  $\text{PbCl}_2(s)$ ? Show calculations to support your answer.