

Chemguide – answers

INTRODUCTION TO SOLUBILITY PRODUCTS

1. a) You are multiplying together two concentration terms: $(\text{mol dm}^{-3}) \times (\text{mol dm}^{-3})$, and so the units are $\text{mol}^2 \text{dm}^{-6}$.

If you got this wrong, re-read the page carefully, and then have another think about your answers to Q2.

b) If nothing happened, the product of the ionic concentrations would be $(1 \times 10^{-3}) \times (1 \times 10^{-3})$, or 1×10^{-6} . But that is bigger than the solubility product (4.8×10^{-9}) which represents a saturated solution. You can't have that, and so some calcium sulphate precipitates out as a white solid until the ionic product is reduced to 4.8×10^{-9} .

c) In this case, the product of the ionic concentrations would be 1×10^{-10} , which is less than the solubility product. What that means is that you haven't got a saturated solution, and you would simply see a colourless, very, very dilute, solution containing calcium ions and sulphate ions (plus whatever other ions were present in the solutions you mixed).

2. a) $K_{\text{sp}} = [\text{Pb}^{2+}] [\text{Br}^{-}]^2 \text{ mol}^3 \text{ dm}^{-9}$
b) $K_{\text{sp}} = [\text{Sr}^{2+}] [\text{CO}_3^{2-}] \text{ mol}^2 \text{ dm}^{-6}$
c) $K_{\text{sp}} = [\text{Ag}^{+}] [\text{Cl}^{-}] \text{ mol}^2 \text{ dm}^{-6}$
d) $K_{\text{sp}} = [\text{Ag}^{+}]^2 [\text{CrO}_4^{2-}] \text{ mol}^3 \text{ dm}^{-9}$
e) $K_{\text{sp}} = [\text{Al}^{3+}] [\text{OH}^{-}]^3 \text{ mol}^4 \text{ dm}^{-12}$
f) $K_{\text{sp}} = [\text{Pb}^{2+}] [\text{SO}_4^{2-}] \text{ mol}^2 \text{ dm}^{-6}$
g) $K_{\text{sp}} = [\text{Ag}^{+}]^3 [\text{PO}_4^{3-}] \text{ mol}^4 \text{ dm}^{-12}$
h) $K_{\text{sp}} = [\text{Bi}^{3+}]^2 [\text{S}^{2-}]^3 \text{ mol}^5 \text{ dm}^{-15}$

(It is very easy to make careless mistakes with these. The safest way is probably to write down the equilibrium expression for the formation of aqueous ions, and then write the solubility product expression. That forces you to look more carefully at the numbers of each ion involved and their charges. I have to admit that I didn't do that, but neither did I get them all right first time!)