Chemistry 3.6 AS 91392 Demonstrate understanding of equilibrium principles in aqueous systems

Writing Excellence answers to **Common Ion Effect** questions

Common Ion Effect QUESTION	
Question: Show, by calculation, that a precipitate of lead(II) hydroxide, $Pb(OH)_2$, will form when 25.0 mL of a sodium hydroxide solution, NaOH, at pH 12.6 is added to 25.0 mL of a $[Pb^{2+}] = 0.5 \times 0.00421 = 2.105 \times 10^{-3}$ lead(II) nitrate, $Pb(NO_3)_2$, solution. $K_s(Pb(OH)_2) = 8.00 \times 10^{-17}$ at 25°C	
ANSWER	
1. write the equation for the dissociation of salt	$Pb(OH)_2 \rightleftharpoons Pb^{2+} + 2OH^-$
2. Write the solubility product expression, *Q*, for the salt (K_s)	$Q = [Pb^{2+}][OH^-]^2$
3. calculate the solubility, s for the first ion after dilution $[Pb^{2+}] = \frac{c \times v}{\text{total } v}$ *3sgf and units*	$[Pb^{2+}] = \frac{0.00421 \times 0.0250}{0.0500}$ $[Pb^{2+}] = 2.105 \times 10^{-3}$ molL^{-1}
4. calculate the concentration of [OH-] from pH $[OH^-] = 10^{-(14-pH)}$ *3sgf and units*	$[OH^-] = 10^{-(14-pH)}$ $[OH^-] = 10^{-1.4}$ $[OH^-] = 0.0398$ molL^{-1}
5. calculate the solubility, s for the second ion after dilution $[OH^-] = \frac{c \times v}{\text{total } v}$ *3sgf and units*	$[OH^-] = \frac{0.00398 \times 0.0250}{0.0500}$ $[OH^-] = 1.99 \times 10^{-2}$ molL^{-1}
6. Calculate Q from expression $Q = [ion1] \times [ion2]^2$ *3sgf (has no units)*	$Q = [ion1] \times [ion2]^2$ $Q = (2.105 \times 10^{-3}) \times (1.99 \times 10^{-2})^2$ $Q = 8.34 \times 10^{-7}$
7. compare Q and Ks and state whether a precipitate will form or not	$K_s(Pb(OH)_2) = 8.00 \times 10^{-17}$ at 25°C $Q = 8.34 \times 10^{-7}$ Since $Q > K_s$, a precipitate of $Pb(OH)_2$ will form.

NOTE: The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.