The solubility product constant of Fe(OH)$_3$ is $1 \times 10^{-39}$ M$^4$. What is the concentration of Fe$^{3+}$ (aq) in equilibrium with Fe(OH)$_3$ at pH 7.0?

**Answer:**

To what value does the pH need to be increased to decrease the concentration of Fe$^{3+}$ (aq) to a single Fe$^{3+}$ (aq) ion per litre of solution?

**Answer:**
Many elemental metals crystallise in one of three cubic forms, either with a face-centred cubic, a body-centred cubic or a simple cubic unit cell. Explain the main differences and similarities between these different crystalline forms.
• Calcium oxalate is a major constituent of kidney stones. Calculate the solubility product constant for calcium oxalate given that a saturated solution of the salt can be made by dissolving 0.0061 g of CaC$_2$O$_4$·H$_2$O(s) in 1.0 L of water.

Marks 2

Answer:

• A sample of 2.0 mg of Cu(OH)$_2$ is added to 1.0 L of a solution buffered at a pH of 8.00. Will all of the Cu(OH)$_2$ dissolve? Show all working.
  (The $K_{sp}$ of Cu(OH)$_2$ is $4.8 \times 10^{-20}$ M$^3$.)

Marks 3

Answer:
In the presence of excess hydroxide ion, $\text{Mg}^{2+}$ can be precipitated as $\text{Mg(OH)}_2(s)$. What amount (in mol) of solid sodium hydroxide must be added to a 0.10 M solution of $\text{Mg(NO}_3)_2$ to just cause precipitation of $\text{Mg(OH)}_2(s)$. The solubility product constant of $\text{Mg(OH)}_2$ is $7.1 \times 10^{-12}$ M$^3$.

ANSWER:

In a separate experiment, the $\text{Mg(OH)}_2$ is precipitated by adding 0.10 mol of $\text{Mg(NO}_3)_2$ to 1.0 L of a 0.10 M $\text{NH}_3$ solution. What amount (in mol) of $\text{NH}_4\text{Cl}$ must be added to this solution to just dissolve the precipitate? The $pK_a$ of $\text{NH}_4\text{Cl}$ is 9.24.

ANSWER: