Worksheet 8.3: Solutions

Analysis of iron in iron ore

No.	Answer
1	An absorbance spectrum would be created by testing the absorbance of the complex ion solution at various wavelengths. The wavelength of maximum absorbance would be chosen (provided this wavelength was not also absorbed by other components in the ore solution).
2	To relate the absorbance of the solution to its concentration.
3	Absorbance of 0.400 corresponds to a concentration of 0.0125 mol L^{-1} 0.0125 mol in 1.0 L means 0.00125 mol in 100.0 mL. $m(\text{Fe}) = n \times M = 0.00125 \times 55.85 = 0.06981$ g $\%\ \text{Fe} = \frac{m(\text{Fe})}{m(\text{ore})} \times 100 = \frac{0.06981}{0.100} \times 100 = 69.8\%$
4	$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$ $Fe^{2+}(aq) \rightarrow Fe^{3+}(aq) + e^-$ $MnO_4^-(aq) + 8H^+(aq) + 5Fe^{2+}(aq) \rightarrow Mn^{2+}(aq) + 4H_2O(l) + 5Fe^{3+}(aq)$
5	$n(MnO_4^-) = c \times V = 0.0335 \times 19.75 \times 10^{-3}$ mol $n(\text{Fe}) = n(Fe^{2+}) = 5 \times n(MnO_4^-)$ $m(\text{Fe}) = n \times M = 5 \times 0.0335 \times 19.75 \times 10^{-3} \times 55.85 = 0.1848$ g $\%\ \text{Fe} = \frac{m(\text{Fe})}{m(\text{ore})} \times 100 = \frac{0.1848}{0.268} \times 100 = 68.9\%$
6	The determined value would be lower, because less permanganate solution would be required for titration (since it will only react with the Fe^{2+}, not the Fe^{3+}).
7	**a** $Fe^{2+}(aq) + 2OH^-(aq) \rightarrow Fe(OH)_2(s)$ **b** $Fe^{3+}(aq) + 3OH^-(aq) \rightarrow Fe(OH)_3(s)$
8	A pure sample of known composition could not be obtained because the: • precipitate may contain a mixture of iron(II) and iron(III) hydroxides • iron hydroxide precipitates are not stable when heated.
9	$2Fe \rightarrow 2Fe(OH)_2 \rightarrow Fe_2O_3$ $n(Fe_2O_3) = \frac{m}{M} = \frac{1.08}{159.7} = 0.006\,763$ mol $n(\text{Fe}) = 2 \times n(Fe_2O_3)$ $m(\text{Fe}) = n \times M = 2 \times 0.006\,763 \times 55.85 = 0.7554$ g $\%\ \text{Fe} = \frac{m(\text{Fe})}{m(\text{ore})} \times 100 = \frac{0.7554}{1.01} \times 100 = 74.8\%$
10	Precipitates other than iron hydroxide may have formed, leading to a larger precipitate mass.

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No.	Answer
11	**a** Spectroscopic **b** Gravimetric **c** Gravimetric **d** Spectroscopic
12	Atomic absorption spectroscopy of a solution prepared by dissolving ore in acid can be used.