

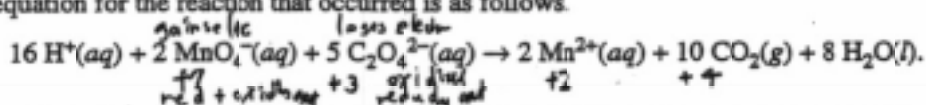
3. Answer the following questions about $\text{BeC}_2\text{O}_4(s)$ and its hydrate.

- (a) Calculate the mass percent of carbon in the hydrated form of the solid that has the formula $\text{BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$
- (b) When heated to $220.^\circ\text{C}$, $\text{BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}(s)$ dehydrates completely as represented below.



If 3.21 g of $\text{BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}(s)$ is heated to $220.^\circ\text{C}$, calculate

- (i) the mass of $\text{BeC}_2\text{O}_4(s)$ formed, and,
- (ii) the volume of the $\text{H}_2\text{O}(g)$ released, measured at $220.^\circ\text{C}$ and 735 mm Hg.
- (c) A 0.345 g sample of anhydrous BeC_2O_4 , which contains an inert impurity, was dissolved in sufficient water to produce 100. mL of solution. A 20.0 mL portion of the solution was titrated with $\text{KMnO}_4(aq)$. The balanced equation for the reaction that occurred is as follows.



The volume of 0.0150 M $\text{KMnO}_4(aq)$ required to reach the equivalence point was 17.80 mL.

- (i) Identify the reducing agent in the titration reaction.
- (ii) For the titration at the equivalence point, calculate the number of moles of each of the following that reacted.
- $\text{MnO}_4^-(aq)$
 - $\text{C}_2\text{O}_4^{2-}(aq)$
- (iii) Calculate the total number of moles of $\text{C}_2\text{O}_4^{2-}(aq)$ that were present in the 100. mL of prepared solution.
- (iv) Calculate the mass percent of $\text{BeC}_2\text{O}_4(s)$ in the impure 0.345 g sample.

a. mass percent

$$\frac{(12.01 \times 2)}{(9.012 + 2 \times 12.01 + 16.00 \times 4 + 3 \times 2 \times 1.01 + 3 \times 16.00)} = 0.1590 \rightarrow \boxed{15.90\%}$$

b. 3.21 g $\text{BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$ $MM = 151.09 \text{ g/mol}$
 $n_{\text{mol}} = 0.0212 \text{ mol of BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}$

i. mass of BeC_2O_4 formed

$$\text{coeff} \times 0.0212 \times MM_{\text{BeC}_2\text{O}_4} = \text{mass formed}$$

$$1 \times 0.0212 \text{ mol} \times \frac{97.03 \text{ g}}{\text{mol}} = \boxed{2.06 \text{ g}}$$