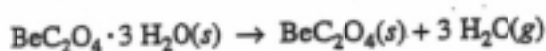


3. Answer the following questions about $\text{BeC}_2\text{O}_4(s)$ and its hydrate.

(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.

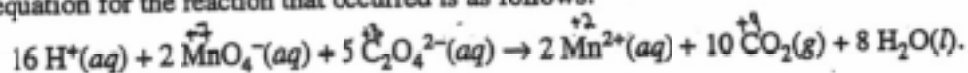


If 3.21 g of $\text{BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}(s)$ is heated to $220.^\circ\text{C}$, calculate

(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 $100.\text{ mL}$ 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.

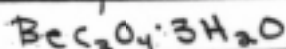
(ii) For the titration at the equivalence point, calculate the number of moles of each of the following that reacted.

- $\text{MnO}_4^-(aq)$
- $\text{C}_2\text{O}_4^{2-}(aq)$

(iii) Calculate the total number of moles of $\text{C}_2\text{O}_4^{2-}(aq)$ that were present in the $100.\text{ mL}$ of prepared solution.

(iv) Calculate the mass percent of $\text{BeC}_2\text{O}_4(s)$ in the impure 0.345 g sample.

3. a. % by mass of C



24g

$$\times 100 = 17.9\%$$

$$(9.012 + 24 + 64 + 54)$$

$$0.345\text{ g} \times \frac{1\text{ mole BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}}{151.012\text{ g}} \times \frac{1\text{ mole BeC}_2\text{O}_4}{1\text{ mole BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}} \times 97.012\text{ g} = \boxed{2.06\text{ g}}$$

$$(ii) PV = nRT \quad V = \frac{nRT}{P}$$

$$n = 3.21\text{ g} \times \frac{3\text{ moles H}_2\text{O}}{151.012\text{ g BeC}_2\text{O}_4 \cdot 3\text{H}_2\text{O}} = 0.0638\text{ moles H}_2\text{O} \quad V = \frac{(0.0638\text{ moles}) \left(\frac{62.4\text{ L Torr}}{\text{mole K}} \right) (493\text{ K})}{735\text{ Torr}}$$