

## Answer on Question #62335 - Chemistry - General Chemistry

Question:

A student has 15.0 mL of a 0.256 M phosphate solution. The student then adds excess ammonium ( $\text{NH}_4^+$ ) and magnesium ( $\text{Mg}^{2+}$ ) to the solution under slightly basic conditions. Phosphate becomes  $\text{HPO}_4^{2-}$  under these conditions and reacts with the  $\text{NH}_4^+$ ,  $\text{Mg}^{2+}$  and water to produce 0.3005 g of struvite. Calculate the Percent Yield of Struvite.

Solution:

- 1) Write the final balanced equation of reaction:  
$$(\text{PO}_4)^{3-}(\text{aq}) + \text{NH}_4^+(\text{aq}) + \text{Mg}^{2+}(\text{aq}) + 6\text{H}_2\text{O} = \text{NH}_4\text{MgPO}_4 \cdot 6\text{H}_2\text{O} (\text{s})$$
- 2) Equation shows that 1 mole of phosphate gives 1 mole of struvite.  
1 mole of struvite =  $14.0 + 4 \cdot 1.0 + 24.3 + 31.0 + 4 \cdot 16.0 + 6 \cdot (2 \cdot 1.0 + 16.0) = 245.3 \text{ g}$ .
- 3) Calculate how many moles of phosphate entered into reaction and theoretical yield:  
15.0 mL = 0.0150 L of 0.256 M solution contains  $0.0150 \text{ L} \cdot 0.256 \text{ mol/L} = 0.004$  moles of phosphate. So in theory we should obtain 0.004 moles of struvite which is  $0.004 \cdot 245.3 = 0.9812 \text{ g}$
- 4) Calculate the percent yield.  
Percent yield = (obtained amount of product/theoretical amount of product) \* 100%.  
 $= (0.3005 \text{ g} / 0.9812 \text{ g}) \cdot 100\% = 30.6\%$

**Answer:**

The percent yield of struvite is 30.6 %