Water of Hydration

Prelab 6

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Name

1:00
Time

M T (W) R F

A student is given a sample of red cobalt sulfate hydrate. She weighed the sample in a dry covered crucible and obtained a mass of 25.050 g for the crucible, cover, and sample. Before adding the sample, the crucible and cover weighed 23.422 g. She then heated the crucible to drive off the water of hydration, keeping the crucible at red heat for about 10 minutes with the cover slightly ajar. She then let the crucible cool, and found it had a lower mass; the crucible, cover and contents then weighed 24.321 g. In the process the sample was converted to blue anhydrous $CoSO_4$. Show all calculations necessary to answer the following questions.

1. What was the mass of the hydrate sample? 1.628 g hydrate

   25.050 - 23.422

2. What is the mass of the anhydrous $CoSO_4$? 0.899 g $CoSO_4$

   24.321 - 23.422

3. How much water was driven off? 0.729 g H_2O

   1.628 - 0.899

mass: 25.050 g
mass: 23.422 g
mass: 24.321 g

4. What is the percentage of water in the hydrate?

$$\% \text{ water} = \frac{\text{mass of water in sample}}{\text{mass of hydrate sample}} \times 100$$

~~0.849~~ / 1.628 · 100 → 0.729 / 1.628

44.79 % H_2O

5. How many grams of water would there be in 100.0 g of hydrate? How many moles?

100.0g of hydrate: ?

45 g H_2O; 2.5 moles H_2O

100g · 0.729 / 1.62

H_2O → 18

6. How many grams of $CoSO_4$ are there in 100.0 g of hydrate? How many moles? What percentage of the hydrate is $CoSO_4$? Convert the mass of $CoSO_4$ to moles. The molar mass of $CoSO_4$ is 154.996 g.

100 - 45

55 g $CoSO_4$; 0.354 moles $CoSO_4$

Moles of $CoSO_4$ = 154.996

55 / 154.996

55 % $CoSO_4$ in hydrate

grams of $CoSO_4$ / mass of hydrate → there are 100 → 55/100

7. How many moles of water are present per mole of $CoSO_4$?

H_2O moles → 2.5

$CoSO_4$ → 0.354

7.062 → 7.0

7 moles H_2O/moles $CoSO_4$

8. What is the formula of the hydrate? $CuSO_4 \cdot 7H_2O$