

Question:

5.00g of a hydrated salt of barium when heated to a constant mass of 2.08. Calculate the number of molecules of water of crystallization in the hydrated salt.

Answer:

The difference in the mass of the initial and heated samples is the mass of water lost:

$$m(H_2O) = 5 - 2.08 = 2.92g$$

The amount of moles of water:

$$\nu(H_2O) = \frac{m(H_2O)}{M(H_2O)} = \frac{2.92g}{18g/mol} = 0.162moles$$

If the salt is $BaCl_2$, the amount of the moles of the salt is:

$$\nu(BaCl_2) = \frac{m(BaCl_2)}{M(BaCl_2)} = \frac{2.08g}{208g/mol} = 0.01moles$$

The amount of moles of water and $BaCl_2$ relate as:

$$\frac{\nu(BaCl_2)}{\nu(H_2O)} = \frac{0.01}{0.162} \approx \frac{1}{16}$$

The amount of water molecules is 16, $BaCl_2 \cdot 16 H_2O$.