Measuring Water Uptake in Setting Plaster

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A sculpture class uses a model of plaster setting. The dry ingredient is calcium sulfate hemihydrate. As the plaster sets, that solid combines with water to form gypsum. Water in the formula of a solid hydrate is part of its crystal structure.

$2(CaSO_4 \cdot \frac{1}{2}H_2O)(s) + 3H_2O(l) \rightarrow 2(CaSO_4 \cdot 2H_2O)(s)$

1 According to the equation, how many moles of liquid water become part of gypsum for every mole of starting hemihydrate that reacts?

(1) 0.5 mol

(2) 1.0 mol

(3) 1.5 mol

(4) 2.0 mol

The class mixes 29.0 g of hemihydrate with 12.0 g of water. Use model molar masses of 145 g/mol for hemihydrate and 18.0 g/mol for water. Assume the hemihydrate reacts completely and that during drying only water outside the crystals evaporates.

2 Calculate the mass of water that becomes part of the crystals. Show how the equation enters your calculation. [1]

Answer and work

3 Predict the mass of the dry casting after the extra water has evaporated. Show your setup. [1]

Answer and work

The class measures 35.1 g on the balance. It assumes the mass reading is accurate and that the model reaction went to completion.

4 Under those assumptions, is the measured casting completely dry? Use the predicted and measured masses to explain. [1]

Answer and work