

## Answer on Question#63275 - Chemistry - General Chemistry

A 3.70 g sample of a mixture of CaO and BaO is placed in a 1.00-L vessel containing CO<sub>2</sub> gas at a pressure of 730 torr and a temperature of 26 °C. The CO<sub>2</sub> reacts with the CaO and BaO, forming CaCO<sub>3</sub> and BaCO<sub>3</sub>. When the reaction is complete, the pressure of the remaining CO<sub>2</sub> is 155 torr .

1) Calculate the mass percentage of CaO in the mixture.

### Answer:

First, we calculate amount of CO<sub>2</sub> in container at start:

We use gas equation:

$$PV = nRT$$

$$0.97 \text{ atm} \cdot 1 \text{ L} = n \cdot 0.082057 \text{ L}\cdot\text{atm}\cdot\text{mol}^{-1}\cdot\text{K}^{-1} \cdot 299 \text{ K}$$

$$n = 0.03954 \text{ mol CO}_2$$

Calculate mol of CO<sub>2</sub> present at end:

$$PV = nRT$$

$$0.2 \text{ atm} \cdot 1 \text{ L} = n \cdot 0.082057 \text{ L}\cdot\text{atm}\cdot\text{mol}^{-1}\cdot\text{K}^{-1} \cdot 299 \text{ K}$$

$$n = 0.00815 \text{ mol}$$

$$\text{mol of CO}_2 \text{ reacted} = 0.03954 - 0.00815 = 0.03139 \text{ mol CO}_2 \text{ consumed}$$

Mass of CO<sub>2</sub> consumed:

$$\text{Molar mass CO}_2 = 44.009 \text{ g/mol}$$

$$0.03139 \text{ mol} = 44.009 \cdot 0.03139 = 1.381 \text{ g}$$

$$\text{Mass of final mixed carbonates} = 3.7 + 1.381 = 5.81 \text{ g}$$

Let the mass of CaO = X

then mass of BaO = (3.7-X)

$$\text{Molar mass CaCO}_3 = 100.0875 \text{ g/mol}$$

$$\text{Molar mass CaO} = 56.0778 \text{ g/mol}$$

$$\text{Molar mass BaCO}_3 = 197.3368 \text{ g/mol}$$

$$\text{Molar mass BaO} = 153.3271 \text{ g/mol}$$

Equation:

$$\left(\frac{100.0875}{56.0778}\right) \cdot X + \left(\frac{197.3368}{153.3271}\right) \cdot (3.7 - X) = 5.81$$

$$1.78X + 1.28(3.7 - X) = 5.81$$

$$1.78X + 4.74 - 1.28X = 5.81$$

$$0.5X = 1.07$$

$$X = 2.14 \text{ g}$$

Mass of CaO = 2.14g

%CaO in sample =  $2,14/4*100 = 53,5\%$

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