Answer on Question #85439 – Chemistry – Other

Task:

When a given mass of CaCO₃ was heated 0.25 dm³ of a gas was collected at 250 and at a pressure of 120 N m⁻²

1) Write an equation for the reaction.

2) Calculate the mass of the gaseous product obtained from (ii) CaCO3.

Solution:

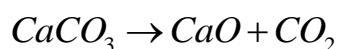At 250??? (suppose it is 250 degrees Celsius, 250°C).

Then,

T = 250°C + 273.15 = 523.15 K

P = 120 N m⁻² = 120 Pa

V = 0.25 dm³ = 0.00025 m³

M(CO₂) = Ar(C) + 2*Ar(O) = 12 + 2*16 = 44 (g/mol).

1) Chemical reaction equation:

$$CaCO_3 \rightarrow CaO + CO_2$$

2) Ideal gas law (Mendeleev-Clapeyron equation):

$$PV = nRT;$$
$$PV = \frac{mRT}{M}$$

where

P – gas pressure (in Pascal);

V – gas volume $\left(\text{in m}^3\right)$;

T – gas temperature $\left(\text{in Kelvins}\right)$;

R – gas constant $8.314 \ (\text{m}^3 \cdot \text{Pa} \cdot \text{K}^{-1}\text{mol}^{-1})$

$$m(CO_2) = \frac{PVM}{RT};$$

$$m(CO_2) = \frac{120\,Pa * 0.00025\,\text{m}^3 * 44\,g/mol}{8.314\,\text{m}^3 \cdot Pa \cdot K^{-1} mol^{-1} * 523.15 K} = 0.0003g = 0.3\,mg$$

$$m(CO_2) = 0.3\,mg$$

Answer: 0.3 mg CO₂.