Answer on Question #72541, Chemistry / General Chemistry

Student A- 5.01g NaCl(s) reacts with 200mL of 0.35M solution of $AgNO_3$ (aq) with percentage yield of 76.3%. Student B- 6.58g $AgNO_3$(aq) reacts with 40mL of 1.45M solution of $BaCl_2$(aq) with percentage yield of 68.5%. What mass of silver chloride solid is produced by each student and what happens when the concentration of the solutions used was doubled?

Solution

Student A:

$NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$

As it's seen from the equation 1 mole of NaCl reacts with 1 mole of $AgNO_3$ producing 1 mole of AgCl.

Find the amounts of the reactants:

$\nu(NaCl) = \frac{m}{M} = \frac{5.01}{58.5} = 0.086$ (mole)

$\nu(AgNO_3) = C_m \times V = 0.35 \times 0.2 = 0.07$ (mole)

As NaCl is in excess then there is produced 0.07 mole of AgCl. Find it's mass:

$m(AgCl) = M \times \nu = 143 \times 0.07 = 10.01$ (g) – theoretical yield;

$m_{pr}(AgCl) = m_{theor} \times w = 10.01 \times 0.763 =$ **7.64 (g)** – mass of solid AgCl is produced by student A.

If the concentration of the solution used was doubled, then $AgNO_3$ would become in excess, so the theoretical yield of AgCl would be 0.086 mole instead of 0.07 mole.

Student B:

$BaCl_2 + 2AgNO_3 \rightarrow 2AgCl + Ba(NO_3)_2$

As it's seen from the equation 1 mole of $BaCl_2$ reacts with 2 moles of $AgNO_3$ producing 2 moles of AgCl.

Find the amounts of the reactants:

$\nu(AgNO_3) = \frac{m}{M} = \frac{6.58}{170} = 0.039$ (mole)

$\nu(BaCl_2) = C_m \times V = 1.45 \times 0.04 = 0.058$ (mole)

0.039 mole of $AgNO_3$ requires 0.0195 mole of $BaCl_2$. So $BaCl_2$ is in excess and there is produced 0.039 mole of AgCl. Find it's mass:

$m(AgCl) = M \times \nu = 143 \times 0.039 = 5.58$ (g) – theoretical yield;

$m_{pr}(AgCl) = m_{theor} \times w = 5.58 \times 0.685 =$ **3.82 (g)** – mass of solid AgCl is produced by student B.

The doubling of the concentration of $BaCl_2$ solution leads to increasing of $BaCl_2$ amount. As it is already in excess, so nothing happens. The theoretical yield of AgCl is still 0.039 mole.

Answer

Student A: m(AgCl) = **7.64 g**

Student B: m(AgCl) = **3.82 g**