Answer on Question#55503 – Chemistry – General Chemistry

Question:

When solutions of silver nitrate and calcium chloride are mixed, silver chloride precipitates out of solution according to the equation
$2AgNO_3(aq)+CaCl_2(aq)\rightarrow 2AgCl(s)+Ca(NO_3)_2(aq)$

Part A
What mass of silver chloride can be produced from 1.14 L of a 0.285 M solution of silver nitrate? Express your answer with the appropriate units.

Part B
The reaction described in Part A required 4.00 L of calcium chloride. What is the concentration of this calcium chloride solution? Express your answer with the appropriate units.

Part A

Solution:

V(solution of AgNO3) = 1.14 L;

C(AgNO3) = 0.285 M;

m(AgCl) - ?

2AgNO3(aq)+CaCl2(aq)→2AgCl(s)+Ca(NO3)2(aq);

According to the equation: n(AgNO3) : n(AgCl) = 1:1;

$\mathrm{C} = \frac{\mathrm{n}}{\mathrm{V}}; \mathrm{n} = \mathrm{CV};$

C – the molar concentration (M);

n – the amount of substance (mol);

V – the volume of the solution (L);

n(AgNO3) = C(AgNO3)×V;

n(AgNO3) = n(AgCl) = 0.3249 mol;

$\mathrm{n} = \frac{\mathrm{m}}{\mathrm{M}}; \mathrm{m} = \mathrm{nM};$

m – the mass (g);

M – the molar mass ($g\times mol^{-1}$);

M(AgCl) = 143.5 $g\times mol^{-1}$;

m(AgCl) = M(AgCl)×n(AgCl);

m(AgCl) = 46.62 g;

Answer: 46.62 g

Part B

Solution:

V(solution of AgNO3) = 1.14 L;

C(AgNO3) = 0.285 M;

V(solution of CaCl2) = 4.00 L;

What is the concentration of this calcium chloride solution?

2AgNO3(aq)+CaCl2(aq)→2AgCl(s)+Ca(NO3)2(aq);

According to the equation: n(AgNO3) : n(CaCl2) = 2:1;

n(CaCl2) = 0.16245 mol;

$$\mathrm{C(CaCl2)} = \frac{\mathrm{n(CaCl2)}}{\mathrm{V}};$$

C(CaCl2) = 0.04 M;

Answer: 0.04 M

Notice:

The question is what the concentration of the calcium chloride solution is. In case, that one wants to discover the mass concentration of the solution, not the molar concentration, we have to suppose that the density of the solution = 1; $\mathrm{D} = \frac{\mathrm{m(the\ solution)}}{\mathrm{V}}$; $\mathrm{m(of\ the\ solution)} = \mathrm{DV}$;

m(the solution of CaCl2) = 4×10^3g;

n(CaCl2) = 0.16245 mol;

M(CaCl2) = 111 g×mol^{-1};

m(CaCl2) = 18.03 g;

m(the solution of CaCl2) = 4×10^3g;

$$\mathrm{W} = \frac{\mathrm{m(the\ solute)}}{\mathrm{m(the\ solution)}}100\%;$$

W(CaCl2) = 0.45%