Day 1 Data

Mass of Na_2CO_3	2.431 g
Mass of $CaCl_2$	2.013 g
Mass filter paper + watch glass	6.178 g
Mass precipitate + filter paper + watch glass	7.818 g
Observations from reaction	*various*

Sample Calculations

Determine moles of sodium carbonate

Molar mass Na_2CO_3 = 105.99 g/mol

$$\frac{2.431\ g\ Na_2CO_3}{1} \times \frac{1\ mol\ Na_2CO_3}{105.99\ g\ Na_2CO_3} = \mathbf{0.0229\ mol\ Na_2CO_3}$$

Determine moles of calcium chloride

Molar mass of $CaCl_2$ = 110.98 g/mol

$$\frac{2.013\ g\ CaCl_2}{1} \times \frac{1\ mol\ CaCl_2}{110.98\ g\ CaCl_2} = \mathbf{0.0181\ mol\ CaCl_2}$$

Determine limiting reactant

Write the precipitation reaction out and balance it:

$Na_2CO_3 + CaCl_2 \rightarrow 2NaCl + CaCO_3$

Since the balanced coefficients of sodium carbonate and calcium chloride are both 1, this means that an equal number of moles of each is required for a stoichiometric mixture. $CaCl_2$ will run out first and is the limiting reactant.

OR

$$\frac{0.0229\ mol\ Na_2CO_3}{1} \times \frac{1\ mol\ CaCO_3}{1\ mol\ Na_2CO_3} = 0.0229\ mol\ CaCO_3$$

$$\frac{0.0181\ mol\ CaCl_2}{1} \times \frac{1\ mol\ CaCO_3}{1\ mol\ CaCl_2} = 0.0181\ mol\ CaCO_3$$

The second equation shows a smaller, limited amount of product, therefore CaCl2 is the limiting reactant.

Determine the theoretical yield of calcium carbonate

Use the amount of limiting reactant to start this calculation.

$$\frac{0.0181\ mol\ CaCl_2}{1} \times \frac{1\ mol\ CaCO_3}{1\ mol\ CaCl_2} \times \frac{100.09\ g\ CaCO_3}{1\ mol\ CaCO_3} = \mathbf{1.81\ g\ CaCO_3}$$

Determine the actual yield of calcium carbonate

Use the dried weight of the precipitate and subtract the filter paper and watch glass masses.

$$7.818\ g - 6.178\ g = \mathbf{1.640\ g\ CaCO_3}$$

Determine the percent yield of calcium carbonate

$$\frac{actual}{theoretical} \times 100 = \frac{1.640\ g}{1.81\ g} \times 100 = \mathbf{90.6\%}$$