**Question 29 (6 marks)**

The flowchart shown outlines the process used to determine the amount of sulfate present in a sample of lawn fertiliser.

![Flowchart](image)

(a) What assumptions were made and how do these affect the validity of this process?  
An assumption was made that all the \( \text{SO}_4^{2-} \) ions are completely precipitated. Another assumption was made that all the \( \text{Ba}^{2+} \) only precipitated the \( \text{SO}_4^{2-} \) ions. These may have \( \text{CO}_3^{2-} \) ions precipitate instead, which means the validity of the process because the answer will not be accurate and reliably achieved. It will always be too high or too low.

(b) It was found that 4.25 g had a sulfate content of 35%. What is the mass of the dried precipitate at Step 4? Include a chemical equation in your answer.

\[
\text{Mass of } \text{BaSO}_4 = \frac{4.25 \times 35}{100} = 1.4875 \text{ g}
\]

\[
\text{So } 1.4875 \text{ g } \text{BaSO}_4 = \frac{2}{1} \times \text{Ba}^{2+} + \text{SO}_4^{2-}
\]

\[
\text{Calcine } \text{BaSO}_4 \text{ into } \text{SO}_4^{2-} \text{ and } \text{Ba}^{2+}
\]

\[
m(\text{BaSO}_4) = 0.01548
\]

\[
m(\text{Ba}^{2+}) = 20 \div 0.01548 = 1302.06
\]

\[
m(\text{BaSO}_4) = 0.01548 \div (13.2 + 32.06 + 4 \times 16)
\]

\[
= 3.619 \text{ (g per mole)}
\]

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