Assume you have a powder of MgSO4 contaminated with some other substance that does not react with Barium or Chloride. The percentage purity of powdered, impure magnesium sulfate, MgSO4, can be determined by gravimetric analysis. 32.50 g of the impure magnesium sulfate is dissolved in water and the solution is made up to 500.0 mL in a volumetric flask. Different volumes of 0.100 M BaCl2(aq) are added to six separate 20.00 mL samples of this solution. This precipitates the sulfate ions as barium sulfate. The precipitate from each sample is filtered, rinsed with de-ionised water and then dried to constant mass.
The results of this analysis
Mass of impure magnesium sulfate = 32.50g
Volume of volumetric flask = 500.0 mL
Volume of magnesium sulfate solution in each sample = 20.00mL

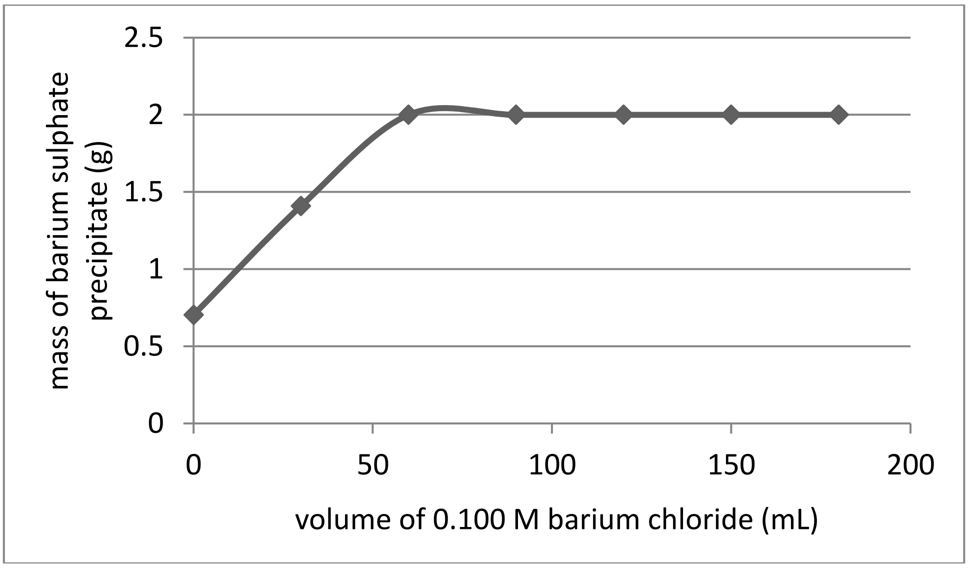
Solution.

Since the table of data on the analysis is not specified, we will add the question to this table.

Table of experimental results

Sample	1	2	3	4	5	6
volume $BaCl_2$(aq) added (mL)	30.0	60.0	90.0	120	150	180
Mass of $BaSO_4$ (s) precipitated (g)	0.704	1.41	2.00	2.00	2.00	2.00

The results are shown in the chart below



Brief description of the method

The method for determining the percentage of magnesium sulfate in its canopy, including impurities, is to precipitate the sulfate ions in the form of a precipitated form, then bring it to the gravimetric form of perforation, and then recalculate the mass of magnesium sulfate ions in the canopy.

The reaction takes place at the addition of 0.100 M barium chloride solution to the prepared, as described in the task, magnesium sulfate solution is written as follows:

$$MgSO_4 + BaCl_2 = BaSO_4 + MgCl_2$$

or in ionic form:

$$Ba^{2+} + SO_4^{2-} = BaSO_4.$$

Next, the precipitate which forms is barium sulfate is separated and calcined to constant weight. At the same time, the reagents are calculated so that the Sorensen index is less than 2 units.

Processing of the results of the experiment

The obtained data show that the resulting mass of barium sulfate is 2.00 g. at the same time, the molar mass of barium sulfate, $M(BaSO_4)$, is 233.4 g/mol ($M(BaSO_4)$=233.4 g/mol).

The formula for barium sulfate shows that: $n(SO_4^{2-})=n(BaSO_4)$. Then:

- in 20 mL sample: $n(SO_4^{2-})=n(BaSO_4)=\frac{m(BaSO4)}{M(BaSO4)}=\frac{2.00}{233.4}=0.00857$ mol;

- in 500 mL flask sample: $n(SO_4^{2-})=n(BaSO_4)=\frac{m(BaSO4)}{M(BaSO4)}V(flask)=\frac{2.00}{233.4}\times 500=0.214$ mol.

At the same time, the magnesium sulfate formula shows that $n(SO_4^{2-})=n(MgSO_4)$, and molar mass of magnesium sulfate: $M(MgSO_4)$=120.4 g/mol. Then:

$m(MgSO_4)=n(SO_4^{2-})\times M(MgSO_4)=0.214\times 120.4=25.8$ g.

The weight of the canopy containing magnesium sulfate is 32.5 g, then the percentage of magnesium sulfate in the canopy will be:

$w\%(MgSO_4)=\frac{m(MgSO4)}{m(sample)}\times 100\%=\frac{25.8}{32.5}\times 100\%=79.4\%$

Answer: the percentage of pure magnesium sulfate ($MgSO_4$) in the canopy is 79.4%.