Study Guides :Mixtures and Filtering

In order to separate a mixture you need to know what the definition of a mixture is first. A mixture is a combination of different substances that can be separated by physical means. This means you're able to separate them into parts, or fractions, based on differences in their physical properties without chemically changing the substances. A mixture can be homogeneous, meaning it has a uniform consistency throughout such as a solution of salt water. The other type of mixture is a heterogeneous mixture which lacks a uniform consistency such as beach sand.

The key to separating a mixture lies in finding some difference in a characteristic property between the different fractions in the mixture. In the same way that you can tell identical twins apart from each other by looking for some subtle difference in their appearance, you also need to look for a difference among the various fractions in a mixture.

For example, if you have a mixture of sand and iron filings that are both the same size particles you would not be able to separate them based on a difference in particle size. One big difference between the two is the fact that iron filings can be attracted by a magnet while the sand is not. All you need to do is to pass the magnet through the mixture. The iron filings would stick to the magnet leaving the sand behind. After a few more passes through the mixture, you would probably have all of the iron filings removed from the mixture leaving just the sand behind.

A typical separation of a mixture question presents you with some information about properties of the fractions in the mixture. You might be given a listing of their densities, boiling points, solubility's in different solvents, ability to be attracted by a magnet, and so on.

Differences in solubility in a particular solvent among the fractions in a mixture, normally require just simple **filtration** to separate them. For example, a mixture of sand and water can be poured through a filter. This will trap the insoluble sand in the filter and allow the water to pass through. However a mixture of sand and salt requires another step. Since sand is insoluble in water while salt does dissolve, you would mix the two into enough water to dissolve the salt. After thorough mixing you would then pour it through a filter. The material left on the filter, called the **residue**, would be the insoluble fraction, in this case the sand. The salt would dissolve into the water and pass through the filter with the water. This liquid, called the **filtrate**, contains the solvent and the soluble fraction, would be allowed to evaporate leaving behind only the salt.

So in order for filtration to work when several solvents are listed, pick whichever solvent shows a difference for each of the fractions. You might even have to filter a mixture more than once using a different solvent each time.

For example, a mixture of table salt (soluble only in water), citric acid (soluble in water and alcohol), and naphthalene (soluble in alcohol). There are two ways you could start this separation, but you need to use a multistep approach in both cases. You could dissolve the entire mixture into water and then filter it. The naphthalene (moth flakes) would not dissolve and would be the residue left behind in the filter. The salt and citric acid would be in the filtrate that passed through the filter. You would have to let the water evaporate from the filtrate before proceeding. Once dry, the salt and citric acid would be added to methanol. This would dissolve just the citric acid. Upon filtering, the salt would be the residue and the citric acid would be alone in the filtrate. You would then let the filtrate evaporate leaving behind just the citric acid. The other way to do this would be to start with methanol first and then water.