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The density of a liquid is calculated by dividing the mass of the liquid by its volume. Water has a higher density than ethanol. As alcoholic drinks contain ethanol and water, the density of the drink is somewhere in between that of pure ethanol and pure water. By making up standard solutions of ethanol and determining the density of these solutions, the % ethanol in a sample of wine can be determined.

Below is one method for determining the % ethanol in wine.

**A. Preparation of standard ethanol solutions**

You should prepare a set of standard ethanol solutions by adding ethanol to water and then measure the density of the solutions. You should make up several standard solutions e.g. 8%, 10%, 12%, 14%, 16% and 18% would be a reasonable set of standards for a typical white wine.

To prepare a 10% ethanol solution:

1. **Carefully** weigh an empty 100cm3 volumetric flask. (To the nearest 0.01g)
2. ![C:\Documents and Settings\esoc\Local Settings\Temporary Internet Files\Content.IE5\TVPNRDS6\MC900352135[1].wmf]()Using a pipette add 10cm3 of ethanol to the 100cm3 volumetric flask.
3. Carefully make up exactly to the mark with deionised water.
4. Re-weigh the flask and contents (again to the nearest 0.01g) and calculate the mass of the 10% solution.
5. Calculate the density = mass of solution ÷ volume of solution

e.g. 90g ÷ 100cm3 = 0.900gcm-3

1. Use this method to prepare a range of standard ethanol solutions of different % ethanol. (A range between 9 and 15% is best)
2. Plot a graph of density versus % ethanol. (Making sure your scale is such that your readings of % ethanol from the density is as accurate as possible.)

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**B. Measuring the density of a sample of wine**

1. Pipette 50 cm3 of wine into a 100 cm3 round-bottomed flask.
2. Make the wine slightly alkaline by adding 2 mol l-1 NaOH (aq) dropwise.
3. Distill the solution and collect 25cm3 of the distillate. By this time the thermometer should be reading 100°C?
4. Pre-weigh a 50cm3 volumetric flask and add the 25cm3 of distillate, with rinsings. Make up to the mark with the water. Weigh this flask to allow you to calculate the density of the wine. Repeat for different types of wine.
5. ![C:\Documents and Settings\esoc\Local Settings\Temporary Internet Files\Content.IE5\4993R5AA\MC900410809[1].wmf]()Use the density value and the calibration graph to calculate the % ethanol in the wines.

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**Tips**

***Accuracy***

*You need to make your measurements as carefully as possible.*

*An error in weighing of 0.01g will give a difference in alcohol content of 0.2%*

*The volume needs even more care. Use a dropper to add the final few cm3 of water so that the meniscus just touches the line and is the same every time. 1 drop of water has a mass of about 0.02g so will have an effect of about 0.4% on your final alcohol content.*

*These errors may sound small but you are working in the main between a range of 11 – 14% for white wines. So in proportion these can be significant errors.*

***Fizz***

*It is impossible to pipette a liquid accurately if it is fizzing. To de-gas a sample. Put it in a flask and stir or shake. (Or shake it in a bottle releasing the pressure by undoing the cap from time to time).*