Finding the concentration of limewater

To find the concentration of 250cm³ limewater containing approximately 1g dm-³ I are going to add hydrochloric acid of exactly 2.00mol dm -³, to find the concentration as accurately as possible I am going to use a method called titration it is accurate because you can add the chemicals drop b y drop so can see exactly the point when the chemicals have fully reacted and how much solution was needed.

The chemical formula is $Ca(OH)_2 + 2HCl \rightarrow CaCl + 2H_2O$

For this experiment I will need:

- A Burette 50cm³
- A conical flask 250cm³
- Volumetric flask 250cm³
- Pipette 25cm³
- Limewater solution 250cm³
- Hydrochloric acid
- Indicator-methyl orange
- Distilled water
- Funnel
- Clamp and stand
- Pipette filler

To get an rough idea of the volume of 2.00mol dm -³ hydrochloric acid I needed to use I needed to work out its theoretical volume.
First I needed to find the moles of calcium hydroxide, I did this by dividing its mass by its relative molecular formula,
1/74.1 = 0.0135
Then I needed to work how many moles there where in a 25cm³
0.0135 x 0.025 = 0.000338

Because the ratios of Calcium hydroxide to hydrochloric acid are 2:1 we need to have twice as many moles
.000378 x 2 = 0.000676
To get volume of hydrochloric acid needed to neutralise the calcium hydroxide we divide the moles by concentration
0.000676/2 =0.000338 dm^{-3} or 0.338cm^{-3}

This is too small of a volume to measure accurately so I will need to dilute the acid to get a more suitable volume. I will use a dilution factor of 100.

I am going to make up 250cm^3 of 0.02 mol dm^{-3} Hydrochloric acid. To do this I will add 2.5cm^3 and add 247.5cm^3 of distilled water I have chosen to make up to this volume to have enough to enable me to do repeat runs.

For this experiment I am going to use methyl orange I am going to use it because it is best suited for strong acids and weak bases. If I were to use a different indicator it will give me a false reading.

Then place 25cm^3 of the limewater into a conical flask using the pipette, then place under the titration equipment then put acid in the burette and record the amount at the start. Next I will add a few drops of your chosen methyl orange to the calcium hydroxide. Then I will titrate the acid in the limewater until the colour of the base changes if successful it should change from yellow to red. As soon as a colour change is observed I will stop the titration and record the amount of acid left. From this you can tell how much acid has been used.
Clean the conical flask using distilled water, then I will set the titration equipment back up and using a fresh sample of limewater solution repeat the experiment until obtain 2 concordant results these are results that are within 0.1 of each other.
Once I have obtained your results the next thing is to work out an average amount of acid used. This amount is used in the final calculations to work out the concentration in moles per litre of the limewater solution then the grams per litre.

run	1	2	2

Final reading cm^3			
Initial reading cm^3			
Volume used cm^3			

Chemical	hazard
2.00 mol dm $^{-3}$	irritant
limewater	irritant
Methyl orange	Skin irritant

Safety precautions	Reason
goggles	To protect eyes from chemicals
Lab coat	To protect body and clothes
gloves	To protect hands from chemicals

I used 2 sources to find the indicator required for this test:

Letts- revise A2 chemistry pg 43
Indicators such as phenolphthalein should not be used because would change before the chemicals have reacted. For strong acids and weak bases Methyl orange would be more suitable

WWW.chemguide.co.uk/physical/acidbaseeqia/idicators.html
Methyl orange is one of the indicators used in titration when a strong acid v weak base are involved.