Chemistry Practical Plan

Aim:
To be able to prove that sulphuric acid is dibasic using both a gas collection procedure, and a titration procedure.

Safety:
- 1.00 M of both H_2SO_4 and NaOH are irritants, and needs to be handled with gloves.
- Goggles must be worn to avoid getting solution in the eyes.
- H_2SO_4 solutions generate a lot of heat when added to water, so the water needs to be added slowly.
- Lab coats have to be worn at all times, to avoid it getting it into your clothes.
- Hair needs to be tied back to prevent distraction throughout the experiments.
- If acid/alkali solution is spilled it will have to be washed off with a weak alkali/acid to neutralise the solution.

Gas Collection Procedure:
One method to prove that sulphuric acid is dibasic is to react magnesium with it. The equation for the reaction is: $Mg_{(s)} + H_2SO_{4(aq)} \rightarrow MgSO_{4(aq)} + H_{2(g)}$. The equation shows us that the number of moles in Magnesium, is the same as the number of moles in Hydrogen gas, because of its 1:1 mole ratio.

Apparatus:
10 cm^3 of H_2SO_4 (1.00M)
0.25g of Mg
Pipette
250 ml Measuring cylinder
Trough filled with water.
Conical flask
Pipe
Spatula
Bung and tube
Weighing scale (accurate to 2d.p)
Plastic tray.
Stand and clamp

Words: 157

Diagram:

Method:
The apparatus will be set up and shown above. I will first put the plastic container in top of the weighing scale, and set the measurements to 0.00 grams. Then I will add magnesium until it reaches to 0.25 grams. Once this is done, I will then add 10 cm^3 Sulphuric acid to the conical flask, by using the pipette.
I will then set up the stand and clamp in such a way that it will hold the inverted measuring cylinder securely in the trough full of water. I also make sure that the tube and the bung is well connected. I will take note of the initial reading of water, and also make sure that there is space for a large volume of gas.

I will then add the magnesium into the conical flask of sulphuric acid, and immediately secure the bung, to avoid any gas from escaping. The volume of gas will rise with the reaction, and the amount of water in the measuring cylinder will also rise, allowing me to calculate the volume of gas.

Words: 179

Equation:
$Mg_{(s)} + H_2SO_{4(aq)} \rightarrow MgSO_{4(aq)} + H_{2(g)}$

Predicted gas volume:
1ml = 1 cm^3

	1	2	3
Initial reading of volume/cm^3	10.00	10.00	10.00
Final reading of volume/cm^3	250.00	250.00	250.00
Actual volume of gas/ cm^3	240.00	240.00	240.00

Average volume:
240.00 + 240.00 + 240.00 / 3 = 240.00 cm^3

Calculation:
Number of moles of magnesium:
Moles = mass/ molar mass
Moles = 0.25/24.3 = 0.01 moles

Number of moles of Sulphuric acid:
Moles = Volume x Concentration / 1000
Moles = 10 x 1.00/1000 = 0.01 moles

Number of moles of Hydrogen gas formed:

Moles = Volume/24,000
Moles = 240.00/24,000 = 0.01 moles

Another way to measure the moles of hydrogen gas would be from the looking at the equation, from the equation we can see that there is a 1 to 1 ratio of Mg of reactant to H_2 product. So for every 0.01 moles of Mg, there would be 0.01 moles of H_2.

Sulphuric acid is dibasic which means that it can loose 2 H ions, to form $SO_4^{2-} + 2H^+$. In the equation, you add magnesium, which reacts with SO_4^{2-} to form Mg SO_4. So in the reaction one atom of Mg reacts with one molecule of H_2SO_4 and form one molecule of H_2. This means that it has taken the two H from H_2SO_4. Hence, sulphuric acid is therefore dibasic.

The pipette is accurate to $\pm 0.01 cm^3$, the weighing scale is accurate to $\pm$ 0.1g, and therefore the largest error in this procedure would be t he human reaction time that is taken to secure the bung when magnesium is added to the sulphuric acid.

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Titration Procedure:

Another method to prove that sulphuric acid is dibasic, Sodium Hydroxide (NaOH) a base can be added to it. The equation for the reaction is: $2NaOH_{(aq)} + H_2SO_{4\,(aq)} \rightarrow Na_2\,SO_{4(aq)} + 2H_2O_{(l)}$. The equation shows us that the volume of NaOH has to be doubled, compared to the volume of H_2SO_4, because two moles of NaOH is needed to neutralise 1 mole of H_2SO_4. This is because Sulphuric acid has two hydrogen atoms (Dibasic). Sulphuric acid cannot be monobasic or tribasic because of its mole ratio, and also because it doesn't have three hydrogen atoms. This gives the reaction a mole ration of 1:2. The titration is set out to prove that two moles of sodium hydroxide will be needed to neutralise the sulphuric acid, because the amount of hydrogen ions needed to be donated to sodium hydroxide takes two moles of base.

Apparatus:

H_2SO_4 (1.00M)
NaOH (1.00M)
Stand and Clamp
White tile
50 cm^3 Burette
Fixed 10 cm^3 Pipette
Conical Flask
Volumetric Flask
Funnel
Phenolphthalein

Words: 147

Diagram:

Method:

The apparatus will be set up and shown above. I will first use a pipette and the volumetric flask to dilute the H_2SO_4, the measurements of the pipette is accurate to $\pm 0.01 cm^3$, so the results are likely to be accurate. I will use the pipette to get H_2SO_4, and put it into the volumetric flask, and then I will fill it up with water up to the mark in the flask. The concentration of both the H_2SO_4, and NaOH would be 1.00M. I will fill up the burette with NaOH up to 0.00 cm^3 using the funnel and write down the initial volume. I will make sure the funnel is taken off to prevent given me any inaccurate readings. Then using the pipette, I will get the diluted H_2SO_4 up to its mark, and put it in the conical flask. I will then put in three drops of Phenolphthalein, as the solutions are strong acids and alkalis, this three drops would be just enough for the solution to turn pink, and titrate it until the end colour is clear.

I will first do a rough titration and repeat the titration 4 times to make sure that it is accurate to within 0.1 cm^3. I will make sure that I will get at least three concordant results to calculate the average titration value.

Words: 224

Equation:

$2NaOH_{(aq)} + H_2SO_{4\,(aq)} \rightarrow Na_2\,SO_{4(aq)} + 2H_2O_{(l)}$

Predicted titration values:

	Rough	1	2	3	4
Initial reading of volume/cm^3	0.00	0.00	0.00	0.00	0.00
Final reading of volume/cm^3	20.00	20.03	20.00	23.90	20.00
Titre volume/cm^3	20.00	20.03	20.00	23.90	20.00

Calculations:

➢Average Titration Volume: ticked are the values used to calculate the average titration values, as it is concordant.
➢Average Titre: 20.03 + 20.00 + 20.00 = 75.0 / 3 = 20.01 cm^3

Number of moles in diluted Sulphuric acid:
Moles = concentration x volume / 1000
Moles = 1.00 x 10/1000 = 0.01 mol^{-1}

Number of moles in Sodium Hydroxide:
Moles = concentration x volume / 1000
Moles = 1.00 x 20.01/1000 = 0.020 mol^{-1}
This clearly shows that two moles of Sodium Hydroxide is needed to neutralize one mole of Sulphuric acid, because it has two H+ protons. This proves that Sulphuric acid is dibasic.

References:

Hazcards
http://allnurses.com/forums/f198/chemistry-2006-2007-club-136569-9.html Words: 51

Total Word Count: 949