ANALYSIS:

Method 1: Measure the volume of hydrogen produced when a known mass of lithium reacts with water.

Set up apparatus. 250cm³ conical flask must contain 100cm³ of distilled water.
Weigh between 0.08g and 0.13g of lithium. Record the exact mass of lithium.
Remove the stopper, add lithium to the flask and quickly replace stopper.
Collect the gas and record final volume of hydrogen.

RESULTS:

I used 0.08g of lithium, this produced 168cm³ of hydrogen gas.

Treatment of results:

Assuming that 1 mole of gas occupies 24,000cm3 at room temperature and pressure

Calculating the number of moles of hydrogen:

168 / 24000 = 0.007 mol

Number of moles of lithium:

0.007 x 2 = 0.014 mol

Using above info and original mass of lithium, RAM of lithium can be calculated as:

1 / 0.014 x 0.08 = 5.7142

Method 2:

Titration of aqueous LiOH with 0.100 mol dm HCl.

1	2	3	4
23.3 cm³	**22.7 cm³**	**21.2 cm³**	**22.9 cm³**

Mean titre is: (22.7 + 22.9) / 2 = 22.8

On average, 25.0 cm of LiOH required 22.8cm of 0.100 mol of HCl

Number of moles of HCl used:

22.8 / 1000 x 0.1 = 0.00228 mol

Number of moles of LiOH:

1:1 ratio so, 0.0228

Number of moles of LiOH present in 100cm of solution:

25cm = 0.00228 x 4 = 0.00912

RAM of Li is therefore :

1/ 0.00912 x 0.08 = 8.77

Hazard concepts:

Lithium reacts violently with water to give off flammable hydrogen gas and corrosive dust. **Lithium hydroxide** (LiOH) is a corrosive alkali.Hydrochloric acid is corrosive to the eyes, skin, and mucous membranes. Acute (short-term) inhalation exposure may cause eye, nose, and respiratory tract irritation and inflammation and pulmonary oedema in humans. Acute oral exposure may cause corrosion of the mucous membranes, oesophagus, and stomach and dermal contact may produce severe burns, ulceration, and scarring in humans. Chronic (long-term) occupational exposure to hydrochloric acid has been reported to cause gastritis, chronic bronchitis, dermatitis, and photosensitization in workers. Prolonged exposure to low concentrations may also cause dental discoloration and erosion

Evaluation:

The overall accuracy of the experiment was not very high due to apparatus and methodological errors.

The main source of error procedure-wise was titrating the LiOH solution and determining when the solution became clear. Measurements of lithium metal were fairly accurate due to use of digital weighing scales, however, when using a water bath to determine amount of hydrogen released, accuracy was not superb.

Repetition of the titration allowed for more reliable results as 2 results became 0.2cm³ off each other. Calculation of a mean titre also helped accuracy.

APPARATUS	ERROR IN ACCURACY	EFFECT OF ERROR ON RESULT	IMPROVEMENT	REASON FOR IMPROVEMENT
Upside down gas cylinder in water bath	Measured to 1 cm³. As accurate as can be expected from a classroom experiment.	Less accuracy would result in inaccurate results, inconsistency and therefore unreliable results	Using a gas syringe to collect hydrogen	This method may be more effective as volume of oxygen can be measured to 0.5 cm³.
Conical flask	Only measure per 50cm³, up to a maximum of 250cm³	More or less LiOH solution than required will result in inaccuracies in the experiment	Use a beaker which has greater accuracy in measurements	Better results can be achieved if accuracy is ensured. The more accurate results are the more successful the experiment will be

METHODOLOGY	ERROR IN ACCURACY	EFFECT OF ERROR ON RESULT	IMPROVEMENT	REASON FOR IMPROVEMENT
Replacing the bung	Hydrogen gas may have escaped whilst replacing the bung	Less hydrogen than expected will affect the calculations and effectively the RAM	Use Vaseline to ensure bung tightly sealed. Use syringe to inject diluted water rather than add lithium	No or little gas will escape making the experiment more accurate
Number of drops of Phenolphthalein	More or less than the expected 5 drops may have been added, or bigger or smaller drops	Excess phenolphthalein would result in solution taking longer to titrate and vice-versa	Add a specific amount of phenolphthalein, for example 10cm^3	If consistent amount of phenolphthalein is added then titration will be more reliable
Shaking of solution	Whilst titrating, the flask may have been shaken more or shaken less	Shaking the flask, distributes molecules more equally so therefore titration is faster	Use an electronic shaker	Better results can be achieved if consistency is ensured. Equal distribution will result in fair accurate results

Validity of results:

Although there were some major sources of error, I believe this experiment to be valid. Accuracy was maintained at a level sustainable in a classroom. Extraneous variables were controlled to the best of my ability.

Reliability of results:

Due to having achieved two results within 0.2cm^3 of each other I would have to say my results are reliable. Consistency in methodology was sustained and this allowed for greater accuracy of results.