

## Acid Rain Investigation

### Background information:

- There are many different kinds of erosion but acid rain or else wind erosion are the two main types which could have eroded the marble statue which was positioned in the garden close to the industrial site.
- Acid rain is made up from of a cocktail of different acids e.g. sulphuric acid, nitric acid, carbonic acid. Sulphuric acid is released into the atmosphere from the burning of fossil fuels like coal and oil, nitric acid is given off from car exhaust fumes, These gases react with water vapour and oxygen from the atmosphere and with the help of sunlight turn to acids and fall to ground in the forms of precipitation with high acidity levels which are between pH 1.5 and 5 (acid rain or acid snow).
- Sulphur dioxide is harmful to humans and can led to bronchitis and other lung diseases.
- Sulphur is released into the atmosphere through burning fossil fuels; most of the world's air pollution is due to the smoke given off from burning things.
- The increasing amount of acid rain, which falls each year, is due to the increasing amount factories and vehicles on our roads.
- Lakes in Scandinavia are effected very badly by acid rain even though very little of it is actually produced there, it is carried mainly by prevailing winds from Germany, France, the UK and other large industrialised European countries.
- Acid rain can destroy trees by removing vital minerals from the soil, buildings, metal work e.g. cars, bridges, it can also destroy lakes and rivers killing all fish and plants which live their, acid rain can also take effect on are health.
- Nitric acid could be the main power in acid rain for it is the most corrosive of all the acids which make up acid rain.



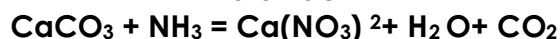
Calcium carbonate + sulphuric acid = calcium sulphate + water + carbon dioxide



This word is equation is not to blame for the erosion of the marble statue because calcium sulphate is an insoluble participate which means that when the calcium sulphate come into contact the statue will be coated preventing it from any further erosion.

With sulphuric acid not the blame for eroding the statue that leaves nitric acid and carbonic acid, carbonic acid is very weak and therefore it would not be possible for it to erode the statue in such a short time, so that means the acid which has eroded the marble statue is nitric acid

Calcium carbonate + nitric acid = calcium nitrate + water + carbon dioxide



What am I going to investigate?:

I am going to find out how the concentration of nitric acid would effect the marble statue and would quickly it will erode depending on how high the concentration of acid is. With the results I gain from this experiment I will draw up a graph to show how the concentration has taken effect.

Safety:

Like all experiments safety is very important and everything should be done carefully, safety goggles should be worn at all times in this experiment, we are using acids which are very strong, especially nitric acid, and therefore can easily burn so extra care is needed. All rules for experiments should be followed, to prevent any unwanted accidents, e.g. chairs below tables, tie tucked in.

Fair test:

To make this experiment fair a number of things must remain the same through-out the investigation:

1. same volume of acid used through-out, will be 25cm<sup>3</sup>.
2. Same type of acid used in the testing, in this experiment it will be nitric acid which I will use.
3. Every investigation must be done in the same temperature, this will be room temperature.
4. Same weight of marble used which will be measured to two decimal places.
5. So my results are correct I will do each experiment twice and find the average from the two tries.

## Apparatus:

1. Electronic scales- will be used to weigh out the marble to an accuracy of two decimal places.
2. Measuring cylinder- this will be used to measure out the volume of the acid.
3. Stop clock- used to time how long the marble is reacting with the acid.
4. Marble chips- will be used to react with the acid; some of the marble will be in powder form to speed up the reaction.
5. Nitric acid- will be used to react with the marble chips.
6. Beaker- will be where the reaction will take place.
7. Safety goggles- used to protect your eyes in case of any spillages, should be worn at all times during the experiment.

## What affects the rate of reaction?

There are three main factors which can effect the rate of reaction on the marble statue they are:

The concentration of the acid- the higher the concentration the more collisions will take place therefore erosion occurs quicker.

The pressure of the acid- the higher the pressure the more collisions due to the particles being closer together.

Temperature- the higher the temperature the more energy the particles will have meaning they will move much quicker and cause more reactions.

Light- the amount of light available can alter the rate of reaction for the light will give energy to the particles which will increase the number of collisions.

The size of the solids surface- the larger the surface area the longer it will take to be broken down, so a reaction on a solid with a small surface area will take a less time.

## Variables:

Controlled- what I will keep the same through out this whole investigation is the mass of the marble which I will be using, it will be measured accurately using electronic scales. The volume of the acid will also be the same and it will be measured out using a measuring cylinder.

**Independent**-this is what will be changed through-out the experiment, I will change the concentration of the acid for each part of the investigation.

**Dependent**- I will measure the length of time it takes for each concentration of acid to erode the marble pieces. This will be done using a stop clock.

Prediction:

I think that if the concentration of the acid is increased the speed of the reaction will increase, this is because with a small concentration of acid mixed with marble there is less acid particles to react with the marble meaning there are fewer successful collisions, with a much larger concentration of acid mixed with marble more collisions will take place because there are more acid particles which means that the reaction will take less time.

Suitable range of readings:

I will have to collect enough readings from my experiment to draw a graph, this means I will need more than 5 readings, so If I record a reading every minute I should have enough information. I will do each experiment two times and take the average results. From this I will draw a graph to show the concentration of acid against time taken.