

## Air Pollution – What are the Key Pollutants and Sources?

Read the passage below.

Use coloured pens / pencils to circle and underline words or phrases as indicated below.

Find the **natural sources** contributing to acid rain. Circle these in **RED**.

Some **pollutants** which contribute to acid rain are **caused by human activities**.

Circle these in **BLACK**.

Find the **processes** by which **acid rain is formed** in the atmosphere. Underline these in **RED**.

Find the **ways** in which **acidic pollution falls** to the Earth. Underline these in **BLACK**.

### Pollutants, Sources and Causes

Rain water is naturally acidic because of carbon dioxide that has dissolved in the rain. Natural rain has a pH of 5.6. Despite rain water being slightly acidic, it is not called acid rain unless the pH value is lower than 5.6.

There are many factors that cause acid rain. Some are natural and some are the result of human activities. Pollution due to human activities is the most common cause of acid rain. Though there are many pollutants in the air, the main pollutants causing acid rain are sulphur dioxide ( $SO_2$ ) and nitrogen oxides ( $NO_x$ ). These air pollutants come mainly from burning fossil fuels for energy e.g. burning coal, industrial factories and road transport. Coal burning is the single largest source of sulphur dioxide accounting for about 50% of annual global emissions, with oil burning accounting for a further 25 to 30%. Natural sources of sulphur dioxide include releases from volcanoes, ocean sea spray and forest fires.

Nitrogen oxides are gases that are by-products of burning at extremely high temperatures e.g. cars and some factories, and of some chemical industries (fertiliser production). Natural sources of nitrogen oxides are biological decomposition in soils, forest fires, volcanic action and lightning.

Once in the atmosphere, sulphur dioxide and nitrogen oxides are carried by the wind, and can (in time, after several complex steps of chemical reactions), be converted into sulphuric and nitric acids. These conversions occur in the atmosphere when sulphur dioxide and nitrogen oxides react with water and oxygen and become acid rain. The brightness of sunlight is another factor that affects how quickly nitrogen oxides and sulphur dioxide are converted to nitric and sulphuric acids.

When acid falls to the ground it is called acid deposition. There are two different forms - dry and wet deposition. Acids are carried through the atmosphere by winds. Dry acid deposition falls to the Earth in the form of gas and dust. Wet acid deposition (acid rain) falls to the Earth as precipitation in the forms of rain, snow or fog. Dry acid deposition tends to fall to the Earth earlier than wet acid deposition. This is because the distance that dry acid deposition travels before falling to the Earth just depends on wind speed and wind direction and does not have to wait for it to rain. For example, in a dry desert region, if there is acid deposition, it will almost always be dry acid deposition since there is so little rain falling. In the UK, there is both dry and wet acid deposition. Wet acid deposition is more common here in the UK than in the south of Spain, as there is a higher amount of rainfall in the UK.

The other two important pollutants are carbon monoxide ( $CO$ ) and carbon particulates (tiny bits of solid suspended in the air), which are both released from cars and power stations. Carbon monoxide is very poisonous gas. It blocks oxygen from being carried in the blood.  $CO$  can change to carbon dioxide ( $CO_2$ ) in the atmosphere but this usually takes a long time. Carbon particulates stick to surfaces and make them dirty. They can be breathed into lungs and can make asthma and lung infections worse.

**END**