Meden School Curriculum Planning							
Subject	Chemistry	**Year Group**	9	**Sequence No.**	11	**Topic**	Chemistry of the atmosphere

Retrieval	Core Knowledge	Student Thinking
What do teachers need to **retrieve** from students before they start teaching **new content**?	What **specific ambitious knowledge** do teachers need teach students in this sequence of learning?	What real life examples can be applied to this sequence of learning to **development of our students thinking, encouraging them to see the inequalities around them** and 'do something about them!'
KS2: Plant growth. In KS2 students learnt that plants need carbon dioxide and water to make their own food. **KS3: Yr 8 Plant structure and reproduction.** Students learnt about the process's photosynthesis and reproduction.	**L1: Oxygen and the atmosphere.** The Earth has an **atmosphere** which makes life possible. It is a layer of **gases** that surrounds the earth, these gases contain oxygen which is what we need to survive. It protects the earth from **harmful UV radiation** from the Sun and keeps the earth at a temperature at approximately 15°C, without it the earth would be at -18°C. The atmosphere is also the reason why we have **liquid water** on the surface of planet earth as it maintains the pressure needed. One source of oxygen in the atmosphere is from the process **photosynthesis** where plants and algae take in carbon dioxide and water to produce oxygen and glucose. The word equation is **carbon dioxide + water → oxygen + glucose**. As plants evolved over the first few billions of years, the levels of **carbon dioxide decreased** and **oxygen increased** allowing the evolution of more complex organisms and animals. Today's atmosphere contains approximately **20% oxygen**. **L2: Composition of the atmosphere.** In lesson 1, students found out that the atmosphere contains 20% oxygen. The remaining atmosphere consists of approximately **78% nitrogen, 0.04% carbon dioxide and trace amounts of argon and water vapour**. Our current composition of the atmosphere has remained the same for the **past 200 million years**. Also found in the air around us is air pollution. **Air pollution** refers to the presence of **dangerous or poisonous substances** and chemicals in the air that we breathe. These include **soot, sulfur dioxide, nitrogen oxides, methane, carbon monoxide and carbon dioxide**. Carbon monoxide and soot are produced when fuels undergo **incomplete combustion**. This is when the fuels burn in an insufficient supply of oxygen. Soot causes **lung damage and respiratory problems** if they are inhaled. Carbon monoxide can cause **fainting, sickness and even death** in large amounts. It is **colourless and odourless** and so is hard to detect. Sulfur dioxide is caused when fossil fuels contain an impurity and are then burned. This causes problems for people with respiratory problems and will then turn into **acid rain** when it combines with the water in the clouds. Another contributor to acid rain is	Careers: Relevant career paths include climate change analysts, environmental health and safety specialists, environmental scientists

KS3: Year 8 Earth science. Students learn about the processes involved in the evolution of the atmosphere.	oxides of nitrogen. These are formed when the nitrogen in the air reacts with oxygen in the combustion engines of vehicles. The nitrogen oxides again cause respiratory problems and when it falls as acid rain, causes lakes to become acidic and many **plants and animals die**. Acid rain **also kills trees, damages limestone buildings and ruins statues**. Methane is released from land fill sites, rice fields and cows. It is a **greenhouse gas** and contributes towards **global warming** alongside carbon dioxide which is produced when fuels undergo **complete combustion** (when there is a plentiful supply of oxygen). To monitor the pollution across Britain, there are many **monitoring stations** both in rural and urban locations. They monitor rainwater pollution, smoke, soot, nitrogen oxides, sulfur dioxide, carbon monoxide and particulates such as ash and dust. **L3: The carbon cycle.** The levels of carbon dioxide in the Earth's atmosphere are rising – and it's down to **human activities and natural causes**. This is leading to **global warming**. Carbon is very important because it is part of all living things. It is constantly recycled through the environment. The main processes involved in the carbon cycle are **photosynthesis, combustion, respiration, decomposition** and when it is passed along the food chain (**feeding**). Photosynthesis reduces the levels of carbon dioxide in our atmosphere where as combustion and respiration increases the levels of carbon dioxide. **L4 & 5: Evolution of the atmosphere.** When the earth was first formed billions of years ago, it was so **hot** that any gases were driven away and no atmosphere could form. Eventually the earth began to **cool** and a **crust** began to form. The earths first atmosphere came from the intense **volcanic activity** that released gases into the air. Gravity then held them in place to form our first atmosphere. The first atmosphere consisted of approximately **95% carbon dioxide, 4% water vapour and trace amounts of nitrogen, ammonia and methane**. The earth continued to cool and the **water vapour condensed** into the oceans. The levels of carbon dioxide partially decreased due to it being **dissolved in the oceans**. Once in the oceans, the **carbonates formed precipitates**. These precipitates formed **sediments** such as calcium carbonate on the seabed which later formed **sedimentary rocks** such as limestone. Marine organisms also used these carbonate precipitates to form their **shells and skeletons**. Carbon from carbon dioxide has also been **locked up in fossil fuels**. When trees and plants died in the absence of oxygen in swamps, they became compressed under heat and pressure over millions of years and formed **coal**. **Natural gas and oil** were produced from the burial of marine organisms such as plankton on the seabed under intense pressure and temperatures. **Photosynthesis reduced** the levels of **carbon dioxide** and **increased the levels of oxygen**. Oxygen reacted with the ammonia in the air to form nitrogen and water. **L6: Evidence for the evolution of the atmosphere.** Over time, scientists have developed different theories of how the atmosphere evolved. Due to the **large time scale** involved, scientists do not have much evidence and so came up with theories. Scientists believe that our early atmosphere is similar to	

	the atmospheres of Venus and Mars. Scientists use **evidence** from the **fossils of early bacteria** to determine that there wasn't much oxygen in the atmosphere as fossils of certain bacteria have been discovered that are older than organisms that do rely on oxygen to survive. Other evidence has come from other fossils such as **stromatolites** which are calcium carbonate rocks that consist of a mass of algae and trapped sediment. Certain rocks called **'red beds'** contain lots of iron oxide, these are used to pinpoint when there were sufficient levels of oxygen in the atmosphere to react with the iron to form iron oxide. **L7: GPA graph drawing.** The levels of carbon dioxide have changed dramatically over the past few billion years. One dramatic increase was due to the industrial revolution. Students are to draw graphs to show this increase of carbon dioxide in the atmosphere.	
KS3: Yr 8 Earth Science. Students learn about the greenhouse gases and what the greenhouse effect is.	**L8: The greenhouse effect.** The greenhouse effect is where certain gases, called **greenhouse gases**, act as an **insulating layer** around the earth keeping it warm enough to support life. If we didn't have this, it would be too cold for life to exist. These greenhouse gases include **carbon dioxide, methane and water vapour**. **Short wavelength ultraviolet radiation** from the sun passes through the atmosphere and is **absorbed** by the earths surface. The earth then emits this radiation as **long wavelength radiation**, **infrared radiation**, in order to cool itself. This thermal radiation then warms the surface of the earth. Some of this radiation will escape into space but some will be **trapped** by the greenhouse gases. It is then re-radiated back down to earth, continuing to warm the surface of the earth. Carbon dioxide can remain in the atmosphere for 50-200 years where as methane will remain for approximately 8-12 years. However, methane is more potent as it is 20 times more effective at trapping heat. Water vapour is the most **abundant** greenhouse gas in the atmosphere.	Global warming and climate change are very prevalent in the news. Last year, The COP26 summit brought parties together to accelerate action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change. Scientists have warned that we are already at a tipping point that might lead to "non-linear, abrupt environmental change within continental- to planetary-scale systems". Lots of measures are being put in place to avoid this such as The UN's Sustainable Development Goals including universal calls to action to protect life on land and in water, producing clean water and tackling climate change. Meanwhile, the EU's Environmental Action Plan includes nine priority objectives that aim to ensure "we live well, within the planet's ecological limits". It is happening around us now, in our lifetimes, as scientists have reported that the last seven years have been the
KS3: Yr 8 Earth Science. Students learn about climate change and the effects.	**L9: Global warming.** Global warming where the Earth's temperature is increasing, this is sometimes known as the **enhanced greenhouse effect**. Many human activities have led to the increase in greenhouse gases in the atmosphere. These activities include **burning fossil fuels** which has released locked up carbon dioxide into the atmosphere, **deforestation** which reduces the reduces the amount of carbon dioxide removed from the atmosphere by photosynthesis, we call these **'CO_2 sinks'**. Increased animal farming releases more methane into the atmosphere (it is a by-product of digestion and decomposition of waste) as well as the paddy fields that grow rice. Methane is also released into the atmosphere due to the decomposition of rubbish in landfill sites. Global warming can lead to **climate change**. Climate change is any **significant long-term change in the expected patterns of average weather in a region (or the whole Earth) over a significant period of time**. Global warming and climate change results in many devastating effects such as **rising sea levels, polar caps and glaciers melting**, leading to **flooding**. More areas will suffer from **drought** as they become drier from increased	

	temperatures. These droughts result in **famine** as crops are unable to grow. More extreme weather will occur such as more **frequent storms, hurricanes and tornadoes**. Animals will become **extinct** due to **habitats being destroyed**. **L10: Data task. How do trees clean our air?** Alongside carrying out the process of photosynthesis, trees are very important in helping clean the air we breathe in. They store **30% of carbon emissions** resulting from human activities. The trees act as a physical barrier to block the pollutants from reaching people as well as benefiting mental health, **reduce surface flooding**, provide shade in the summer, reduce owners spending on air conditioning as well as contributing to **mitigating global climate change**. Students use data to determine where and when the greatest amounts of pollutants in the atmosphere can be found. **L11: Revision** **L12: EOTT** **L13: GPA**	warmest years on record, with global temperatures rising more than 1°C above pre-industrial levels and edging closer to the limit laid out under the Paris agreement. In 2019, inspired by Greta Thunberg, across the UK thousands of school children walked out of school in a mass protest to shown their concern about the threat of climate change. One of the effects of climate change is the melting of polar ice caps and glaciers. In 2019 the Greenland ice sheet lost 532 billion tonnes of ice. The rate of melting has been monitored since 2003 and 2019's ice lost was more than double the average of 255 billion tonnes and broke the previous record set in 2012 by 15%.