Meden School Curriculum Planning							
Subject	Chemistry	**Year Group**	9	**Sequence No.**	12	**Topic**	History of the atom and periodic table

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!'
Year 8: Atomic structure topic. Students learnt the properties of the sub-atomic particles. **Year 8: Atomic structure topic.** Students were introduced to elements having an atomic number and a mass number.	**L1: What is an atom?** Over time, different scientists have come up with a hypothesis to explain what the atom consists of/looked like. **John Dalton** was one of the early scientists who proposed a theory about what an atom is. He said that every element has its own unique type of atom which **are small, solid, invisible spheres**. Scientists now know that the atom consists of three smaller particles (**sub-atomic particles**) called **protons, neutrons and electrons**. The electrons have a negative charge and can be found in **shells** around the edge of an atom. The **nucleus**, which is in the centre of the atom contains two types of sub-atomic particles, the **protons** which are positively charged and the **neutrons** which have no charge, they are neutral. Two important properties that we use to describe these sub-atomic particles are **mass and charge**. Protons have a charge of +1 and a mass of 1. Electrons have a charge of -1 and a mass which is described as 'very small' and neutrons which have a charge of 0 and a mass of 1. Scientists often write really big or small numbers in standard form. When doing this the number is always written in the form **A x 10^n** where A is a number between 1 and 10. **L2: Sub-atomic particles and nuclear symbols.** In an atom of a particular element, there are always the **same number of protons**, this never changes. The numbers of protons, neutron and electrons in an atom can be found on an elements **nuclear symbol** on the periodic table. The **atomic number** (bottom number) is the number of **protons**. The number of **neutrons** can be found from the **mass number** (top number) which tells us the number of protons and neutrons. To find the number of neutrons, mass number – atomic number. To find the number of **electrons**, this is the same as the number of protons in a **neutral atom**. This is why an atom has **no overall charge** as the proton charge and the electron charge balance each other.	

	L3 & 4: The history of an atom. What scientists believe an atom consists of has changed over time and there are a few notable scientists who had theories that were accepted for long periods of time. **Democritus**, from ancient Greece, said that all matter was composed of **small particles** that could be **divided no further**. Different atoms had **different sizes, shapes, mass, positions and arrangement**. After lots of experiments and chemical reactions, John Dalton stated that atoms were **solid spheres** and that different spheres made up the **different elements**. **JJ Thomson** came to the conclusion that the atom could no longer be a solid sphere from his experiments, the atom must also contain **small, negatively charged particles** and the positive charge is spread throughout. He called this model the **'Plum pudding model'**. **Ernest Rutherford and Ernest Marsden** came up with the **'Nuclear model'**, they fired positive alpha particles at a thin sheet of gold. They expected most of the particles to pass straight through, the majority did but some were deflected or reflected backwards. They came to the conclusion that an atom is **mostly empty space** with most of the **mass concentrated at the centre** in a **positively charged nucleus**. They said that electrons surrounded the nucleus in a **'cloud'**. **Niels Bohr** proposed a slightly modified version of the nuclear model, **'Bohr's nuclear model'** where he decided that if the electrons were in a 'cloud' around the nucleus then the atom would collapse because of the attraction to the positive nucleus. The electrons must be in **shells at fixed distances from the nucleus**. After further experiments, Rutherford concluded that the nucleus could be divided into smaller particles each of which had the same charge as a hydrogen nuclei, these were referred to as **protons.** James **Chadwick** later discovered neutrons. **L5: GPA – Comparing the different models of the atom.** Students complete a task using the information from the previous few lessons to compare the different models of the atom. Students answer an exam question. **L6: The early periodic table.** There have been many versions of the periodic table with different scientists contributing and rebutting previous versions. These scientists include **John Newland, Dmitri Mendeleev, Henry Moseley, Johann Dobereiner and Antoine Lavoisier**. One of the early periodic tables was put forward by **Antoine Lavoisier**, he has often been referred to as the father of modern medicine. He grouped the elements based on their **properties**, for example as gases, non-metals, metals or earths. **Johann Dobereiner** had a theory called the **'law of triads'** where he grouped three elements with similar appearances and reactions. In total he had 5 triads. A limitation of his law of triads were that new elements were discovered and some known elements did not fit into any of the triads**. John Newland** proposed a new periodic table where he based his grouping on the octaves you find in music. His law**, the law of octaves**, noticed a pattern that each element was similar to the element eight places further on. Some limitations of his table were that he placed more than one element in a box to keep the pattern and he grouped metals with non-metals.	L3: The first person in recorded history to discover a new element was Hennig Brand, a bankrupt German merchant. Brand tried to discover the philosopher's stone—a mythical object that was supposed to turn inexpensive base metals into gold. L6: From a chemistry point of view, very little is mentioned about a few scientists who had a hand in what we now know as the periodic table. A French geology professor, Alexandre Béguyer de Chancourtois, made a significant advance towards it, even though at the time few people were aware of it. He was the first to use a periodic arrangement of all the known elements, showing that similar elements appear at periodic atom weights. Henry Moseley provided a

	L7: Mendeleev's periodic table. Our periodic table is based on the work of **Dmitri Mendeleev**, a Russian scientist who is known as **father of the periodic table**. Mendeleev left **gaps** in his table as he thought these were **undiscovered elements**. In his table, there were 8 groups ordered by atomic mass and similar properties. Like Newland, he also had multiple elements in one box however he would swap elements in order for their properties to fit better in another group. For the gaps, he **predicted the properties** of these missing elements and these predictions made his table more widely accepted later when elements were discovered which had matching properties to his predictions. **Henry Moseley** developed Mendeleev's ideas and proved him correct. He carried out experiments where he fired an x-ray gun at samples of elements and measured the **wavelengths of x-rays given**. This gave a way to measure atomic number which gives us the number of protons in an atom. This is how the current periodic table is ordered, in increasing **atomic number**. **L8: The modern periodic table.** There are over **100 known elements, 90 are natural** and the rest have been made in a science lab. The elements can be grouped according to their **similarities and differences** – this is how the periodic table is arranged. There are two types of elements, **metals and non-metals**. There are more metals compared to non-metals and all of the main elements have been grouped in **vertical columns called groups**. These groups have **similar chemical properties**. Several of these groups have specific names, for example **group 1** are called the **alkali metals**, **group 7** are called the **halogens**, **group 0** are the **noble gases** and the group in the middle are called the **transition metals**. Groups 3, 4, 5 and 6 do not have specific names. At A Level, group 2 become the alkaline earth metals. The **horizontal rows** are called **periods**. Most of the elements in the periodic table are **solids** but there are a few exceptions such as bromine and mercury. **L9: Revision** **L10: EOTT** **L11: GPA**	definitive way of identifying new elements based on measurements of X-ray frequencies. Mendeleev gets credit for 'discovering' the periodic table but the inspiration and data used came from Amedeo Avogadro, Johann Wolfgang Dobereiner and Stanislao Cannizzaro. Newland, another scientist who is credited with an earlier periodic table also predicted the existence of other elements but this does not get taught, more emphasis is placed on Mendeleev predicting the existence of other elements. L8: Some scientists feel there are no limits to the periodic table. No one is sure how long it will take, but it is certainly possible for new elements to be discovered in the future.