Medium Term Planning - Topic: ATOMIC STRUCTURE

Curriculum Intent	**In addition to working further on objectives from Year __, pupils will be taught, following National Curriculum guidelines, the following this topic:**
Skills/National Curriculum Links	• Use chemical symbols of atoms to produce the chemical formulae of a range of elements and compounds. • Explain the significance of chemical symbols used in formulae and equations. • Justify in detail how mass may appear to change in a chemical reaction. • Describe unfamiliar chemical reactions with more complex balanced symbol equations, including state symbols. • Write balanced symbol equations. • Justify in detail how mass may appear to change in a chemical reaction. • Describe unfamiliar chemical reactions with more complex balanced symbol equations, including state symbols. • Write balanced symbol equations. • Use experimental data to explain the classification of a substance as a compound or mixture. • Suggest an appropriate separation or purification technique for an unfamiliar mixture. • Explain in detail how multi-step separation techniques work. • Explain in detail how fractional distillation can separate miscible liquids with similar boiling points. • Evaluate separation or purification techniques for a given mixture. • Justify why the model of the atom has changed over time. • Evaluate the current model of an atom. • Use the Periodic table to find atomic number and mass number data and use it to determine the number of each sub-atomic particle in any given form. • Recognise and describe patterns in sub-atomic particles of elements listed in the Periodic Table. • Explain why we can be confident that there are no missing elements in the first 10 elements of the Periodic Table. • Use the Periodic table to find atomic number and use it to determine the number of each sub-atomic particle in an ion. • Use SI units and prefixes to describe the size of an atom and its nucleus in standard form. • Use the Periodic Table to find atomic number and determine the electronic structure for the first 20 elements. • Make predictions for how an element will react when given information on another element in the same group.
Spiritual, moral, social, and cultural development	**SMSC:** group work from practical activities in this section. Also pupils can work in groups to produce a timeline for the development of the atom. **PSHE/British Values:** The history of the is important development of the atom when learning about british values and world values. Students will complete teamwork, leadership and put science into everyday situations. They will show mutual respect during classwork. **Skills Builder:**Listening (Receiving, retaining and processing info), Speaking (The oral transmission of info and ideas), Problem solving (Find a solution to a situation or challenge), Creativity (imagination and generation of new ideas), Staying positive (The ability to use tactics and strategies to overcome setbacks), aiming high (Set clear and tangible goals), Leadership and teamwork
Numeracy	
Literacy	**Vocabulary Tier 2:** atoms, elements, periodic table, groups, columns, molecule, nucleus, electrons, neutrons, protons, combine, metals, nonmetals, orbiting, balanced, separate, vapor, crystals, usable, solution, solvent **Vocabulary Tier 3:** global community, symbols, arrangement, metalloids, semi-metals, metallic, non-metallic, bonds, chemical formula. aqueous solution atomic number balanced symbol equation biofuel chromatography electronic structure ion isotope law of conservation of mass mass number noble gases product reactant shell state symbol symbol equation word equation. **Reading:** Following a written method and read risk assessments. Students may be directed to the textbook; this could be in lesson or at home on Kerboodle. **Writing:** Describing and explaining scientific phenomenon, free response writing for describing precautions taken, use of word mat to promote sentence formation. **Oracy:** inclusion of BEST resources which are research evidence on common misunderstandings in science, effective diagnostic questioning and formative assessment, constructivist approaches to building understanding, and effective sequencing of key concepts that promote metacognitive talk and dialogue.
Becoming future ready	**Careers/Employability:** Scientist Chemist Drug development Teacher Post-doctoral researcher
Adaptation	Throughout this topic, quality first teaching will provide differentiation:

QFT/SEND Provision

By product: Linear assessments and differentiated practical work.
By resource: Lessons are differentiated per class and students, worksheets are available if support and assessments are linear.
By Intervention: by providing different levels of supervision and support
By Progressive Questioning: exploring pupils' understanding through interactive dialogue.
By Grouping: according to prior attainment, gender, social preference, preferred learning style.
By Task: Pupils should be involved in the identification of targets which are meaningful to them and in the selection of an appropriate task from the given range.
By Offering Optional Activities: In class or as homework, to extend learning.
This QFT/SEND provision will be explicit within the lesson-by-lesson schemes of work.

Implementation Curriculum Delivery

Learning Outcomes (Core Knowledge)

To be able to:
1.1.**1 All substances are made of atom**s. An atom is the smallest part of an element that can exist.
Atoms of each element are represented by a chemical symbol, for example, O represents an atom of oxygen, Na represents an atom of sodium. There are about 100 different elements. **Elements are shown in the Periodic Table.**
Compounds are formed from elements by chemical reactions. Chemical reactions always involve the formation of one or more new substances, and often involve a detectable energy change. **Compounds contain two or more elements chemically combined in fixed proportions and can be represented by formulae using the symbols of the atoms from which they were formed.** Compounds can only be separated into elements by chemical reactions.
1.1.1 **Chemical reactions can be represented by word equations or equations using symbols and formulae.**
2.2.2 In chemical equations, the three states of matter are shown as (s), (l), and (g), with (aq) for aqueous solutions. Students should be able to include appropriate state symbols in chemical equations for the reactions in this specification.
3.1.1 T**he law of conservation of mass states that no atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants**.
This means that chemical reactions can be represented by symbol equations which are balanced in terms of the numbers of atoms of each element involved on both sides of the equation.
Students should understand the use of the multipliers in equations in normal script before a formula and in subscript within a formula.
3.1.3 **Some reactions may appear to involve a change in mass but this can usually be explained because a reactant or product is a gas and its mass has not been taken into account**. For example: when a metal reacts with oxygen the mass of the oxide produced is greater than the mass of the metal or in thermal decompositions of metal carbonates carbon dioxide is produced and escapes into the atmosphere leaving the metal oxide as the only solid product.
1.1.2 **A mixture consists of two or more elements or compounds not chemically combined together. The chemical properties of each substance in the mixture are unchanged.**
Mixtures can be separated by physical processes such as filtration, crystallisation, and simple distillation. These physical processes do not involve chemical reactions.
Students should be able to:

- **describe, explain, and give examples of the specified processes of separation**
- suggest suitable separation and purification techniques for mixtures when given appropriate information.

1.1.2 **Mixtures can be separated by physical processes such as fractional distillation and chromatography.**
These physical processes do not involve chemical reactions.
Students should be able to:

- describe, explain, and give examples of the specified processes of separation
- suggest suitable separation and purification techniques for mixtures when given appropriate information.

1.1.3 **New experimental evidence may lead to a scientific model being changed or replaced.**
Before the discovery of the electron atoms were thought to be tiny spheres that could not be divided. The discovery of the electron lead to the plum-pudding model of the atom. The plum-pudding model suggested that the atom was a ball of positive charge with negative electrons embedded in it.
The results from the alpha scattering experiments of Geiger and Marsden led to the plum-pudding model being replaced by the nuclear model.
Niels Bohr adapted the nuclear model by suggesting that electrons orbit the nucleus at specific distances. The theoretical calculations of Bohr agreed with experimental observations.
Later experiments led to the idea that the positive charge of any nucleus could be subdivided into a whole number of smaller particles, each particle having the same amount of positive charge. The name proton was given to these particles.
In 1932 the experimental work of James Chadwick provided the evidence to show the existence of neutrons within the nucleus.
Students should be able to:

- describe why the new evidence from the scattering experiment led to a change in the atomic model
- describe the difference between the plum-pudding model of the atom and the nuclear model of the atom.

Details of experimental work supporting the Bohr model are not required. Details of alpha particle scattering experiments are not required. Details of Chadwick's experimental work are not required.
1.1.4 **The relative electrical charges of the particles in atoms are:**

Name of particle	**Relative charge**
proton	**+1**
neutron	**0**

electron	**-1**

In an atom, the number of electrons is equal to the number of protons in the nucleus. Atoms have no overall electrical charge.

The number of protons in an atom of an element is its atomic number. **All atoms of a particular element have the same number of protons**. Atoms of different elements have different numbers of protons.

Students should be able to use the nuclear model to describe atoms.

1.1.5 **Almost all of the mass of an atom is in the nucleus. The relative masses of protons, neutrons, and electrons are:**

Name of particle	**Mass**
proton	**1**
neutron	**1**
electron	**very small**

The sum of the protons and neutrons in an atom is its mass number.

1.1.5 Atoms are very small, having a radius of about 0.1 nm (1×10^{-10} m).

The radius of a nucleus is less than 1/10 000 of that of the atom (about 1×10^{-14} m).

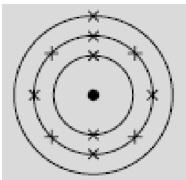
Almost all of the mass of an atom is in the nucleus.

Atoms of the same element can have different numbers of neutrons; these atoms are called isotopes of that element.

Atoms can be represented as shown in this example:

(mass number) (atomic number) $^{23}_{11}\text{Na}$

1.1.6 **The electrons in an atom occupy the lowest available energy levels (innermost available shells). The electronic structure of an atom can be represented by numbers or by a diagram. For example, the electronic structure of sodium is 2,8,1 or**



showing two electrons in the lowest energy level, eight in the second energy level, and one in the third energy level.

Red denotes interleaving; aspects of knowledge covered previously.

Current learning to be developed in the future within:

At A level you will learn the energy levels for different elements in the periodic table and be able to write electronic configuration for elements in the different blocks.

Assessment

Refer to assessment maps for formative and summative assessment opportunities.

Impact

Attainment and Progress – Refer to assessment results / data review documentation.