Navigator Curriculum - Formal Curriculum

- A formal academic curriculum for students closer to age related expectations.
- Aspirational and challenging.
- It is typically for our children with high functioning autism or moderate learning difficulties.
- A broad and balanced secondary curriculum.
- Leads to good GCSE, Level 1 and Level 2 outcomes.
- Subjects become more specialist.

10.1 - Navigator Curriculum - *Science/ 8 Lessons weekly*

Year	2021 – 2022 Autumn 1 Unit 1	2021 – 2022 Autumn 2 Unit 2	2021 – 2022 Spring 1 Unit 3	2021 – 2022 Spring 2 Unit 4	2021 – 2022 Summer 1 Unit 5	2021 – 2022 Summer 2 Unit 6
	Topic: Chemistry 1 C3 Structure and bonding, C4 Chemical calculations, C5 Chemical changes **Suggested Key Questions:** **What are the various types of bonds?** **How does the type of bonding in carbon substances affect their properties?** **How do chemical formula's represent different types of chemical reactions?** **What are the different types of chemical reactions?** **Key Skills and Knowledge:** **C3** Students have developed their	**Topic:** Chemistry 1 C5 Chemical changes conti, C6 Electrolysis, C7 Energy changes. **Suggested Key Questions:** **What do the terms exothermic/ endothermic mean?** **What are the different types of chemical reactions?** **Where is electrolysis used?** **How energies change during reactions?** **Key Skills and Knowledge:** **C6** Students are introduced to electrolysis. They will	**Topic:** Physics 1 P1 Conservation and dissipation of energy, P2 Energy transfer by heating, P3 Energy resources. **Suggested Key Questions:** **What is conservation of energy?** **How can heat energy be transferred?** **How is demand for energy changing?** **Key Skills and Knowledge:** **P1** Students will continue to develop their	**Topic:** Physics 1 P3 Energy resources conti, P4 Electric circuits, P5 Electricity in the home. **Suggested Key Questions:** **What are the different types of circuits and the differences between them?** **How can electricity be generated via a magnetic field?** **Key Skills and Knowledge:** **P4** Students will describe the structure of an atom	**Topic:** Physics 1 P5 Electricity in the home conti, P6 Molecules and matter, P7 Radioactivity. **Suggested Key Questions:** **What is static and how does it form?** **What are the different types of circuits and the differences between them?** **How can electricity be generated via a magnetic field?** **Key Skills and Knowledge:** **P6** Students will increase their understanding of	**Topic:** Physics 2 P8 Forces in balance, P9 Motion, P10 Forces and motion. **Suggested Key Questions:** **How do forces interact?** **What do the different types of motion graphs show?** **How do forces affect motion?** **Key Skills and Knowledge:** **P8** students have compared vectors and scalars using

	understanding of the states of matter from KS3. They have built upon their understanding of the particle model, using this to explain the energy transfers involved when substances change state. Students have also learnt about the different types of bonding in substances. They should know that covalent bonding is the sharing of one or more pairs of electrons between non-metal atoms; ionic bonding involves a metal and non-metal atom, with the metal atom losing one or more electrons and the non-metal atom gaining one or more electron; and metallic bonding involves a delocalised sea of electrons surrounding the positive metal ions. Students should have also learnt how the bonding of a substance affects its bulk properties. They should be able to describe the difference in bonding and properties of giant ionic structures, simple covalent molecules, and giant covalent structures (including different arrangements of carbon). Students should understand that covalent, metallic, and ionic bonding is strong, but that it is how the particles interact (intermolecular forces) that determines	build upon their knowledge from *Chapter C3* to explain why ionic compounds can undergo electrolysis when molten or in solution. They should also be able to explain the movement of particles during electrolysis, and the reactions that occur at the electrodes. Students will then apply their understanding of electrolysis to the extraction of aluminium, and learn how to investigate the electrolysis of a solution. They should be able to predict the products of electrolysis and higher-tier students should be able to write balanced half equations. **C7** Students will learn about the energy transfers that occur during chemical reactions. They should understand that an exothermic reaction transfers energy from the system to the surroundings, and an endothermic reaction transfers energy from the surroundings to the system. This is a key concept that students should be confident with. Students should be able to interpret experimental data to identify if a reaction is exothermic or endothermic and should be able to describe some uses of	understanding of energy and energy transfer begun in Key Stage 3. This includes development of an energy stores model and the processes, such as forces and electrical currents, through which energy can be transferred. Students will learn how to measure the work done by a force acting over a distance and how this concept can be used to analyse energy changes in gravitational stores, through lifting and falling, and elastic potential stores during stretching using the relevant mathematical relationships. The conservation of energy through changes in the gravitational, kinetic, and elastic stores will also be discussed. They will consider the dissipation of energy during transfers such as those caused by friction or electrical heating, leading to the idea of efficiency during different energy changes and its calculation. The concept of efficiency will then be applied to the selection of electrical devices. Finally, the students will learn about the rate of energy transfer in different systems through the through the concept of power and how this power rating can be used to determine total energy change over time. **P2**	in terms of charged particles and the process of charging by friction resulting in ions and the transfer of electrons. This leads to the concept of an electric field surrounding charged objects causing attractive or repulsive forces between them. The students will then describe electric circuits and the components used to construct them using the concept of current as the rate of charge flow through components due to a potential difference between points in the circuit. Resistance was introduced and the cause of a heating effect and corresponding energy transfer. Students will investigate the factors affecting the resistance of a wire and the corresponding current-potential difference graphs. Further investigations of the components and analysis of the current-potential difference graphs will show ohmic and non-ohmic behaviours for wires, filaments, and diodes. The relationship between the resistance of a thermistor and its temperature along with the relationship between the resistance of a light-dependent resistor and light level have been investigated. Finally, the students investigate and analyse	the concept of density as a property of a material or object by measuring and calculating the density of solids and liquids. This leads to a discussion of the states of matter, solid liquid and gas, the properties of matter which is in these states and the changes which occur as a material changes from one state to another. The changes in the properties of matter were used to introduce the kinetic theory and to analyse the changes in temperature occurring during heating and the concept of latent heat. The students move on to discuss the concept of internal energy in more detail; analysing the behaviour of particles in a solid, liquid or gas as the temperature changed. Students will describe latent heat of fusion and vaporisation mathematically, calculating energy changes during the appropriate phase changes and attempted to measure the latent heat of fusion for ice using electrical heating. The students will analyse the relationships between the pressure and temperature of a fixed mass of gas, determining that the pressure is proportional to the absolute temperature. They described the cause of	the examples of distance and displacement along with the nature of forces. Representations of vectors using scale diagrams led to descriptions of the forces acting in a wide variety of situations and the identification of Newton's third law. The concept of balanced and unbalanced forces was used to determine the behaviour of objects and the application of Newton's first law of motion. Higher tier students have produced free body diagrams demonstrating the forces acting on an isolated object. The *GCSE Physics* students have analysed the rotational effects of forces through the idea of moments using both a mathematical approach and an investigation into the turning effect. These students also examined the application of levers and gears in increasing the size of the available force or the movement of an object. While all students determined the centre of mass of an object experimentally only the *GCSE Physics* students have gone further with the idea of equilibrium and have used it to analyse the equilibrium conditions in seesaws, and other objects, mathematically using a rigorous approach. All higher tier students have analysed the forces acting on an object in additional depth using a parallelogram of forces approach to determine the resultant

	properties such as melting point, boiling point, and electrical conductivity. **C4** Students will build upon their understanding of the structure of atoms and sub-atomic particles to understand relative atomic mass and relative formula mass. Students should be able to use relative atomic masses to calculate relative formula masses of compounds. For higher-tier students, this was then related to the mole and Avogadro's constant, and the relevant calculations introduced. Students should be able to use the equation number of moles = mass (g) / A_r and use moles to balance symbol equations and calculate reacting masses. Students will apply their understanding of relative atomic mass, relative formula mass, and moles to concentrations. All students should be able to carry out calculations with concentrations in g/dm^3. **C5** students will revise and develop their understanding of the reactivity series from KS3. They will study the reactions of the metals potassium, sodium, lithium, calcium,	exothermic and endothermic reactions. Students will further develop their qualitative understanding of the energy transfers in a reaction into a quantitative understanding. They should be confident with sketching and interpreting reaction profile diagrams and higher-tier students should be able to use bond energies to calculate overall energy changes for a reaction, identifying if it is exothermic or endothermic. Students will also apply their understanding of the reactivity series and electrolysis to chemical cells and fuel cells.	Students will develop their understanding of the heating and cooling processes, which transfer energy within a material or from one object to another. They will investigate thermal conductivity and the differences in the processes of thermal conduction in metals and non-metals. The GCSE Physics students will describe the transfer of energy between objects through absorption and emission of infra-red radiation as a part of the electromagnetic spectrum. This includes the factors that affect the rate of this transfer such as temperature and surface colour. Higher tier GCSE Physics students will apply this knowledge to the concept of the Greenhouse Effect and its relationship to the wavelength of the radiation penetrating or being absorbed by Earth's atmosphere. All students will analyse the changes in temperature when a material is heated, leading to the experimental determination of specific heat capacity along with corresponding calculations. The concept of specific heat capacity will then be used to explain the choice of materials used in heating systems.	a range of series and parallel circuits describing the path of current at junctions, the potential difference across branches and components, and the effect on resistance of series and parallel branches. **P5** Students will compare direct and alternating currents in terms of current direction. An oscilloscope will be used to analyse changes in the potential difference causing the current and to measure the peak voltage, period and frequency of a low voltage sinusoidal a.c. signal. The students will describe the UK mains supply and the wires used within it, outlining the National Grid and the high voltages associated with it. Understanding of mains circuits, including the function of the neutral and earth wires, has been applied to three pin plugs and a simple ring-main. The choice of materials used for construction of mains circuits such as wires, cables and plugs was discussed along with the need for a fuse to prevent overheating and insulation for protection from short circuits. Students will mathematically analyse circuits to determine the power supplied by a current and the	pressure in terms of random particle behaviour and impact between the particles and the container, explaining the changes in pressure in terms of changes in the motion of the gas particles as the temperature decreases. Finally, the GCSE Physics students will investigate the relationship between gas pressure and volume, determining that as the pressure increases the volume of the gas is decreased or vice versa. Noting that this was a linear relationship led to Boyle's law and calculations based on it. The behaviour of the gas during compression was again explained using a particle model. Higher level students also note that work was done during the compression of a gas and this can have a heating effect. **P7** Students will describe how the structure of the nucleus was discovered by the radiation emitted during nuclear decay and how experimentation and developments in our understanding of subatomic particles have driven to changes in the model used to describe the atom from the plum pudding model, through to the Rutherford model and then Bohr model.	force or a 'missing force' when an object is in equilibrium. In addition, the students have resolved forces at right angles to analyse systems and determine if a system is in equilibrium. **P9** students have analysed the motion of objects in depth starting from a recap of the concept of speed and this relationship to distance travelled and time taken. The representation of motion using distance-time graphs representing single and multiple objects has been analysed to give detailed descriptions of the movement of the objects. The students have defined acceleration in terms of changes in velocity before analysing it graphically and mathematically. Higher tier students have also outlined circular motion in terms of constant acceleration but with constant speed. All students have then investigated acceleration caused by an unbalanced force on ramp, linking acceleration to the gradient of a line on a velocity-time graph. Students have continued to analyse graphs representing motion by looking at the area beneath the line on a velocity-time graph and its relationship to the distance

	magnesium, zinc, iron, and copper with water and acids and should be able to recall and describe these reactions. They will apply their understanding of the reactivity series to displacement reactions and the extraction of metals, as well as introducing higher-tier students to the concepts of oxidation and reduction as the loss and gain of electrons respectively. Students will also learn about salts and how they are prepared, including from metals and acids, acids and bases, and acids and carbonates. Students should be able to prepare a pure, dry sample of a salt from an insoluble metal oxide or carbonate as part of the required practical. Finally, students will learn about the pH scale. Higher-tier students should be able to explain how pH relates to H+(aq) ion concentration and the difference between strong and weak acids.		Finally, the reduction of energy transfers to the surroundings by insulation, such as loft or cavity wall insulation, will be studied and applied to the context of reducing energy loss in buildings to reduce heating costs including the idea prioritising home improvements in line with payback time. **P3** Students will examine the different sources of energy that are used to generate electricity or provide heating for homes. They will consider the effect of the production and use of biofuels on the environment along with the concept of carbon-neutrality before outlining the use of nuclear power in comparison to fossil fuels. Student will describe and evaluate renewable resources such as wave power, wind power, hydroelectricity and tidal technology and how these can be used to generate electricity in specific locations. In addition, students will describe the operation of geothermal power stations and their links to radioactive decay. The principles of solar cells and both small-scale and large-scale solar heating systems have been outlined. The students will compare all of the energy resources in	relationship between power and the resistance of components. This will be linked back to the charge transfer in a circuit and the concept of electrical heating as charges move within or through components. Finally, students will consider the importance of efficiency within mains powered electrical devices linking this concept back to energy transfer by a current and to the simplified system of energy efficiency ratings used when considering the purchase of an appliance.	The students will describe the changes in the nucleus which occur during alpha, beta, and gamma decay along with neutron emission in terms of atomic (proton) number and mass number using the appropriate nuclear notation for isotopes. The properties of alpha, beta, and gamma radiation have been demonstrated leading to a discussion of their use in thickness monitoring and then the safety measures required when using radioactive materials. Students will then move on to discuss the concepts of activity, count rate, and the patterns in radioactive decay that explain half-life and the associated graphs despite the random nature of individual decays. Higher tier students will perform calculations involving the relationship between the initial activity, current activity, and half-life. GCSE Physics students will discuss the application of radioactivity to medical tracers within the body releasing gamma rays detected by gamma cameras and evaluated in terms of risks and benefits. These students will also look at both nuclear fission and fusion in relation to nuclear power. Chain	travelled by an object. Students have used the gradient of a distance-time graph to determine the speed of an object. In addition, higher tier students have used the tangent of a line on a distance-time graph to determine the speed. All students have then applied these techniques to analyse a range of graphs to extract all of the possible information from them. **P10** Students began this chapter by experimentally determining the relationships between a force acting on an object and the acceleration, and the mass of the object and the acceleration. The results led of the formulation for Newton's second law of motion and its application. Higher-tier students have also defined the inertial mass of an object. The students have then compared the concepts of mass and weight, linking then through the idea of a gravitational field before looking at the forces acting on an object as it falls through a fluid and the resulting terminal velocity. The forces

			terms of local environmental impacts such as pollution and global environment impacts such as acid rain and contribution to global warming. Finally, the students will describe how the different resources could be applied in combination to meet the base load and changing energy demands throughout a single day before finally considering the capital costs and operating cost over the operational lifetime of the resource.		reactions involving fissionable isotopes have been described along with an outline of a fission reactor, its fuel rods, control rods, and physical construction. The dangers associated with nuclear fission, in particular accidents and the handling of waste has been debated. Nuclear fusion reactions in stars was discussed and compared to the difficulties of producing stable fission reactions on Earth.	acting during stopping a car have been analysed; identifying two phases of the motion; thinking and braking distance and the effects of a wide range of factors on both of these distances. Students have calculated the size of the accelerations experienced during braking with higher tier students deriving an appropriate equation involving the stopping distance. Finally, all of the students have investigated the effect of forces on the stretching of a range of materials identifying both linear and non-linear relationships between the force and extension. Students have applied Hook's law as appropriate and.
Links to Gatsby Benchmarks:	Benchmark 3 – Addressing the needs of the student and * - Personal Guidance Benchmark 4 – Linking Curriculum to learning Students to consider what skills are needed to be a forensic scientist/ chemical engineer … lead onto looking at what skills are needed for different roles they are	Benchmark 3 – Addressing the needs of the student and * - Personal Guidance Benchmark 4 – Linking Curriculum to learning Students to consider what skills are needed to be a forensic scientist/ chemical engineer … lead onto looking at what skills are needed for different roles they are	Benchmark 2, – Learning from the Career and Labor Market information. Benchmark 3 – Addressing the needs of the student and * - Personal Guidance Benchmark 5- Encounters with employers and employees Students to consider what skills are needed to access the	Benchmark 2, – Learning from the Career and Labor Market information. Benchmark 3 – Addressing the needs of the student and * - Personal Guidance Students to consider what qualifications are needed to access the opportunities they are interested in. Research.	Benchmark 2, – Learning from the Career and Labor Market information. Benchmark 3 – Addressing the needs of the student and * - Personal Guidance Students begin consider how technology may shape the job market.	Benchmark 2, – Learning from the Career and Labor Market information. Benchmark 3 – Addressing the needs of the student and * - Personal Guidance Benchmark 4 – Linking Curriculum to learning Benchmark 8 – Personal Guidance Students to consider what skills are needed to access the opportunities they are

	interested in and what qualifications.	interested in and what qualifications.	opportunities they are interested in. Research.			interested in. Going into work places/remote visits. Research.