DIXONS UNITY ACADEMY

Science Curriculum Principles

Our uniting 'sentence' is: "The science department instilled a passion for science in every student that empowered them to make a positive contribution and pursue a sustainable career within the STEM industries.".

By the end of their education, a student of Science at Dixons Unity Academy will:

- Know fundamental scientific principles from biology, chemistry and physics that will provide a foundation for understanding and navigating the world. Student knowledge is structured around the big ideas in science which range from the particulate nature of matter, the cellular basis of living organisms, to the structure of the universe.
- Understand the processes of scientific inquiry that leads to the creation and development of concepts and theories. Students will understand how science can be used to explain observations and make predictions about natural phenomena.

To achieve a true understanding of Science, topics have been intelligently sequenced based on the following rationale:

- Scientific knowledge is broadly hierarchical in nature – students must have a secure understanding of each key block of knowledge before progressing onto the next stage. Therefore, in order to support this, topics have been meticulously planned and ordered to ensure that students are always building on and deepening their previous learning.
- In biology, primary students are introduced to different animals (including humans), further animals and plants and their life processes. From year 7 students learn about the structure, function and behaviour of living organisms in detail, building up from the microscopic cellular level to the macro-scale interactions in an ecosystem. These topics are then extended with the expectation that students learn to apply this knowledge and make links with other topics.
- In chemistry, primary students are introduced to the properties of everyday materials. Students explore ideas such as floating, sinking and melting. They investigate different materials and their uses, before moving onto more abstract concepts such as solubility, conductivity and changes of state. From year 7, students start with a rigorous grounding in the fundamentals of secondary level chemistry: states of matter, the periodic table, chemical reactions and the behaviour of materials. Having mastered the foundation knowledge, students are fully equipped with the necessary knowledge and skills to tackle the more challenging content, such as chemical bonding and quantitative chemistry.
- In physics, primary students are introduced to the fundamentals of forces, electricity, sound, light and space – focusing on concrete concepts and experiences. These topics are taught explicitly and then revisited in more depth throughout. From year 7 students continue to study these topics, as well as introducing more challenging concepts such as energy, pressure and density. As they continue to study these topics in more detail the focus shifts to a more quantitative appreciation of the subject matter and mathematical skills.
- Experimental work is a key feature of Science and at the start of Y7 'working scientifically' skills are taught explicitly. These skills have been carefully mapped across all topics throughout all years so that students are given many opportunities to apply and develop these concepts. For example, each topic deliberately includes several opportunities to revisit graph and table interpretation skills.

The Science curriculum will address social disadvantage by addressing gaps in students' knowledge and skills":

- Our curriculum is designed around the most disadvantaged learners. We are careful not to assume any prior knowledge or cultural capital and always teach new knowledge explicitly.
- The Education Endowment Foundation published a major report in 2017 examining the disadvantaged attainment gap in science. The strongest factor affecting pupils' science scores is their literacy levels. In our department, we actively promote literacy every lesson through reading, annotating and discussing challenging texts. We also support children to answer questions in full sentences by verbally modelling sentence starters, giving adequate thinking time and allowing children to 'turn and talk' with a partner. We plan frequent extended writing tasks and support children with verbal rehearsal activities, sentence starters and keywords.
- Disadvantaged students and those from identified underrepresented groups receive priority for extra intervention sessions. For example, students have the opportunity to receive additional guidance and tutoring in small groups to close specific gaps in their understanding during weekly 'Prep' and 'Morning Mastery' sessions. Teachers also prioritise these students when creating and implementing their Intervention Prevention plans. Disadvantaged students are also always prioritised when selecting students for small group trips to museums and universities and for science competitions. At GCSE level, students are provided with suitable revision resources (e.g. revision guides and stationary) to give all students a fair opportunity to be successful.
- All students are taught the same rigorous curriculum. Although students at secondary level are taught in groups, we have the same high expectations of all students – we do not narrow or dilute the curriculum. All students are taught from the same student work booklets so that everyone is given access to the same powerful and catalytic knowledge. That being said, teachers understand the need to supplement the work booklets with additional practice/scaffolds or extension material, as required for individual students.
- Students with special educational needs or disabilities are given extra support through the use of Learning Support Assistants. Students are taught in small groups so that individual needs can be catered for. Students with profound barriers to learning receive additional teaching and practice of core concepts to achieve mastery. Students have access to a rich and diverse curriculum focussing on key skills and powerful knowledge delivered with the appropriate scaffolding and challenge to ensure all pupils master the entire curriculum. Students who are new to English receive support with vocabulary and literacy.

We fully believe that Science can contribute to the personal development of students at Dixons Unity Academy:

- The social development of our students is nurtured through the explicit teaching and practice of effective teamwork and communication skills when working in groups for scientific investigations. Groups are selected by the teacher to ensure that students learn to effectively collaborate with others from different backgrounds or from outside of their friendship circle.
- Science naturally provides many opportunities for balanced discussions of moral and ethical issues. For example, we explore the moral complexities of organ transplant, the controversial use of genetic engineering and the disputed use of stem cells for disease treatment. Students are given time to discuss these issues both in pairs and as a class to allow students to develop spiritually.
- When teaching topics such as the theory of evolution and the Big Bang theory, this provides a chance to develop students' cultural awareness as we can discuss viewpoints of these theories from different religions and cultures. We also discuss historical sexism in scientific developments – for example, the famous case of Rosalind Franklin's discovery of the structure of DNA.
- Science lessons also provide a wealth of opportunities to explore personal development relating to physical and mental health. For example, students study the effects of smoking, drugs and alcohol from both a scientific and social perspective. When teaching about the digestive system, students are taught about the importance of a balanced diet and how to interpret nutritional information.
- We want students to become respectful and responsible citizens who contribute positively to society. For example, students are taught in detail about global warming, pollution and energy resources so that they understand the importance of recycling, reducing waste and cutting down their carbon footprint.
- Our science curriculum contributed to the whole academy anti-racism agenda. We ensure that we teach about prominent scientific figures that are representative of all cultures and ethnicities, for example George Washington Carver and Henrietta Lacks.

Our belief is that homework should be interleaved revision of powerful knowledge that has been modelled and taught in lessons. This knowledge is recalled and applied through a range of low stakes quizzing and practice.

Opportunities are built in to make links to the world of work to enhance the careers, advice, and guidance that students are exposed to:

- Topics in KS3 and KS4 have a 'careers spotlight', where students will explore a profession linked to that particular unit of work. For example, when Y8 students study chemical reactions they learn about careers in chemical engineering.
- Problem solving activities are built into the curriculum that allow students to apply scientific knowledge to certain career based scenarios. For example, when learning about health and disease, students have to write an explanation to a patient from the point of view of a doctor explaining why they are prescribing painkillers rather than antibiotics.
- We aim to work collaboratively with our local community to show the career opportunities available to our students within Science in our city

A true love of Science involves learning about various cultural domains. We teach beyond the specification requirements, but do ensure students are well prepared to be successful in GCSE examinations:

- Opportunities to explore the history and philosophy of science are embedded into the curriculum. For example reading rich texts about an array of topics, such as: the history of space exploration, Semmelweis' work on Germ Theory and how new chemical elements get their names. Whilst not examined, they are included for engagement and to build cultural capital.
- Although students' practical skills are no longer examined through coursework, we believe it is absolutely essential that all students can plan and carry out practical's using laboratory equipment safely and accurately so that they are fully prepared for future study and employment. In KS3, we want students to be exposed to a wide variety of engaging practical's, such as investigations into the effectiveness of different brands of indigestion tablets and hand sanitiser, and finding the best metal for making frying pans. In KS4 there is a greater focus on the GCSE Required Practical's – but we are not restricted to this list of experiments.
- Students that wish to develop their science knowledge beyond the curriculum can select STEM enrichment Club. There is also an ever-growing collection of science based non-fiction books in the library which are very popular with our students

Curriculum Overview

All children are entitled to a curriculum and to the powerful knowledge which will open doors and maximise their life chances. Below is a high-level overview of the critical knowledge children will learn in this subject, at each key stage from Year 7 through to Year 11, to equip students with the cultural capital they need to succeed in life. Our powerful, knowledge-rich curriculum teaches both **substantive knowledge** (facts; knowing that something is the case; what we think about) and **procedural knowledge** (skills and processes; knowing how to do something; what we think with). There are no skills without bodies of knowledge to underpin them. The curriculum is planned vertically and horizontally giving thought to the optimum knowledge sequence for building secure schema.

		Cycle 1	Cycle 2	Cycle 3
YEAR 7	**New learning**	Science skills Development of scientific theories; planning an investigation and displaying and analysing results; bouncing balls investigation (these skills are embedded in all future topics from year 7 – 11) Cells and life processes Plant and animal cells; using a microscope to view cells; specialised cells; unicellular organisms; introduction to respiration, photosynthesis and diffusion Forces and space Forces and space Force diagrams; resultant forces; balanced and unbalanced forces; air resistance investigation; the solar system; day/night and seasons	Particles and solutions Solids, liquids and gases; changes of state; dissolving; solubility; separating mixtures; rock salt investigation Energy Energy stores and transfer pathways; law of conservation of energy; efficiency; advantages and disadvantages of renewable and non-renewable energy resources and heat energy transfer investigation. Reproduction Puberty; reproductive systems; pregnancy; parts of a flower and plant reproduction	Elements Atoms; elements, compounds and mixtures; the periodic table; chemical formulae; properties of metals and non-metals and introduction to chemical reactions Ecology Competition in ecosystems; adaptations of plants and animals; food chains and webs; pyramids of numbers and classification Acids and alkalis pH scale; indicators; neutralisation reactions; indigestion tablet investigation and making salts practical Waves Behaviour of sound waves; amplitude and frequency; oscilloscope traces; hearing and the ear Behaviour of light waves; reflection, refraction and dispersion investigations; colours of light; seeing and the eye.
	Revisited learning	Science skills builds on how science works skills previously taught through investigations. Cells and life processes builds on previous knowledge from the Animals (including Humans) topics.	Specialised cells and life processes, forces causes an energy transfer, science skills applied to investigations.	States of matter applied to elements topics, life processes, space linked to sound waves, science skills applied to investigations.
	Additional information	Careers in aeronautical engineering (forces and space topic)	Careers in midwifery (reproduction topic)	Careers in veterinary medicine / nursing (ecology topic)
YEAR 8	**New learning**	The Body Skeletal system; muscular system; food groups; digestive system; respiratory system; circulatory system; the heart and exercise Metals Properties of metals; reactions of metals and reactivity series; extraction of metals from ores and recycling metals	Plants Photosynthesis; structure of leaves; plant roots and minerals; fertilisers; bioaccumulation and testing leaves for starch Chemical reactions Chemical equations; rates of reaction theory and investigations; conservation of mass and exo/endothermic reactions	Inheritance and variation DNA and genetics; environmental and inherited variation; natural selection and extinction Pressure density and moments Pressure and calculations; density and calculations; calculating moments; application to real life challenges

		Forces and motion Weight, mass and gravity; Hooke's law theory and investigation; speed calculations and distance-time graphs	Electricity and magnetism Circuit components and diagrams; series and parallel circuit theory and investigation; current, voltage and resistance; magnets; magnetic fields and electromagnets	Environmental chemistry Burning fuels theory and investigation; Earth's changing atmosphere; global warming; acid rain and water cycle
	Revisited learning	Cells and life processes, metal and non-metal properties, year 7 forces knowledge is further developed, science skills applied to investigations.	Specialised cell knowledge is developed, photosynthesis, ecology year 7 simple chemical reactions and electricity and magnetism knowledge is further developed, science skills applied to investigations.	Cell structure, chemical reactions, forces knowledge from year 7, science skills applied to investigations.
	Additional information	Careers in medicine / nursing (the body topic)	Careers in chemical engineering (chemical reactions topic)	Careers in medicine / nursing (inheritance topic)
YEAR 9	**New learning**	AQA GCSE Combined Science Trilogy Atomic structure and periodic table Development and current model of the atom; group 1; 7 and 0 elements; properties of metals and non-metals Cell biology Structure of eukaryotic and prokaryotic cells; cell division; advantages and disadvantages of stem cells; microscopy and cell transport (diffusion; active transport and osmosis) Particle model of matter States of matter; changes of state; density; internal energy; energy transfers and gas pressure	AQA GCSE Combined Science Trilogy Bonding and structure Ionic; covalent and metallic bonding; solids; liquids and gases and properties of substances Organisation Organ systems in plants and animals Atomic structure Model of an atom; radioactive decay and nuclear radiation	AQA GCSE Combined Science Trilogy Infection and response Pathogens; spread and prevention of infection; immune response and treatment of infectious diseases Chemistry of the atmosphere Composition and evolution of the Earth's atmosphere; greenhouse gases and pollutants
	Revisited learning	Builds on year 7 and 8 knowledge of cells and life processes, periodic table, elements, compounds, mixtures, chemical equations and separation techniques. Science skills continue to be embedded.	Builds on year 7 and 8 knowledge of body systems and life processes, properties of matter and states of matter. Science skills continue to be embedded.	Builds on KS2 knowledge of infectious diseases, and year 7 and 8 knowledge of the Earth's atmosphere and burning fossil fuels. Science skills continue to be embedded.
	Additional information	Careers in microbiology (cell biology topic)	Careers in plant science and horticulture (organisation topic)	Careers in pharmacology (infection and response topic)
YEAR 10	**New learning**	AQA GCSE Combined Science Trilogy Atomic structure Model of an atom; radioactive decay and nuclear radiation Bioenergetics	AQA GCSE Combined Science Trilogy Electricity Circuit components; current; potential difference; resistance; I-V graphs; mains electricity and national grid	AQA GCSE Combined Science Trilogy Chemical analysis Purity; formulations; chromatography and gas tests Forces

		Respiration and photosynthesis Energy changes in reactions Exothermic and endothermic reactions	Chemical changes Reactivity of metals and acids; pH and electrolysis Homeostasis and response Regulation of internal conditions; nervous and endocrine systems and hormones and fertility Quantitative chemistry Chemical measurement; conservation of mass; chemical calculations and concentration	Scalars and vectors; types of forces; resultant forces; work done; Hooke's law; Newton's laws; speed; acceleration; motion graphs; stopping distances and momentum
	Revisited learning	Builds on knowledge of life processes, chemical reactions, atomic structure from the chemistry topic. Science skills continue to be embedded	Builds on previous knowledge of cellular processes, chemical reactions, electricity. Science skills continue to be embedded	Builds on previous knowledge of separating techniques and simple force and motion knowledge. Science skills continue to be embedded.
	Additional information	Careers in medicine / nursing (radiation topic)	Careers in electrical engineering (electricity topic)	Careers in forensic science (chemical analysis topic) Careers in mechanical engineering (forces topic)
YEAR 11	**New learning**	AQA GCSE Combined Science Trilogy Inheritance; variation and evolution Reproduction; meiosis; genetics; selective breeding; genetic engineering; classification Forces Scalars and vectors; types of forces; resultant forces; work done; Hooke's law; Newton's laws; speed; acceleration; motion graphs; stopping distances and momentum Waves Transverse and longitudinal waves; properties of waves; uses and applications of electromagnetic waves	AQA GCSE Combined Science Trilogy Ecology Adaptation; interdependence; competition; biodiversity and human effects Rate and extent of chemical change Rate of reaction; catalysts; reversible reactions and dynamic equilibrium Homeostasis and response Regulation of internal conditions; nervous and endocrine systems and hormones and fertility Magnetism and electromagnetism Permanent and induced magnetism; magnetic fields; motor effect	AQA GCSE Combined Science Trilogy Using Resources Potable water; life cycle assessments and recycling Chemical analysis Purity; formulations; chromatography and gas tests
	Revisited learning	Builds on knowledge of life processes, reproduction and inheritance, simple forces and motion and sound and light waves. Science skills continue to be embedded.	Builds on previous knowledge of ecology, chemical reactions, Cellular reactions and organ systems and magnets and magnetic fields. Science skills continue to be embedded.	Builds on previous knowledge of metal recycling and separation techniques. Science skills continue to be embedded.
	Additional information	Careers in mechanical and automotive engineering (forces topic)	Careers in medicine / nursing (homeostasis topic)	Careers in manufacturing engineering (using resources topic)

DIXONS UNITY ACADEMY

Y7 Long Term Plan

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
Cycle 1	Induction						Assessment Weeks						
	Orientation	Science Skills	Science Skills	Science Skills	Cells & Life Processes	Cells & Life Processes	Cells & Life Processes	Forces & Space	Forces & Space	Forces & Space	Particles & Solutions	Particles & Solutions	Particles & Solutions
Cycle 2							Assessment Weeks						
	Energy	Energy	Energy	Energy	Reproduction	Mid-year assessments	Mid-year assessments	Reproduction	Reproduction	Atoms & Elements	Atoms & Elements	Atoms & Elements	Ecology
Cycle 3									Assessment Weeks				
	Ecology	Ecology	Acids & Alkalis	Acids & Alkalis	Acids & Alkalis	Acids & Alkalis	Revision	Revision and assessment	Revision and assessment	Waves	Waves	Waves	Waves

DIXONS UNITY ACADEMY

Y8 Long Term Plan

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
Cycle 1	Induction						Assessment Weeks						
	Orientation	The Body	The Body	The Body	Metal Reactions	Revision and assessment	Revision and assessment	Metal Reactions	Metal Reactions	Forces & Motion	Forces & Motion	Forces & Motion	Plants and Photosynthesis
Cycle 2							Assessment Weeks						
	Plants and Photosynthesis	Plants and Photosynthesis	Chemical Reactions	Chemical Reactions	Chemical Reactions	Chemical Reactions	Electricity & Magnetism	Electricity & Magnetism	Electricity & Magnetism	Electricity & Magnetism Electricity & Magnetism	Variation and Inheritance	Variation and Inheritance	Variation and Inheritance
Cycle 3									Assessment Weeks				
	Variation and Inheritance	Pressure density and moments	Pressure density and moments	Pressure density and moments	Pressure density and moments	Revision	Revision and assessment	Revision and assessment	Revision and assessment	Earth, Materials and the atmosphere	Earth, Materials and the atmosphere	Earth, Materials and the atmosphere	Earth, Materials and the atmosphere

DIXONS UNITY ACADEMY

Y9 Long Term Plan

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
Cycle 1	Induction						Assessment Weeks						
	Orientation	C1 Atomic structure and the periodic table	C1 Atomic structure and the periodic table	C1 Atomic structure and the periodic table	C1 Atomic structure and the periodic table	B1 Cells	B1 Cells	B1 Cells	B1 Cells	P3 Particle Model of Matter	P3 Particle Model of Matter	P3 Particle Model of Matter	C2 Bonding and properties of matter
Cycle 2							Assessment Weeks						
	C2 Bonding and properties of matter	C2 Bonding and properties of matter	C2 Bonding and properties of matter	B2 Organisation	B2 Organisation	Revision and assessment	Revision and assessment	B2 Organisation	B2 Organisation	B2 Organisation	P4 Atomic Structure	P4 Atomic Structure	P4 Atomic Structure
Cycle 3									Assessment Weeks				
	B3 Infection and Response	B3 Infection and Response	B3 Infection and Response	B3 Infection and Response	B3 Infection and Response	Revision	Revision	Revision and assessment	Revision and assessment	C9 Chemistry of the Atmosphere	C9 Chemistry of the Atmosphere	C9 Chemistry of the Atmosphere	C9 Chemistry of the Atmosphere

Y10 Long Term Plan

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
Cycle 1	Induction						Assessment Weeks						
	Orientation	P4 Atomic Structure	P4 Atomic Structure	P4 Atomic Structure	B4 Bioenergetics	Revision and assessment	Revision and assessment	B4 Bioenergetics	B4 Bioenergetics	B4 Bioenergetics	C5 Energy Changes	C5 Energy Changes	P2 Electricity
Cycle 2							Assessment Weeks						
	P2 Electricity	P2 Electricity	P2 Electricity	P2 Electricity	P2 Electricity	C4 Chemical Changes	C4 Chemical Changes	C4 Chemical Changes	B5 Homeostasis	B5 Homeostasis	B5 Homeostasis	B5 Homeostasis	C3 Quantitative Chemistry
Cycle 3									Assessment Weeks				
	C3 Quantitative Chemistry	C3 Quantitative Chemistry	C8 Chemical Analysis	C8 Chemical Analysis	P5 ForcesP5 Forces	P5 Forces	P5 Forces	Revision and assessment	Revision and assessment	Revision and assessment	P5 Forces	P5 Forces	

DIXONS UNITY ACADEMY

Y11 Long Term Plan

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
Cycle 1	Induction						Assessment Weeks						
	Orientation	B6 Inheritance, variation and evolution	B6 Inheritance, variation and evolution	B6 Inheritance, variation and evolution	P5 forces	P5 forces	P5 forces	P6 Waves	P6 Waves	MOCKS	MOCKS	P6 Waves	B7 Ecology
Cycle 2							Assessment Weeks						
	B7 Ecology	C6 Rates of Reaction	C6 Rates of Reaction	C6 Rates of Reaction	B5 Homeostasis	B5 Homeostasis	B5 Homeostasis	P7 Magnets and electromagnets	MOCKS	MOCKS	P7 Magnets and electromagnets	C10 Using Resources	C10 Using Resources
Cycle 3									Assessment Weeks				
	C8 chemical analysis	GCSE preparation	GCSE preparation	GCSE preparation									