Science at Noel Baker Academy

'Science is knowledge arranged and classified according to truth, facts, and the general laws of nature'

Luther Burbank.

At Noel Baker Academy, we ensure that all students experience a knowledge-rich science curriculum, which is thoughtfully sequenced by our subject specialists. Within our expert scientific roles we teach to the top, to provide the breadth and depth of key scientific principles. Our science specialists want to develop every student's love for our subject so they can appreciate how science will influence their lives and no matter what their background, prior attainment or needs, they can access any career in science if they wish.

Year 7 Science

Unit 1: Introduction to science
Scientists need the key knowledge of rules, hazards and practical delivery before they can undergo investigations. Introduction to science will guide you through our three disciplines, the rules of the laboratory, the common language we use in science and how you use laboratory equipment and make measurements in scientific investigations.

Unit 2: Energy and Forces
Energy is described as a mathematical concept, it is needed when anything happens and this is why we start learning about energy in Year7. We then will develop our knowledge further by discovering how when two objects interact, each one will exert a force on each other. These forces can transfer energy between the objects.

Unit 3: Fields and Materials
In this unit we build on prior knowledge of forces by finding out how electric and magnetic fields exert forces on objects. We will investigate how circuits work and how we calculate density of different materials.

Unit 4: Space Physics
In our space unit students can apply what they have learned about energy, forces and fields to exploring the planet we live on and how we relate the fundamentals of physics to our solar system and universe.

Unit 5: Discovering the atom
All substances are made of atoms. We will learn all about the history of the atom and how scientists have developed the model we know today. It is important we learn about the structure of the atom before we move onto the knowledge of how atoms interact.

Unit 6: Atomic interactions
In this unit we can start to investigate how atoms behave and interact with each other. Metal and non-metal atoms rearrange into different substances when they interact and you will find out how by transfer or sharing of electrons compounds can be made.

Unit 7: The Earth

In this unit we link chemistry and biology which assists with the transition into the next discipline. We explore the structure of the Earth and how all the systems work together in a constant recycle. We explore human impact on the Earth and what we can do to reduce this impact.

Unit 8: Ecology

In this unit we explore where all living organisms originated from and how they have evolved and adapted over time, even before technology existed. The topic explores the relationships and interactions between all living organisms.

Unit 9: Organisation of living things

In this unit students explore how our understanding of organisms evolved as technology did with topics such as organisational hierarchy and the history of the discovery of the same. We explore organ systems and introduce pathogens, respiration and diffusion in preparation for Yr8 and beyond.

Unit 10: Nutrition and digestion

In this unit we_build upon respiration and diffusion in the digestive system and why biological molecules are needed for life. We look further at where we can obtain bio molecules which links into healthy eating and deficiency.

Unit 11: Reproduction

In our final topic in Year 7 we will find out how organisms reproduce either sexually or asexually and how reproduction is important for their survival on Earth.

Year 8 Science

Unit 1: Working scientifically

At the start of year 8 we revisit at the knowledge required in carrying out a valid investigation and how to record results accurately. We increase the topic in complexity by introducing language and skills such as hypothesis, predictions, conclusions and how to ensure data is reliable. Students are introduced to significant figures and standard form.

Unit 2: Energy

This unit builds on particle theory and increases in complexity to explain heat transfer and changes of state. We begins to explain energy as a quantity that can be quantified and calculated in energy transfers, work and power.

Unit 3: Forces and fields

In this unit we explores how objects move and the factors which affect their motion. We introduce waves and exploration of how and why humans see what they do.

Unit 4: Electricity

The topic increases the complexity of circuits and the rules governing how energy flows around a circuit. This topic allows students to put into practice the knowledge of energy and electricity in designing and investigating factors of resistance and electromagnetism as well as introducing them to how electricity is generated.

Unit 5: Atomic structure, bonding and the periodic table

This topic builds on students' knowledge of the atom and increases in complexity to describe and represent the structure of the first 20 elements and the patterns in the periodic table. This topic explores how unstable atoms become stable when electrons are lost or gained.

Unit 6: Reactivity of metals and forming salts

In this unit we explore further patterns within the periodic table, forming a picture of how reactive metals are from the observations we made from reactions. We investigate what chemistry mean by a salt are and how they are made during a chemical reaction.

Unit 7: Energy changes in reactions

This unit secures deeper knowledge of atoms and chemical reactions by introduces exothermic and endothermic reactions as well as the conservation of mass.

Unit 8: Separation techniques and using resources

In this unit students learn how substances can be separated into their components parts by various physical methods and how some materials in common household use are made, reused or recycled.

Unit 9: Life processes

This unit revisits the energy transfers required in respiration and builds upon learning on subcellular structures and their functions. Students explore the organ systems associated with respiration and introduces how diffusion occurs in gas exchange before moving onto the negative effects on these systems of alcohol, drugs and smoking. We introduces non-communicable diseases before exploring energy transfers in plants.

Unit 10: Biological molecules

Biological molecules are revisited as they are required for energy release and the use of the products by animals and plants. This topic increases in complexity with students learning about enzymes, exploring their optimum conditions and enzyme rate graphs.

Unit 11: Evolution and extinction

Students revisit knowledge that animals and plants are adapted to survive. This topic explores variation and competition as well as looking at theories around evolution and evidence for extinction and a common ancestor.

Unit 12: Scientific theories and models

The final topic in year 8 will continue to develop the understanding of scientific theories and the ideas developed by scientists in preparation for more advanced studies. We investigate the maths involved in the representing of scientific data as well as introducing the importance of peer review.

Year 9 Science

Unit 1: Energy

The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. It also became a key tool for understanding chemical reactions and biological systems. Limits to the use of fossil fuels and global warming are critical problems for this century. Physicists and engineers are working hard to identify ways to reduce our energy usage.

Unit 2: Atomic Structure and the periodic table

The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. The arrangement of elements in the modern periodic table can be explained in terms of atomic structure which provides evidence for the model of a nuclear atom with electrons in energy levels.

Unit 3: Atomic Structure and Radiation

Ionising radiation is hazardous but can be very useful. Although radioactivity was discovered over a century ago, it took many nuclear physicists several decades to understand the structure of atoms, nuclear forces and stability. Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation.

Unit 4: Particle Model of Matter

The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain!

Unit 5: Bonding, Structure and Properties

Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies.

Unit 6: Chemical Changes

Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organising their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes.

Unit 7: Energy changes

Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications.

Unit 8: Cell biology

Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells.

Unit 9: Bioenergetics

In bioenergetics we will explore how plants harness the Sun's energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.

Unit 10: Organisation

Building on from cells we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis.

Year 10 Science

Unit 1: Electricity

Electric charge is a fundamental property of matter everywhere. Understanding the difference in the microstructure of conductors, semiconductors and insulators makes it possible to design components and build electric circuits. Many circuits are powered with mains electricity, but portable electrical devices must use batteries of some kind. Electrical power fills the modern world with artificial light and sound, information and entertainment, remote sensing and control. The fundamentals of electromagnetism were worked out by scientists of the 19th century. However, power stations, like all machines, have a limited lifetime. If we all continue to demand more electricity this means building new power stations in every generation – but what mix of power stations can promise a sustainable future?

Unit 2: Forces

Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible.

Unit 3: Quantitative Chemistry

Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas.

Unit 4: Chemical changes

Chemical reactions of metals have helped biochemists to understand the complex reactions that take place in living organisms. The extraction of important resources from the Earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'.

Unit 5: Energy changes

Energy changes are an important part of chemical reactions. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other ways.

Unit 6: Rates of chemical change

Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way.

Unit 7: Organic Chemistry

The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents.

Unit 8: Infection and Response

Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria. Unfortunately many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics.

Unit 9: Homeostasis and Response

Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes. In this section we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility.

Unit 10: Inheritance, Variation and Evolution

We will discover how the number of chromosomes are halved during meiosis and then combined with new genes from the sexual partner to produce unique offspring. Gene mutations occur continuously and on rare occasions can affect the functioning of the animal or plant. These mutations may be damaging and lead to a number of genetic disorders or death. Very rarely a new mutation can be beneficial and consequently, lead to increased fitness in the individual. Variation generated by mutations and sexual reproduction is the basis for natural selection; this is how species evolve. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. Once new varieties of plants or animals have been produced it is possible to clone individuals to produce larger numbers of identical individuals all carrying the favourable characteristic. Scientists have now discovered how to take genes from one species and introduce them in to the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial.

Unit 11: Ecology

The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.

Year 11 Science

Unit 1: Waves

Wave behaviour is common in both natural and man-made systems. Waves carry energy from one place to another and can also carry information. Designing comfortable and safe structures such as bridges, houses and music performance halls requires an understanding of mechanical waves. Modern technologies such as imaging and communication systems show how we can make the most of electromagnetic waves.

Unit 2: Magnetism and electromagnetism

Electromagnetic effects are used in a wide variety of devices. Engineers make use of the fact that a magnet moving in a coil can produce electric current and also that when current flows around a magnet it can produce movement. It means that systems that involve control or communications can take full advantage of this.

Unit 3: Space Physics

Questions about where we are, and where we came from, have been asked for thousands of years. In the past century, astronomers and astrophysicists have made remarkable progress in understanding the scale and structure of the universe, its evolution and ours. New questions have emerged recently. ‘Dark matter’, which bends light and holds galaxies together but does not emit electromagnetic radiation, is everywhere – what is it? And what is causing the universe to expand ever faster?

Unit 4: Chemical Analysis

Analysts have developed a range of qualitative tests to detect specific chemicals. The tests are based on reactions that produce a gas with distinctive properties, or a colour change or an insoluble solid that appears as a precipitate. Instrumental methods provide fast, sensitive and accurate means of analysing chemicals, and are particularly useful when the amount of chemical being analysed is small. Forensic scientists and drug control scientists rely on such instrumental methods in their work.

Unit 5: Chemistry of the atmosphere

The Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists use very complex software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and engineers to develop solutions that help to reduce the impact of human activity.

Unit 6: Using Resources

Industries use the Earth's natural resources to manufacture useful products. In order to operate sustainably, chemists seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. Chemists also aim to develop ways of disposing of products at the end of their useful life in ways that ensure that materials and stored energy are utilised. Pollution, disposal of waste products and changing land use has a significant effect on the environment, and environmental chemists study how human activity has affected the Earth's natural cycles, and how damaging effects can be minimised.

Science Enrichment activities

At Noel Baker Academy pupils will be invited to take part in STEM clubs which will provide them with the key skills scientists used to investigate current issues in science. All pupils will undertake national science week activities to broaden their knowledge of how science supports life on Earth. Pupils will also have the options of trips to the museum of making, bigbang and GSCE Science live!

Further studies and career progression

At A-level you can choose which subject in science you want to take. You might decide to just take chemistry but a lot of universities like to see students have at least two science a-levels if you are interested in going to university to study a science degree. If you've got a specific career in mind, think about which degree will give you the best grounding for this job. Some science careers will require you to have a postgraduate degree so think about whether you want or need to complete a masters or PhD.

A chemistry or chemistry-related degree can lead to a graduate career in industries such as manufacturing, pharmaceuticals, petrochemicals and healthcare. Specific job roles include analytical scientist, chemist, medical scientist, forensic scientist, pharmacologist and toxicologist.

A biology or biology-related degree can lead to a graduate career in areas such as agriculture, biomedicine, environmental conservation, food and drink, genetics, horticulture and marine biology. Specific job roles include biologist, microbiologist, marine biologist, biochemist, biotechnologist, geneticist and zoologist.

A physics or physics-related degree can lead to a graduate career in several career sectors, including aerospace and defence, automotive, computing, healthcare and telecommunications. Specific job roles include physicist, geophysicist, nanotechnologist, astrophysicist, medical physicist and meteorologist.

If you decide that you don't want to become a scientist, science degrees open up plenty of alternative career routes. You could become a science journalist, work in technical sales, or try your hand at teaching or lecturing. Or, if you'd like to work on the legal side of science, you could become a patent attorney. Science graduates also often find work in business and finance.