ASHLAWN SCHOOL

Key Stage 5 Curriculum Journey:

The curriculum in BTEC Science will enable learners to develop and deepen their knowledge and understanding of Biology, Chemistry and Physics in a vocational context

THE YEAR 12 BTEC APPLIED SCIENCE CURRICULUM JOURNEY

	HALF TERM 1	HALF TERM 2	HALF TERM 3	HALF TERM 4	HALF TERM 5	HALF TERM 6
Topic and learning focus	Unit 1 Principles and Applications of Science	Unit 1 Principles and Applications of Science	Unit 3 Science Investigation Skills Unit 2 Practical Scientific Procedures and Techniques Unit 8 Physiology of Human Body Systems	Unit 3 Science Investigation Skills Unit 2 Practical Scientific Procedures and Techniques Unit 8 Physiology of Human Body Systems	Unit 3 Science Investigation Skills Unit 2 Practical Scientific Procedures and Techniques Unit 8 Physiology of Human Body Systems	Unit 2 Practical Scientific Procedures and Techniques Unit 8 Physiology of Human Body Systems
Foundational Knowledge Prior learning needed	Demonstrate knowledge of scientific facts, terms, definitions and scientific formulae Understand the 3 types of bonding, the physical properties of elements, the periodic table Recognise cell organelles from light microscopes Understand the similarities and differences between plant and animal cell structure and function Calculate magnification and size of cells and organelles from drawings or images Understand cell specialisation in terms of structure and function, Understand the features common to all waves and use the following terms as applied to waves Understand the difference between the two main types of wave Understand that all electromagnetic waves travel with the same speed in a vacuum		***Unit 3*** Understanding variables in the investigation • Independent • Dependent • Control ***Unit 2*** Previous practical skills from Core practicals – how to set up a practical experiment, collect results, draw conclusions and evaluate the data.		***Unit 3*** Understanding variables in the investigation • Independent • Dependent • Control	
Core Knowledge and skills	Demonstrate understanding of scientific concepts, procedures, processes and techniques and their application Understand ionic and covalent bonding and intermolecular forces Understand the quantities used in chemical reactions, the physical properties of elements and the periodic table		***Unit 3*** Developing a hypothesis for an investigation Be able to formulate a hypothesis or a null hypothesis based on relevant scientific ideas.		***Unit 3*** Be able to formulate a hypothesis or a null hypothesis based on relevant scientific ideas. Be able to select and justify the use of	***Unit 8*** Describe the gross anatomy and function of the organs of the lymphatic system. Describe the effect disorder on the lymphatic system and possible corrective

	Understand the ultrastructure and function of organelles, recognise cell organelles from electron micrographs and the use of light microscopes Understand how to distinguish between gram positive and gram negative bacterial cell walls Calculate magnification and size of cells and organelles from drawings or images Understand cell specialisation in terms of structure and function Understand the structure and function of epithelial, nervous and muscular tissue Understand the features common to all waves and use the following terms as applied to waves Understand the industrial application of diffraction Understand the concept and applications of stationary waves resonance Understand the principles of fibre optics Understand that all electromagnetic waves travel with the same speed in a vacuum Be able to use the inverse square law in relation to the intensity of a wave Understand how the regions of the electromagnetic spectrum are grouped according to the frequency	Selection of appropriate equipment, techniques and standard procedures Be able to select and justify the use of equipment/techniques/standard procedures for quantitative and/or qualitative investigations. Understand risks and hazards associated with the investigation. Be able to produce a clear, logically ordered method to obtain results. Be able to select relevant measurements and the range of measurements to be recorded. Understand the importance of obtaining data accurately/reliably and to appropriate levels of precision. Understand how variables can be controlled/measured/monitored. Understand how the data/information can be analysed. Be able to collect data accurately/reliably and to appropriate levels of precision. Be able to display data in an appropriate format Be able to make any recommendations for improvements to the investigation. ***Unit 2*** Undertake and investigate titration and colorimetry to determine the concentration of solutions ***Unit 8*** Explain the impact of disorders of the musculoskeletal system and their associated corrective treatments. Explain the functional role of the musculoskeletal system in the human body. Describe the effect of disorder of muscles	equipment/techniques/standard procedures for quantitative and/or qualitative investigations. Understand risks and hazards associated with the investigation. Produce a clear, logically ordered method to obtain results. Select relevant measurements and the range of measurements to be recorded. Understand the importance of obtaining data accurately/reliably and to appropriate levels of precision. Understand how variables can be controlled/measured/monitored. Understand how the data/information can be analysed. Collect data accurately/reliably and to appropriate levels of precision. Tabulate data in a clear and logical format using correct headings with units where appropriate. Identify anomalous data and take appropriate action. Display data in an appropriate format	treatment(s). ***Unit 2*** Use chromatographic techniques to produce chromatograms. Explain the use of chromatographic techniques to separate mixtures. Summarise key personal competencies developed in relation to scientific skills undertaken.

		and joints and possible corrective treatment(s).	Make any recommendations for improvements to the investigation. ***Unit 2*** Obtain data using different equipment to construct cooling curves. Determine the rate of cooling of substances using cooling curves. ***Unit 8*** Explore the physiology of the digestive system and the use of corrective treatment for nutritional deficiency	
Developmental Knowledge and Skills	Analyse, interpret and evaluate scientific information to make judgements and reach conclusions Understand covalent bonding, particularly tetrahedral basis of organic chemistry Understand the quantities used in chemical reactions Understand the reasons for trends in ionisation energy across Periods 2–4 and down Groups 1, 2 and 7 Understand electronic arrangement of elements using s, p, d notation Understand how to distinguish between gram positive and gram negative bacterial cell walls and why each type reacts differently to some antibiotics. Understand structural and physiological differences between fast and slow twitch muscle fibres and their relevance in sport. Understand synaptic structure and the role of neurotransmitters, including acetylcholine Understand the features common to all waves and use the following terms as applied to waves Graphical representation of wave features Understand the difference between the two main types of wave: transverse and longitudinal	***Unit 3*** Carry out relevant calculations where appropriate Identify trends/patterns in data. Be able to compare primary and secondary data. Use data to draw conclusions that are valid and relevant to the purpose of the investigation. Interpret a statistical tests using tables of critical values and a 5% significance level, with reference to the null hypothesis Discuss evidence of the reliability of the data collected during the investigation. Identify strengths and weaknesses within method/techniques/standard procedures/equipment used. ***Unit 2*** Demonstrate skilful application of procedures and techniques in titration and colorimetry to accurately determine the concentration of solutions. ***Unit 8***	***Unit 3*** Carry out relevant calculations where appropriate Be able to identify trends/patterns in data. Be able to compare primary and secondary data. Be able to use data to draw conclusions that are valid and relevant to the purpose of the investigation. Interpret a statistical test using tables of critical values and a 5% significance level, with reference to the null hypothesis Discuss evidence of the reliability of the data collected during the investigation. Identify strengths and weaknesses within	***Unit 8*** Explain the physiological reasoning for corrective treatment(s) associated with the disorder of the lymphatic system. ***Unit 2*** Analyse own chromatograms and relate the factors that affect the separation of mixtures to the quality of results obtained. Analyse skills developed and suggest improvements to own practice.

	Understand concepts of displacement, coherence, path difference, phase difference, superposition as applied to diffraction gratings. Understand the industrial application of diffraction Be able to use the inverse square law in relation to the intensity of a wave		Compare how disorders of the musculoskeletal system can affect how muscles bring about movement of joints and the importance of corrective treatment.		method/techniques/standard procedures/equipment used. ***Unit 8*** Analyse the role of digestive enzymes on nutrient uptake in each part of the digestive system. Explain the use of corrective treatments for nutrient deficiency ***Unit 2*** Analyse the rate of cooling of substances from your data using cooling curves to draw conclusions	
Complex Knowledge	Make connections, use and integrate different scientific concepts, procedures, processes or techniques Understand the following: ● balanced equations ● relative atomic mass ● atomic number and relative molecular mass ● moles, molar masses and molarities. Understand the quantities used in chemical reactions: ● mass, volume of solution, concentration ● reacting quantities ● percentage yields. Understand the conduction of a nerve impulse (action potential) along an axon, including changes in membrane permeability to sodium and potassium ions and the role of the myelination in saltatory conduction Understand how the applications of electromagnetic waves in communications are related to frequency		***Unit 3*** Interpret a statistical test using tables of critical values and a 5% significance level, with reference to the null hypothesis ***Unit 2*** Evaluate the accuracy of procedures and techniques used in titration and colorimetry in relation to outcomes and suggest improvements. ***Unit 8*** Evaluate the effect of corrective treatment(s) associated with a musculoskeletal disorder		***Unit 3*** Interpret a statistical test using tables of critical values and a 5% significance level, with reference to the null hypothesis ***Unit 2*** **E**valuate the accuracy of practical work in calorimetry in relation to the analysis of the cooling curve. ***Unit 8*** Evaluate the impact of nutritional deficiency and corrective treatments used, on human health.	***Unit 2*** Evaluate the chromatographic techniques used in relation to outcomes and suggest improvements. Evaluate scientific skills developed in terms of potential for future progression. ***Unit 8*** Evaluate the effect of corrective treatment(s) for a disorder of the lymphatic system.
Literacy (including reading)	Key vocabulary Scientific articles	Key vocabulary Scientific articles	Key vocabulary Scientific articles Lab reports Research methods and referencing	Key vocabulary Scientific articles Research methods and referencing Lab reports	Key vocabulary Scientific articles Coursework assignment writing technique	Key vocabulary Scientific articles Coursework assignment writing technique

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Cultural Capital	Universal Cell Theory Gram staining Development of Periodic Table Scientists involved in the understanding of intermolecular forces	Universal Cell Theory Development of key technology including fibre optics, Bluetooth and WiFi	Peer review of scientific documents	Peer review of scientific documents	Peer review of scientific documents	Peer review of scientific documents
Social, Moral, Spiritual and Cultural Development	The treatment of neurological diseases including Parkinson's The effect of drugs on synapses Impact of COPD	Applications of wave technology to medicine Access to communication (WiFi/Broadband) for all	Treatments of diseases Health and safety regulations and their implementation	Treatments of diseases Health and safety regulations and their implementation	Treatments of diseases Health and safety regulations and their implementation	Treatments of diseases Health and safety regulations and their implementation
Fundamental British Values	Rule of law for drug productions Weekly collaborative tasks to encourage students to help each other.	Cooperation and respect during practical tasks and group work. Weekly collaborative tasks to encourage students to help each other. Rule of law surrounding privacy in communication systems	Weekly collaborative tasks to encourage students to help each other. Cooperation and respect during practical tasks and group work. Discussion and debate over the scientific data and it's interpretation The law as applied to Health and Safety legislation	Discussion and debate over the scientific data and it's interpretation Weekly collaborative tasks to encourage students to help each other. Cooperation and respect during practical work and group tasks The law as applied to Health and Safety legislation	Discussion and debate over the scientific data and it's interpretation Weekly collaborative tasks to encourage students to help each other. Cooperation and respect during practical work and group tasks The law as applied to Health and Safety Legislation	Discussion and debate over the scientific data and it's interpretation Weekly collaborative tasks to encourage students to help each other. Cooperation and respect during practical work and group tasks The law as applied to Health and Safety legislation
Assessment	Transition test - 30 marks of short answer questions based on the transition work from GCSE	One short answer assessment approximately 30 marks in each subject area Biology, Chemistry and Physics on the	Unit 1 - additional mock paper depending on external exam dates	Unit 3 - one further short assessment, approximately 30 marks	Unit 3 is an externally assessed paper, this takes place early in half term 5	Unit 2, 6 and 8 are coursework units, approximately one assignment will be

	One further short answer assessments each 30 marks. In each subject area, Biology, Chemistry and Physics covering cells, bonding and electromagnetic waves	principles and applications of science. Formal Mock Paper, using past paper, mark scheme and grade boundaries	Unit 1 - external exams in Biology, Chemistry and Physics Unit 3 - short answer assessment, approximately 30 marks, based on science investigation skills, practical scientific procedures and techniques, and the physiology of human body systems	Unit 3 - Mock Exam using past papers, mark schemes and grade boundaries Unit 2 and Unit 8 are coursework units, approximately one assignment will be completed in each unit in each half term	Unit 2 and Unit 8 are coursework units, approximately one assignment will be completed in each unit each half term Unit 6 is an independent investigation, there is no formal assessment of this unit at this point	completed in each unit each half term

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Key Stage 5 Curriculum Journey:

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THE YEAR 13 BTEC APPLIED SCIENCE CURRICULUM JOURNEY

	HALF TERM 1 and 2	HALF TERM 3 and 4	HALF TERM 5
Topic and learning focus	Unit 5 Principles and Applications of Science II	Unit 4 Laboratory Techniques and their Application Unit 9 Human Regulation and Reproduction	Unit 4 Laboratory Techniques and their Application Unit 9 Human Regulation and Reproduction
Foundational Knowledge Prior learning needed	• Understand how to relate the properties of substances to their production and uses • Understand the general formulae of alkanes and alkenes, cracking of hydrocarbons and the combustion of alkanes. • Know the Kelvin scale of temperature. • Understand the measurement of enthalpy changes, including ,specific heat capacity of water, heat = $m \times C \times \Delta T$ • Understand the structure of the human lung and overall ventilation system. • Understand how surface area to volume ratio affects transport of molecules in living organisms. Be able to use the following quantities and units: o power [Watt (W), kilowatt (kW), megawatt (MW), gigawatt (GW) o convert °C to K Know the following definitions: • work done as energy transferred • work done as force × distance moved in direction of force ($\Delta W = F \times \Delta s$) • work done by a gas as pressure × change in volume of gas ($\Delta W = p \times \Delta v$) • Understand the following concepts: • law of conservation of energy • ideal gas equation	Consolidate the topic of 'Principles and Applications of Science': • ionic and covalent bonding and intermolecular forces • the quantities used in chemical reactions, the physical properties of elements and the periodic table • the ultrastructure and function of organelles, recognise cell organelles from electron micrographs and the use of light microscopes • how to distinguish between gram positive and gram negative bacterial cell walls • Calculate magnification and size of cells and organelles from drawings or images • cell specialisation in terms of structure and function • the structure and function of epithelial, nervous and muscular tissue • the features common to all waves Understand the industrial application of diffraction • the concept and applications of stationary waves resonance • the principles of fibre optics • electromagnetic waves travel with the same speed in a vacuum • use the inverse square law in relation to the intensity of a wave	Secure and consolidate the topic of Practical Scientific Procedures and Techniques: • investigate titration and colorimetry to determine the concentration of solutions Science Investigation Skills: • Formulate a hypothesis • Selection of appropriate equipment, techniques and standard procedures • justify the use of equipment/techniques/standard procedures for quantitative and/or qualitative investigations. • Understand risks and hazards • Produce a clear, logically ordered method to obtain results. • Select relevant measurements and the range of measurements to be recorded. • Understand the importance of obtaining data accurately/reliably and to appropriate levels of precision. • Understand how variables can be controlled/measured/monitored. • Understand how the data/information can be analysed. • Display data in an appropriate format

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	Be able to use the following quantities and units: • density kg/m3 • density ρ = ⍰ ⍰	• the regions of the electromagnetic spectrum are grouped according to the frequency	
Core Knowledge and skills	• Understand the uses of substances including catalysts • Understand purification, extraction and manufacture of a range of chemicals including titanium and aluminium Understand the following: • straight chain, branched and cyclic alkanes and alkenes, including isomers • IUPAC nomenclature • structure representations, full (displayed) structural formulae showing all the bonds, shortened structural formulae • 3D representations using wedge/dashed line diagrams, skeletal formulae • symmetric and asymmetric alkenes • sigma and pi-bonding in alkanes and alkenes • hybridisation • bond lengths and strengths in alkanes, alkenes, benzene • increase in boiling point with chain length and intermolecular forces of attraction • mechanisms of hydrocarbon reactions • free radical substitution in alkanes • electrophilic addition of water, halogens, hydrogen halides and sulfuric acid in alkenes • stability of carbocations • reactions of commercial importance • Know the definition of enthalpy change, Δ*H*, as change in heat content. • Know the standard conditions • Understand enthalpy change under standard conditions, ΔHo. • Know the units of standard enthalpy change kJ mol-1. • Understand the system and surroundings. • Understand the sign convention. • Understand exothermic and endothermic reactions and processes.	Unit 4 • Explain how health and safety measures in a scientific organisation comply with legislation. • Describe the potential hazards relevant to different scientific working environments. • Prepare and test the purity of an organic liquid and draw conclusions. • Describe the industrial manufacture and testing of an organic liquid. • Prepare and test the purity of an organic solids and draw conclusions. • Describe the industrial manufacture and testing of an organic solid. • Explain how scientific information in a workplace laboratory is recorded and processed to meet the needs of the customer and to ensure traceability. • Explain how useful scientific information is obtained from large datasets and the potential issues and benefits. Unit 9 • Describe the organisation and function of the nervous system in relation to cardiovascular and respiratory requirements. • Describe how homeostatic mechanisms maintain normal function. • Describe the structure and function of reproductive anatomy. • Describe how hormones are involved in gamete development and conception.	

	• Understand reaction profiles • Know the definitions of a range of standard enthalpy changes related to reactions below: Combustion, formation, hydration, interpretation of the size and sign of values, literature values. Understand the measurement of enthalpy changes: • Understand the structure and function of the heart. • Understand the characteristic features of blood vessels and pressure changes. • Understand how factors can increase the risk of cardiovascular disease (CVD). • Investigate the effect of caffeine on heart rate in Daphnia. • Understand the benefits and risks of treatments for CVD. • Understand the mechanics of ventilation of the lungs. • Understand the principles that relate to efficient gas exchange in the human lung • Understand the roles of the kidney in excretion and osmoregulation. • Know the function of the urinary system. • Understand the structure and function of a kidney nephron. • Understand how to treat kidney disease. • Understand the methods used to transport molecules through cell membranes. Be able to use the following quantities and units: pressure (Pascals (Pa), Newton per metre squared (Nm−2)). Be able to calculate efficiency Understand the following concepts: • internal energy, first law of thermodynamics ($Q = \Delta U + W$) • isothermal and adiabatic processes • idealised engine cycles • second law of thermodynamics • heat engines, refrigerators and heat pumps • maximum theoretical coefficient of performance (COP) • Understand the changes of state of substances used in industrial and domestic processes. Understand the following concepts and apply them in industrial and domestic situations:	

	• Elasticity, stress-strain curves, elastic limit, strength, yield point, • plastic deformation, creep, fatigue, ductility, brittleness, malleability, elastic hysteresis. • Be able to use the following quantities and units: • tensile/compressive stress (Newton per metre squared (Nm−2)), tensile/compressive strain (no units), Young's modulus (Newton per metre squared (Nm−2)). • Understand the following definitions: • tensile/compressive stress, Young's modulus *E,* Hooke's law $F = k\Delta x$, work done in stretching/compressing a wire/spring = $\frac{1}{2}F\Delta x = \frac{1}{2}k(\Delta x)2$ • Understand the following concepts and apply them in industrial and domestic situations.	
Developmental Knowledge and Skills	• Understand the use of free radical polymerisation of alkenes and hydration of ethane • Understand the enthalpy change in water in contact with a reaction • Calculate enthalpy changes from supplied data. • Understand the use of electrocardiograms (ECG). • Understand the importance of spirometer readings of lung volumes. • Understand the importance of the methods used to measure lung function for respiratory conditions. • Understand the effects of exercise on the following using data from spirometer traces. • Understand how the kidney is involved in water, electrolyte and acid base balances. • Understand the structure of the cell surface membrane with reference to the fluid mosaic model.	Unit 4 • Compare the health and safety measures taken in relation to legislation for different scientific working environments, referencing potential hazards. • Demonstrate skilful application of techniques in preparing and testing the purity of an organic liquid and draw detailed conclusions. • Compare the laboratory and industrial manufacture and testing of an organic liquid. • Demonstrate skilful application of techniques in preparing and testing the purity of an organic solid and draw detailed conclusions • Compare the laboratory and industrial manufacture and testing of an organic solid. • Analyse the differences in the storage and communication of scientific information indifferent work place laboratories. Unit 9 • Explain how nervous impulses are initiated, transmitted and coordinated in the control of the cardiovascular and respiratory systems. • Explain the role of hormones in homeostatic mechanisms.

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			• Explain how the regulation of male and female reproductive systems can affect human reproductive health.	
Complex Knowledge	Calculate enthalpy changes from supplied data.		Unit 4 • Evaluate the measures taken for different working environments to ensure high standards of health and safety that comply with legislation. • Analyse the factors affecting the yield and purity of an organic liquid in the laboratory and their relevance to its industrial manufacture. • Analyse the factors affecting the yield and purity of an organic solid in the laboratory and their relevance to its industrial manufacture • Evaluate the challenges to organisations in making available large volumes of scientific information Unit 9 • Assess the role of the nervous system in coordinating the cardiovascular and respiratory systems. • Analyse the impact of homeostatic dysfunction on the human body. • Evaluate how conception may be prevented and promoted.	
Literacy (including reading)	Key vocabulary Scientific articles	Key vocabulary Scientific articles	Key vocabulary Scientific articles Lab reports Research methods and referencing	Key vocabulary Scientific articles Coursework assignment writing technique
Cultural Capital	Development of Organ Transplants and dialysis treatment	Universal Cell Theory Development of key technology including fibre optics, Bluetooth and WiFi	Peer review of scientific documents	Peer review of scientific documents
Social, Moral, Spiritual and Cultural Development	The treatment of kidney failure and effects of diet, exercise and gender on CHD	Applications of wave technology to medicine Access to communication (WiFi/Broadband) for all	Treatments of diseases Health and safety regulations and their implementation	Treatments of diseases Health and safety regulations and their implementation
Fundamental British Values	Weekly collaborative tasks to encourage students to help each other.	Cooperation and respect during practical tasks and group work. Weekly collaborative tasks to encourage students to help each other.	Weekly collaborative tasks to encourage students to help each other. Cooperation and respect during practical tasks and group work.	Discussion and debate over the scientific data and it's interpretation Weekly collaborative tasks to encourage students to help each other. Cooperation and respect during practical work and group tasks

			Discussion and debate over the scientific data and it's interpretation The law as applied to Health and Safety legislation		The law as applied to Health and Safety Legislation
Assessment	One short answer assessments each 30 marks. In each subject area, Biology, Chemistry and Physics covering reactions, body systems and the behaviour of materials	One short answer assessment approximately 30 marks in each subject area Biology, Chemistry and Physics on the principles and applications of science. Formal Mock Paper, using past paper, mark scheme and grade boundaries	Unit 5 - additional mock paper depending on external exam dates Unit 5 - external exams in Biology, Chemistry and Physics	Unit 4 and Unit 9 are coursework units, approximately one assignment will be completed in each unit each half term	Unit 4 and Unit 9 are coursework units, approximately one assignment will be completed in each unit each half term