

Department	SCIENCE (Applied Science)
Key Stage	KEY STAGE 5
Course Level	Level 3 BTEC Extended certificate
Exam Board	Pearson Edexcel

Unit	Title	Weighting	Examination Method
1	Principles and applications of Science I	25%	External written exam
2	Practical scientific procedures and techniques	25%	Internal coursework
3	Science investigation skills	33%	External written exam
9	Human regulation and reproduction	17%	Internal coursework

Dates Delivered	Unit Title	End Points	Substantive Knowledge What will they learn about in this topic?	Disciplinary Knowledge What subject concepts will be developed through this topic?	Assessment Method
Year 12 Autumn term	Unit 1 Principles and applications of Science I	<p>In Biology, pupils will be able to describe the structure and function of organelles in eukaryotic and prokaryotic cells. They will then be able to apply this knowledge and explain how cells and tissues may be specialised for their function.</p> <p>Students will be able to describe and explain how action potentials arise in neurones and how electrical impulses and transmitted along neurones and across synapses.</p> <p>In Chemistry, students will be able to use the Aufbau principle to describe atomic structure. They will be able to describe ionic,</p>	<p>Biology topic 1 : Cell structure and specialisation Know that cell theory is a unifying concept stating that cells are a fundamental unit of structure, function and organisation in all living organisms.</p> <ul style="list-style-type: none"> Describe the ultrastructure and function of organelles in the following cells: prokaryote cells (bacterial cell) – nucleoid, plasmids, 70S ribosomes, capsule, cell wall o eukaryotic cells (plant and animal cells) – plasma membrane, cytoplasm, nucleus, nucleolus, endoplasmic reticulum (smooth and rough), Golgi apparatus, vesicles, lysosomes, 80S ribosomes, mitochondria, centriole o eukaryotic cells (plant-cell specific) – cell wall, chloroplasts, vacuole, tonoplast, amyloplasts, plasmodesmata, pits. Recognise cell organelles from electron micrographs and the use of light microscopes. Compare the similarities and differences between plant and animal cell structure and function. Distinguish between gram-positive and gram-negative bacterial cell walls and why each type reacts differently to some antibiotics. Calculate magnification and size of cells and organelles from drawings or images 	<p>Graph and data analysis</p> <p>Application of knowledge</p> <p>Unit conversion</p> <p>Linking topics</p> <p>Rearranging of equations</p>	<p>End of topic tests at the end of topic (identified in substantive knowledge)</p> <p>Full mock papers done at end of Biology, end of Chemistry and end of Physics</p> <p>External assessment in January</p>

covalent and metallic bonding and use this knowledge to explain trends in properties of ionic, metallic and covalent substances. Students will be able to define first ionisation energy and electronegativity. They will be able to discuss trends in first ionisation energy, melting points, atomic radius and electronegativity across periods and groups in the periodic table. They will also be able to calculate expected mass, percentage mass, concentration and RFM.

In Physics, pupils will be able to define and label waves with the following characteristics; amplitude, wavelength and frequency. They will be able to calculate wave speed and periodic time. Students will be able to describe and explain wave behaviours including reflection, refraction, resonance and diffraction. They will be able to relate these wave behaviours to practical applications such as endoscopes. Students will be able to describe uses, properties and dangers of electromagnetic waves

Biology topic 2: Tissues

Describe cell specialisation in terms of structure and function, to include:

- palisade mesophyll cells in a leaf
- sperm and egg cells in reproduction
- root hair cells in plants
- white blood cells
- red blood cells

Biology topic 3: Nervous system

- Describe the structure and function of epithelial tissue including squamous tissues and ciliated cells
- Describe the structure and function of endothelial tissue, as illustrated by blood vessels in the cardiovascular system, including the risk factors that damage endothelial cells and affect the development of atherosclerosis.
- Describe the structure and function of muscular tissue.
 - Compare fast and slow twitch muscle fibres
- Describe the structure and function of nervous tissue
 - Describe how action potentials are generated in neurones
 - Compare myelinated and non-myelinated neurones
 - Describe the role of neurotransmitters in the nervous system

Chemistry topic 1: Atomic structure and bonding

- Describe the electronic structure of atoms
- Describe ionic bonding:
 - Define ionic bonding as strong electrostatic attraction between oppositely charged ions
 - Describe effects ionic radius and ionic charge have on the strength of ionic bonding
 - Describe formation of ions in terms of electron loss or gain
 - Draw electronic configuration diagrams of cations and anions.
- Describe covalent bonding:

- Define covalent bonding as strong electrostatic attraction between two nuclei and the shared pair(s) of electrons between them
- Draw dot and cross diagrams to show electrons in simple covalent molecules, including those with multiple bonds and dative covalent (coordinate) bonds
- Describe the relationship between bond lengths and bond strengths in covalent bonds o tetrahedral basis of organic chemistry.
- Describe metallic bonding
- Describe the following intermolecular forces:
 - van der Waals
 - dipole-dipole
 - hydrogen bonding.

Calculate the following

- Concentration
- RFM
- Moles
- Reacting quantities
- Percentage yields

Chemistry topic 2: Trends in the periodic table

Describe the physical properties of elements based on:

- first ionisation energy
- reasons for trends in ionisation energy across Periods 2–4 and down groups 1, 2 and 7
- electron affinity
- atomic radius
- ionic radius
- electronegativity
- type of bonding in the element
- trends – melting point and boiling point
- physical properties of metals – electrical conductivity, thermal conductivity, malleability, ductility.
- Describe the chemical properties of elements including:
 - products and reactivity of all Period 2 and 3 elements with oxygen

			<ul style="list-style-type: none"> - products and reactivity of metals with oxygen, water, dilute hydrochloric acid and dilute sulfuric acid - position of metals in the reactivity series in relation to position in the periodic table - oxidation - reduction - variable oxidation states of transition metal ions - displacement reactions of metals/halogens 		
			<p>Physics topic 1: Wave behaviours</p> <ul style="list-style-type: none"> - Define the terms wavelength, frequency, amplitude and oscillation, transverse waves, longitudinal waves - Be able to label wave diagrams with amplitude and wavelength - Calculate wave speed - Describe how interference patterns are formed - Describe how stationary waves are formed - Calculate refractive index - Describe the processes of refraction and reflection - Explain how total internal reflection is used in optic fibres - Compare digital and analogue signals 		
			<p>Physics topic 2: Electromagnetic waves</p> <p>Understand that all electromagnetic waves travel with the same speed in a vacuum.</p> <ul style="list-style-type: none"> • 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. • Describe how the applications of electromagnetic waves in communications are related to frequency, including: <ul style="list-style-type: none"> - satellite communication - mobile phones - Bluetooth® -infrared - Wi-Fi. 		

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Year 12 Spring /summer term	Unit 2 Practical scientific procedures and techniques	<p>Students will carry out a range of practical work, including</p> <ul style="list-style-type: none"> • Making a standard solution • Carrying out titrations using a pH meter or indicator • Colorimetry • Paper chromatography • Thin layer chromatography <p>They will be able to calibrate equipment, analyse results and evaluate method based on their experimental results</p>	<p>Learning Aim A: Students will use a range of methods to calculate an unknown concentration</p> <hr/> <p>Learning Aim B: Students will investigate the freezing point of a known chemical and make a judgement of its purity</p> <hr/> <p>Learning Aim C: Students will analyse pigments in plants and amino acids using paper and thin layer chromatography</p> <hr/> <p>Learning Aim D: Pupils will assess the progress of their practical skills and evaluate their next steps.</p>	<p>Using scientific equipment to measure volumes accurately</p> <p>Calculating concentration</p> <p>Calculating Rf values</p> <p>Drawing and analysing graphs</p> <p>Evaluation of methods and justification of improvements</p>	Internally assessed	<p>Edexcel link for specification</p> <p>https://qualifications.pearson.com/en/qualifications/btec-nationals/applied-science-2016.html</p>

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Year 13 Autumn term	Unit 3 Science investigation skills	Pupils will carry out a range of experiments including: <ul style="list-style-type: none"> - The effect of concentration and temperature on enzyme action - The effect of temperature and concentration on diffusion - The impact of abiotic factors on plant distribution - Combustion in fuels - Current, potential difference and resistance in circuits 	<p>A -> Planning a scientific investigation</p> <ul style="list-style-type: none"> • Be able to formulate a hypothesis or a null hypothesis based on relevant scientific ideas. • 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. • Identify independent, dependent and control variables • 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 <p>B -> Data collection, processing and analysis/interpretation</p> Be able to collect data accurately/reliably and to appropriate levels of precision. <ul style="list-style-type: none"> • Be able to tabulate data in a clear and logical format using correct headings with units where appropriate. 	Drawing results tables Drawing and analysing graphs Evaluation of methods and justification of improvements Linking topics Application of knowledge Calculations using graphs	Assessed in year 13 mocks at end of topic Externally assessed in January	Edexcel link for specification https://qualifications.pearson.com/en/qualifications/btec-nationals/applied-science-2016.html

- Be able to identify anomalous data and take appropriate action.
- Be able to recognise when it is appropriate to take repeats.
 - Be able to make qualitative observations and draw inferences.
- Be able to carry out relevant calculations where appropriate, involving:
 - mean and standard deviation
 - use and interpretation of error bars
 - measuring gradients of a line and/or curve
 - use of statistical tests, including t-test, chi-squared and correlation analysis
 - use of standard form
 - percentage error of measuring equipment.
- Be able to display data in an appropriate format, including:
 - choosing an appropriate graph/chart/tables
 - correct plotting/labelling/scales.

C -> Drawing Conclusions

- 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.
 - Interpretation of statistical tests using tables of critical values and a 5% significance level, with reference to the null hypothesis.
 - Be able to make any recommendations for

			<p>improvements to the investigation. • Be able to explain anomalous data.</p> <ul style="list-style-type: none"> • Be able to determine quantitative and discuss qualitative sources of error. • Be able to discuss evidence of the reliability of the data collected during the investigation. • Be able to identify strengths and weaknesses within method/techniques/standard procedures/equipment used. • Be able to suggest improvements to an investigation. 			
			<p>D -> Enzymes in Action</p> <ul style="list-style-type: none"> - Describe how enzymes work with reference to protein structure - Investigate how concentration of enzymes, concentration of substrate, pH and temperature affect enzyme activity 			
			<p>E -> Diffusion of molecules</p> <ul style="list-style-type: none"> - Describe the arrangement of particles in solids, liquids and gases - Define the term diffusion - Investigate the effect of temperature and concentration on the rate of diffusion 			
		<p>Pupils will be able to identify independent, dependent and control variables. They will be able to collect and analyse data to make conclusions. Pupils will be able to evaluate methods and justify improvements</p>	<p>F -> Plants and their environment</p> <p>-Select appropriate ecological sampling techniques to investigate the effect of abiotic</p>			

			<p>factors on plant populations, including:</p> <ul style="list-style-type: none"> - transects - quadrats (open and gridded) - point frames 		
			<p>G -> Energy content off fuels</p> <ul style="list-style-type: none"> - Draw the structure of alcohols and hydrocarbons - Discuss hazards associated with fuels - Investigate how carbon chain length affects the energy given out from fuels during combustion 		
			<p>H -> Electrical Circuits</p> <p>Identify components in circuits</p> <ul style="list-style-type: none"> • Cells, batteries, power packs. • Ammeter. • Voltmeter. • Lamps. • Resistors – thermistors, LDRs. • Diodes – photodiodes, LEDs <ul style="list-style-type: none"> - Investigate factors that affect resistance in a circuit - Calculate resistance - Calculate power 		

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Year 13 Spring/ summer term	Unit 9 Human regulation and reproduction	Pupils will be able to describe and explain the structure and function of the nervous system, reproductive system and kidney. They will be able to describe why homeostasis is important and explain how heart rate, blood glucose level and blood water potential are controlled. They will be able to describe and explain symptoms of conditions that arise from heart rate, blood glucose level and blood water potential not being regulated. Pupils will be able to describe the processes of spermatogenesis, oogenesis and fertilisation. They will be able to describe and explain factors that lead to infertility and explain how treatments for infertility work	Learning Aim A: Pupils will be able to describe and explain how the cardiac cycle is controlled with reference to the nervous system	Research and referencing Application of knowledge Linking topics	Internally assessed	Edexcel link for specification https://qualifications.pearsen.com/en/qualifications/btec-nationals/applied-science-2016.html
			Learning Aim B : Pupils will be able to explain how blood glucose and water levels are controlled and the impact of a lack of regulation			
			Learning Aim C: Pupils will be able to processes of spermatogenesis, oogenesis and fertilisation. They will be able to describe and explain factors that lead to infertility and explain how treatments for infertility work			