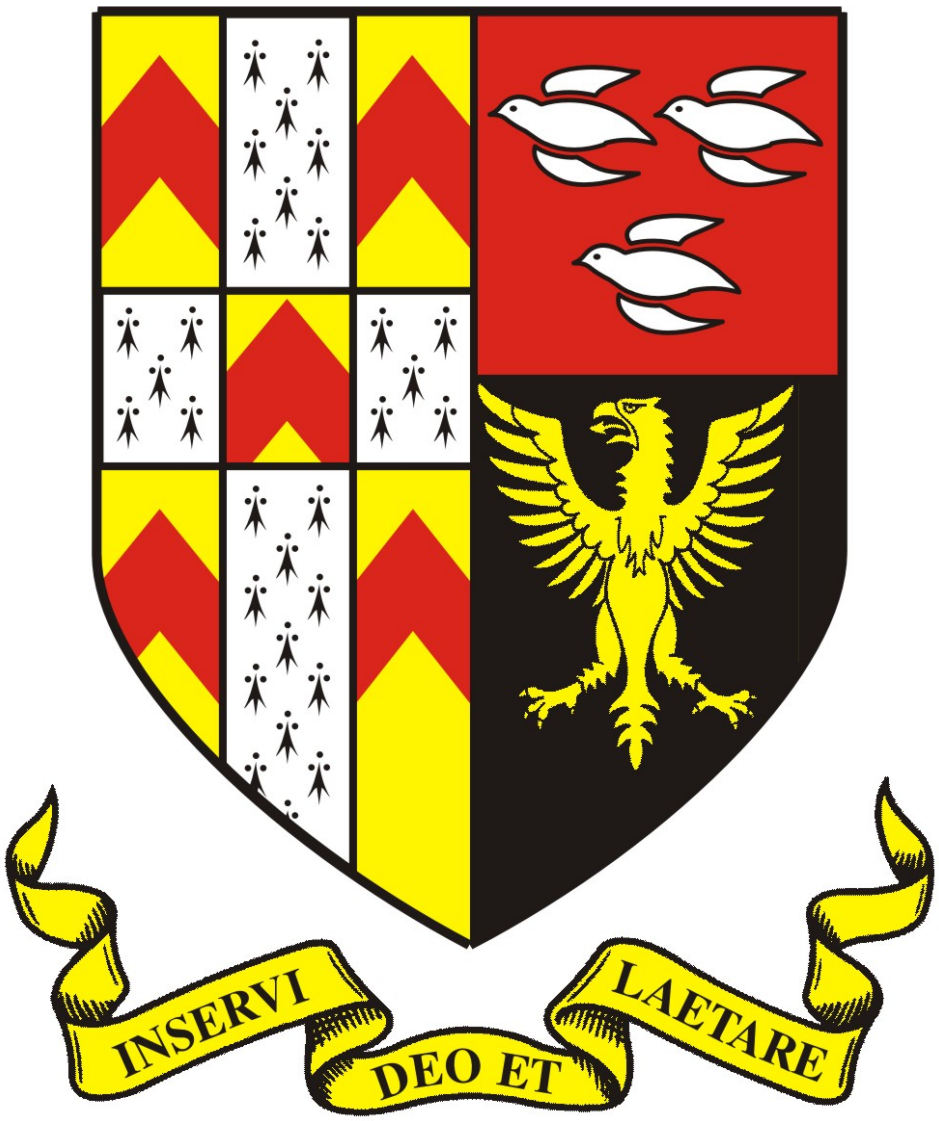
Name……

Applied Science
BTEC
Bridging the Gap



Welcome to BTEC Applied Science!

This pack has been designed to help you bridge the gap from GCSE to Level 3 BTEC to ensure that you understand what you've let yourself in for and that you are ready for your new course in September.

You will start by looking at the topics covered in Year 12 to give you an idea of how the course will be structured and what resources are available and when you will be doing tests, exams and practical assessments.

Then you will review what you already know and be given some work to do to make sure you're all ready to start in September to give yourself the best chance of success.

Bridging the Gap

Everything at A Level builds on your GCSE knowledge, skills and understanding and so you will first need to review everything you have done in Core and Additional GCSE.

Some of you have an advantage in that you have also done separate sciences – you will also have to review this work.

On the following pages you will find checklists that include everything you need to know before we start the Y12 course. It will be your homework over the summer to ensure that you have revised it all thoroughly. Tick off the statements as you revise them.

At the back of this booklet we some questions to work through. You must bring this booklet to your first lesson in September and hand it in to your teacher. They will mark it and give it back to you.

What can I expect?

BTEC Level 3 Certificate in Applied Science – Year 12
The Edexcel BTEC Level 3 Certificate in Applied Science is a 180 guided learning hour qualification that consists of **two** mandatory units.

Unit	Title	Learning hours	Brief description	Assessment
1	**Principles and Applications of Science I**	90	Chemistry, biology and physics topics	External - 90 minute exam worth 90 marks
2	**Practical Scientific Procedures and Techniques**	90	Practical techniques commonly used in chemistry, biology and physics laboratories	Internal - assignments

BTEC Level 3 Extended Certificate in Applied Science
The Edexcel BTEC Level 3 Extended Certificate is completed in Year 13 through an additional 180 guided learning hours across two units. This completes a combined total of four units from both Year 12 and 13.

Unit	Title	Learning hours	Brief description	Assessment
3	**Science Investigation Skills**	120	Investigation skills used in the science industry	External - practical task
8 Option	**Physiology of Human Body Systems**	60	Human lymphatic, musculoskeletal and digestive systems	Internal - assignments

How will I learn?

Over the course you will have around five hours of lessons a week that will cover all the theory and practical skills you will need.
You will be given homework questions every week and these will be expected to be completed by the next lesson in most cases.

You are expected to be spending five hours per week out of class completing homework, reviewing your work and reading around the subject.

In addition to the lessons you will receive, there is plenty of support available:

- Teachers: Your teacher is your first point of call as they are the experts – you will have two experienced teachers who will always offer their time when they are available to help you in and out of lessons.

- Notes: You will be expected to organise these in a folder and add any extra notes that you write in or out of lessons and bring these along to lessons where we will check these regularly.

- Textbook: You will be given a textbook. These have notes, questions and revision tips and quizzes.

- Specification and past papers: Download a BTEC specification from the website: http://qualifications.pearson.com/en/qualifications/btec-nationals/applied-science-2016.html

Applied Science Unit 1 PLC – Chemistry content

			Now	After lesson	After revision
Structure and bonding in applications in science	**Electronic structure**	Understand the electronic structure of atoms			
		Explain the arrangement of electrons in electronic orbitals			
		Describe the Aufbau principle			
		Describe Bohr's theory			
	Ionic bonding	Understand ionic bonding:			
		Describe the strong electrostatic attraction between oppositely charged ions			
		Explain the effects ionic radius and ionic charge have on the strength of ionic bonding			
		Explain how ions form in terms of electron loss or gain			
		Recognise and draw electronic configuration diagrams of cations and anions.			
		Understand covalent bonding:			
		Describe the strong electrostatic attraction between two nuclei and the shared pair(s) of electrons between them			
		Draw and interpret 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			
		Explain the tetrahedral basis of organic chemistry.			
	Metallic bonding	Understand metallic bonding:			
		Explain the properties of metals caused by de-localised electrons			
		Explain the properties of metals caused by positive metal ions			
		Explain the properties of metals caused by regular layer structure.			
	Intermolecular forces	Understand the following intermolecular forces:			
		Describe and explain van der Waals forces			
		Describe and explain dipole-dipole forces			
		Describe and explain hydrogen bonding			
	Calculating quantities	Understand the following:			
		Interpret and construct balanced equations			
		Calculate and explain relative atomic mass			
		Describe atomic number and relative molecular mass			
		Calculate and interpret moles, molar masses and molarities			
		Understand the quantities used in chemical reactions:			
		Calculate using mass, volume of solution, concentration			
		Calculate and interpret reacting quantities			
		Calculate and interpret percentage yields			

			Now	After lesson	After revision
Production and uses of substances in relation to properties	**Periodic table**	Understand the periodic table:			
		Describe the elements in periods 1, 2, 3 and 4			
		Recognise and explain the atomic structure of elements in groups – s block, p block, d block			
		Explain the layout of periodic table in relation to s, p, d notation			
		Recognise and state electronic arrangement of elements using s, p, d notation			
	Physical properties related to atomic structure	Understand the physical properties of elements:			
		Describe what is meant by first ionisation energy			
		Explain the reasons for trends in ionisation energy across Periods 2–4 and down Groups 1, 2 and 7			
		Describe what is meant by electron affinity and explain differences between elements			
		Describe what is meant by atomic radius and explain differences between elements			
		Describe what is meant by ionic radius and explain differences between elements			
		Describe what is meant by electronegativity and explain differences between elements			
		Describe the type of bonding in different elements and explain differences			
		Describe the trends in melting point and boiling point across the periods			
		Describe and explain physical properties of metals – electrical conductivity, thermal conductivity, malleability, ductility			
	Chemical properties related to atomic structure	Understand the chemical properties of elements:			
		Describe and explain the products and reactivity of all period 2 and 3 elements with oxygen			
		Describe and explain the products and reactivity of metals with oxygen, water, dilute hydrochloric acid and dilute sulfuric acid			
		Describe the position of metals in the reactivity series in relation to position in the periodic table			
		Describe and explain what is meant by oxidation and reduction			
		Describe and explain variable oxidation states of transition metal ions			
		Describe displacement reactions of metals/halogens			
		Describe and explain the uses and applications of substances produced within this unit.			

Applied Science Unit 1 PLC – Biology content

			Now	Revisit 1	Revisit 2
Cells	Cell structure and function	Know that cell theory is a unifying concept that states that cells are a fundamental unit of structure, function and organisation in all living organisms.			
		Understand the ultrastructure and function of organelles in the following cells:			
		Prokaryote cells (bacterial cell): nucleoid, plasmids, 70S ribosomes, capsule, cell wall			
		Eukaryotic cells (plant and animal cell): plasma membrane, cytoplasm, nucleus, nucleolus, endoplasmic reticulum (smooth and rough), Golgi apparatus, vesicles, lysosomes, 80S ribosomes, mitochondria, centriole			
		Eukaryotic cells (plant-cell specific): cell wall, chloroplasts, vacuole, tonoplast, amyloplasts, plasmodesmata, pits.			
	Cell specialisation	Interpret microscope and electron micrograph images:			
		Recognise cell organelles from electron micrographs and the use of light microscopes.			
		Understand the similarities and differences between plant and animal cell structure and function.			
		Understand how to distinguish between gram positive and gram negative bacterial cell walls and why each type reacts differently to some antibiotics.			
		Understand cell specialisation in terms of structure and function:			
		Explain the structure and function of palisade mesophyll cells in a leaf			
		Explain the structure and function of sperm and egg cells in reproduction			
		Explain the structure and function of root hair cells in plants			
		Explain the structure and function of white blood cells			
		Explain the structure and function of red blood cells.			
Tissue structure and function	Epithelial tissue	Understand the structure and function of epithelial tissue to include:			
		Describe the structure and function of squamous epithelial tissue as illustrated by the role of alveolar epithelium in gas exchange			
		Describe, explain and interpret data on the effect of Chronic Obstructive Pulmonary Disease (COPD) and smoking			
		Describe the structure and function of columnar epithelial tissue as illustrated by goblet cells and ciliated cells protecting lungs from pathogens.			
	Endothelial tissue	Understand the structure and function of endothelial tissue:			
		Describe the structure and function of blood vessels in the cardiovascular system			
		Describe, explain and interpret the risk factors that damage endothelial cells and affect the development of atherosclerosis			

			Now	After lesson	After revision
Tissue structure and function	**Muscle tissue**	Understand the structure and function of muscular tissue:			
		Describe the microscopic structure of a skeletal muscle fibre and how muscles contract			
		Describe and explain the structural and physiological differences between fast and slow twitch muscle fibres and their relevance in sport.			
	Nerve tissue	Understand the structure and function of nervous tissue:			
		Describe the structure and function of non-myelinated and myelinated neurones			
		Describe and explain 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			
		Interpret graphical displays of a nerve impulse and EEG recordings			
		Describe synaptic structure and the role of neurotransmitters, including acetylcholine			
		Explain how imbalances in certain, naturally occurring brain chemicals can contribute to ill health, including dopamine in Parkinson's disease and serotonin in depression			
		Describe and explain the effects of drugs on synaptic transmission, including the use of L-Dopa in the treatment of Parkinson's disease.			

Applied Science Unit 1 PLC – Physics content

			Now	Revisit 1	Revisit 2
Working with waves		Understand the features common to all waves; use and define the following terms as applied to waves:			
		periodic time			
		speed			
		wavelength			
		frequency			
		amplitude			
		oscillation			
		Interpret and make calculations using features and values from graphical representation of wave features.			
		Understand the difference between the two main types of wave:			
		Describe transverse waves in terms of the direction of vibration and energy transfer and recognise their features			
		Describe longitudinal waves in terms of the direction of vibration and energy transfer and recognise their features			
		Describe and explain the use of diffraction gratings:			
		Explain what is meant by displacement			
		Explain what is meant by coherence			
		Explain what is meant by path difference			
		Explain what is meant by phase difference			
		Explain what is meant by superposition			
		Understand the industrial application of diffraction gratings to include emission spectra and identifying gases.			
		Be able to use the wave equation wave speed = frequency x wavelength $v = f\lambda$			
		Understand the concept and applications of stationary waves resonance			
		Explain how stationary waves are formed			
		Describe nodes and anti-nodes			
		Explain how musical instruments use stationary waves and draw and recognise fundamental frequencies and harmonics for tubes open at both ends and one end only			
		Be able to use the equation Wave speed = √(Tension/ μ) where μ = mass/length of string $v = \sqrt{(T/\mu)}$			
	Waves in communication	Understand the principles of fibre optics:			
		refractive index $n = c/v = \sin i / \sin r$			
		total internal reflection			
		calculation of critical angles at a glass–air interface: $\sin C = 1/n$ where C is the critical angle			
		Understand the applications of fibre optics in medicine to include endoscopes.			

			Now	Revisit 1	Revisit 2
		Understand the applications of fibre optics in communication to include:			
		Describe the difference between analogue and digital signals			
		Describe how to convert analogue to digital signals			
		Explain which part of the electromagnetic spectrum is used in broadband			
		Use of electromagnetic waves in communication			
		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: Intensity = a constant / (distance from source)^2 $I = k / r^2$			
		Understand how the regions of the electromagnetic spectrum are grouped according to the frequency.			
		Understand how the applications of electromagnetic waves in communications are related to frequency			
		Know the frequency range of electromagnetic radiation used for satellite communication			
		Know the frequency range of electromagnetic radiation mobile phones			
		Know the frequency range of electromagnetic radiation used for Bluetooth®			
		Know the frequency range of electromagnetic radiation used for infrared			
		Know the frequency range of electromagnetic radiation used for wi-fi.			
		Compare different ranges of electromagnetic radiation and explain why they are suitable for their use			

Questions

1. a) Draw labelled diagrams of a plant cell and an animal cell. Label each of the organelles and explain their function.

   b) Produce a table comparing plant and animal cells, making sure that you include both similarities and differences. Explain why there are differences.

2. Research five different types of pathogen and find images of each, labelling the organelles and any other features. Explain how they cause disease and how the disease is treated.

3. Produce a half page account of how vaccinations were developed, referring to Edward Jenner's work on the smallpox vaccine.

4. On a periodic table label where you would find
   a) metals
   b) non-metals
   c) the two elements which are liquid at room temperature
   d) hydrogen
   e) transition metals

5. i) Describe the properties of Group 1 elements in the periodic table, describing any similarities and any trends as you go down the group.
   ii) Describe the properties of Group 7 elements in the periodic table, describing any similarities and any trends as you go down the group.

6. Produce a half page account of how the arrangement of the periodic table was developed, and how it is arranged. Explain what information is usually given for each element on the table, and what this information means.

7. a) Draw, label and give examples of i) a transverse wave ii) a longitudinal wave
   b) Draw a diagram to show the different regions of the electromagnetic spectrum. Label the frequency and wavelength range of each region, and describe how each is detected and what they are used for.

8. a) Draw diagrams to show the difference between the arrangement of particles in solids, liquids and gases. Explain how these arrangements account for the differences in properties between solids, liquids and gases.
   b) Draw a sketch graph to temperature and time as a solid is heated until it turns into a liquid and a gas. Label the different regions of the graph and explain what is happening.

9. Research the discovery of seismic waves and how they are measured. Explain how this information is used to predict earthquakes and to design buildings which will withstand earthquakes.