Education & Skills Funding Agency

Science content common to all T Levels within the Health and Science route

There are three T Level pathways in the Health and Science route:

1. T Level Technical Qualification in Health, (Level 3) (603/7066/X)
2. T Level Technical Qualification in Healthcare Science, (Level 3) (603/7083/X)
3. T Level Technical Qualification in Science, (Level 3) (603/6989/9)

Core knowledge and understanding in these three T Level qualifications is divided into Sections A and B. Science concepts are found in sections B1 Core Science concepts and B2 Further Science concepts. The content in section B1, Core Science concepts, is the same for each of the T Levels in this route. The table below shows how the Core Science concepts content in section B1 aligns with the BTEC National Extended Diploma in Applied Science and the GCE AS and A level subject content for biology, chemistry, and physics.

The content of section B2, Further Science concepts, varies according to the pathway within the Health and Science route.

All the T Level Science content in section B1 is mandatory. BTEC offers a mandatory and optional content structure and BTEC optional content is shown in red type.

T level students will need to undertake a variety of assessment types such as those that take place in Higher Education for Health-related courses including examinations, controlled assessments, and Objective Structured Clinical Examinations.

Each T Level Core assessment consists of an externally set written exam(s) and an employer set project: both sets of exams assess students' knowledge, understanding and application of contexts, theories and principles relating to the core content in the specification The written exams assess route and pathway knowledge through 'unseen' examination (which samples content), meaning breadth can be assessed at appropriate level 3 depth, whilst limiting the overall duration of assessment. Written exams for each of the T Levels in the Health and Science route will draw from the same T Level Core Science content outlined section B1 of the specification. The written exam structure will provide students with relevant exam and revision skills for HE. The employer set project is a more substantial project-based assessment set by employers through the awarding organisation and will develop their critical thinking and problem-solving skills. The project will draw upon knowledge and understanding from across the core content synoptically and will allow learners to effectively respond to a 'brief'.

Published: February 2022

The occupational specialism components are also externally assessed through synoptic assignments, except for the observation element, which takes place in a controlled environment is internally marked by providers and externally moderated.

BTEC assessment is external, internal, and synoptic. External and internal assessment is linked to a specific unit.

Science		
Science content common to the three T Levels[1] in the Healthcare Science route	**BTEC in Applied Science[2]**	**A Level[3]**
Mandatory B1 Core Science	**(M = mandatory unit, O = optional unit)**	**Mandatory for A level qualification in brackets**
Cells and Tissues: • Principles of cell theory • Structure of eukaryotic/prokaryotic cells • Specialised eukaryotic cells in complex multi-cellular organisms • Differences between prokaryotic cells and eukaryotic cells • Structure and function of the organelles found within eukaryotic cells • Plant and animal cells; presence of specific organelles and their function	**Cell and Tissue Structure and Function (Unit 1-M)** • Ultrastructure and function of organelles in the following cells: • prokaryote cells • eukaryotic cells (plant and animal cells) eukaryotic cells (plant-cell specific) • Cell specialisation: white/red blood cells, root hair and palisade mesophyll cells • Structure and function of epithelial tissue • Structure and function of endothelial tissue • Structure and function of muscular tissue • Structure and function of nervous tissue (including ECG readings) •	**Cells (Biology)** • Cell theory • Prokaryotic and eukaryotic cells and their structure and ultrastructure • Division of multicellular organisms cells into tissues/organs/systems • The cell cycle and copying of genetic information • Mitosis and meiosis/gene copies

[1] T Level Technical Qualification in Health ; Healthcare Science (qualhub.co.uk) ; T Level Technical Qualification in Health and Science: Science (qualhub.co.uk)
[2] BTEC Level 3 National Extended Diploma in Applied Science
[3] GCE AS and A level subject content for biology, chemistry, physics and psychology

Biological Molecules • Structure, properties and functions of Proteins Carbohydrates Lipids	**Biological Molecules and Metabolic Pathways (Unit 10-O)** • Structure and function of water, carbohydrates, proteins and nucleic acids, lipids • Causes and effects of disruption to biochemical processes (e.g. cystic fibrosis) • Respiration • Photosynthesis	**Biological Molecules (Biology)** • Biological molecules are often polymers and are based on a small number of • chemical elements • Role and function of nucleic acids (DNA and RNA), carbohydrates, proteins, lipids, • inorganic ions and water. • Sequence of bases in the DNA molecule determines the structure of proteins, • including enzymes • Enzymes as catalysts • ATP as a source of energy for biological processes •
Exchange and Transport Mechanisms • Impact of surface to volume on exchange and specialised systems • Cellular exchange and transport mechanisms (diffusion, facilitated diffusion and osmosis) • Specialised cells in relation to the rate of transport across internal and external membranes	**Cell transport mechanisms (Unit 5-M)** • The structure of the cell surface membrane with reference to the fluid mosaic model • Methods used to transport molecules through cell membranes (osmosis, diffusion, facilitated diffusion, active transport, the processes of endocytosis and exocytosis • How surface area to volume ratio affects transport of molecules in living organisms.	**Exchange and Transport (Biology)** • Selective exchange of substances with their environment and exchange surfaces • Size and metabolic rate/adaptations to exchange and transport • Passive and active transport • Structure of plasma membranes and the control of movements in and out of cells
Genetics • Purpose of DNA and RNA as the carriers of genetic information • Structure of DNA and RNA and their role in the mechanism of inheritance • Complementary base pairing in forming the helical structure of DNA	**Genetics and Genetic Engineering (Unit 11-O)** • Structure and function of nucleic acids, the basis of the genetic code, protein synthesis • process of cell division in eukaryotic cells • contributes to genetic variation	**Genetics and Evolution (Biology)** • Transfer of genetic information from one generation to the next can lead to continuity, variation or new species • Impact of reproductive isolation • Gene sequencing

• Process and stages of semi-conservative replication of DNA • Genetic continuity between generations • of cells • Link between the semi-conservative replication process and variation • Difference between genetics and genomics	• principles of inheritance and their • application in predicting genetic traits • DNA techniques and the use of genetic engineering technologies	• Prediction of protein sequences from genetic codes • Gene technologies/alteration of gene function. • Medical and industrial implications of advances in gene technology
Microbiology • Classification and characteristics of bacteria, fungi, parasites, viruses • Benefits of using light, scanning electron and transmission electron microscopes when investigating microorganisms • Calculating magnification • Differential staining techniques	**Microbiology and Microbiological** **Techniques (Unit 17-O)** • Similarities and differences in relative sizes, structural features and means of reproduction/ replication in bacteria (prokaryotes), fungi, including yeasts (eukaryotes), protozoa, viruses, viroids, prions • Undertake microscopy for specimen examination • Slide and sample preparation • Setting up a compound light microscope • Aseptic techniques to culture microorganisms • Factors controlling microbial growth in industrial, medical and domestic applications	
Immunology • Nature of infection • Causative agents of infection and examples of resulting diseases (bacteria, viruses, fungi, prions, protoctists, parasites) • Ways in which causative agents enter the body • How infectious diseases can spread amongst	**Diseases and Infections (Unit 12-O**) • Types of diseases and infections that can affect humans: pathogens and infectious • disease, dietary and environmental • diseases, genetic and degenerative • diseases.	

populations and communities • Definition of an antigen and an antibody • Antigens and the initiation of the body's response • Stages and cells involved in the body's response to an antigen • Cell-mediated immunity and antibody-mediated immunity • Role of T and B memory cells in the secondary immune response	• Disease progression over time. • Methods by which infectious diseases can be spread • Methods by which infectious diseases can be prevented from spreading • Management of infectious diseases • How infectious diseases can be treated • and managed • How the human body responds to diseases and infections (cell-mediated and humoral response) •	
Materials and chemical properties • Atomic structure and physical and chemical properties of metals • Periodic table and the position of elements • Position in an atom of protons, electrons and neutrons	**Periodicity and Properties of elements (Unit 1-M)** • Electronic structure of atoms • Ionic, covalent and metallic bonding • Intermolecular forces • Balancing equations • Quantities used in chemical reactions • Periodic table, elements and groups • Physical properties of elements • Chemical properties of elements • **Properties and uses of substances (Unit 5-M)** • The chemical properties of substances • Use of substances (e.g., as catalysts) • Purification, extraction and manufacture of e.g. metals • Structures, reactions and properties of commercially important organic compounds •	**Formulae, equations and amounts of substance** **empirical and molecular formulae (Chemistry)** • Balanced chemical equations • Avogadro constant and the amount of substance (mole) • relative atomic mass and relative isotopic mass • calculation of reacting masses, mole concentrations, volumes of gases, per cent • yields and atom economies • Atomic structure • Bonding and structure • **Inorganic chemistry and the periodic table (Chemistry)** • Organisation of elements according to their proton number and electronic • Structures • Classification of elements into s, p and d blocks

	Materials in domestic and industrial application (Unit 5-M) • Elasticity, stress-strain curves, elastic limit, strength, yield point, plastic deformation, creep, fatigue, ductility, brittleness, malleability, elastic hysteresis • Density • Tensile/compressive stress • tensile/compressive strain • Young's modulus • **Materials Science (Unit 22-O)** • Classification and properties of different • materials • Nanotechnology materials • Benefits and limitations of polymer technology • materials used in applications to • reduce carbon emissions	• Metal and non-metallic groups • Transition metals • Trends in element properties • **Mechanical properties of matter (Physics)** • Stress, strain, Young modulus • Force-extension graphs, energy stored
Acids/bases and chemical change • Physical properties of acids • Concept of strong and weak acids • Determining the name of the salt produced in the reaction: • acid + base → salt + water	**Applications of Inorganic Chemistry (Unit 13-O)** • Calculation of the pH of strong acids, strong alkalis, weak acids and • buffer solutions • acid-base equilibria • Behaviour of strong and weak acids and alkalis and buffer solutions • Oxidation-reduction reactions • Titrimetric methods involving oxidation-reduction reactions	**Equilibria (Chemistry)** • Dynamic nature of equilibria • Effects of temperature, pressure and concentration changes on the position of equilibrium • Acid-base reactions • Ionic product of water • Calculation of pH for strong acids and bases • Dissociation constants • Calculation of pH for weak acids • Buffer solutions • Redox • Oxidation states and their calculation • Oxidation and reduction as electron transfer, applied to reactions of s, p and d block elements

Rates of reaction and energy changes • Principles of collision theory • Effect of temperature on rates of reaction • Definition of a catalyst and the role of catalysts in a reaction	**Energy changes in industry (Unit 5-M)** • Kelvin scale • Enthalpy change definition • Exothermic and endothermic reactions **Thermal physics, materials and fluids (Unit 5-M)** • Thermal physics in domestic and industrial applications (units, work done, efficiency, thermodynamic concepts, states of change) • **Industrial Chemical Reactions (Unit 18-O)** • Enthalpy changes • Entropy and Gibbs energy, equilibrium constant • Rate of reaction (collision theory) • Chemical equilibrium	**Energetics (Chemistry)** • Enthalpy changes • Reaction rates • Entropy • **Kinetics (Chemistry)** • Collision theory • Effect of temperature changes on rate of reaction • Role of catalysts in providing alternative routes of lower activation energy • Determination and use of rate equations • Orders of reactions
Chemical analysis of substances • Principles tests and techniques: • Thin layer chromatography • Column chromatography • Gas chromatography • High performance liquid chromatography • Mass spectrometry • The principle of titration	**Practical Scientific Procedures and Techniques (Unit 2-M)** • Undertake titration and colorimetry to determine the concentration of solutions • Preparation and standardisation of solutions using titration • practical application of colorimetry techniques • Undertake chromatographic techniques to identify components in mixtures	**Modern analytical techniques** • The use of mass spectrometry, infrared spectroscopy, nuclear magnetic resonance spectroscopy and chromatography in analysis, including techniques for the elucidation of structure

	Practical Chemical Analysis (Unit 19-O) • Colorimetric determinations • Spectroscopic techniques to identify compounds and determine concentrations • Gas chromatography • High-performance liquid chromatography (HPLC)	
Electricity • Calculate, charge and current using Q=IT • Calculate, current, potential difference and resistance, using Ohm's law V=IR • Calculate total resistance of multiple fixed resistors in a series and parallel circuit • Alternating and direct current • Mains electricity in the UK	**Electrical Circuits and their Applications (Unit 15-O)** • Electrical symbols, units and definitions • Electrical formulae and relationships • Electrical properties and uses of materials • Circuits in parallel and series • Measurement devices, AC/DC • Domestic electricity production • Transducers and sensors	**Electric circuits (Physics)** • Current • EMF and potential difference • Resistance • DC circuits • Capacitance
Magnetism and electromagnetism • Magnetism and magnetic poles • Magnetic fields • Uses of electromagnetism and electromagnets (transformers, induction heating, MIR)	**Medical Physics Applications (Unit 21-0)** • Magnetic resonance imaging (MRI)	**Fields (Physics)** • Force fields/electric and gravitational • B-fields • Flux and electromagnetic induction
Waves • Definition of a wave • Relationship between frequency, wavelength and speed using the wave equation v=fλ • Properties of longitudinal and transverse waves • Uses of different types of waves (including	**Waves (Unit 1-M)** • Wave terms (speed, frequency, wavelength, periodicity, amplitude, oscillation) • Properties of longitudinal and transverse waves • Principles underlying use of diffraction gratings	**Waves (Physics)** • Polarisation and diffraction Path difference, phase and coherence, interference • Graphical treatment of superposition and stationary waves

medical; cancer treatment, sterilisation, ultrasound for scanning/cleaning computer equipment	• Be able to use the wave equation: v = fλ • Be able to use the equation • calculation of speed v = √(T/μ) • Principles of fibreoptics • Use of electromagnetic waves in communications	
Particles and radiation • Types and properties of ionising radiation (alpha, beta, gamma) • Definitions of half-life and count-rate • Main types of radioactive decay in relation to unstable nuclei • How radiation interacts with matter • Applications of radioactivity within the health and science sector	**Medical Physics Applications (Unit 21-0)** • X-rays • Computerised tomography (CT) or computerised axial tomography (CAT) • Gamma ray imaging • Radiotherapy, Gamma Knife surgery and proton beam therapy	**Quantum and Nuclear Physics (Physics)** • Photons and particles • Nuclear decay • Nuclear energy/fission and fusion
Units • SI Units • Converting between units (e.g. kg to g) • Significant figures and science notation		**Units** • The use of SI units and their prefixes • The limitations of physical measurements
	Additional content BTEC only	**Additional content A Level only**
	Investigative Project (Unit 6-M)	
	Contemporary Issues in Science (Unit 7-M)	
	Astronomy and Space Science (Unit 16-O)	
	Forensic Evidence, Collection and Analysis (Unit 23-O)	
	Cryogenics and Vacuum Technology (Unit 24-O)	

	Forensic Fire Investigation Unit 25-O)	
	Forensic Traffic Collision Investigation (Unit 26-O)	
		Biodiversity
		Ecosystems
		Energy for Biological Processes
		Organic Chemistry
		Vectors and scalars
		Mechanics
		Matter