



Bryntirion Comprehensive School

BTEC Level 1 / 2 Principles of Applied Science

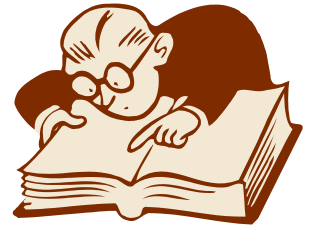
# Student Handbook

Merlin Crescent Bridgend, Mid Glamorgan, CF31 4QR, 01656 641100



## What are Vocational Qualifications?

Vocational qualifications are nationally recognised qualifications. They are different from traditional GCSE and A Levels because they are linked to a particular area of work.



## What makes Vocational Qualifications different?

- Students develop skills, knowledge and understanding in the vocational area they are studying.
- Each vocational course is made up of a number of units, allowing students to build up their qualification in stages.
- Students are assessed through coursework.
- Students produce evidence for their key skills qualification through their vocational course.
- Students take responsibility for their own learning by planning their work, doing research and regularly reviewing their progress.



## Why do we offer BTEC courses?

- They prepare students for the world of work and provide a good starting point for other qualifications such as NVQs that can be studied in the workplace.
- Employers value the qualities that vocational students bring to the workplace e.g. organisation, time management, communication and research skills.
- Universities value the independent study skills that vocational students bring to their courses.
- The courses are flexible so that they meet the needs of a wide range of students. They are available at different levels in a variety of formats. They can be taken alongside other qualifications such as traditional GCSEs, A levels.
- They give students the opportunity to try a range of activities such as designing products, organising events, investigating how professionals work and working in teams.





## What will happen in lessons?

The lessons will vary according to the subject and level but all students should experience most of these activities:

- Discussion - one to one or in groups
- Research - group or individual using a variety of methods
- Evaluating outcomes- manually or using ICT
- Presentations/critiques - in groups or individually
- Practical work
- Display work
- Visits to organisations/museums
- Work with established artists



## Which styles of teaching will be used?

Different styles of teaching will be required throughout the course. This will depend on the unit being taught, the stage of delivery and the type of assessment required for that unit.

- **Teacher input**

At the start of a unit there will be a lot of teacher input; question and answer sessions, discussions, note taking and handouts. This may all happen at the beginning of a unit or at different points throughout the unit. It is important to note any information you are given, as it may be required at a later stage in the unit.

- **Student investigation**

Once the assignment has been explained and the tasks have been set, you will have to work on your own and develop design ideas, creating a final outcome to meet the requirements of the task. **The work you produce must be your own; you can use visuals from magazines or the internet, however you must use these as a starting point and develop your own ideas and inspirations. You will not be allowed to copy the work of other students.** You will have to check regularly with your teacher to make sure that your work is correct and to discuss any ideas that you want to develop.

- **Group work**

For some tasks you may have to work in a group, either to find information or to produce evidence. This is quite acceptable providing that all students





take an equal share of the work and that individual contributions are identified.

- **Practical Work.**

Making something such as a display in Retail or a piece of art in Art and Design

- **Learning by experience**

Learning by experience and is usually done in the workplace (e.g. work experience or work placement) or by setting up work situations in the classroom (e.g. a role play of a business interview). Whether real or pretend, a lot can be learned from this type of situation and it is important to make the most of it by preparing thoroughly beforehand and recording any information you find. Inviting visitors into school from the vocational area is another good way of linking your work with what really happens in the workplace.

### **Developing skills**

During your course you will be taught many skills:

- communication skills
- research skills using a variety of methods
- I.C.T. skills using a variety of programs
- practical skills using different techniques and equipment
- presentation skills using a variety of formats
- organisational skills

You will be expected to practise these skills and apply them where appropriate throughout the course.





## What will be expected of you?

You will be expected to do all of the following as part of your day-to-day work

- Read and research
- Keep a record of the information you find and the sources
- Plan your work in a logical order and keep a record of your progress
- Talk to your teachers about your ideas and how to achieve the best results
- Produce drafts and final copies of your work
- Produce good quality work with high standards of grammar and spelling
- Present your work in a suitable format according to the purpose and the audience
- Evaluate your work and make suggestions for improvement
- Meet deadlines
- Keep a record of the work you have completed, including the grades and points you have been awarded



## Who will be involved with each course?

### **Subject teachers (assessors)**

They are responsible for planning lessons, preparing resources, assessing work and making sure that the units are completed on time.

### **Lead internal verifier (IV)**

This is the teacher in charge of the course. Ms Bidder is in charge of the courses you will be following. She will make sure that the units are being taught correctly and that sufficient resources are available. She will check (IV) the assessment of all teachers on the course and work with the external verifier.





### **Quality Nominee**

This is Mr G. Mahoney and she oversees all of the vocational courses to make sure that standards are being met. This will be done by:

- Visiting lessons
- Looking at students' work
- Collecting information on student achievement
- Surveying teacher/student views

### **External Verifier**

This person has knowledge of the subject and the course and may visit to sample the work from a unit.

### **Exam Officer**

The examinations officer is Mrs J Evans and she is responsible for registering students for the course and for claiming qualifications.





## Qualification Structure

The Pearson BTEC Level 1/Level 2 First Award in Principles of Applied Science is taught over 120 guided learning hours (GLH). It has four mandatory units. Learners must complete all mandatory units.

This BTEC First Award has units that your centre assesses (internal) and a unit that Pearson sets and marks (external).

Unit	Mandatory units	Assessment	Guided Learning Hours (GLH)
1	Principles of Science	External	30
2	Chemistry and Our Earth	Internal	30
3	Energy and Our Universe	Internal	30
4	Biology and Our Environment	Internal	30





## Unit Details

### Unit 1 Principles of Science

#### **Unit introduction**

It is important that science technicians and scientists are able to use and apply fundamental core concepts to work efficiently and effectively in science organisations and other organisations that use science.

It is essential, for example, that biologists working in health-related science organisations have knowledge of cell structures and their function, tissues and organ systems, and the roles of the nervous and endocrine systems. Biologists working in horticulture will need knowledge of plant cells and the function of plant organs, and those working in forensic science will require knowledge of DNA.

In the chemical industry, science employees need to have knowledge of atomic structure, elements in the periodic table and chemical compounds and need to be able to use and apply this knowledge to chemical reactions involved in the manufacture of useful products. Knowledge of acids, alkalis and pH is essential for people working in soil science, environmental science and cosmetic science. Science employees working in organisations involving energy will need knowledge of the different forms of energy, energy stores, energy transformations and alternative energy sources. Physicists working for the National Grid will need knowledge of energy transfers, energy transfer measurement and energy efficiency. Scientists working in hospital scanning departments will need knowledge of the dangers and uses of X-rays and other features of the electromagnetic spectrum.

The aim of this unit is to study fundamental core science concepts in biology, chemistry and physics. The assessment for this unit focuses on your understanding and application of these concepts, and so will not be vocational in context. A strong grasp of these concepts will enable you to use and apply this knowledge and understanding in vocational contexts when studying other units within this specification.







## Learning aims

In this unit you will:

A explore cells, organs and genes

B explore the roles of the nervous and endocrine systems in homeostasis and communication

C explore atomic structure and the periodic table

D explore substances and chemical reactions

E explore the importance of energy stores, energy transfers and energy transformations

F explore the properties and applications of waves in the electromagnetic spectrum.

You will be asked to apply knowledge and understanding of these learning aims in familiar and unfamiliar contexts to solve mathematical and non-mathematical problems.





## Learning aims and unit content

### What needs to be learnt

#### Learning aim A: Explore cells, organs and genes

A.1 The basic structure, function and adaptations of the following eukaryotic cells:

- a. motor and sensory neurones
- b. red blood cell
- c. white blood cell
- d. egg cell
- e. sperm cell
- f. root hair cell
- g. xylem and phloem cells
- h. guard cell.

A.2 The function of the following components of eukaryotic cells:

- a. nucleus - contains genetic information that controls the activities of the cell
- b. cytoplasm - where most chemical reactions take place
- c. cell membrane - allows entry and exit of substances
- d. chloroplasts - the sites of photosynthesis
- e. cell wall - provides structural support
- f. vacuole - contains cell sap and provides extra support for the cell
- g. mitochondria - the sites of respiration.

A.3 Cells form tissues, tissues form organs and organs work together to form organ systems, as illustrated by the cardiovascular system (it is not necessary to learn the detail of each organ in this system).

A.4 The functions of the following plant organs:

- a. roots - take in water from the soil and provide anchorage
- b. xylem - carries water and mineral salts
- c. phloem - carries glucose
- d. leaf - where photosynthesis takes place.

A.5 Loss of water vapour from the leaves drives transpiration.





A.6 DNA is a double helix containing a sequence of complementary base pairs:

- a. adenine pairs with thymine
- b. guanine pairs with cytosine.

A.7 Chromosomes, in the nucleus, are made up of DNA, and sections of DNA represent genes which give instructions for individual characteristics.

A.8 Alleles are different forms of the same gene that give rise to heterozygous and homozygous genotypes.

A.9 Monohybrid inheritance using Punnett squares and genetic diagrams.

A.10 Pedigree analysis using homozygous and heterozygous individuals.

A.11 Determination of genotypes and phenotypes of offspring from genetic diagrams and pedigree analysis.

A.12 The probability, percentage or ratio of offspring displaying particular inherited characteristics from genetic crosses.

A.13 Gene mutations occur when the base sequence on a DNA molecule is changed:

- a. genetic mutations can change the characteristics of organisms
- b. genetic mutations can be beneficial or harmful to organisms.





## What needs to be learnt

### Learning aim B: Explore the roles of the nervous and endocrine systems in homeostasis and communication

B.1 Homeostasis is the maintenance of a constant internal environment that is controlled by nervous and hormonal communication.

B.2 The structure of the nervous system is made up of the central nervous system (CNS) (brain and spinal cord) and the peripheral nervous system (PNS) (sensory and motor neurones). The PNS transmits electrical impulses to and from the CNS.

B.3 The difference between involuntary and voluntary responses.

B.4 The transmission of electrical impulses from receptor to effector and the role of chemical transmission across synapses.

B.5 The components of a simple reflex arc and its role in protecting the body from harm.

B.6 The endocrine system consists of glands that release hormones into the blood stream, which travel through the blood to target organs.

B.7 The differences in communication between the endocrine and nervous systems:

- a. speed of communication
- b. method of transport or transmission
- c. duration of response.

B.8 Blood glucose concentration is regulated by the endocrine system using insulin and glucagon (insulin lowers blood glucose concentrations and glucagon raises it).

B.9 The process for body temperature regulation by the nervous system using the following mechanisms:

- a. sweating
- b. shivering
- c. raising/lowering of body hair
- d. vasoconstriction and vasodilation.





## What needs to be learnt

### Learning aim C: Explore atomic structure and the periodic table

C.1 Elements as metals or non-metals according to their position in the periodic table.

C.2 The structure of the atom as a nucleus containing protons and neutrons, surrounded by electrons in shells (energy levels).

C.3 The nucleus of an atom is very small compared to the overall size of the atom.

C.4 Atoms of a given element have the same number of protons in the nucleus and this number is unique to that element.

C.5 The meaning of the terms 'atomic number', 'mass number' and 'relative atomic mass'.

C.6 The relative charge and relative mass of a proton, a neutron and an electron.

C.7 Atoms contain equal numbers of protons and electrons.

C.8 Elements are arranged in the periodic table in order of increasing atomic number, in rows called periods. Elements with similar properties are placed in the same vertical column - these columns are called groups.

C.9 Definition of an isotope of an element, as having the same number of protons but a different number of neutrons.

C.10 The existence of isotopes means that some relative atomic masses are not whole numbers.

C.11 The relative atomic mass of an element from the relative masses and abundances of its isotopes.

C.12 Rules about the filling of electron shells (energy levels) to predict the electronic configuration of the first 20 elements in the periodic table as diagrams and in the form 2.8.1.

C.13 The connection between the number of outer electrons and the position of an element in the periodic table.





## What needs to be learnt

### Learning aim D: Explore substances and chemical reactions

D.1 Use the periodic table to recognise elements and formulae of simple compounds.

D.2 Definitions of elements, compounds, mixtures, molecules (molecular elements).

D.3 Word equations for reactions in this unit.

D.4 Simple balanced chemical equations for reactions in this unit.

D.5 Chemicals react to form products with different properties, including acids, alkalis and salts.

D.6 Definition of:

- a. acids
- b. bases
- c. alkalis as a subset of bases which are soluble in water.

D.7 Neutralisation reactions using hydrochloric acid, nitric acid and sulfuric acid, with a metal oxide (copper oxide or zinc oxide) and sodium hydroxide.

D.8 The reactions of hydrochloric acid and sulfuric acid with metals (not group 1 metals).

D.9 The reactions of hydrochloric acid, sulfuric acid and nitric acid with sodium carbonate, copper carbonate and calcium carbonate.

D.10 The chemical tests for hydrogen and carbon dioxide.

D.11 pH tests using universal indicator and litmus.

D.12 Hazard symbols for the chemicals used in this learning aim.

D.13 Applications of neutralisation reactions:

- a. indigestion remedies (safe dose, chemicals used)
- b. reducing acidity of soils
- c. reducing acidity of lakes, caused by acid rain.

D.14 Formulae of all reagents named in this learning aim.





## What needs to be learnt

### Learning aim E: Explore the importance of energy stores, energy transfers and energy transformations

#### E.1 Forms of energy and their uses:

- a. thermal
- b. electrical
- c. light
- d. sound
- e. mechanical (kinetic and potential)
- f. nuclear.

#### E.2 Energy stores and their uses:

- a. chemical
- b. kinetic (in a moving object)
- c. gravitational potential (due to the position of an object in a gravitational field)
- d. elastic potential (in a stretched or compressed spring)
- e. thermal (in a warm object)
- f. nuclear.

#### E.3 Energy transfers (from one place to another):

- a. mechanically (when a force moves through a distance)
- b. electrically (electrical devices)
- c. by conduction (temperature differences)
- d. by convection (currents in a fluid)
- e. by radiation (infrared and sound).

#### E.4 Energy transfer measurement:

- a. joule (J) as the unit of energy
- b. principle of conservation of energy
- c. diagrams to represent energy transfers and energy dissipation
- d. watt (W) as the unit of power
- e. power calculations using: time (sec s) power (watts) = energy (joules)
- f. cost of electricity per unit (kWhr).

#### E.5 Efficiency of energy transfers and transformations:

- a. efficiency as the proportion of energy transferred to useful forms
- b. calculations involving efficiency using:  $\frac{\text{useful energy}}{\text{total energy supplied}} \times 100\%$





E.6 Sources and storage of energy:

- a. renewable (solar, wind, biofuels, hydroelectric, wave, tidal, geothermal)
- b. non-renewable (fossil fuels, nuclear)
- c. using energy stores effectively
- d. storage of energy using batteries and fuel cells.







## What needs to be learnt

### Learning aim F: Explore the properties and applications of waves in the electromagnetic spectrum

#### F.1 Wave characteristics:

- a. amplitude (m)
- b. frequency (Hz)
- c. wavelength (m)
- d. wave speed (m/s).

#### F.2 Wave calculations:

- a. using wave speed (m/s) = wavelength (m) x frequency (Hz)
- b. using values expressed in standard form.

#### F.3 The electromagnetic (e.m.) spectrum:

- a. radio waves, microwaves, infrared, visible (including the colours of the visible spectrum), ultraviolet, X-rays and gamma rays
- b. the e.m. spectrum is continuous from radio waves to gamma rays, grouped in order of wavelength or frequency
- c. each group has a range of wavelengths with different uses and dangers.

#### F.4 Uses of electromagnetic radiation in transferring energy:

- a. radio waves (broadcasting and satellite transmissions)
- b. microwaves (cooking, satellite transmissions, communications and weather forecasting)
- c. infrared (cooking, thermal imaging, optical fibres, television remote controls and security systems)
- d. visible light (vision, photography and illumination)
- e. ultraviolet (fluorescent lamps, detecting forged bank notes and disinfecting water)
- f. X-rays (observing the internal structure of objects and medical X-rays)
- g. gamma rays (sterilising food and medical equipment, and the detection of cancer and its treatment).

#### F.5 Harmful effects of excessive exposure to electromagnetic radiation:

- a. microwaves (internal heating of body cells)
- b. infrared (skin burns)
- c. ultraviolet (damage to surface cells and eyes, leading to skin cancer and eye conditions)
- d. X-rays and gamma rays (mutation or damage to cells in the body).





## Unit 2 Chemistry and Our Earth

### Unit introduction

A knowledge and understanding of the properties of chemical substances is vital for making certain scientific decisions. For example, this knowledge and understanding would be applied when deciding which starting materials to use when carrying out chemical reactions to manufacture products such as pharmaceuticals, computer-chip technology materials and food products.

You will cover the properties of elements from groups 1 and 7 in the periodic table, where some elements, like sodium, are very reactive metals, while others, like chlorine, are very reactive non-metals. Other elements, like helium, are very unreactive - helium's properties make it suitable for use in balloons and in the gas mixture for diving tanks. This is extended further as you study the structure of elements, and how they bond together to form molecules, which are covalently or ionically bonded. You will also look at how the physical and chemical properties of chemical substances are influenced by their structure and bonding.

Industrial processes need to take into account the rate at which a chemical reaction takes place. Reactions have to be slow enough to be safe but fast enough to allow the chemicals to be made profitably. You will study the factors that affect the rates of chemical reactions and the reaction conditions that optimise their effectiveness in industry.

You will also study how the Earth's natural activities, and the use of naturally occurring materials as starting materials in industrial processes, have an impact on the Earth and the environment. This is extended to studying sustainable development issues, with regard to human activities and possible solutions to reduce the amount of fossil fuels used in domestic and industrial situations.

The aim of this unit is to use and develop the knowledge that you have learnt in Unit 1 using locally relevant industrial and related contexts. These contexts might include the role of environmental science in best industrial practice and maximising the yield of industrial reactions.

### Learning aims

In this unit you will:

A investigate chemical reactivity and bonding

B investigate how the uses of chemical substances depend on their chemical and physical properties

C investigate the factors involved in the rate of chemical reactions

D understand the factors that are affecting the Earth and its environment.





## Learning aims and unit content

### What needs to be learnt

#### Learning aim A: Investigate chemical reactivity and bonding

A.1 Chemical and physical properties of groups 1 and 7 of the periodic table:

- trends in physical properties of groups 1 and 7 (appearance, melting point, boiling point, electrical conductivity)
- reactivity with water for group 1
- displacement reactions for group 7
- trends in chemical properties in group 1 and group 7 - relationship with electronic configuration.

A.2 Bonding and structure:

- formulae of molecules (in A.2b and A.2c)
- covalent bonding (hydrogen, chlorine, carbon dioxide, methane, water, oxygen)
- ionic bonding (sodium chloride, magnesium oxide, magnesium chloride)
- properties of simple covalent, giant covalent and ionic materials.

#### Learning aim B: Investigate how the uses of chemical substances depend on their chemical and physical properties

B.1 Use of chemicals based on their physical properties:

- electrical conductivity
- thermal conductivity
- melting and boiling points
- solubility in different solvents
- viscosity.

B.2 Use of chemicals based on their chemical properties:

- sodium azide in airbags
- argon in welding
- silicon in computer-chip technology
- carbon dioxide in fire extinguishers.





## What needs to be learnt

### Learning aim C: Investigate the factors involved in the rate of chemical Reactions

#### C.1 Equations:

- word equations
- simple balanced equations (including state symbols: (s), (l), (g), (aq))
- recognise reactants and products in a reaction (displacement, combustion, neutralisation reactions)
- reversible and irreversible chemical change.

#### C.2 Reaction rates:

- effect of catalysts (lowering the energy needed for a reaction to occur), surface area, concentration and temperature on rate of reaction
- use of reaction rate graphs
- collision theory.

#### C.3 Industrial processes:

- the concept of yield (mass of product obtained) and that the actual yield is less than the theoretical yield
- altering rates of reaction
- atom economy.

### Learning aim D: Understand the factors that are affecting the Earth and its environment

#### D.1 Natural activity factors (tectonic plates and volcanic eruptions) influencing:

- the Earth's crust
- the evolution of the atmosphere and oceans.

#### D.2 Human activity factors:

- obtaining materials from the sea, land and air, e.g. coal, natural gas, oil, metal ores, salt, nitrogen, oxygen
- production of useful materials from their natural sources
- effects on the environment (local and global effects)
- effects of chemical processing (energy factors, health and safety, disposal).



### D.3 Sustainable development issues:

- a. human choices (recycling, use of fossil fuels versus nuclear fission fuels)
- b. human solutions (renewable energy, biofuels (ethanol), nuclear fusion).





## Unit 3 Energy and Our Universe

### **Unit introduction**

Nuclear scientists are currently investigating the use of nuclear fusion to gain a source of energy that is safe and does not have the radioactivity issues associated with nuclear fission. Meanwhile, medical physicists are researching ways of improving the use of medical imaging and methods to fight cancer.

In this unit, you will explore ionising radiations, their uses and sources, including alpha, beta, gamma and X-rays. You will also investigate radioactive decay, half-life, nuclear fission and fusion, and issues associated with nuclear energy.

Most electrical devices (televisions, computers, washing machines, etc.) need electrical energy that is transmitted from power stations to homes and businesses to operate. You will be introduced to the basics of electrical circuits, power supplies and the transmission of electrical energy. You will also investigate how this important form of energy is brought to homes.

Our Universe is a fascinating place, which is evolving over time. You will look at the composition of the Solar System, methods of exploring it and the evidence for a constantly changing and expanding Universe.

The aim of this unit is to enable you to develop knowledge and skills related to important fundamental physical concepts. Where possible, this should be done in locally relevant industrial and related contexts such as energy supply and safe working with nuclear materials. With an emphasis on experimental investigations, and to some extent computer simulations, you will also explore some aspects of the physics of our world and beyond.

### **Learning aims**

In this unit you will:

A understand ionising radiation, its uses and sources

B know how electrical energy produced from different sources can be transferred through the National Grid to homes and industry

C know the components of the Solar System, the way the Universe is changing and the methods we use to explore space.





## Learning aims and unit content

### What needs to be learnt

#### Learning aim A: Understand ionising radiation, its uses and sources

A.1 The structure of nuclei using the terms 'atomic (proton) number' and 'mass (nucleon) number', and using symbols in the format:

A.2 Alpha, beta and gamma radiations are emitted from unstable nuclei in a random process.

A.3 An alpha particle is equivalent to a helium nucleus, a beta particle is an electron emitted from the nucleus and gamma rays are high-frequency electromagnetic waves.

A.4 Ionising radiations cause atoms to gain or lose electrons to form ions.

A.5 Alpha, beta and gamma radiations are compared in terms of their abilities to penetrate and ionise.

A.6 Effects of different radiations on living cells.

A.7 Uses of ionising radiations, including alpha, beta, gamma and X-rays.

A.8 Investigate radioactive decay in terms of reducing activity and amount of radioactive material.

A.9 Investigate half-life of radioactive isotopes in terms of reducing activity.

A.10 Calculations involving half-life and their graphical representations.

A.11 Nuclear fission is large nuclei breaking down to form small nuclei.

A.12 Nuclear fusion is the creation of larger nuclei from smaller nuclei.

A.13 Energy release by the process of controlled nuclear fission.

A.14 Energy release by nuclear fusion in stars and the difficulty in harnessing energy from nuclear fusion on Earth.





A.15 Environmental issues associated with nuclear energy (storage of waste products, uncontrolled release of radioactive material).

### What needs to be learnt

**Learning aim B: Know how electrical energy produced from different sources can be transferred through the National Grid to homes and industry**

#### B.1 Electric circuits:

- a. the need for a complete circuit
- b. electrical symbols (battery, cell, switch, fuse, voltmeter, ammeter, resistor, filament lamp)
- c. current (A, mA)
- d. voltage (V, mV)
- e. resistance ( $\Omega$ ,  $k\Omega$ )
- f. construct simple series and parallel circuits
- g. measure current and voltage using meters
- h. use the equation: voltage (volts) = current (amps)  $\times$  resistance (ohms)  
 $V = IR$
- i. direct current (d.c.) and alternating current (a.c.).

#### B.2 Power supplies:

- a. types of batteries
- b. solar cell
- c. simple generators - rotating a coil in a permanent magnetic field
- d. production of electricity - basic alternating current generator, batteries as a source of direct current (rechargeable and non-rechargeable)
- e. environmental impact - comparison of environmental impact of electricity generation from renewable and non-renewable sources
- f. electrical power and the equation: power (watts) = voltage (volts)  $\times$  current (amps)  $P = VI$
- g. efficiency of electricity generation from different sources
- h. National Grid - used to transmit electrical energy (power)
- i. step-up and step-down transformers and the reduction of energy losses during transmission.







## What needs to be learnt

**Learning aim C: Know the components of the Solar System, the way the Universe is changing and the methods we use to explore space**

### C.1 The Universe:

- a. the structure and dynamic nature of the Universe (Solar System, stars and galaxies, large-scale structure)
- b. looking back in time.

### C.2 The Solar System:

- a. composition - stars, planets, dwarf planets and natural satellites, comets and meteors, asteroids
- b. formation of the Solar System.

### C.3 Observing the Universe:

- a. optical, radio, infrared, UV, X-ray and gamma telescopes
- b. reflecting, ground-based and space-based telescopes
- c. space probes and robots.

### C.4 The changing Universe:

- a. the Big Bang theory
- b. evidence for an expanding Universe (galaxies moving away from each other (red shift))
- c. cosmic microwave background radiation as support for the Big Bang theory.





## Unit4 Biology and Our Environment

### **Unit introduction**

Environmental science technicians and scientists work for local authorities, the government and charities to monitor the effects of human activities on local, national and global environments.

You will study the different activities that humans carry out that cause damage to the environment. You will gain an understanding of how the pollutants released from human activities affect air, water and land, using primary and/or secondary data to determine how different pollutants affect living things. The use of indicators in measuring pollution levels is explored and you will study the methods and schemes used to try to reduce or counteract the effects of human activity on the environment.

Scientists in health programmes monitor the various factors that impact on human health and seek to improve the health of the population. To complete your study of this unit, you will investigate the causes of disease, including genetic disease, and how various diseases can be prevented and treated. You will have the opportunity to investigate the problems associated with the misuse of treatment regimes and implications that resistant forms of bacteria have on the future treatment of disease.

You will study and compare the adaptations of different organisms and how these adaptations determine the success of organisms in their environment. You will have the opportunity to demonstrate how adaptations bring about evolution or, on the contrary, bring about species extinction.

The aim of this unit is to further develop your understanding of the core concepts you have learnt in Unit 1 by studying relationships between different organisms and the environment. Where possible this should be done using industrial and related contexts such as local government monitoring of the environmental impact of industries and proper use of medicines.

### **Learning aims**

In this unit you will:

A investigate the relationships that different organisms have with each other and with their environment

B demonstrate an understanding of the effects of human activity on the environment and how these effects can be measured

C explore the factors that affect human health.





## Learning aims and unit content

### What needs to be learnt

#### Learning aim A: Investigate the relationships that different organisms have with each other and with their environment

##### A.1 The characteristics of organisms vary within and across species:

- a. genetic variation - variation in characteristics can be caused by genes, including genetic mutation
- b. environmental variation - some characteristics can be influenced by the environment.

##### A.2 Evolution is a gradual process, involving gene mutation and natural selection, that can lead to the development of new species:

- a. populations or organisms show variation
- b. organisms less well adapted to their environment are less likely to survive due to competition for resources, predation and environmental influences
- c. organisms best adapted to their environment will survive to breed and pass on their genes to the next generation
- d. over a period of time the proportion of individuals with the favourable adaptation will increase and the individuals without the adaptation may disappear altogether.

##### A.3 Interdependence of organisms can be illustrated using food chains and webs, and by predator-prey relationships.

##### A.4 Organisms are classified depending on their characteristics:

- a. the main characteristics of the five kingdoms
- b. division of the animal kingdom into vertebrates and invertebrates
- c. the main characteristics of vertebrates.

##### A.5 Construct and use keys to show how organisms can be identified.



## What needs to be learnt

### Learning aim B: Demonstrate an understanding of the effects of human activity on the environment and how these effects can be measured

#### B.1 How human activities alter ecosystems through:

- a. deforestation to supply timber and clear land for agriculture
- b. agriculture to meet an increasing demand for food
- c. transportation - of food and for travel.

#### B.2 How pollutants produced as a result of human activity can affect ecosystems:

- a. overuse of fertiliser causing eutrophication
- b. toxic herbicides and pesticides that can bioaccumulate and disrupt terrestrial and aquatic food chains.

#### B.3 Living and non-living indicators can be used as a measure of the level of pollution in an ecosystem:

- a. lichens are sensitive to sulfur dioxide
- b. algae and freshwater shrimps as indicators of water pollution
- c. dissolved oxygen and nitrate concentration in water as non-living indicators of water pollution
- d. limestone buildings can be eroded by acid rain.

#### B.4 There are measures that can be taken to counteract or reduce the impact of pollutants on ecosystems:

- a. recycling and reusing materials saves natural resources and reduces the amount of waste produced
- b. conservation techniques of reforestation, replacement planting and breeding programmes
- c. use of renewable resources
- d. using organic fertilisers and biological pest control as an alternative to chemical fertilisers and pesticides.





## What needs to be learnt

### Learning aim C: Explore the factors that affect human health

C.1 Infectious disease can be caused by microorganisms (bacteria and viruses) that affect living cells:

- a. bacteria produce toxins that harm living cells
- b. viruses invade living cells causing cell death.

C.2 The methods used to prevent and treat disease:

- a. vaccinations can be used to prevent disease
- b. antibiotics can be used to treat disease caused by bacteria.

C.3 Bacteria can become resistant to antibiotics.

C.4 Non-infectious disease can be caused by lifestyle or the environment:

- a. misuse of recreational drugs can lead to mental illness
- b. inadequate diet can lead to deficiency diseases
- c. cigarette smoke can cause diseases of the circulatory system
- d. ultraviolet light can cause skin cancer
- e. excessive consumption of alcohol can lead to liver disease
- f. poor air quality can lead to asthma.

C.5 Influence of genes on human health:

- a. genetic disorders can affect human health
- b. pedigree analysis can be used to show the inheritance of genetic disease.

C.6 Physical activity helps to keep the body healthy.





## Appeals Policy/Procedures

It is an over-riding principle that all candidates are entitled to the right to fair, valid and reliable assessment and that decisions on assessment should be provided with clear and constructive feedback. Bryntirion Comprehensive School will always seek to uphold this principle. If a candidate feels they have not been treated fairly or there is evidence of staff malpractice with respect to his or her work they should first discuss the matter with the Subject Co-ordinator. If a satisfactory outcome cannot be obtained then the candidate may use the formal appeals procedure.

### **Appeal to Pearson**

Once Bryntirion Comprehensive School's own procedures have been exhausted and the candidate feels that the matter has not been satisfactorily address then an appeal can be made to the BTEC Quality Standards Manager.

### **Complaints Procedure**

A complaint from a candidate involves any dispute other than one regarding assessment (which is dealt with by the Appeals Procedure). Again, any such complaint cannot be referred to Pearson unless and until the internal processes of Bryntirion Comprehensive School have been exhausted. The only exception to this is in the case of Bryntirion Comprehensive School's processes having become overly protracted.





## Appeals Procedure

### Introduction

Candidates should have access to fair and reliable assessment in which he plays a full part. If this 'access' is to be meaningful the candidate must have the right to appeal against assessment decisions which are unclear or seem unfair. The Appeals Procedure must provide an appropriate audit trail of the process and be clearly logged with concise detailed information at each stage. If a candidate is dissatisfied with an assessment decision then they must have a right of appeal.

### **Stage 1**

The candidate should raise the issue with the assessor during/at the end of an assessment session or within 7 days of the assessment.

The assessor must reconsider the reasons underpinning the decision and provide clear feedback. If the assessor is upholding the original assessment decision, then the candidate must be provided with full information describing what is required to demonstrate their achievement.

This should be provided in writing, and relate specifically to the standards relevant to the assessment decision.

If the candidate remains unhappy with the decision, the candidate then completes an Appeals Form, which will be forwarded to the Internal Moderator/(s).

### **Stage 2**

The Internal Moderator/(s) reviews all evidence and assessment records in order to consider the appeal. A decision should be made within 5 working days and the candidate and assessor must be informed orally and in writing using the appropriate section of the Appeals Form.

If the candidate is dissatisfied with the decision the appeal proceeds to stage 3.

### **Stage 3**

The third and final stage involves the right of appeal to the Assessment Appeals Panel. The Internal Moderator/(s) should pass all records to the senior manager and /or Head of Sixth Form.





The senior manager and/or Head of Sixth Form will convene an Appeals Panel consisting of, for example,

- The senior manager and/or Head of Sixth Form.
- a different assessor
- an independent assessor/Internal Moderator/(s)

Both the candidate and assessor will be invited to make their case to the Panel. The Panel will reach its decisions within 10 working days. Results of the appeals panel will be final.

Details of the appeal will be made available to the External Moderator

If the centre's appeals procedure has been exhausted and the candidate is still dissatisfied, he/she can make a final appeal to the BTEC Quality Standards Manager.







## Complaints Procedure

### Introduction

Bryntirion Comprehensive operates a specific complaints procedure relating to issues not covered by the appeals procedure.

Any individuals involved in the provision of Edexcel qualifications (not just candidates) may have broader issues they wish to raise.

Disputes, other than those of assessment (which are to be dealt with through the appeals procedure) may involve issues such as alleged discrimination, non-professional practice or personality difficulties, e.g. between assessor and candidate.

Where complaints remain unsettled at a local level, the complainant can raise the issue with Edexcel through the BTEC Quality Standards.

### **Stage 1 - Informal Procedure**

The Candidate raises a complaint with/against a member of staff  
Where possible this should be resolved informally between the individuals concerned.

Where resolution is not possible the candidate may choose to go to Stage 2 or where the candidate feels it is appropriate to move straight to Stage 2 they have that opportunity.

### **Stage 2 - Formal Procedure**

The candidate makes a complaint against a member of staff or action or policy of the organisation.

The candidate makes a complaint in writing to the Head teacher.

The Head Teacher or their nominee will respond acknowledging the complaint within 5 working days.

The Head Teacher or their nominee will investigate the complaint and will seek to resolve the complaint within 30 working days.

The Head Teacher's decision is final.



## Assessment Malpractice Policy/Procedures

### Purpose:

- ✚ That Bryntirion Comprehensive School has policies and procedures in place to deal with malpractice.
- ✚ To ensure that issues are dealt with in an open, fair and effective manner.
- ✚ That Bryntirion Comprehensive School provides appropriate deterrents and sanctions to minimise the risk of malpractice.
- ✚ To impose appropriate penalties and/or sanctions on learners or staff where incidents (or attempted incidents) of malpractice are proven.

### Definitions:

**Learner malpractice:** any action by the learner which has the potential to undermine the integrity and validity of the assessment of the learner's work (plagiarism, collusion, cheating, etc).

**Assessor malpractice:** any deliberate action by an assessor which has the potential to undermine the integrity of BTEC qualifications.

**Plagiarism:** taking and using another's thoughts, writings, inventions, etc as one's own.

**Minor acts of learner malpractice:** handled by the assessor by, for example, refusal to accept work for marking and learner being made aware of malpractice policy. Learner resubmits work in question.

**Major acts of learner malpractice:** extensive copying/plagiarism, second or subsequent offence, inappropriate for the assessor to deal with. To be referred to the Programme Leader and subsequently the Quality Nominee.

### Responsibilities

**Centre:** should seek proactive ways to promote a positive culture that encourages learners to take individual responsibility for their learning and respect the work of others.





**Assessor:** responsible for designing assessment opportunities which limit the opportunity for malpractice and for checking the validity of the learner's work.

**Internal Verifier/Lead Internal Verifier:** responsible for malpractice checks when internally verifying work.

**Quality Nominee:** required to inform Edexcel of any acts of malpractice.

**Heads of Centre or their nominees:** responsible for any investigation into allegations of malpractice.

## Procedures

### Addressing learner malpractice:

- Promote positive and honest study practices.
- Learners should declare that work is their own: check the validity of their work.
- Use learner induction and handbook to inform about malpractice and outcomes.
- Ensure learners use appropriate citations and referencing for research sources.
- Assessment procedures should help reduce and identify malpractice.

### Addressing staff malpractice:

- Staff BTEC induction and updating should include BTEC requirements.
- Use robust internal verification and audited record keeping.
- Audit learner records, assessment tracking records and certification claims.

### Dealing with malpractice:

- Inform the individual of the issues and of the possible consequences.
- Inform the individual of the process and appeals rights.
- Give the individual the opportunity to respond.
- Investigate in a fair and equitable manner.





- Inform Pearson of any malpractice or attempted acts of malpractice, which have compromised assessment. Pearson will advise on further action required.
- Penalties should be appropriate to the nature of the malpractice under review.
- Gross misconduct should refer to learner and staff disciplinary procedures.

**To protect the integrity of Bryntirion Comprehensive School and BTEC qualifications, the school will:**

- Seek to avoid potential malpractice by using the induction period and relevant documentation to inform learners of the school's policy on malpractice and the penalties for attempted and actual incidents of malpractice.
- Show learners the appropriate formats to record cited texts and other materials or information sources.
- Ask learners to declare that their work is their own.
- Ask learners to provide evidence that they have interpreted and synthesised appropriate information and acknowledged any sources used.
- Conduct an investigation into the nature of the malpractice allegation. Such an investigation will be supported by the Senior Leadership Team and all personnel linked to the allegation. It will proceed through the following stages:
  - Make the individual fully aware at the earliest opportunity of the nature of the alleged malpractice and of the possible consequences should malpractice be proven.
  - Give the individual the opportunity to respond to the allegations made.
  - Inform the individual of the avenues for appealing against any judgement made.
  - Document all stages of any investigation.

