OCR
RECOGNISING ACHIEVEMENT

AS/A Level GCE

GCE Human Biology

OCR Advanced Subsidiary GCE in Human Biology H023

OCR Advanced GCE in Human Biology H423

specification

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Contents

Changes since the first printed version are indicated with vertical black lines. Changes can be found on pages 35, 47 and 53.

1 About these Qualifications

This booklet contains OCR's Advanced Subsidiary GCE and Advanced GCE specifications in Human Biology for teaching from September 2008.

This specification provides a concept-based course that gives teachers a flexible approach to the delivery of AS and A Level Human Biology.

It is designed for those students who wish to focus their study of biological science more specifically on the human animal. Due regard is given though to the importance of plants and micro-organisms, particularly in their interactions with humans. Key biological concepts are presented in real-world, work-related contexts. Synoptic links between different areas are stressed, particularly in the A2 units.

All externally assessed units are available in both the winter and summer series. In both AS and A2, one unit is shorter than the other, allowing centres to prepare candidates effectively for a winter series sitting, if they so choose.

Practical skills are assessed at AS through a series of short, structured assessments that can be used during the normal teaching of the specification. At A2, there is an extended investigation.

1.1 The Three-Unit AS

The Advanced Subsidiary GCE is both a 'stand-alone' qualification and also the first half of the corresponding Advanced GCE. The AS GCE is assessed at a standard appropriate for candidates who have completed the first year of study (both in terms of teaching time and content) of the corresponding two-year Advanced GCE course, ie between GCSE and Advanced GCE.

From September 2008 the AS GCE is made up of **three** mandatory units, of which **two** are externally assessed and **one** is internally assessed and includes the assessment of practical skills. These units form 50% of the corresponding six-unit Advanced GCE.

1.2 The Six-Unit Advanced GCE

From September 2008 the Advanced GCE is made up of **three** mandatory units at AS and **three** further mandatory units at A2.

Two of the AS and **two** of the A2 units are externally assessed.

The third AS unit and the third A2 unit are internally assessed and will include the assessment of practical skills.

1.3 Qualification Titles and Levels

These qualifications are shown on a certificate as:

- OCR Advanced Subsidiary GCE in Human Biology.
- OCR Advanced GCE in Human Biology.

Both qualifications are Level 3 in the National Qualifications Framework (NQF).

1.4 Aims

The aims of these specifications are to encourage candidates to:

- develop their interest in, and enthusiasm for, human biology, including developing an interest in further study and careers in human biology;
- appreciate how society makes decisions about scientific issues and how the sciences contribute to the success of the economy and society;
- develop and demonstrate a deeper appreciation of the skills, knowledge and understanding of *How Science Works*;
- develop essential knowledge and understanding of different areas of human biology and how they relate to each other.

1.5 Prior Learning/Attainment

These specifications have been developed for students who wish to continue with a study of human biology at Level 3 in the National Qualifications Framework (NQF). The AS specification has been written to provide progression from GCSE Science and GCSE Additional Science, or from GCSE Human Biology; achievement at a minimum of grade C in these qualifications should be seen as the normal requisite for entry to AS Human Biology. However, students who have successfully taken other Level 2 qualifications in Science or Applied Science with appropriate human biology content may also have acquired sufficient knowledge and understanding to begin the AS Human Biology course. Other students without formal qualifications may have acquired sufficient knowledge of human biology to enable progression onto the course.

Recommended prior learning for the AS units is shown in the introduction to each AS unit. The A2 units build upon the knowledge and understanding acquired at AS.

Recommended prior learning for the A2 course is successful performance at Advanced Subsidiary Human Biology.

2 Summary of Content

2.1 AS Units

Unit F221: *Molecules, Blood and Gas Exchange*

- Module 1: Molecules and Blood

  1.1.1 The Blood
  1.1.2 Molecules
  1.1.3 Preventing Blood Loss
  1.1.4 Blood for Medical Use

- Module 2: Circulatory and Gas Exchange Systems

  1.2.1 The Heart and Monitoring Heart Function
  1.2.2 The Circulatory System
  1.2.3 The Lungs and Investigating Lung Function

Unit F222: *Growth, Development and Disease*

- Module 1: The Developing Cell

  2.1.1 Mitosis as Part of the Cell Cycle
  2.1.2 Detecting and Treating Cancer

- Module 2: The Developing Individual

  2.2.1 The Biological Basis of Individuality and the Monitoring of Fetal Development
  2.2.2 The Developing Infant

- Module 3: Infectious Disease

  2.3.1 Controlling the Spread of Infectious Disease
  2.3.2 Acquiring Immunity
  2.3.3 The Future of Infectious Disease Control

- Module 4: Non-Infectious Disease

  2.4.1 Coronary Heart Disease (CHD)
  2.4.2 Lung Disease
  2.4.3 Diabetes

Unit F223: *Practical Skills in Human Biology*

- Qualitative task
- Quantitative task
- Evaluative task

2.2 A2 Units

Unit F224: *Energy, Reproduction and Populations*

- Module 1: Energy and Respiration

  4.1.1 Respiration
  4.1.2 Athletic Performance

- Module 2: Human Reproduction and Populations

  4.2.1 Fertility and Contraception
  4.2.2 Assisted Reproduction
  4.2.3 Food, Farming and Populations – Producing Food
  4.2.4 Food, Farming and Populations – Human Impact on the Environment

Unit F225: *Genetics, Control and Ageing*

- Module 1: Genetics in the Twenty-First Century

  5.1.1 Inheritance of Human Genetic Disease
  5.1.2 Genetic Techniques
  5.1.3 Counselling Individuals on Genetic Issues
  5.1.4 Transplant Surgery and Cloning

- Module 2: The Nervous System

  5.2.1 Monitoring Visual Function
  5.2.2 Treating Central Nervous System Injuries
  5.2.3 Modifying Brain Function

- Module 3: Homeostasis

  5.3.1 The Importance of Homeostasis
  5.3.2 Managing Type 1 and Type 2 Diabetes
  5.3.3 Urine Production
  5.3.4 Treating Kidney Disease

- Module 4: The Third Age

  5.4.1 The Effects of Ageing on the Reproductive System
  5.4.2 The Effects of Ageing on Other Body Systems

Unit F226: *Extended Investigation in Human Biology*

- Designing a data collection strategy
- Collecting and processing raw data
- Analysis and evaluation

3 Unit Content

Each unit is divided into a number of teaching modules. Within each module, the content is divided into two columns: **Context and exemplification** and **Assessable learning outcomes**. Only the statements in the right-hand column will be examined; statements in the left-hand column are included to provide guidance on delivery. References to HSW (How Science Works) are to Appendix C. References to the GCSE Criteria for Science are to Appendix D.

3.1 AS Unit F221: *Molecules, Blood and Gas Exchange*

Module 1: Molecules and Blood

This module provides candidates with a knowledge and understanding of the composition and function of blood and the processes that prevent excessive blood loss.

In addition, this module covers the structures and functions of other biologically important molecules and the different mechanisms for transporting these molecules into and out of cells.

Links

GCSE Criteria for Science: 3.7(i) (e); 3.9(i) (a)

1.1.1 The Blood

Context and exemplification	Assessable learning outcomes
• Studying cells can provide valuable information about health. • The cell is the basic unit of all living things. • An understanding of how to use a light microscope is developed along with an understanding of the importance of electron microscopy in Biology.	Candidates should be able to: (a) describe how blood samples are taken and blood smears (films) are made; (b) describe the procedure for the differential staining of blood smears to show leucocytes; (c) describe the use of a haemocytometer to count the numbers of erythrocytes and leucocytes (to include details of dilution); (d) describe the structure, as seen with a light microscope, of red blood cells (erythrocytes), neutrophils, lymphocytes, monocytes and macrophages as specialised cells with particular functions related to their structures; (e) outline the structure and function of platelets; (f) compare the ultrastructure of a leucocyte and a palisade mesophyll cell, as seen with an electron microscope, to illustrate the differences between animal and plant cells as examples of *eukaryotic cells* (to include the cell surface membrane, Golgi apparatus, rough and smooth endoplasmic reticulum (ER), ribosomes, lysosomes, vesicles, mitochondria, chloroplasts, cytoskeleton, cell wall, nucleus and nucleolus);

	(g) calculate the linear dimensions and magnification of drawings or photographs of cells (HSW3); (h) describe, with the aid of diagrams, the fluid mosaic model of the structure of the typical mammalian cell surface (plasma) membrane, with reference to phospholipids, intrinsic proteins, extrinsic proteins, cholesterol, glycolipids and glycoproteins; (i) outline the roles of membranes within and at the surface of cells (HSW1); (j) outline the interrelationship between the organelles involved in the production and secretion of proteins (no detail of protein synthesis is required here).

1.1.2 Molecules

Context and exemplification	**Assessable learning outcomes**
• Proteins, carbohydrates and lipids are three of the key groups of macromolecules essential for life and health. • Understanding the structure of these macromolecules allows an understanding of their functions in organisms.	Candidates should be able to: (a) describe, with the aid of diagrams, the basic structure of an amino acid; (b) describe, with the aid of diagrams, the condensation reaction between two amino acids to form a peptide bond; (c) outline the molecular structure of haemoglobin as an example of a globular protein, including the meaning of the following terms: *primary structure, secondary structure, tertiary structure, quaternary structure* and *prosthetic group*; (d) outline the role of haemoglobin in carrying oxygen (details of oxygen dissociation curves are **not** required); (e) describe the differences between plasma, serum, tissue fluid and lymph; (f) describe the normal composition of blood plasma; (g) explain how the properties of water make it an ideal transport medium; (h) explain the importance of electrolytes in body fluids and outline how they are measured in plasma and urine; (i) explain the mechanisms of diffusion, facilitated diffusion (to include channel and carrier proteins) and osmosis (to include channel proteins), with reference to the structure of the red blood cell membrane; (j) describe the mechanism of active transport, with reference to the structure of the red blood cell membrane; (k) describe the processes of endocytosis and

	exocytosis, with reference to neutrophils; (l) explain the meaning of the term *water potential*; (m) explain, in terms of water potential, why the concentration of plasma proteins, glucose and electrolytes will affect the water potential of blood; (n) outline how the concentration of glucose is measured in human blood; (o) describe the basic structure of carbohydrates, with reference to monosaccharides, disaccharides and polysaccharides; (p) describe, with the aid of diagrams, the structure of the ring form of alpha glucose; (q) outline the role of glucose as a respiratory substrate; (r) describe the formation of glycogen by condensation reactions to form glycosidic bonds; (s) describe how the structure of the glycogen molecule adapts it to its function as an energy store in liver and muscle; (t) describe, with the aid of diagrams, the basic structure of glycerol and fatty acids; (u) outline the formation of triglycerides by the condensation reactions between glycerol and fatty acids; (v) describe the structures of saturated and unsaturated fatty acids and outline their roles and importance in the human body; (w) describe, with the aid of diagrams, the structure of a phospholipid molecule.
1.1.3 Preventing Blood Loss	
Context and exemplification	**Assessable learning outcomes**
• First-aiders, paramedics and staff in hospital accident and emergency departments are trained to carry out first-aid procedures to prevent blood loss in cases of trauma. • Enzymes play a key role in the prevention of blood loss, through their involvement in blood clotting.	Candidates should be able to: (a) describe the first-aid procedure to prevent excessive blood loss; (b) outline the mechanism of blood clotting as an enzyme controlled process, with reference to the role of platelets, damaged tissue, thromboplastin, calcium ions, prothrombin, thrombin, fibrinogen and fibrin; (c) state that enzymes are globular proteins; (d) explain how the structure of a globular protein enables enzyme molecules to catalyse specific metabolic reactions, with reference to the specificity of the active site, the formation of enzyme substrate complexes and the lowering of activation energy; (e) describe and explain the effects of enzyme

	and substrate concentration on the rate of enzyme-catalysed reactions, with reference to the enzymes involved in blood clotting.

1.1.4 Blood for Medical Use

Context and exemplification	Assessable learning outcomes
• The blood transfusion service and blood banks must maintain blood in a condition suitable for use and ensure that it is not a source of infection.	Candidates should be able to: (a) describe the conditions in which blood for transfusion is stored; (b) describe and explain the effects of changing pH and changing temperature on enzyme activity, with reference to the storage of blood for transfusion; (c) explain the role of co-factors in enzyme activity, with reference to the removal of calcium ions in blood stored for transfusion; (d) outline the types of blood products stored: whole blood, leuco-depleted blood, packed red cells, platelets, clotting factors and plasma; (e) outline the use of blood products: whole blood, leuco-depleted blood, packed red cells, platelets, clotting factors and plasma; (f) outline how blood products are screened and treated to prevent the transmission of HIV and hepatitis C (HSW6b, 7b, 7c).

Practical skills are assessed using specific OCR-set experiments. The practical work outlined below may be carried out as part of skill development. Centres are not required to carry out any of these experiments or investigations.

Collection of quantitative data:

- Investigating enzyme-catalysed reactions.

Collection and presentation of qualitative (descriptive) data:

- Production of blood smears;
- Use of haemocytometers to perform cell counts;
- Preparing temporary slide mounts of plant and animal tissue.

Presentation, analysis and evaluation of quantitative data:

- Calculation of rates;
- Plotting graphs of rates.

Evaluation of data collection strategies:

- Identifying anomalous results;
- Assessing the effects of the apparatus used.

Module 2: Circulatory and Gas Exchange Systems

This module provides candidates with a knowledge and understanding of the structure and function of the circulatory and gas exchange systems.

Ways of monitoring the activity of the heart, circulation and gas exchange system to indicate good health, indicate potential problems and to provide scope for improvement in athletic performance are also covered.

Links

GCSE Criteria for Science: 3.7(i) (d); 3.9(i) (a)

1.2.1 The Heart and Monitoring Heart Function

Context and exemplification	Assessable learning outcomes
• It is important for health professionals to be able to monitor the action of the heart, either by measuring the electrical changes that take place, or through effects on the circulatory system. • An understanding of heart function is important to athletes who wish to maximise their performance and also to those who wish to remain physically fit throughout life.	Candidates should be able to: (a) describe, with the aid of diagrams and photographs, the internal and external structure of the human heart; (b) describe the cardiac cycle, the role of the valves and the pressure and volume changes occurring in the heart; (c) outline how an electrocardiogram (ECG) is used to monitor heart function; (d) with reference to the ECG, explain how heart action is initiated, including the roles of the SA node, AV node and Purkyne tissue and the myogenic nature of cardiac muscle (detail of nervous and hormonal control is not required); (e) explain how changes in stroke volume and heart rate affect cardiac output; (f) describe how the 'pulse' rate can be measured and interpreted.

1.2.2 The Circulatory System

Context and exemplification	Assessable learning outcomes
• It is important for health professionals and individuals to monitor blood pressure in order to prevent or diagnose problems relating to the circulatory system.	Candidates should be able to: (a) describe, with the aid of diagrams and photographs, the structure of arteries, arterioles, capillaries, venules and veins; (b) relate the structure of arteries, arterioles, capillaries, venules and veins to their functions; (c) define the term *mass transport*; (d) explain the need for a mass transport system in humans; (e) explain the importance of the closed double circulatory system in maintaining differences in blood pressure in different parts of the

	circulatory system; (f) explain why blood needs to be pressurised, with reference to the transfer of materials between cells and capillaries; (g) describe how a sphygmomanometer is used to measure systolic and diastolic blood pressure; (h) describe how the systolic and diastolic blood pressure measurements are interpreted.

1.2.3 The Lungs and Investigating Lung Function

Context and exemplification	**Assessable learning outcomes**
• The way in which cells grow and become specialised to form tissues and organs is fundamental to our understanding of the way in which the body works. • It is important for health professionals to monitor various aspects of lung function in order to prevent or diagnose and treat lung disease. • Measurements of lung function are also carried out on athletes during training. • Individuals in the emergency services, workplace, lifeguards and others should be able to carry out the correct procedures when faced with cases of respiratory arrest.	Candidates should be able to: (a) explain the meaning of the terms *tissue* and *organ*; (b) explain the relationships between cells, tissues and organs, with reference to squamous epithelial cells in the alveoli of the lung; (c) describe, with the aid of diagrams and photographs, the structure of ciliated epithelium, goblet cells and squamous epithelial cells and relate their structures to their functions; (d) describe and interpret photomicrographs of lung tissue; (e) relate cell size to cell surface area to volume ratio, in relation to the exchange of materials with the environment; (f) outline the main features of the gaseous exchange surface of the lungs (only details relating to the cells in contact with blood capillaries, elastic fibres and the role of surfactant are required); (g) describe the process of gaseous exchange in the alveoli; (h) describe the use of a spirometer and peak flow meter to measure tidal volume, vital capacity, forced expiratory volume per second (FEV1) and peak expiratory flow rate (PEFR); (i) analyse and interpret data from a spirometer; (j) describe the possible causes of respiratory arrest; (k) explain how expired air resuscitation should be carried out on adults, children and babies in order to maintain blood oxygen concentration.

Practical skills are assessed using specific OCR-set experiments. The practical work outlined below may be carried out as part of skill development. Centres are not required to carry out any of these experiments or investigations.

Collection of quantitative data:

- Measuring pulse rates, linking in to the idea of pulse rates changing with respect to exercise and fitness.

Collection and presentation of qualitative (descriptive) data:

- Heart dissection.

Presentation, analysis and evaluation of quantitative data:

- Study and interpretation of ECG traces, identifying normal patterns;
- Examination and interpretation of spirometer traces.

Evaluation of data collection strategies:

- Identifying anomalous results;
- Assessing the limitations of the apparatus used.

3.2 AS Unit F222: *Growth, Development and Disease*

Module 1: The Developing Cell

This module provides candidates with a knowledge and understanding of mitotic cell division. The module also covers cell differentiation and how uncontrolled cell division can result in the formation of tumours. The detection and treatment of common types of cancer is outlined.

Links

GCSE Criteria for Science: 3.7(i) (e), (c); 3.9(i) (a)

2.1.1 Mitosis as Part of the Cell Cycle

Context and exemplification	**Assessable learning outcomes**
• Mitosis is the dramatic part of cell division, yet accounts for only a small proportion of the cell cycle. • Stem cells have the capacity to divide and differentiate into any tissue. Studying stem cells and their differentiation has opened up new possibilities for the treatment of disease.	Candidates should be able to: (a) describe the cell cycle, with reference to interphase (G_1,S and G_2), mitosis and cytokinesis leading to diploid cells; (b) describe the structure of DNA and explain the importance of complementary base pairing and hydrogen bonding; (c) explain how DNA replicates semi-conservatively during the S phase of the cell cycle (HSW1); (d) outline the processes taking place at the G_1 and G_2 points in the cycle; (e) describe the appearance of the components of the nucleus and cell during mitosis with reference to: nuclear envelope, centrioles, spindle fibres, centromere, chromatids and chromosomes; (f) define the term *apoptosis*; (g) state that cell deletion by apoptosis and cell addition by mitosis are essential for normal growth and repair; (h) explain that damage to the p53 gene by agents such as UV radiation and chemicals in tobacco smoke can lead to DNA damage going undetected and leading to mutations; (i) explain that cancer is the result of uncontrolled cell division; (j) describe the role of oncogenes and proto-oncogenes in uncontrolled cell division; (k) define the term *stem cell*; (l) explain the term *differentiation,* with respect to the production of erythrocytes and leucocytes derived from stem cells in bone marrow.

Context and exemplification	Assessable learning outcomes
• An understanding of the risk factors and symptoms associated with cancer in the general population contributes to the early diagnosis of cancer and an improvement in prevention and recovery. • Detection of cancer involves skilled professionals from a variety of backgrounds, including radiologists, who conduct and interpret the results of scans, and pathologists, who interpret the results of biopsies. • Treatment and advice involves health professionals who inform and support both the patient and their family throughout their treatment. • The development of treatments is ongoing with new treatments being subjected to rigorous testing procedures involving clinical trials.	Candidates should be able to: (a) outline the factors that may increase the risk of developing cancers, with reference to types of radiation, carcinogens, ageing, viruses and heredity; (b) evaluate the epidemiological evidence linking smoking with lung cancer; diet with bowel cancer and mutations in the BRCA1 gene with breast cancer (HSW7b, 7c); (c) outline the methods of detecting cancers of the breast and lungs, with reference to MRI, X-rays, mammography, thermography, CT scans, ultrasound and PET scans; (d) define the term *prevalence*, with reference to breast cancer in post-menopausal women compared with the rest of the female population; (e) outline methods used to treat cancers of the breast, with reference to Tamoxifen™, surgery (lumpectomy and mastectomy, removal of lymph nodes), chemotherapy, immunotherapy and complementary therapies (HSW6a, 6b, 7b, 7c); (f) describe how clinical trials may be used to establish the value of a cancer treatment, with reference to the need for 'blind' or 'double blind' trials, randomisation and the use of placebos (HSW6b, 7b); (g) discuss the social, ethical and economic consequences of both the development and use of cancer treatments.

Practical skills are assessed using specific OCR-set experiments. The practical work outlined below may be carried out as part of skill development. Centres are not required to carry out any of these experiments or investigations.

Collection and presentation of qualitative (descriptive) data:

- Preparation of onion or garlic root tips to show the stages of mitosis;
- Observing, drawing and labelling of prepared slides showing the stages of mitosis;
- Extraction of DNA from plant material.

Module 2: The Developing Individual

In this module, the monitoring of development from conception to maturity is considered. Patterns of normal development will be examined and the effect of environmental and genetic factors will be discussed.

Links

GCSE Criteria for Science: 3.7(i) (e); 3.9(i) (a)

From other modules within this specification:

F221 Module 1, Module 2

2.2.1 The Biological Basis of Individuality and the Monitoring of Fetal Development.

Context and exemplification	Assessable learning outcomes
• Advice and guidance to mothers is offered from before conception to birth by skilled health professionals. • An increased understanding of fetal development and improvements in medical technology allow the subsequent development of the individual to be monitored. Consequently, the medical personnel involved with antenatal care include doctors, midwives and radiographers. • Good maternal health with respect to diet, limiting alcohol intake and not smoking reduces the risk of abnormalities in the fetus. .	Candidates should be able to: (a) explain the significance of meiosis in producing haploid gametes; (b) describe, with the aid of diagrams, the stages of meiosis: interphase, prophase 1, metaphase 1, anaphase 1, telophase 1, prophase 2, metaphase 2, anaphase 2, telophase 2 (no details of the stage names within prophase 1 are required); (c) explain the importance of chiasma formation, crossing over, independent assortment of chromosomes (metaphase 1) and chromatids (metaphase 2) resulting in genetic variation between gametes and subsequently genetic variation between individuals; (d) outline the programme of antenatal care in the United Kingdom, with reference to pre-conceptual care (to include immune status with regard to rubella and the use of folic acid supplements) and routine post-conceptual care; (e) state the dietary changes recommended during pregnancy with reference to DRV values for energy, protein, calcium, iron, vitamin A, vitamin C and folic acid and the reasons for the changes with respect to the role of these nutrients; (f) describe how human fetal growth can be measured using ultrasound to measure biparietal diameter of cranium and crown-rump length of back; (g) describe how alcohol and nicotine can affect the growth and development of the fetus (HSW6a, 6b, 7b, 7c); (h) explain the use of fetal ultrasonography, amniocentesis and chorionic villus sampling

	(CVS) for detecting named disorders and assessing fetal development. The advantages and disadvantages of each technique should be outlined (HSW6a, 6b); (i) outline how a karyotype is produced and used to determine fetal sex and to diagnose chromosomal mutations, with reference to Turner's and Klinefelter's syndromes; (j) explain how chromosome mutations such as Turner's and Klinefelter's may occur during meiosis (with reference to non-disjunction only).

2.2.2 The Developing Infant

Context and exemplification	**Assessable learning outcomes**
• Measurement of infant growth is carried out by specialists on a regular basis to monitor development. • Patterns of normal growth have been well established and are published as growth charts. Monitoring growth patterns can identify developmental problems at an early stage, leading to early intervention.	Candidates should be able to: (a) describe methods of measuring infant growth by monitoring changes in weight, height and head circumference (HSW5b); (b) outline the importance of: carbohydrates, lipids, essential fatty acids, proteins, essential amino acids; calcium, iron, phosphorus and vitamins A, C and D in maintaining healthy growth in infants; (c) describe, with the aid of diagrams, the pattern of growth during the human life cycle; (d) explain and interpret growth charts for males and females from birth to 18 years of age (HSW5b); (e) distinguish between absolute and relative growth rates; (f) explain that humans are multicellular organisms in which genetically identical cells are organised into tissues, tissues into organs and organs into organ systems; (g) describe the differential growth patterns of lymphatic, reproductive and nervous tissue.

Practical skills are assessed using specific OCR-set experiments. The practical work outlined below may be carried out as part of skill development. Centres are not required to carry out any of these experiments or investigations.

Collection of quantitative data:

- Collect raw data to construct growth charts;
- Carry out a diet analysis;
- Carry out analysis of the fat content of skimmed and full fat milk using copper sulphate.

Collection and presentation of qualitative (descriptive) data:

- Observing, drawing and labelling of prepared slides showing the stages of meiosis;
- Carry out simple chemical tests to show the presence of protein, carbohydrate and/or lipid.

Presentation, analysis and evaluation of quantitative data:

- Construct growth charts;
- Compare the results of a diet analysis to published DRV values.

Evaluation of data collection strategies:

- Identifying anomalous results;
- Assessing the limitations of the apparatus used.

Module 3: Infectious Disease

In this module, the nature of pathogens and the response of the body to infection will be studied in the context of TB and HIV/AIDS. The management and treatment of infectious diseases will also be considered, including the consequences of the development of drug-resistant strains of pathogens.

Links

GCSE Criteria for Science: 3.7(i) (a), (e)

From other modules within this specification:

F221 Module 1

2.3.1 Controlling the Spread of Infectious Disease

Context and exemplification	Assessable learning outcomes
• Infectious diseases have a major impact on populations both in social and economic terms. Drug treatments exploit the differences between eukaryotic cells and prokaryotic and viral pathogens. • Research continues to produce new drugs but pathogens can evolve resistance to any new drug. • Plants have historically provided a valuable source of medicines and plant biodiversity should be preserved in the face of rapid global change and loss of habitats.	Candidates should be able to: (a) explain what is meant by the term *infectious disease*; (b) define the terms *epidemic, endemic* and *pandemic*; (c) describe, with the aid of diagrams and photographs, the structure of *Mycobacterium tuberculosis* as an example of a prokaryotic cell; (d) describe, with the aid of diagrams, the structure of the Human Immunodeficiency Virus (HIV); (e) describe the symptoms, causes and means of transmission of tuberculosis (TB) and HIV/ AIDS; (f) outline the use of antibiotics in the treatment of infectious disease; (g) explain how the use of antibiotics leads to the evolution of resistant strains, with reference to TB and MRSA (HSW6a); (h) outline the precautions that should be used to reduce the spread of resistant bacteria in hospitals (HSW6a, 7c); (i) state that plants can be used as a source of antimicrobial compounds and other medicinal drugs (HSW6b, 7b); (j) explain that similarities in DNA can be used to establish relationships and identify potential medicinal properties (HSW7b); (k) discuss the role of seed banks in the *ex situ* conservation of rare plant species or plant species extinct in the wild (HSW6b).

2.3.2 Acquiring Immunity

Context and exemplification	Assessable learning outcomes
• The immune system is studied with reference to the role of vaccination in the control of infectious disease. • Childhood vaccination remains a contentious issue as do issues surrounding the availability of vaccines, for example, influenza. • Vaccination is also key to controlling infections in individuals who work or holiday where infectious diseases are endemic.	(a) explain what is meant by the term *vaccine*; (b) outline the programme of vaccination used in the United Kingdom (HSW7c); (c) explain what is meant by the term *immune response*, distinguishing between the non-specific and specific response; (d) describe the origin, maturation and mode of action of phagocytes and lymphocytes in the non-specific and specific immune response; (e) compare and contrast the modes of action of B and T lymphocytes in fighting infection; (f) distinguish between active and passive immunity and natural and artificial immunity; (g) describe the role of memory cells in long term immunity; (h) explain the role of vaccination programmes in the prevention of epidemics by establishing herd immunity; (i) describe, with the aid of diagrams, the general structure of an antibody and relate its structure to its function; (j) explain the role of antibodies in ABO blood group incompatibility and Rhesus (Rh) incompatibility; (k) outline the biological problems involved in developing and using a vaccine against HIV (HSW6a, 7b); (l) discuss the ethical issues relating to the development of a vaccine for Human Papilloma Virus (HPV) to prevent cervical cancer (HSW6b, 7c); (m) outline how individuals can be tested for TB and HIV infection (HSW6b).

2.3.3 The Future of Infectious Disease Control

Context and exemplification	Assessable learning outcomes
• Organisations such as the Health Protection Agency (HPA) in the UK and the World Health Organisation (WHO) monitor the spread of infectious diseases by collecting data and, based on this, provide guidance and advice to the public and to governments.	Candidates should be able to: (a) outline the importance of epidemiological data such as morbidity and mortality rates in assessing the incidence and prevalence of disease; (b) interpret data to assess the global impact and importance of TB and HIV infection (HSW7c); (c) explain what is meant by the term *notifiable disease*; (d) discuss the social, ethical, economic and

	biological factors involved in attempts to control and prevent TB and HIV/AIDS (HSW6b);
	(e) outline the problems involved in controlling the spread of newly evolved infectious diseases to prevent future pandemics (HSW7b, 7c).

Practical skills are assessed using specific OCR-set experiments. The practical work outlined below may be carried out as part of skill development. Centres are not required to carry out any of these experiments or investigations.

Collection of quantitative data:

- Investigate antibacterial activity of plant extracts.

Collection and presentation of qualitative (descriptive) data:

- Observing, drawing and labelling of prepared slides of white blood cells.

Presentation, analysis and evaluation of quantitative data:

- Plot graphs showing antibacterial effects of plant extracts.

Evaluation of data collection strategies:

- Assess the problems involved in investigating antibacterial activity.

Module 4: Non-Infectious Disease

Coronary heart disease, smoking-induced lung cancer, asthma and type 2 diabetes can be studied as examples of non-infectious diseases.

The cost to the NHS of non-infectious diseases is increasing, with spending on prevention, treatment and management of these conditions accounting for a large proportion of the NHS budget. Changes in legislation regarding smoking reflect the cost to the NHS of the management of smoking-related diseases.

Links

GCSE Criteria for Science: 3.7(i) (e)

From other modules within this specification:

F221 Module 2

2.4.1 Coronary Heart Disease (CHD)

Context and exemplification	Assessable learning outcomes
• An understanding of the risk factors associated with CHD allows individuals to take more responsibility for their own health and well-being. • Prompt action by competent first-aiders and trained paramedics can make the difference between life and death following a heart attack. • There are many surgical procedures for the treatment of CHD.	Candidates should be able to: (a) explain what is meant by the terms *non-infectious disease* and *infectious disease* and give examples, each taken from the specification; (b) describe CHD as a consequence of atherosclerosis leading to angina pectoris and/or heart attack (myocardial infarction or MI); (c) distinguish between heart attack and cardiac arrest; (d) describe first aid treatment to a conscious person suffering a suspected heart attack; (e) describe first aid treatment to a casualty with suspected cardiac arrest; (f) outline the use of defibrillators and aspirin by qualified medical practitioners; (g) describe the global distribution of CHD and discuss the influence of environmental, behavioural, social and genetic factors on the distribution (HSW6b, 7c); (h) identify the risk factors associated with CHD including: diet, blood pressure, exercise, smoking, genetic influences; (i) calculate body mass index (BMI) and waist/hip ratios and relate these to risk levels for CHD (HSW5b); (j) outline medical treatment for CHD to include coronary by-pass surgery, angioplasty and heart transplants;

	(k) discuss the economic cost of treatment and prevention of CHD (HSW6b, 7c); (l) consider the ethical, social and medical factors in management of CHD in populations including the role of NICE (National Institute for Health and Clinical Excellence) recommendations (HSW6b, 7b, 7c).

2.4.2 Lung Disease

Context and exemplification	**Assessable learning outcomes**
• Lifestyle choices and modern living can have an adverse effect on the respiratory system.	Candidates should be able to: (a) explain the meaning of the terms *chronic* and *acute* in the context of health and disease; (b) describe the short-term and long-term effects of smoking on the respiratory system, with reference to COPD (Chronic Obstructive Pulmonary Disease) and lung cancer; (c) outline the possible causes, symptoms and treatment of asthma including the use of beta agonists and steroids to relieve symptoms.

2.4.3 Diabetes

Context and exemplification	**Assessable learning outcomes**
• The incidence of type 2 diabetes is growing rapidly in developed countries. • The adoption of 'Western' dietary habits by migrants from less economically developed countries and the increasing affluence in countries such as China and India are leading to increases in the global prevalence of type 2 diabetes.	Candidates should be able to: (a) distinguish between type 1 (insulin dependent) and type 2 (non-insulin dependent) diabetes (details of insulin action are **not** required); (b) describe the link between type 2 diabetes and diet (HSW7c); (c) describe procedures for the diagnosis of type 2 diabetes, with reference to the fasting blood glucose test and glucose tolerance test; (d) outline the use of biosensors for monitoring blood-glucose levels (HSW6a); (e) analyse data to describe the distribution of type 2 diabetes within populations (to include changes due to migration and accelerated economic development).

Practical skills are assessed using specific OCR-set experiments. The practical work outlined below may be carried out as part of skill development. Centres are not required to carry out any of these experiments or investigations.

Collection of quantitative data:

- Investigate the use of test strips to measure glucose concentrations.

Evaluation of data collection strategies:

- Collection of quantitative data.

3.3 AS Unit F223: *Practical Skills in Human Biology*

This unit assesses practical and investigative skills developed within contexts encountered during AS Human Biology.

Candidates are required to carry out **three** tasks:

1. Qualitative Task [10 marks]
2. Quantitative Task [10 marks]
3. Evaluative Task [20 marks]

Tasks will be chosen from a selection provided by OCR.

The Qualitative and Quantitative tasks will test skills of observation and measurement.

Candidates will carry out these tasks under controlled conditions.

Each task will be internally assessed using a mark scheme provided by OCR.

Candidates may attempt more than one task from each category with the best mark from each category being used to make up the overall mark.

Centres will supply OCR with a single mark out of 40.

How Science Works

5a Carry out experimental and investigative activities, including appropriate risk management, in a range of contexts.

5b Analyse and interpret data to provide evidence, recognising correlations and causal relationships.

5c Evaluate methodology, evidence and data, and resolve conflicting evidence.

The mark schemes supplied by OCR will be based on the following generic criteria:

1. Qualitative Task Candidates carry out a practical task using instructions supplied by OCR.	Candidates should be able to: (a) demonstrate skilful and safe practical techniques using suitable **qualitative** methods; (b) make and record valid observations, organise results suitably.
2. Quantitative Task Candidates carry out a practical task using instructions supplied by OCR. The data collected in one of the tasks will form the basis of the assessment in the Evaluative task.	Candidates should be able to: (a) demonstrate skilful and safe practical techniques using suitable **quantitative** methods; (b) make and record accurate measurements to an appropriate degree of precision.
3. Evaluative Task This task will extend the quantitative task. Candidates will be required to evaluate the quality of the data collected and procedures.using scientific knowledge and understanding to explain the data collected (AO1 and AO2). Evaluative tasks will **not** require additional data collection.	Candidates should be able to: (a) process results quantitatively and interpret the results to reach valid conclusions; (b) use scientific knowledge and understanding to suggest explanations for trends and patterns in the data; (c) identify and explain the main limitations of the data collection strategy and suggest reasons for simple improvements to the experiment; (d) comment upon the reliability of the data collected and discuss the validity of the conclusions.

The Tasks

Tasks, mark schemes and guidance for teachers and technicians can be downloaded from the OCR Interchange site.

Further advice and guidance on the use and marking of the tasks can be found in the Practical Skills Handbook.

3.4 A2 Unit F224: *Energy, Reproduction and Populations*

Module 1: Energy and Respiration

This module provides candidates with knowledge and understanding of the need for energy and the role of ATP as an immediate source of energy for biological processes.

The module also covers the biology behind improving and maintaining athletic performance.

Links:

GCSE Criteria for Science: 3.7(i) (c); 3.9(i) (a)

From other modules within this specification:

F221 Module 1, Module 2

F222 Module 1

4.1.1 Respiration

Context and exemplification	Assessable learning outcomes
• Various substrates and respiratory pathways can result in differing efficiencies and energy release. This has a direct effect on the performance of the body and therefore on health. • This information is also used by coaches and athletes to achieve a peak in performance at an appropriate time for competition.	Candidates should be able to: (a) outline the need for ATP in living organisms, as illustrated by anabolic reactions, active transport, movement, and the maintenance of body temperature; (b) describe, with the aid of diagrams, the structure of ATP; (c) state that ATP provides the immediate source of energy for biological processes; (d) state the locations of glycolysis, the link reaction and the Krebs cycle; (e) outline glycolysis, with reference to the production of pyruvate and NAD; (f) outline the link reaction, with reference to the decarboxylation of pyruvate (3C) to acetyl (2C) coenzyme A and the reduction of NAD; (g) outline the Krebs cycle, with reference to the formation of citrate from acetate and oxaloacetate and the reconversion of citrate to oxaloacetate (names of intermediate compounds are **not** required); (h) explain that during the Krebs cycle, decarboxylation and dehydrogenation occur, NAD and FAD are reduced and substrate level phosphorylation occurs; (i) outline the process of oxidative phosphorylation, with reference to the roles of electron carriers, oxygen and the

	mitochondrial cristae; (j) outline the process of chemiosmosis, with reference to the electron transport chain, proton gradients and ATPsynthase (HSW7a); (k) state that oxygen is the final electron acceptor in aerobic respiration; (l) evaluate the experimental evidence for the theory of chemiosmosis; (m) explain why the theoretical maximum yield of ATP per molecule of glucose is rarely, if ever, achieved in aerobic respiration; (n) explain why anaerobic respiration produces a much lower yield of ATP than aerobic respiration; (o) define the term *respiratory substrate*; (p) explain the difference in relative energy values of carbohydrate, lipid and protein respiratory substrates; (q) define the term *respiratory quotient* (RQ); (r) describe and explain how a respirometer can be used to investigate how differences in temperature or respiratory substrates can affect the rate of respiration in yeast.

4.1.2 Athletic Performance

Context and exemplification	**Assessable learning outcomes**
• Awareness of the long-term effects of exercise on the body is important for individuals and all health professionals in order to prevent disease rather than cure it. • Understanding of the muscular system and the biochemistry of exercise has enabled athletes to improve their strength, endurance and stamina. • The biological and ethical issues of enhancing performance need to be addressed by athletes and medical professionals.	Candidates should be able to: (a) explain the short-term and long-term consequences of exercise on the body, with reference to the respiratory and cardiovascular systems and the structure of skeletal muscle; (b) discuss how much exercise needs to be taken for significant sustained improvement in aerobic fitness; (c) discuss the benefits of the use of carbohydrate loading diets to improve athletic performance (HSW6a, 7b); (d) outline alternative methods of enhancing performance, with reference to recombinant erythropoietin (RhEPO), blood doping and use of steroids (HSW6a, 6b, 7c); (e) describe how the information in a sequence of nucleotides is used to construct haemoglobin; (f) explain the process and purpose of transcription and translation, including the role of messenger RNA, transfer RNA and ribosomes; (g) describe and explain the oxygen dissociation curve for haemoglobin;

(h) describe and explain the significance of the oxygen dissociation curves of adult oxyhaemoglobin at different levels of carbon dioxide (Bohr effect);

(i) describe and explain the difference in affinity for oxygen between haemoglobin and myoglobin;

(j) describe and explain the build up of an oxygen deficit and oxygen debt/EPOC (Excess Post-exercise Oxygen Consumption);

(k) explain the effect of the gene mutation resulting in sickle cell anaemia on the structure and oxygen transport efficiency of haemoglobin;

(l) outline how DNA is repaired;

(m) outline the role of DNA in the process of cellular ageing;

(n) describe, with the aid of diagrams, photographs and electron micrographs, the histology and ultrastructure of skeletal muscle;

(o) describe the sliding filament theory of muscle contraction, to include the importance of the power stroke and the role of ATP and calcium ions.

Practical skills are assessed through an extended investigation. Advice and guidance on preparing candidates for the extended investigation can be found in the *Teacher Support: Extended Investigation* handbook, published separately.

Module 2: Human Reproduction and Populations

This module provides candidates with knowledge and understanding of human reproduction, techniques for assisted reproduction and the need to make informed and ethical decisions.

Energy and nutrient flows through ecosystems and the impact of human activities are also covered.

Links:

GCSE Criteria for Science: 3.7(i) (a), (c), (e); 3.7(iv) (a) 3.9(i) (a), (b)

From other modules within this specification:

F221 Module 1

F222 Module 2

4.2.1 Fertility and Contraception

Context and exemplification	Assessable learning outcomes
• An understanding of the processes involved in reproduction and contraception allow informed decisions to be made. • Many professionals, including staff in family planning clinics, youth services staff and doctors, are involved in giving contraceptive advice to clients and patients.	Candidates should be able to: (a) describe, with the aid of diagrams and photographs, the parts of the male and female urinogenital systems; (b) describe, with the aid of diagrams and photographs, the ovary and testes as seen under the light microscope; (c) describe and explain gametogenesis, emphasising the importance of meiosis; (d) describe, with the aid of diagrams and photographs, the structure of the secondary oocyte and sperm; (e) describe the role of hormones in gametogenesis and in the menstrual cycle; (f) describe the passage of sperm from the testis to the fallopian tube; (g) describe the process of fertilisation and explain its importance in restoring chromosome number and introducing variation; (h) describe the process of implantation and the development of the placenta; (i) discuss the role of hormones in pregnancy, birth and lactation: human chorionic gonadotrophin (HCG), oestrogen, progesterone, human placental lactogen (HPL), oxytocin, FSH and prolactin; (j) compare and contrast methods of contraception from biological and ethical viewpoints: the birth control pill, condom, diaphragm, Norplant®, DMPA (Depo-Provera®), tubal ligation and vasectomy

	(HSW6a, 7c); (k) discuss the use of anti-implantation methods such as IUDs and the 'morning after pill' from biological and ethical viewpoints (HSW6a, 6b, 7c).

4.2.2 Assisted Reproduction

Context and exemplification	**Assessable learning outcomes**
• Many staff in family planning clinics are involved in giving fertility advice. • There have been major advances in the field of assisted reproduction, raising the demand for techniques that increase fertility for couples who are unable to conceive. • Assisted reproductive techniques also raise important ethical issues upon which health professionals, social workers and other agencies have to advise.	Candidates should be able to: (a) outline the causes of male infertility (abnormal sperm and absence of sperm) and the type of treatment available: intrauterine insemination, IVF, intracytoplasmic sperm injection (ICSI), donor sperm insemination, and surgical sperm retrieval (HSW6a); (b) outline the causes of female infertility (ovulatory disorders, oviduct blockage, endometriosis and antisperm antibodies) and the treatments available: ovulation induction, artificial insemination, IVF, frozen embryo replacements and gamete intra-Fallopian transfer (GIFT) (HSW6a); (c) describe the maintenance and use of sperm banks (HSW6a, 6b, 7c); (d) describe how embryos can be stored and used (HSW6a, 6b, 7c); (e) define the terms *multiple pregnancy* and *multiple birth*; (f) explain how multiple pregnancy may occur; (g) describe the risks associated with multiple pregnancy, including demands on the mother, 'vanishing twin' syndrome, risk of premature birth and disabilities; (h) outline how monoclonal antibodies can be used in pregnancy testing; (i) discuss the process of fertility treatment from biological, ethical and economic viewpoints (HSW6a, 7c).

4.2.3 Food, Farming and Populations – Producing Food

Context and exemplification	**Assessable learning outcomes**
• To assess the impact of human activity on the environment, it is important to understand the flow of energy and recycling of nutrients through ecosystems. • The need for sustainable agriculture is of particular interest to ecologists and agriculturists.	Candidates should be able to: (a) explain that light energy is used during photosynthesis to produce complex organic molecules; (b) explain how respiration in plants and animals depends upon the products of photosynthesis; (c) outline the light-dependent stage of photosynthesis, including the conversion of

	light energy into chemical energy in the form of ATP and reduced NADP (details of cyclic and non-cyclic photophosphorylation are not required); (d) outline how the products of the light-dependent stage are used in the light-independent stage (Calvin cycle) to produce triose phosphate (TP) (reference should be made to ribulose bisphosphate (RuBP), ribulose bisphosphate carboxylase (rubisco) and glycerate 3-phosphate (GP), but **no other** biochemical detail is required); (e) explain the role of carbon dioxide in the light-independent stage (Calvin cycle); (f) state that TP can be used to make carbohydrates, lipids and amino acids; (g) describe, with the aid of diagrams, how microorganisms recycle nitrogen within ecosystems (only *Nitrosomonas*, *Nitrobacter* and *Rhizobium* need to be identified by name); (h) outline, with the aid of diagrams, the flow of energy through a food chain involving maize grown as animal feed and beef reared for human consumption, to include a consideration of the efficiency of energy transfers in the food chain; (i) distinguish between *intensive* and *extensive* food production; (j) discuss the advantages and disadvantages of intensive farming and extensive farming with reference to their comparative ability to provide resources in a sustainable fashion (HSW6a, 6b, 7c); (k) define the term *succession* and outline how agriculture can result in a deflected succession; (l) discuss the conflict between agriculture and conservation in intensive farming, with reference to hedgerow removal, use of chemicals, and disposal of farm waste (HSW7c).

4.2.4 Food, Farming and Populations – Human Impact on the Environment

Context and exemplification	**Assessable learning outcomes**
• Globally, more effort is being made to understand and take responsibility for human impact on the environment and to take steps to reduce this impact.	Candidates should be able to: (a) discuss the factors that alter the birth rate and death rate in human populations, with reference to food production, advances in medical technology and disease control (HSW6a, 6b, 7c);

(b) define the term *ecosystem*;

(c) outline how the impact of the rise in human population may affect ecosystems and result in a loss of biodiversity (HSW7c);

(d) discuss the ecological, economic and scientific importance of biodiversity, with reference to aesthetic, medical and agricultural considerations (HSW6b);

(e) describe the effect of human activity on the carbon cycle, to include deforestation and burning fossil fuels and their contribution to global climate change;

(f) evaluate the evidence that links carbon dioxide level to climate change (HSW7a, 7b, 7c);

(g) explain what is meant by the term *carbon footprint* and outline some different ways that individuals and governments can minimise carbon emissions (HSW1, 3, 7c).

Practical skills are assessed through an extended investigation. Advice and guidance on preparing candidates for the extended investigation can be found in the *Teacher Support: Extended Investigation* handbook, published separately.

3.5 A2 Unit F225: *Genetics, Control and Ageing*

Module 1: Genetics in the Twenty First Century

In this module, fundamental principles of heredity are considered in relation to the inheritance of genetic diseases. Recent advances in our understanding of genetics and practical techniques that have arisen from this knowledge are also considered as well as the potential uses for these techniques in the future.

The role of genetic counsellors is studied as well as possible solutions for the shortage of donated organs for transplant surgery. The profound ethical implications of new genetic technologies are considered within these contexts.

Links

GCSE Criteria for Science: 3.7(i) (c), (e)

From other modules within this specification:

F221 Module 1

F222 Module 1, Module 2

5.1.1 Inheritance of Human Genetic Disease

Context and exemplification	Assessable learning outcomes
• Understanding how genes are inherited is essential for understanding genetic disease.	Candidates should be able to: (a) explain the terms *gene*, *allele*, *locus*, *phenotype*, *genotype*, *dominant* and *recessive*; (b) explain, with reference to cystic fibrosis (CF), Huntington's disease and phenylketonuria (PKU), how gene mutation may or may not lead to the inheritance of genetic disease; (c) explain the term *codominance* with reference to the inheritance of sickle cell anaemia and the ABO blood groups; (d) explain why the sickle cell allele has a selective advantage in areas where malaria is endemic, resulting in an increase in the frequency of the mutant allele; (e) recognise cells in blood smears, including sickle celled erythrocytes; (f) explain the term *sex linkage* with reference to the inheritance of haemophilia; (g) use pedigree diagrams to explain and predict the inheritance of genetic diseases; (h) explain the term *autosomal linkage* with reference to the inheritance of nail patella syndrome and the ABO blood groups; (i) explain how crossover frequencies are used

	to map gene loci on chromosomes; (j) explain how non-disjunction and translocation of chromosomes can result in Down's syndrome, Turner's syndrome and Klinefelter's syndrome; (k) recognise karyotypes to illustrate Down's syndrome, Turner's syndrome and Klinefelter's syndrome; (l) discuss the ethical issues connected with the occurrence and inheritance of Down's syndrome, Turner's syndrome and Klinefelter's syndrome (HSW6a, 6b, 7c).

5.1.2 Genetic Techniques

Context and exemplification	**Assessable learning outcomes**
• The Human Genome Project is rapidly increasing our understanding of human genetics and genetic disease. • Many techniques now exist to add, modify and replace DNA sequences. • These techniques have medical, ethical and social implications.	Candidates should be able to: (a) outline the function of restriction enzymes (restriction endonucleases) and ligase enzymes in separating and joining specific DNA sequences; (b) describe, with the aid of diagrams, the palindromic nature of restriction enzyme recognition sequences; (c) explain the terms *intron*, *exon* and *minisatellite* with reference to the techniques and uses of gel electrophoresis, and the Polymerase Chain Reaction (PCR), including DNA profiling; (d) describe, with the aid of diagrams, the technique of genetic engineering in microorganisms, including the formation of recombinant DNA in bacterial plasmids; (e) describe, with the aid of diagrams, the technique of genetic engineering using a eukaryotic cell line in order to produce a human protein; (f) discuss the potential use of gene therapy in the treatment of genetic disease (HSW6a, 6b, 7c); (g) discuss the ethical implications of genetic engineering in humans, with reference to somatic cell and germ cell therapy (HSW6b); (h) outline how the Human Genome Project has enabled the sequencing of human DNA and describe the possible uses of this information (HSW7a, 7b).

5.1.3 Counselling Individuals on Genetic Issues

Context and exemplification	Assessable learning outcomes
• The role of genetic counsellors in providing information to individuals and families can be important for making informed decisions.	Candidates should be able to: (a) explain how pedigree analysis can indicate the probability of genetic disease occurring (HSW6a); (b) describe the role of the genetic counsellor (HSW6b); (c) discuss the ethical issues involved in the work of the genetic counsellor (HSW6b).

5.1.4 Transplant Surgery and Cloning

Context and exemplification	Assessable learning outcomes
• The availability of tissues and organs for donation is limited. • The use of alternative sources of tissues and organs, from clones or from non-human sources, is highly controversial. • Cloning has ethical implications, especially when it is combined with genetic engineering.	Candidates should be able to: (a) explain the significance of genetic compatibility in transplant surgery with reference to the major histocompatibility (MHC) system (HSW6a, 6b, 7b, 7c); (b) state the potential sources of donated organs and outline the advantages and disadvantages of each source (HSW6b, 7c); (c) outline the potential of genetic engineering in the use of non-human organs for transplant surgery (HSW6a, 6b, 7a, 7b, 7c); (d) outline the potential for cloning human embryos in order to create a supply of embryonic stem cells for therapeutic use and 'designer babies' in reproductive cloning (HSW6a, 6b, 7c); (e) discuss the ethical issues involved in therapeutic and reproductive cloning and in transplant surgery (HSW6a, 6b, 7c).

Practical skills are assessed through an extended investigation. Advice and guidance on preparing candidates for the extended investigation can be found in the *Teacher Support: Extended Investigation* handbook, published separately.

Module 2: The Nervous System

In this module, the structure and function of the human nervous system is studied. The eye is used as an example of a sensory receptor and the roles of eye test and reflexes in diagnosing problems with the eye and nervous system are considered.

Modern brain scanning techniques are studied with respect to diagnosing traumatic brain injury and the unique problems associated with damage to neurones are investigated. The effects of drugs on the nervous system are also studied within this module.

Links

GCSE Criteria for Science: 3.7(i) (d), (e); 3.9(i) (a)

From other modules within this specification:

F221 Module 2

F222 Module 2

5.2.1 Monitoring Visual Function

Context and exemplification	Assessable learning outcomes
• The eye is used as an example of one of the many ways in which external stimuli are detected. • Health professionals can use eye responses to indicate levels of consciousness.	Candidates should be able to: (a) outline the organisation of the central nervous system and peripheral nervous system; (b) describe, with the aid of diagrams and photographs, the structure of the eye and outline the functions of its parts; (c) describe, with the aid of diagrams and electronmicrographs, the structure of the retina (including rods, cones, bipolar cells and ganglion cells); (d) describe, with the aid of diagrams, how a sensory receptor converts a stimulus into nerve impulses with reference to the rod cell in the retina; (e) outline assessment of receptor activity through routine eye tests (with reference to visual acuity, colour vision and response of pupil); (f) outline the use of blink/iris reflex tests to indicate levels of consciousness.

5.2.2 Treating Central Nervous System Injuries

Context and exemplification	Assessable learning outcomes
• The effects of damage and disease on the nervous system can be assessed in several ways. • Treating damage to the central nervous system is difficult and managing the effects of the damage is often all that is possible.	Candidates should be able to: (a) describe, with the aid of diagrams, photographs and images from MRI and CT scans, the gross structure of the human brain; (b) outline the functions of the cerebrum, cerebellum and medulla oblongata; (c) outline the organisation of the autonomic nervous system into a sympathetic and a parasympathetic system; (d) describe, with the aid of diagrams, photographs and electron micrographs, the structure of a sensory neurone, a relay neurone and a motor neurone and outline their functions in a reflex arc; (e) describe and explain, with the aid of diagrams, the transmission of an action potential in a myelinated neurone; (f) explain the importance of saltatory conduction and the refractory period in the transmission of nerve impulses; (g) describe, with the aid of diagrams and electronmicrographs, the structure and function of a cholinergic synapse; (h) outline the role of synapses with reference to the direction of the nerve impulse and the interconnection of nerve pathways; (i) define the term *traumatic brain injury*; (j) outline how CT and MRI scans and nerve conduction velocity tests can be used in the assessment of brain and spinal cord damage (HSW7b); (k) explain why damaged neurones are unable to regenerate (reference should be made to inhibitory molecules in scar tissue and poor regenerative response); (l) explain the potential use of stem cells to replace lost or damaged neurones (HSW6a, 7b); (m) describe the effects of strokes on short- and long-term memory (HSW6b, 7c); (n) describe the techniques that may be used to improve memory in stroke patients (HSW6b).

5.2.3 Modifying Brain Function

Context and exemplification	Assessable learning outcomes
• The effects of drugs on brain chemistry are complex. • Understanding the effects of drugs helps to shape medical, ethical, legal and social responses to their use and abuse.	Candidates should be able to: (a) define the term *drug*, with reference to both therapeutic and abusive aspects (HSW6a, 7c); (b) describe how drugs can be used to modify brain activity and function, with reference to dopamine for the treatment of Parkinson's disease and diamorphine (heroin) for the relief of severe pain (HSW6b); (c) outline how opioids mimic the effects of naturally occurring endorphins, with reference to blocking the transmission of pain; (d) discuss the use of cannabis, both therapeutically and recreationally (HSW6a, 7a, 7b, 7c); (e) distinguish between psychological and physical dependency, with reference to heroin and alcohol.

Practical skills are assessed through an extended investigation. Advice and guidance on preparing candidates for the extended investigation can be found in the *Teacher Support: Extended Investigation* handbook, published separately.

Module 3: Homeostasis

In this module, the mechanism of homeostasis is studied using the control of body temperature as an example. The control of erythropoietin production and its function in homeostasis is studied in the context of kidney structure and function. The profound effects of kidney disease and its causes and treatment, are used to illustrate the importance of homeostasis. The ethics of organ donation are also considered.

Links

GCSE Criteria for Science: 3.7(i) (d)

From other modules within this specification:

F222 Module 4

F224 Module 1

5.3.1 The Importance of Homeostasis

Context and exemplification	Assessable learning outcomes
• The human body uses both nervous and endocrine systems to respond to changes in its external and internal environment. • Maintaining the correct temperature is essential for metabolic reactions. • Monitoring body temperature and responding to deviations from normal body temperature can save lives.	Candidates should be able to: (a) discuss the importance of homeostasis in humans in maintaining a dynamic equilibrium of normal body constants (set points); (b) explain, with the aid of diagrams, the principles of homeostasis in terms of receptors, effectors and negative feedback; (c) outline the role of the autonomic nervous system in homeostasis; (d) describe how body temperature is controlled with reference to the roles of the peripheral temperature receptors, the hypothalamus and the effect of thyroxine on metabolic rate; (e) interpret data and flow diagrams that illustrate the principles of homeostatic mechanisms; (f) explain the technique for, and the importance of, measuring core body temperature; (g) describe the causes and consequences of hypothermia and explain how it is treated (HSW6a); (h) describe the causes and consequences of hyperthermia and explain how it is treated (HSW6a).

5.3.2 Managing Type 1 and Type 2 Diabetes

Context and exemplification	Assessable learning outcomes
• Type 1 and type 2 diabetes illustrate the problems that result if homeostatic control systems fail. • The increasing number of people with type 1 and type 2 diabetes and associated health problems has led to the development of specialist teams within health services to manage and treat these conditions.	Candidates should be able to: (a) outline the role of the pancreas as an endocrine gland; (b) describe, with the aid of diagrams and photographs, the structure of an islet of Langerhans; (c) explain how blood glucose concentration is regulated by negative feedback control mechanisms, with reference to insulin and glucagon; (d) compare and contrast the causes of type 1 and type 2 diabetes; (e) outline the risk factors associated with the development of type 1 and type 2 diabetes; (f) compare and contrast the treatment of type 1 and type 2 diabetes (HSW6a, 6b); (g) describe the role of the diabetes nurse in the long-term care of a person with diabetes (HSW6b); (h) explain the importance of regular checks on blood pressure, examination of the retina, and kidney function tests for a person with diabetes (HSW6a, 7c).

5.3.3 Urine Production

Context and exemplification	Assessable learning outcomes
• Metabolic reactions within cells produce 'waste' products that must be removed. • The removal of much of this 'waste' through the production of urine affects the body's water balance. • Urine composition can be monitored and changes in composition can indicate that homeostatic control mechanisms are not functioning correctly.	Candidates should be able to: (a) define the term *excretion*; (b) explain the importance of removing nitrogenous waste products and carbon dioxide from the body; (c) describe, with the aid of diagrams and photographs, the gross structure of the kidney and the detailed structure of the nephron with the associated blood vessels; (d) interpret diagrams and photographs showing the histology of the kidney in section; (e) describe and explain the processes of ultrafiltration and selective reabsorption in the kidney resulting in the production of urine; (f) explain, using correct water potential terminology, the function of the kidney, hypothalamus and pituitary gland in the control of water balance; (g) describe the roles of ADH and cyclic AMP in the movement of aquaporins to the cell

	surface (plasma) membrane of cells in the collecting duct; (h) explain how changes in the chemistry of urine may indicate a malfunction in the control of blood glucose and water balance; (i) outline the differences between diabetes mellitus and diabetes insipidus.

5.3.4 Treating Kidney Disease

• When kidneys become diseased, it is not only the removal of 'waste' products and the production of urine that are affected. The production of key enzymes and hormones that control water balance can also be affected. • Treatment of kidney disease or failure may require dialysis or a transplant. • The limitations imposed by the need for regular dialysis and the shortage of organ donors make both options problematic.	Candidates should be able to: (a) outline the homeostatic functions of renin (angiotensinogenase) and erythropoietin in the kidney (details of the rennin-angiotensin pathway are **not** required); (b) outline the causes of kidney failure and describe how it is diagnosed; (c) explain why renin and erythropoietin production changes in diseased kidneys and suggest why kidney failure may be associated with cardiovascular disease; (d) outline the treatments available to maintain kidney function in kidney disease (HSW6a, 6b); (e) describe the mechanisms of haemodialysis and peritoneal dialysis in the treatment of kidney failure (HSW6a, 6b); (f) interpret diagrams and photographs of the apparatus used for haemodialysis; (g) outline the use of recombinant erythropoietin (RhEPO) in kidney failure and dialysis (HSW6a); (h) discuss the advantages and disadvantages of the use of kidney transplants as an alternative to dialysis in the treatment of kidney failure (HSW6a, 7c); (i) discuss the practical and ethical issues involved in the use of donor organs for kidney transplants.

Practical skills are assessed through an extended investigation. Advice and guidance on preparing candidates for the extended investigation can be found in the *Teacher Support: Extended Investigation* handbook, published separately.

Module 4: The Third Age

In this module, the detection and treatment of the effects of ageing on the reproductive, nervous, skeletal, cardiovascular and respiratory systems are considered. This provides ample opportunity to revise these systems studied earlier in the specification. Candidates should be encouraged to approach this module in a caring and sensitive manner and not to see ageing exclusively as a disadvantage.

Links

GCSE Criteria for Science: 3.7(i) (c), (e)

From other modules within this specification:

F222 Module 1, Module 4

F224 Module 2

5.4.1 The Effects of Ageing on the Reproductive System

- The menopause affects all women.
- Medical intervention allows women to manage the effects of the menopause.

Candidates should be able to:

(a) describe the effects of ageing on the reproductive system;

(b) describe the changes in physiology associated with the menopause;

(c) explain the use of HRT in treating the symptoms of the menopause, including oestrogen (oral or patch) and progestin (HSW6a);

(d) discuss the cyclic and continual therapy methods for taking HRT;

(e) discuss the side-effects of using HRT in treating the menopause, including increasing bone mass density, endometrial cancer, heart disease and breast cancer (HSW6a, 6b, 7c);

(f) discuss alternative methods of treating the symptoms of the menopause including the use of phyto-oestrogens and antioxidants (HSW6b, 7c).

5.4.2 The Effects of Ageing on other Body Systems

Context and exemplification	**Assessable learning outcomes**
• Changes in health associated with ageing can have many implications for individuals and their friends and families. These implications will also have consequences for the population as a whole. • Individual experiences of ageing vary widely and there are many positive aspects. • Maintaining a healthy lifestyle when young can pre-empt problems in later life.	Candidates should be able to: (a) describe the effects of ageing on the brain (HSW6a, 6b); (b) describe the symptoms and possible causes of Alzheimer's disease; (c) consider the issues involved in the care of patients with dementia (HSW6b, 7c); (d) describe the effects of ageing on the peripheral nervous system, with reference to

	vision and hearing; (e) describe the symptoms, causes and treatment of cataracts, glaucoma and macular degeneration (HSW6a, 6b); (f) describe the effects of ageing on the skeletal system, with reference to osteoarthritis and osteoporosis; (g) outline methods of preventing osteoporosis (reference should be made to calcium, vitamin D, HRT and exercise) (HSW6a,7c); (h) describe the use of bone density tests in the detection of osteoporosis; (i) describe the effects of ageing on the cardiovascular and respiratory systems; (j) discuss the social consequences of an ageing population (HSW6b, 7c).

Practical skills are assessed through an extended investigation. Advice and guidance on preparing candidates for the extended investigation can be found in the *Teacher Support: Extended Investigation* handbook, published separately.

3.6 A2 Unit F226: *Extended Investigation in Human Biology*

Candidates are required to carry out a single Extended Investigation made up of three connected sections, each of which assesses a particular group of skills:

1. Skill A [15 marks]
2. Skill B [10 marks]
3. Skill C [15 marks]

The work produced by a candidate for each skill area should be validated by the teacher as being the work of that candidate.

The investigation will be internally assessed using generic mark descriptors provided by OCR. Individual mark descriptors are awarded on an achieved/not achieved basis.

Centres will supply OCR with a single mark out of 40 for the Extended Investigation.

Skill A Designing a data collection strategy	Use knowledge and understanding to pose scientific questions and define scientific problems. Describe safe and skilful practical techniques and processes, selecting appropriate methods.
Skill B Collecting and processing raw data	Make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy.
Skill C Analysis and evaluation	Analyse, interpret, evaluate and explain the methodology and results of the investigation.

4 Schemes of Assessment

4.1 AS GCE Scheme of Assessment

AS GCE Human Biology (H023)	
AS Unit F221: *Molecules, Blood and Gas Exchange*	
30% of the total AS GCE marks 1h written paper 60 marks	Candidates answer **all** questions.
AS Unit F222: *Growth, Development and Disease*	
50% of the total AS GCE marks 1 h 45 min written paper 100 marks	Candidates answer **all** questions. This assessment contains an advance notice containing two articles (case study 1 and case study 2). One question will be on an **Advance Notice** article which will be available to centres via OCR Interchange and will be included as an insert with the question paper. For further details on the **Advance Notice** article see Appendix H.
AS Unit F223: *Practical Skills in Human Biology*	
20% of the total AS GCE marks Coursework 40 marks	Candidates complete three tasks from a selection supplied by OCR. Tasks are marked by the centre using mark schemes supplied by OCR. Please see the *Teacher Support: Practical Skills* handbook for more details.

4.2 Advanced GCE Scheme of Assessment

Advanced GCE Human Biology (H423)	

AS Units: Unit F221 being 15% of the total Advanced GCE marks, Unit F222 being 25% of the Advanced GCE marks and Unit F223 being10% of the Advanced GCE marks.

A2 Unit F224: *Energy, Reproduction and Populations*	
15% of the total Advanced GCE marks 1 h 15 min written paper 60 marks	Candidates answer **all** questions. This unit contains some synoptic assessment and Stretch and Challenge questions.
A2 Unit F225: *Genetics, Control and Ageing*	
25% of the total Advanced GCE marks 2 h written paper 100 marks	Candidates answer **all** questions. This unit contains some synoptic assessment and Stretch and Challenge questions.
A2 Unit F226: *Extended Investigation in Human Biology*	
10% of the total Advanced GCE marks Coursework 40 marks	Candidates complete a single extended investigation set by themselves and/or their teacher(s). Investigations are marked and authenticated by the teacher using a generic mark scheme. Please see Appendix B in this specification and the *Teacher Support: Extended Investigation* handbook for more details.

4.3 Unit Order

The normal order in which the unit assessments could be taken is AS Units F221, F222 and F223 in the first year of study, leading to an AS GCE award, then A2 Units F224, F225 and F226 leading to the Advanced GCE award.

Alternatively, candidates may take a valid combination of unit assessments at the end of their AS GCE or Advanced GCE course in a 'linear' fashion.

4.4 Unit Options (at AS/A2)

There are no optional units in the AS GCE specification; for AS GCE Human Biology candidates must take AS Units F221, F222 and F223.

There are no optional units in the Advanced GCE specification; for Advanced GCE Human Biology candidates take AS Units F221, F222 and F223, *and* A2 Units F224, F225 and F226.

4.5 Synoptic Assessment (A Level GCE)

Synoptic assessment tests the candidates' understanding of the connections between different elements of the subject.

Synoptic assessment involves the explicit drawing together of knowledge, understanding and skills learned in different parts of the Advanced GCE course. The emphasis of synoptic assessment is to encourage the development of the understanding of the subject as a discipline. All A2 units, whether internally or externally assessed, contain synoptic assessment.

Synoptic assessment requires candidates to make and use connections within and between different areas of human biology at AS and A2, for example, by:

- applying knowledge and understanding of more than one area to a particular situation or context;
- using knowledge and understanding of principles and concepts in planning experimental and investigative work and in the analysis and evaluation of data;
- bringing together scientific knowledge and understanding from different areas of the subject and applying them.

All A2 units, F224, F225 and F226, contain some synoptic assessment.

4.6 Assessment Availability

There are **two** examination series each year, in January and June.

The availability of units is shown below.

Level	Unit	January 2009	June 2009	January 2010	June 2010	January 2011	June 2011
AS	F221	✓	✓	✓	✓	✓	✓
AS	F222		✓	✓	✓	✓	✓
AS	F223		✓		✓		✓
A2	F224			✓	✓	✓	✓
A2	F225				✓	✓	✓
A2	F226				✓		✓

The availability shown for 2011 will apply for subsequent years.

4.7 Assessment Objectives

Candidates are expected to demonstrate the following in the context of the content described:

AO1 Knowledge and Understanding

- recognise, recall and show understanding of scientific knowledge;
- select, organise and communicate relevant information in a variety of forms.

AO2 Application of Knowledge and Understanding

- analyse and evaluate scientific knowledge and processes;
- apply scientific knowledge and processes to unfamiliar situations including those related to issues;
- assess the validity, reliability and credibility of scientific information.

AO3 How Science Works

- demonstrate and describe ethical, safe and skilful practical techniques and processes, selecting appropriate qualitative and quantitative methods;
- make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy;
- analyse, interpret, explain and evaluate the methodology, results and impact of their own and others' experimental and investigative activities in a variety of ways.

AO Weightings in AS GCE

Unit	% of AS GCE			Total/%
	AO1	AO2	AO3	
AS Unit F221: *Molecules, Blood and Gas Exchange*	14	14	2	30
AS Unit F222: *Growth, Development and Disease*	21	24	5	50
AS Unit F223: *Practical Skills in Human Biology*	3	2	15	20
	38	40	22	100

AO Weightings in Advanced GCE

Unit	% of Advanced GCE			Total/%
	AO1	AO2	AO3	
AS Unit F221: *Molecules, Blood and Gas Exchange*	7	7	1	15
AS Unit F222: *Growth, Development and Disease*	10.5	12	2.5	25
AS Unit F223: *Practical Skills in Human Biology*	1.5	1	7.5	10
A2 Unit F224: *Energy, Reproduction and Populations*	5	9	1	15
A2 Unit F225: *Genetics, Control and Ageing*	9	13.5	2.5	25
A2 Unit F226: *Extended Investigation in Human Biology*	1	1.5	7.5	10
	34	44	22	100

4.8 Quality of Written Communication

Quality of Written Communication is assessed in all units and credit may be restricted if communication is unclear.

Candidates will:

- ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear;
- select and use a form and style of writing appropriate to purpose and to complex subject matter;
- organise information clearly and coherently, using specialist vocabulary when appropriate.

5 Technical Information

5.1 Making Unit Entries

Please note that centres must be registered with OCR in order to make any entries, including estimated entries. It is recommended that centres apply to OCR to become a registered centre well in advance of making their first entries. Centres must have made an entry for a unit in order for OCR to supply the appropriate forms or moderator details for coursework.

It is essential that unit entry codes are quoted in all correspondence with OCR. See Sections 4.1 and 4.2 for these unit entry codes.

5.2 Making Qualification Entries

Candidates must enter for qualification certification separately from unit assessment(s). If a certification entry is **not** made, no overall grade can be awarded.

Candidates may enter for:

- AS GCE certification (entry code H023).
- Advanced GCE certification (entry code H423).

A candidate who has completed all the units required for the qualification may enter for certification either in the same examination series (within a specified period after publication of results) or at a later series.

AS GCE certification is available from June 2009.
Advanced GCE certification is available from June 2010.

5.3 Grading

The AS GCE is awarded on the scale A–E. All GCE units are awarded a–e. The Advanced GCE is also awarded on the scale A–E. To be awarded an A*, candidates will need to achieve a grade A on their full A Level qualification and an A* on the aggregate of their A2 units. Grades are reported on certificates. Results for candidates who fail to achieve the minimum grade (E or e) will be recorded as unclassified (U or u) and this is **not** certificated.

A Uniform Mark Scale (UMS) enables comparison of candidates' performance across units and across series. The three-unit AS GCE has a total of 300 *uniform* marks and the six-unit Advanced GCE has a total of 600 *uniform* marks.

OCR converts the candidate's raw mark for each unit to a *uniform* mark. The maximum *uniform* mark for any unit depends on that unit's weighting in the specification. In these Human Biology specifications, the six units of the Advanced GCE specification have UMS weightings of 15%/25%/10%/15%/25%/10% (and the three units of the AS GCE specification have UMS weightings of 30%/50%/20%). The *uniform* mark totals are 90/150/60/90/150/60, respectively. Each unit's *raw* mark grade boundary equates to the *uniform* mark boundary at the same grade. Intermediate marks are converted on a pro-rata basis.

Uniform marks correspond to *unit* grades as follows:

(Advanced GCE) Unit Weighting	Maximum Unit Uniform Mark	Unit Grade					
		a	b	c	d	e	u
25%	150	150–120	119–105	104–90	89–75	74–60	59–0
15%	90	90–72	71–63	62–54	53–45	44–36	35–0
10%	60	60–48	47–42	41–36	35–30	29–24	23–0

OCR adds together the unit *uniform* marks and compares these to pre-set boundaries (see the table below) to arrive at *qualification* grades.

Qualification	Qualification Grade					
	A	B	C	D	E	U
AS GCE	300–240	239–210	209–180	179–150	149–120	119–0
Advanced GCE	600–480	479–420	419–360	359–300	299–240	239–0

Candidates achieving at least 480 *uniform* marks in their Advanced GCE, ie grade A, and who also gain at least 270 *uniform* marks in their three A2 units will receive an A* grade.

5.4 Result Enquiries and Appeals

Under certain circumstances, a centre may wish to query the grade available to one or more candidates or to submit an appeal against an outcome of such an enquiry. Enquiries about unit results must be made immediately following the series in which the relevant unit was taken.

For procedures relating to enquires on results and appeals, centres should consult the OCR *Administration Guide for General Qualifications* and the document *Enquiries about Results and Appeals – Information and Guidance for Centres* produced by the Joint Council. Copies of the most recent editions of these papers can be obtained from OCR.

5.5 Shelf-life of Units

Individual unit results, prior to certification of the qualification, have a shelf-life limited only by that of the qualification.

5.6 Unit and Qualification Re-sits

There is no restriction on the number of times a candidate may re-sit each unit before entering for certification for an AS GCE or Advanced GCE.

Candidates may enter for the full qualifications an unlimited number of times.

5.7 Guided Learning Hours

AS GCE Human Biology requires **180** guided learning hours in total.
Advanced GCE Human Biology requires **360** guided learning hours in total.

5.8 Code of Practice/Subject Criteria/Common Criteria Requirements

These specifications comply in all respects with current *GCSE, GCE, GNVQ and AEA Code of Practice* as available on the QCA website, the subject criteria for GCE Human Biology and *The Statutory Regulation of External Qualifications 2004*.

5.9 Arrangements for Candidates with Particular Requirements

For candidates who are unable to complete the full assessment or whose performance may be adversely affected through no fault of their own, teachers should consult the *Access Arrangements and Special Consideration: Regulations and Guidance Relating to Candidates who are Eligible for Adjustments in Examinations* produced by the Joint Council. In such cases, advice should be sought from OCR as early as possible during the course.

5.10 Prohibited Qualifications and Classification Code

Candidates who enter for the OCR GCE specifications may not also enter for any other GCE specification with the certification title *Human Biology* in the same examination series.

Every specification is assigned to a national classification code indicating the subject area to which it belongs. Centres should be aware that candidates who enter for more than one GCE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Achievement and Attainment Tables.

The classification code for these specifications is 1030.

5.11 Coursework Administration/Regulations

Supervision and Authentication

As with all coursework, teachers must be able to verify that the work submitted for assessment is the candidate's own work. Sufficient work must be carried out under direct supervision to allow the teacher to authenticate the coursework marks with confidence.

Submitting marks to OCR

Centres must have made an entry for a unit in order for OCR to supply the appropriate forms or moderator details for coursework. Coursework administration documents are sent to centres on the basis of estimated entries. Marks may be submitted to OCR either via Interchange, on the computer-printed Coursework Mark Sheets (MS1) provided by OCR (sending the top copy to OCR and the second copy to their allocated moderator) or by EDI (centres using EDI are asked to print a copy of their file and sign it before sending to their allocated moderator).

Deadline for the receipt of coursework marks is:
15 May for the June series.

The awarding body must require centres to obtain from each candidate a signed declaration that authenticates the coursework they produce as their own.

For regulations governing coursework, centres should consult the OCR *Administration Guide for General Qualifications.* Further copies of the coursework administration documents are available on the OCR website (www.ocr.org.uk).

Standardisation and Moderation

All internally-assessed coursework is marked by the teacher and internally standardised by the centre. Marks must be submitted to OCR by the agreed date, after which postal moderation takes place in accordance with OCR procedures.

The purpose of moderation is to ensure that the standard for the award of marks in internally-assessed coursework is the same for each centre, and that each teacher has applied the standards appropriately across the range of candidates within the centre.

The sample of work which is submitted to the moderator for moderation must show how the marks have been awarded in relation to the marking criteria.

Minimum Coursework Required

If a candidate submits no work for a unit, then the candidate should be indicated as being absent from that unit on the coursework mark sheets submitted to OCR. If a candidate completes any work at all for that unit then the work should be assessed according to the criteria and marking instructions and the appropriate mark awarded, which may be zero.

6 Other Specification Issues

6.1 Overlap with other Qualifications

There is a degree of overlap between the content of these specifications and those for Advanced GCE Chemistry, Science, Geography and Geology. The links between the specifications may allow for some co-teaching, particularly in the areas of biochemistry, environmental science and microbiology.

Examples of overlap include:

Chemistry

F221: *Molecules, Blood and Gas Exchange*

Geography

F224: *Energy, Reproduction and Populations*

6.2 Progression from these Qualifications

Throughout the course, candidates are introduced to the ideas underpinning the study of human biology and their application to a variety of contexts, both everyday and more specialised. Their understanding of How Science Works in human biology is deepened.

The specification thus provides a valuable education for candidates who take their study of human biology no further. It is also an excellent foundation for further study of human biology, biomedical science or other biological sciences.

6.3 Key Skills Mapping

These specifications provide opportunities for the development of the Key Skills of *Communication*, *Application of Number*, *Information Technology*, *Working with Others*, *Improving Own Learning and Performance* and *Problem Solving* at Levels 2 and/or 3. However, the extent to which this evidence fulfils the Key Skills criteria at these levels will be totally dependent on the style of teaching and learning adopted for each unit.

The following table indicates where opportunities *may* exist for at least some coverage of the various Key Skills criteria at Levels 2 and/or 3 for each unit.

Unit	C				AoN			IT			WwO			IoLP			PS		
	.1a	.1b	.2	.3	.1	.2	.3	.1	.2	.3	.1	.2	.3	.1	.2	.3	.1	.2	.3
F221	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
F222	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
F223				✓	✓	✓	✓	✓	✓	✓									
F224	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
F225	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
F226		✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓

6.4 Spiritual, Moral, Ethical, Social, Legislative, Economic and Cultural Issues

These specifications offer opportunities that can contribute to an understanding of these issues in the following topics:

- a sense of awe and wonder at the way in which the human body functions to produce a healthy, co-ordinated individual;
- that humans are living organisms holding a place in nature and society, as well as having a profound effect on them;
- the social, moral and ethical implications of population control;
- the social, moral and ethical implications of genetic engineering and stem cell technology;
- the economic importance of the pharmaceutical industry and biotechnology.

6.5 Sustainable Development, Health and Safety Considerations and European Developments

These specifications support these issues, consistent with current EU agreements, in the following topics:

- the conflict between agricultural productivity and conservation;
- ecosystem management and sustainable community practices;
- safe laboratory practice;
- the risk factors associated with coronary heart disease;
- smoking and related diseases;

- cancer;
- maternal health and fetal development;
- the control of infectious diseases;
- precautions to reduce the spread of resistant bacteria;
- immunity and vaccination;
- diet and malnutrition;
- effects of exercise on the body;
- the risks associated with performance-enhancing drugs;
- brain and spinal injuries;
- effects of alcohol on the body;
- contraception, IVF and abortion;
- hormone replacement therapy;
- genetic disorders;
- genetic screening and counselling;
- diabetes and its treatment;
- the effects of ageing on the locomotory system;
- Alzheimer's disease;
- cataracts;
- complementary therapies.

Although these specifications do not make specific reference to scientific aspects of the European Dimension, it may be drawn into the course of study in many ways, eg the Human Genome Project and disease transmission and control.

6.6 Avoidance of Bias

OCR has taken great care in the preparation of these specifications and assessment materials to avoid bias of any kind.

6.7 Language

These specifications and associated assessment materials are in English only.

6.8 Disability Discrimination Act Information Relating to these Specifications

AS/A levels often require assessment of a broad range of competences. This is because they are general qualifications and, as such, prepare candidates for a wide range of occupations and higher level courses.

The revised AS/A level qualification and subject criteria were reviewed to identify whether any of the competences required by the subject presented a potential barrier to any disabled candidates. If this was the case, the situation was reviewed again to ensure that such competences were included only where essential to the subject. The findings of this process were discussed with disability groups and with disabled people.

Reasonable adjustments are made for disabled candidates in order to enable them to access the assessments. For this reason, very few candidates will have a complete barrier to any part of the assessment. Information on reasonable adjustments is found in *Access Arrangements and Special Consideration Regulations and Guidance Relating to Candidates who are Eligible for Adjustments in Examinations* produced by the Joint Council (refer to Section 5.9 of this specification).

Candidates who are still unable to access a significant part of the assessment, even after exploring all possibilities through reasonable adjustments, may still be able to receive an award. They would be given a grade on the parts of the assessment they have taken and there would be an indication on their certificate that not all of the competences have been addressed. This will be kept under review and may be amended in the future.

Practical assistants may be used for manipulating equipment and making observations. Technology may help visually impaired students to take readings and make observations.

Appendix A: Performance Descriptions

Performance descriptions have been created for all GCE subjects. They describe the learning outcomes and levels of attainment likely to be demonstrated by a representative candidate performing at the A/B and E/U boundaries for AS and A2.

In practice most candidates will show uneven profiles across the attainments listed, with strengths in some areas compensating in the award process for weaknesses or omissions elsewhere. Performance descriptions illustrate expectations at the A/B and E/U boundaries of the AS and A2 as a whole; they have not been written at unit level.

Grade A/B and E/U boundaries should be set using professional judgement. The judgement should reflect the quality of candidates' work, informed by the available technical and statistical evidence. Performance descriptions are designed to assist examiners in exercising their professional judgement. They should be interpreted and applied in the context of individual specifications and their associated units. However, performance descriptions are not designed to define the content of specifications and units.

The requirement for all AS and A level specifications to assess candidates' quality of written communication will be met through one or more of the assessment objectives.

The performance descriptions have been produced by the regulatory authorities in collaboration with the awarding bodies.

AS performance descriptions for human biology

	Assessment Objective 1	Assessment Objective 2	Assessment Objective 3
Assessment Objectives	**Knowledge and understanding of science and of How Science Works** Candidates should be able to: • recognise, recall and show understanding of scientific knowledge; • select, organise and communicate relevant information in a variety of forms.	**Application of knowledge and understanding of science and of How Science Works** Candidates should be able to: • analyse and evaluate scientific knowledge and processes; • apply scientific knowledge and processes to unfamiliar situations including those related to issues; • assess the validity, reliability and credibility of scientific information.	**How Science Works** Candidates should be able to: • demonstrate and describe ethical, safe and skilful practical techniques and processes, selecting appropriate qualitative and quantitative methods; • make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy; • analyse, interpret, explain and evaluate the methodology, results and impact of their own and others' experimental and investigative activities in a variety of ways.
A/B boundary Performance Descriptions	Candidates characteristically: a) demonstrate knowledge and understanding of most principles, concepts and facts from the AS specification; b) select relevant information from the AS specification; c) organise and present information clearly in appropriate forms using scientific terminology.	Candidates characteristically: a) apply principles and concepts in familiar and new contexts involving only a few steps in the argument; b) describe significant trends and patterns shown by data presented in tabular or graphical form; interpret phenomena with few errors; and present arguments and evaluations clearly; c) comment critically on statements, conclusions or data; d) carry out accurately most of the calculations specified for AS; e) translate successfully data that is presented as prose, diagrams, drawings, tables or graphs from one form to another.	Candidates characteristically: a) devise and plan experimental and investigative activities, selecting appropriate techniques; b) demonstrate safe and skilful practical techniques and comment effectively on ethical issues; c) make observations and measurements with appropriate precision and record them methodically; d) interpret, explain, evaluate and communicate the results of their own and others' experimental and investigative activities, in appropriate contexts.

E/U boundary Performance Descriptions	Candidates characteristically: a) demonstrate knowledge and understanding of some principles and facts from the AS specification; b) select some relevant information from the AS specification; c) present information using basic terminology from the AS specification.	Candidates characteristically: a) apply a given principle to material presented in familiar or closely related contexts involving only a few steps in the argument; b) describe some trends or patterns shown by data presented in tabular or graphical form; c) identify, when directed, inconsistencies in conclusions or data; d) carry out some steps within calculations; e) translate data successfully from one form to another, in some contexts.	Candidates characteristically: a) devise and plan some aspects of experimental and investigative activities; b) demonstrate safe practical techniques and comment on ethical issues; c) make observations and measurements and record them; d) interpret, explain and communicate some aspects of the results of their own and others' experimental and investigative activities, in appropriate contexts.

A2 performance descriptions for human biology

	Assessment Objective 1	Assessment Objective 2	Assessment Objective 3
Assessment Objectives	**Knowledge and understanding of science and of How Science Works** Candidates should be able to: • recognise, recall and show understanding of scientific knowledge • select, organise and communicate relevant information in a variety of forms.	**Application of knowledge and understanding of science and of How Science Works** Candidates should be able to: • analyse and evaluate scientific knowledge and processes • apply scientific knowledge and processes to unfamiliar situations including those related to issues • assess the validity, reliability and credibility of scientific information.	**How Science Works** Candidates should be able to: • demonstrate and describe ethical, safe and skilful practical techniques and processes, selecting appropriate qualitative and quantitative methods • make, record and communicate reliable and valid observations and measurements with appropriate precision and accuracy • analyse, interpret, explain and evaluate the methodology, results and impact of their own and others' experimental and investigative activities in a variety of ways.
A/B boundary Performance Descriptions	Candidates characteristically: a) demonstrate detailed knowledge and understanding of most principles, concepts and facts from the A2 specification b) select relevant information from the A2 specification c) organise and present information clearly in appropriate forms using scientific terminology.	Candidates characteristically: a) apply principles and concepts in familiar and new contexts involving several steps in the argument b) describe significant trends and patterns shown by complex data presented in tabular or graphical form; interpret phenomena with few errors; and present arguments and evaluations clearly c) evaluate critically any statements, conclusions or data d) carry out accurately most of the calculations specified for A2; and apply the principles of statistical analysis when directed e) translate successfully data that is presented as prose, diagrams, drawings, tables or graphs from one form to another f) select a wide range of facts, principles and concepts from both AS and A2 specifications g) link together appropriate facts principles and concepts from different areas of the specification.	Candidates characteristically: a) devise and plan experimental and investigative activities, selecting appropriate techniques b) demonstrate safe and skilful practical techniques and comment effectively on ethical issues c) make observations and measurements with appropriate precision and record these methodically d) interpret, explain, evaluate and communicate the results of their own and others' experimental and investigative activities, in appropriate contexts e) use an appropriate statistical technique to assess the validity of a hypothesis.

E/U boundary Performance Descriptions	Candidates characteristically: a) demonstrate knowledge and understanding of some principles, concepts and facts from the A2 specification b) select some relevant information from the A2 specification c) present information using basic terminology from the A2 specification.	Candidates characteristically: a) apply given principles or concepts in familiar and new contexts involving a few steps in the argument b) describe, and provide a limited explanation of, trends or patterns shown by complex data presented in tabular or graphical form c) identify, when directed, inconsistencies in conclusions or data d) carry out some steps within calculations e) translate data successfully from one form to another, in some contexts f) select some facts, principles and concepts from both AS and A2 specifications g) put together some facts, principles and concepts from different areas of the specification.	Candidates characteristically: a) devise and plan some aspects of experimental and investigative activities b) demonstrate safe practical techniques and comment on ethical issues c) make observations and measurements and record them d) interpret, explain and communicate some of the results of their own and others' experimental and investigative activities, in appropriate contexts e) use a given statistical technique.

Appendix B: Assessment Criteria for A2 Unit F226: *Extended Investigation in Human Biology*

This unit is teacher assessed and externally moderated.

In defining the assessment criteria, it is recognised that investigative tasks vary widely, both in the procedures used and in the nature of the evidence collected by the candidate.

The mark descriptors within each skill are intended to provide guidance to teachers on how to reward achievement.

For examples of suitable Extended Investigations, teachers should refer to the GCE Human Biology *Teacher Support: Extended Investigation Handbook.* Copies can be ordered from OCR Publications or downloaded from the OCR website (**www.ocr.org.uk**).

Candidates carry out a single extended investigation. The topic **must** be taken from an area of the **A2** Human Biology specification.

Candidates are expected to spend about **four hours** collecting data as part of their investigation.

Candidates are also expected to spend an appropriate amount of time designing their data collection strategy and analysing and evaluating the results of the investigation.

Candidates are assessed in three skill areas, **A**, **B** and **C**. The marks for the three skill areas are added together to provide a total mark out of 40 for this unit, which is then submitted to OCR.

Authentication and marking of candidates' work

Candidates must complete and hand in a separate report for each skill area. Teachers must verify that, to the best of their knowledge, each report is the work of the candidate concerned.

Skill A (15 marks)

Candidates must complete and hand in their report for Skill A before they begin to collect data. The report **must** be authenticated and marked by the teacher and **a copy** returned to the candidate.

In this skill area candidates should:

- identify and describe the aims of the investigation;
- describe the biological knowledge that they have researched in order to help them devise their data collection strategy;

- describe and justify the choice of the equipment, materials and experimental procedures that they will use to achieve the aims of the investigation;

- produce a risk assessment;

- include a list of references to the key sources that they have used to help them devise their data collection strategy.

Skill B (10 marks)

Candidates must complete and hand in their report for Skill B as soon as they have finished collecting data. They are expected to retain a copy of this section to allow them to analyse and evaluate their data. The report should be authenticated and marked by the teacher.

In this skill area candidates should:

- record, in an appropriate format, the observations and measurements made in an appropriate manner;

- ensure that there are a sufficient number of good quality measurements;

- process their raw data and present the processed data in an appropriate format.

Skill C (15 marks)

Candidates must complete and hand in their report for Skill C after they have completed their analysis and evaluation of the whole investigation. The report should be authenticated and marked by the teacher.

In this skill area candidates should:

- describe and explain the trends and patterns in their data, using appropriate biological knowledge and understanding;

- relate the data collected to the original aims of the investigation;

- evaluate the limitations of their data collection strategy;

- assess the validity of the conclusions that they have made.

Moderation of candidates' work

Where candidates are assessed by different teachers within a centre, a system of internal moderation must be devised and used to ensure that the same standards are being used in the award of marks to all candidates.

Skill A

Designing a data collection strategy (15 marks)

Mark	Descriptor
	The candidate:
A1	States a scientifically valid question that can be answered by the investigation.
A2	States a testable **quantitative** prediction.
A3	Uses detailed, relevant scientific knowledge and understanding from Unit F221 and/or F222 to justify the stated question and/or prediction.
A4	Uses detailed, relevant scientific knowledge and understanding from Unit F224 and/or F225 to justify the stated question and/or prediction.
A5	Identifies an independent variable, a dependent variable and factors to be controlled or taken into account.
A6	Proposes an appropriate range for, and number of values of, the independent variable and an appropriate number of measurements of the dependent variable.
A7	Uses, appropriately referenced, material from one secondary source to design an appropriate data collection strategy.
A8	Uses, appropriately referenced, material from a second secondary source or uses data collected from preliminary studies to design an appropriate data collection strategy.
A9	Produces a written risk assessment for the data collection strategy.

A10	Describes, in detail, a strategy for collecting precise and accurate data.
A11	Sequences the steps in the data collection strategy in a clear, logical manner.
A12	Justifies the proposed data collection strategy in terms of maximising the validity of the data that will be collected.
A13	Proposes an appropriate format for recording the raw (independent and dependent variable) data that will be collected.
A14	States how the raw data collected will be processed in order to answer the question asked or test the prediction made.
A15	Proposes an appropriate format for presenting the processed data graphically.

Skill B

Collecting and processing raw data (10 marks)

Mark	Descriptor
	The candidate:
B1	Collects data in a safe manner and, if appropriate, an ethical manner.
B2	Collects and records data sufficient to answer the stated question and/or prediction.
B3	Produces a report summarising how the effects of uncontrolled variables and other factors were minimised during the collection of data.
B4	Records raw data with appropriate precision and accuracy.
B5	Records raw data in an appropriate format.
B6	Carries out simple processing of the raw data.
B7	Carries out detailed processing of the raw data.
B8	Uses significant figures appropriately when processing the raw data.
B9	Identifies, using an appropriate method, anomalous values (outliers) in the raw data.
B10	Plots, **by hand**, an appropriate graph of the **processed** data.

Skill C

Analysis and Evaluation (15 marks)

Mark	Descriptor
	The candidate:
C1	Describes the trends and patterns in the processed data.
C2	Makes a valid statement about the trends and patterns in the processed data and the original question asked and/or prediction made.
C3	Uses detailed scientific knowledge and understanding from Unit F221 and/or F222 to explain the trends and patterns in the processed data.
C4	Uses detailed scientific knowledge and understanding from Unit F224 and/or F225 to explain the trends and patterns in the processed data.
C5	Comments on the reliability of the raw data collected.
C6	Comments on the accuracy of the raw data collected.
C7	Comments on the reliability of the data collection strategy.
C8	Lists **three** significant limitations in the data collection strategy that will have affected the accuracy and/or precision of the raw data collected.
C9	Explains the effect one significant limitation will have had on the accuracy and/or precision of the raw data collected.
C10	Explains the effect a second significant limitation will have had on the accuracy and/or precision of the raw data collected.

C11	Lists **three** improvements to the data collection strategy that would improve the accuracy and precision of the raw data collected.
C12	Explains the effect one improvement would have on the accuracy and precision of the raw data collected.
C13	Explains the effect a second improvement would have on the accuracy and precision of the raw data collected.
C14	Comments on the validity of the outcome of the investigation.
C15	Uses appropriate technical terms, spelled correctly, throughout the investigation.

Appendix C: How Science Works

Incorporating Section 3.6 of the QCA criteria in the specification.

References in this specification to *How Science Works* (HSW) are to the following statements. A number of Learning Outcomes have been identified that exemplify these criteria, though all Learning Outcomes can be used to address *How Science Works*, particularly statement 2. These references have been written by re-arranging the statements in Section 3.6 of the QCA Subject Criteria.

1. Use theories, models and ideas to develop and modify scientific explanations.

2. Use knowledge and understanding to pose scientific questions, define scientific problems, present scientific arguments and scientific ideas.

3. Use appropriate methodology, including ICT, to answer scientific questions and solve scientific problems.

4. Communicate information and ideas in appropriate ways using appropriate terminology.

5. Obtaining, analysing and evaluation data:

- **a.** carry out experimental and investigative activities, including appropriate risk management, in a range of contexts.
- **b.** analyse and interpret data to provide evidence, recognising correlations and causal relationships.
- **c.** evaluate methodology, evidence and data, and resolve conflicting evidence.

6. Applications, implications and ethical considerations:

- **a.** consider applications and implications of science and appreciate their associated benefits and risks.
- **b.** consider ethical issues in the treatment of humans, other organisms and the environment.

7. Scientific knowledge in its social context:

- **a.** appreciate the tentative nature of scientific knowledge.
- **b.** appreciate the role of the scientific community in validating new knowledge and ensuring integrity.
- **c.** appreciate the ways in which society uses science to inform decision making.

Appendix D: GCSE Criteria for Science

The **Links** section at the beginning of each module contains references to the QCA GCSE Criteria for Science.

These criteria define the subject-specific essentials for **GCSE Science** (section 3.7) and **GCSE Additional Science** (section 3.9) specifications.

The specific references are:

Section 3.7 (i)

organisms and health

(a) organisms are interdependent and adapted to their environments.

(b) variation within species can lead to evolutionary changes and similarities and differences between species can be measured and classified.

(c) the ways in which organisms function are related to the genes in their cells.

(d) chemical and electrical signals enable body systems to respond to interna and external changes, in order to maintain the body in an optimum state.

(e) human health is affected by a range of environmental and inherited factors, by the use and misuse of drugs and by medical treatments.

(iv) **environment, Earth and universe**

(a) the effects of human activity on the environment can be assessed using living and non-living indicators.

Section 3.9 (i)

cells and growth

(a) chemical reactions essential for life and growth take place inside cells. Differences between plant and animal cells lead to different patterns of growth and development.

energy flows and element cycles

(b) plant biomass provides energy and nutrients for other organisms. Through the consumption of organisms and decay, energy flows through the biosphere and chemical elements are recycled within it.

Appendix E: Mathematical Requirements

In order to be able to develop their skills, knowledge and understanding in human biology, students need to have been taught, and to have acquired competence in, the appropriate areas of mathematics relevant to the subject as indicated below.

1 Arithmetic and numerical computation:

- (a) recognise and use expressions in decimal and standard form;
- (b) use ratios, fractions and percentages;
- (c) make estimates of the results of calculations (without using a calculator);
- (d) use calculators to find and use power, exponential and logarithmic functions.

2 Handling data:

- (a) use an appropriate number of significant figures;
- (b) find arithmetic means;
- (c) construct and interpret frequency tables and diagrams, bar charts and histograms;
- (d) understand simple probability;
- (e) understand the principles of sampling as applied to scientific data;
- (f) understand the terms mean, median and mode;
- (g) use a scatter diagram to identify a correlation between two variables;
- (h) use a simple statistical test;
- (i) make order of magnitude calculations.

3 Algebra:

- (a) change the subject of an equation;
- (b) substitute numerical values into algebraic equations using appropriate units for physical quantities.

4 Graphs:

- (a) translate information between graphical, numerical and algebraic forms;
- (b) plot two variables from experimental or other data;
- (c) calculate rate of change from a graph showing a linear relationship.

Appendix F: Health and Safety

In UK law, health and safety is the responsibility of the employer. For most establishments entering candidates for AS and Advanced GCE, this is likely to be the local education authority or the governing body. Employees, i.e. teachers and lecturers, have a duty to cooperate with their employer on health and safety matters. Various regulations, but especially the COSHH Regulations 2002 and the Management of Health and Safety at Work Regulations 1999, require that before any activity involving a hazardous procedure or harmful micro-organisms is carried out, or hazardous chemicals are used or made, the employer must provide a risk assessment. A useful summary of the requirements for risk assessment in school or college science can be found at www.ase.org.uk/htm/teacher_zone/safety_in_science_education.php.

For members, the CLEAPSS® guide, *Managing Risk Assessment in Science** offers detailed advice. Most education employers have adopted a range of nationally available publications as the basis for their Model Risk Assessments. Those commonly used include:

- *Safety in Science Education*, DfEE, 1996, HMSO, ISBN 0 11 270915 X.

  Now out of print but sections are available at:
  www.ase.org.uk/htm/teacher_zone/safety_in_science_education.php;

- *Topics in Safety*, 3rd edition, 2001, ASE ISBN 0 86357 316 9;

- *Safeguards in the School Laboratory*, 11th edition, 2006, ASE ISBN 978 0 86357 408 5;

- CLEAPSS® *Hazcards*, 2007 edition and later updates*;

- CLEAPSS® *Laboratory Handbook**;

- *Hazardous Chemicals*, A Manual for Science Education, 1997, SSERC Limited

  ISBN 0 9531776 0 2 (see www.sserc.org.uk/public/hazcd/whats_new.htm).

Where an employer has adopted these or other publications as the basis of their model risk assessments, an individual school or college then has to review them, to see if there is a need to modify or adapt them in some way to suit the particular conditions of the establishment.

Such adaptations might include a reduced scale of working, deciding that the fume cupboard provision was inadequate or the skills of the candidates were insufficient to attempt particular activities safely. The significant findings of such risk assessment should then be recorded, for example on schemes of work, published teachers guides, work sheets, etc. There is no specific legal requirement that detailed risk assessment forms should be completed, although a few employers require this.

Where project work or individual investigations, sometimes linked to work-related activities, are included in specifications this may well lead to the use of novel procedures, chemicals or micro-organisms, which are not covered by the employer's model risk assessments. The employer should have given guidance on how to proceed in such cases. Often, for members, it will involve contacting CLEAPSS® (or, in Scotland, SSERC).

*****These, and other CLEAPSS® publications, are on the CLEAPSS® Science Publications CD-ROM issued annually to members. Note that CLEAPSS® publications are only available to members. For more information about CLEAPSS® go to www.cleapss.org.uk. In Scotland, SSERC (www.sserc.org.uk) has a similar role to CLEAPSS® and there are some reciprocal arrangements.

Appendix G: Using OCR Interchange to download Practical Skills tasks and Advance Notice articles

All materials for the assessment of GCE Human Biology AS Practical Skills (for Unit F223) as well as the Advance Notice article (for Unit F222) can be obtained from OCR Interchange.

How to use OCR Interchange

OCR Interchange is a secure extranet enabling registered users to administer qualifications on-line. Your Examinations Officer is probably using OCR Interchange to administer qualifications already. If this is not the case, then your centre will need to register.

Your Examinations Officer will be able to:*

- download the relevant documents for you by adding the role of 'Science Co-ordinator' to their other roles; or
- create a new user account for you (adding the Science Co-ordinator role) so that you can access the GCE Human Biology pages and download documents when you need them.

*Note that in order to assign the role of Science Co-ordinator to others, the Examinations Officer will need to hold the role of Centre Administrator.

The website address for Interchange is:

https://interchange.ocr.org.uk

The teacher who has downloaded these materials is responsible for ensuring that any pages labelled **confidential** are stored securely so that students do not have the opportunity to access them.

It is intended that the circulation of the Practical Tasks and Advance Notice article is limited to those students who are currently undertaking that task. These materials should be photocopied and issued to students at the start of the activity. Numbering the documents may help to keep track of them.

Registering for Interchange

If your Examinations Officer is not already a registered user of Interchange then he/she will need to register before the Human Biology tasks or Advance Notice article can be downloaded.

This is a straightforward process:

- Go to the website – https://interchange.ocr.org.uk
- The first page has a New User section
- Click on Sign Up to access the OCR Interchange Agreement Form 1
- Download this document and fill in your details
- Return form by post to OCR Customer Contact Centre, Westwood Way, Coventry, CV4 8JQ or fax the form back to 024 76 851633
- OCR will then contact the Head of Centre with the details needed for the Examinations Officer to access OCR Interchange.

Appendix H: Procedures for the Advance Notice Article in Unit F222

This will consist of an article relevant to the content of Unit F222.
It will be available for download *via* OCR Interchange **at least** five weeks before the examination.

The instructions for teachers and candidates that will accompany the Advance Notice article are given below:

Notes for Guidance (candidates)

1. This leaflet contains an article which is needed in preparation for a question in the externally assessed examination F222.

2. You will need to read the article carefully and also have covered the learning outcomes for Unit F222 (Growth, Development and Disease). The examination paper will contain questions on the article. You will be expected to apply your knowledge and understanding of the work covered in Unit F222 to answer this question.

3. You can seek advice form your teacher about the content of the article and you can discuss it with others in your class. You may also investigate the topic yourself using any resources available to you.

4. You will not be able to bring your copy of the article, or other materials, into the examination. The examination paper will contain a fresh copy of the article as an insert.

5. You will not have time to read this article for the first time in the examination if you are to complete the examination paper within the specified time. However, you should refer to the article when answering the questions.

Notes for Guidance (teachers)

1. This Advance Notice material should be issued to candidates on or after the date shown on the front cover of the candidate instruction sheet at the discretion and convenience of the centre. Candidates can be given the material at any point, but it is suggested that this should be at least four weeks before the examination date.

2. Candidates will need to read the article carefully. Time can be built into the teaching programme to introduce the article content. Candidates should be able to discuss the article freely and be given support and advice in the interpretation of the content so that they are able to answer the questions based on the article in the externally assessed examination. Candidates should also be encouraged to investigate the topics covered in the article for themselves.

3. Candidates will be expected to apply their knowledge and understanding of Unit F222 to questions based on the article.

4. The Advance Notice material must not be taken into the examination. The examination paper F222 will contain a fresh copy of the article, as an insert. Candidates should be reminded that they do not have sufficient time during the examination to read the article for the first time. They should, however, refer to the article printed in the insert in the examination paper to help them to answer the questions.