Oxford Cambridge and RSA Examinations

RECOGNISING ACHIEVEMENT

OCR ADVANCED SUBSIDIARY GCE IN HUMAN BIOLOGY 3886
OCR ADVANCED GCE IN HUMAN BIOLOGY 7886

Foreword

This booklet contains OCR's Advanced Subsidiary GCE (AS) and Advanced GCE (A Level) **Human Biology** specifications for teaching from September 2003.

The Advanced Subsidiary is assessed at a standard appropriate for candidates who have completed the first year of study of a two year Advanced GCE course: i.e. between GCSE and Advanced GCE. It forms the first half of the Advanced GCE course in terms of teaching time and content. When combined with the second half of the Advanced GCE course, known as 'A2', the Advanced Subsidiary forms 50% of the assessment of the total Advanced GCE. However, the Advanced Subsidiary can be taken as a 'stand-alone' qualification. A2 is weighted at 50% of the total assessment of the Advanced GCE.

The first year of certification of the OCR Advanced Subsidiary GCE in Human Biology is 2004.

The first year of certification of the OCR Advanced GCE in Human Biology is 2005.

In these specifications, the term **module** is used to describe specified teaching and learning requirements. The term **unit** describes a unit of assessment.

Each teaching and learning module is assessed by its associated unit of assessment.

These specifications meet the requirements of the *Common Criteria* (QCA, 1999), the *GCE Advanced Subsidiary and Advanced Level Qualification-Specific Criteria* (QCA, 1999) and the relevant Subject Criteria (QCA, 1999).

Support and In-Service Training for Teachers

To support teachers using these specifications, OCR will make the following materials and services available:

- direct access to the Science subject team;
- a full programme of In-Service Training (INSET) meetings;
- up-to-date copies of these specifications;
- specimen question paper and mark scheme, available from the Publications Department (telephone 0870 870 6622; fax: 0870 870 6621; e-mail: publications@ocr.org.uk);
- past question papers and mark-schemes after each examination session;
- teacher support materials, including a Human Biology Coursework Guidance Handbook;
- written advice on coursework proposals;
- individual feedback to each Centre on the moderation of coursework;
- a report on the examination, compiled by the senior examining personnel after each examination session;
- OCR website(www.ocr.org.uk).

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SECTION A: SPECIFICATION SUMMARY

COURSE OUTLINE

The OCR Advanced Subsidiary GCE and Advanced GCE Human Biology specifications cover the relevant content identified in the Biology Subject Criteria (QCA 1999) in compulsory units.

The assessment of investigative work is by coursework in both AS and A2.

SPECIFICATION CONTENT

There are **four** content modules of equal size; the content is set in 'real world' contexts:

2856: Blood, Circulation and Gaseous Exchange;
2857: Growth, Development and Disease;
2866: Energy, Control and Reproduction;
2867: Genetics, Homeostasis and Ageing.

SCHEME OF ASSESSMENT

The Advanced Subsidiary GCE forms 50% of the assessment weighting of the full Advanced GCE. Advanced Subsidiary GCE is assessed at a standard between GCSE and Advanced GCE and can be taken as a stand-alone specification, or as the first part of the full Advanced GCE course.

Assessment is by means of **three** units of assessment for Advanced Subsidiary GCE and **six** units of assessment for Advanced GCE.

Advanced Subsidiary GCE

Candidates take Units 2856, 2857 and 2858.

In Unit 2858, candidates take Components 01 and 02.

Advanced GCE

Candidates take Units 2856, 2857, 2858, 2866, 2867 and 2868.

In Unit 2858, candidates take Components 01 and 02.

UNITS OF ASSESSMENT

Level	Unit/ Component No.	Name	Raw Mark Total	Duration	Mode of Assessment	Weighting %	
						AS	A Level
AS	2856	Blood, Circulation and Gaseous Exchange	60	60 mins	Written Exam	30	15
AS	2857	Growth, Development and Disease	60	60 mins	Written Exam	30	15
AS	2858	Case Studies/ Investigative Skills in Human Biology					
	2858/01	Case Studies	45	45 mins	Written Exam	20	10
	2858/02	Investigative Skills	60	–	Coursework	20	10
A2	2866	Energy, Control and Reproduction	90	90 mins	Written Exam		15
A2	2867	Genetics, Homeostasis and Ageing	120	120 mins	Written Exam		20
A2	2868	Extended Investigation in Human Biology	90	–	Coursework		15

In Unit 2858, candidates take both Components 01 and 02.

QUESTION PAPER REQUIREMENTS

The question papers for Units 2856 and 2857 have a common format. They contain both structured questions and questions which require more extended answers. All questions on these papers are compulsory. Quality of Written Communication is assessed within those parts of the questions that require more extended answers.

The question paper for Unit 2858 (Component 01) is based on pre-release material published to candidates several weeks before the examination as shown on the GCE timetable. The questions comprise structured parts and parts requiring more extended answers. All questions are compulsory.

The question paper for Unit 2866 includes questions on this unit and synoptic questions that require candidates to draw together knowledge gained in the study of AS Modules 2856 and 2857. The questions comprise structured parts and parts requiring more extended answers. All questions are compulsory.

The question paper for Unit 2867 includes questions on this unit and synoptic questions that require candidates to draw together knowledge gained in the study of AS Modules 2856 and 2857, and A2 Module 2867. The questions comprise structured parts and parts requiring more extended answers. All questions are compulsory.

COURSEWORK

For Advanced Subsidiary GCE (Unit 2858, Component 02), candidates are internally assessed on **four** investigative skills. **One** mark per skill must be awarded for each candidate. Work is marked by the teacher, internally standardised in the Centre, and externally moderated by OCR.

For Advanced GCE (Unit 2868), candidates are internally assessed on **seven** investigative skills in a single extended investigation. **One** mark per skill must be awarded for each candidate. Work is marked by the teacher, internally standardised in the Centre, and externally moderated by OCR. There is an element of synoptic assessment in Unit 2868.

KEY SKILLS

Key Skills signposting appears in **three** sections of OCR specifications:

- *Key Skills Coverage* – the matrix aids curriculum managers in mapping the potential Key Skills coverage within each OCR Advanced Subsidiary/Advanced GCE specification.
- *Specification Content (Section 5)* – the specific evidence references enable subject teachers to identify opportunities for meeting specific Key Skills evidence requirements within the modules they are delivering.
- *Appendix A* – provides guidance to teachers in trying to identify those parts of their normal teaching programme which might most appropriately be used to develop or provide evidence for the Key Skills signposted.

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* as required by QCA's subject criteria for Biology.

Through class work, coursework and preparation for external assessment, candidates may produce evidence for Key Skills at Level 3. However, the extent to which this evidence fulfils the requirements of the QCA Key Skills specifications at this level will be dependent on the style of teaching and learning adopted for each module. In some cases, the work produced may meet the evidence requirements of the Key Skills specifications at a higher or lower level.

Throughout Section 5 the symbol  is used in the margin to highlight where Key Skills development opportunities are signposted. The following abbreviations are used to represent the above Key Skills:

C = Communication
N = Application of Number
IT = Information Technology
WO = Working with Others
LP = Improving Own Learning and Performance
PS = Problem Solving

These abbreviations are taken from the Key Skills specifications for use in programmes starting from September 2000. References in Section 5 and Appendix A, for example **IT3.1**, show the Key Skill (IT), the level (3) and subsection (1).

Centres are encouraged to consider the OCR Key Skills scheme to provide certification of Key Skills for their candidates.

KEY SKILLS COVERAGE

For each module, the following matrix indicates those Key Skills for which opportunities for at least *some* coverage of the relevant Key Skills unit (at Level 3) exist.

Module	Communication	Application of Number	Information Technology	Working with Others	Improving own Learning and Performance	Problem Solving
2856	✔		✔	✔		
2857	✔		✔	✔	✔	
2858	✔	✔	✔		✔	✔
2866	✔		✔	✔		
2867	✔		✔	✔		
2868	✔	✔	✔		✔	✔

OVERLAP WITH OTHER QUALIFICATIONS

There are overlaps between this specification in Human Biology and the OCR GCE specifications for Chemistry, Physics A, Science, Geography A and Geography B. There are also overlaps between this specification and OCR VCE specifications in Science and Health and Social Care. The links between the specifications may allow for some co-teaching, especially in the areas of biochemistry, microbiology and health science (See Section 1.4).

SECTION B: GENERAL INFORMATION

1 Introduction

1.1 RATIONALE

These OCR Human Biology specifications lead to qualifications at Advanced Subsidiary GCE and Advanced GCE in Human Biology. Candidates take **three** units of assessment for Advanced Subsidiary GCE and a further **three** units for A2 if they are seeking an Advanced GCE award. Advanced Subsidiary and A2 combined constitute the full Advanced GCE specification.

These specifications have been developed for candidates who wish to continue with a study of biology beyond Foundation or Intermediate Level, specialising in the study of those aspects of biology that relate particularly to humans. This specification adopts an approach based on situations in the 'real world', e.g. the biomedical and caring professions, health, alternative medicine, conservation and social issues, current research, ethics, and sports and leisure studies. These give the subject relevance and interest. Examples of 'real world' contexts are suggested in each section of the specification and the learning outcomes are linked to these. The scheme of assessment has been constructed to reflect this. Some questions on the written papers are set in these contexts or relate to applications of Human Biology. Coursework assessment, which is a requirement in both AS and A2, may be based, if candidates wish, on secondary data collected during work experience placements, or other secondary sources, such as the Internet, so that their work can have clear relevance. The mark descriptors for the assessment of investigative skills at AS build on those for GCSE Science; the skills cover the same areas as Sc1 at GCSE.

Human Biology is a science subject and as such practical activities and the processes of scientific investigation are an important part of learning, and should not simply be limited to the minimum necessary to meet the coursework requirements.

Some candidates may wish to follow a course for only one year to Advanced Subsidiary GCE, in order to broaden their curriculum. The content relating to a wide range of 'real world' contexts make the specification of general interest and it complements and supports studies in many other subjects, including environmental science, psychology, health and child care, social studies and sports science, as well as the other sciences. Other candidates will continue for a further year extending their course to Advanced GCE. Such a course prepares candidates to progress into further or higher education, to follow vocational or academic courses in biomedicine or health care, biological sciences, conservation, social science, sports and leisure studies or related subjects, or to enter employment where a knowledge of Human Biology would be useful. Study of Advanced Subsidiary GCE or Advanced GCE Human Biology should also be seen as making a contribution towards life-long learning.

The layout of the content of the specification indicates both the learning outcomes expected and the contexts in which they should be considered. Questions on the written papers will be set solely on the learning outcomes, but if teaching is in the contexts given, students will be well prepared to answer examination questions and these contexts may also provide stimuli for coursework tasks.

The Advanced Subsidiary GCE specification builds from grades CC in GCSE Science: Double Award, or equivalent in Science: Biology. For this reason, recommended prior knowledge for the Advanced Subsidiary units, in Section 5, is described in terms of National Curriculum statements. However, candidates from other educational backgrounds with equivalent experience will have the necessary prior knowledge.

It is expected that social, economic, ethical, medical and technological aspects of Human Biology will be incorporated into the delivery of these specifications. References to these aspects of Human Biology are integrated into the units throughout the course, for example, disease prevention (Module 2856), stem cell technology (Module 2857), the enhancement of athletic performance (Module 2866) and genetic modification (Module 2867).

1.2 CERTIFICATION TITLE

These qualifications are shown on a certificate as

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

1.3 LANGUAGE

These specifications and associated assessment materials are available in English only.

1.4 OVERLAP WITH OTHER QUALIFICATIONS

There are overlaps between these specifications in Human Biology and the OCR GCE specifications for Chemistry, Physics A, Science, Geography A, Geography B. There are also overlaps between these specifications and the OCR VCE specifications for Science and Health and Social Care. The links between the specifications may allow for some co-teaching, especially in the areas of biochemistry, physiology and microbiology. Listed below are some examples of the links between Human Biology and the other specifications. The list is not intended to be exhaustive. Teachers will find other such links allowing them to support and enhance the learning of their candidates.

1.4.1 Overlap with Chemistry (3882, 7882)

- Foundation Chemistry (Module 2811) supports the study of biological molecules in the Human Biology Advanced Subsidiary specification, Modules 2856 and 2857. Chemical bonding and the properties of water are included in the Chemistry module.
- There are strong links between the Human Biology Advanced Subsidiary specification and the optional module on Biochemistry (Module 2815, Component 02) in the Chemistry specification.

1.4.2 Overlap with Physics A (3883, 7883)

- There are strong links between Section 5.4.2, The Nervous System, in Module 2866 of the Human Biology Advanced GCE specification and the sections on The Eye and Sight and The Ear and Hearing in the optional Health Physics module (2825, Component 05).

1.4.3 Overlap with Science (3885, 7885)

- There are strong links between the AS and A2 Human Biology specifications and those for Science, particularly with reference to topics such as biological molecules, energy transfer, genetics and inheritance, evolution and environmental concerns.

1.4.4 Overlap with Geography A (3832, 7832)

- Aspects of human nutrition and health studied in Module 2857 (Growth, Development and Disease) of the Human Biology specification will support the section on Food Supplies in the optional module Agriculture and Food in the Geography A specification.
- There are strong links to be made between fieldwork techniques and methods of data analysis and presentation for all candidates when completing Advanced Subsidiary Module 2858 (Component 02), Investigative Skills, and A2 Module 2868, Extended Investigation.

1.4.5 Overlap with Geography B (3834, 7834)

- Aspects of human health and disease in the Human Biology specifications support Module 2691 (Issues in the Environment) and Module 2692 (Issues in Sustainable Development) in the Geography B specification.
- There are strong links to be made between fieldwork techniques and methods of data analysis and presentation for all candidates when completing Advanced Subsidiary Module 2858 (Component 02), Investigative Skills, and A2 Module 2868, Extended Investigation.

1.4.6 Overlap with VCE Science (7774, 7794) (Under Review)

- Investigative techniques, methods of analysis, presentation of evidence, and approaches to scientific enquiry are common to Human Biology and VCE Science.
- A study of transport and lung function in Module 2856, and human health and disease throughout the Human Biology specifications support the compulsory VCE unit on Monitoring the Activity of the Human Body (Unit 7441).
- A study of Human Biology, Blood, Circulation and Gaseous Exchange (Module 2856), Growth, Development and Disease (Module 2857) and Genetics, Homeostasis and Ageing (Module 2867) support the compulsory VCE unit on Synthesising Organic and Biochemical Compounds (Unit 7444).
- A study of human health and disease throughout the specifications supports the optional VCE units on Using Psychology (Unit 7458), Maintaining Environmental Health (Unit 7454) and Using Nutrition to Maintain Health (Unit 7461).
- There are links between Infectious Disease (Module 2857, Section 5.2.3) in the Human Biology AS specification and the optional VCE unit on Maintaining Environmental Health (Unit 7459).

1.4.7 Overlap with VCE Health and Social Care (7744, 7764, 7784)

(Under Review)

- There are strong links throughout this specification with the VCE specification in Health and Social Care, such that they complement each other.
- A study of preventative medicine throughout the specification supports the VCE units on Physical Aspects of Health (Module 7292) and Educating for Health and Well-Being (Module 7296).
- Module 2857, Section 5.2.2, supports the VCE Module, Factors Affecting Human Growth and Development (Module 7293).
- Module 2866, Section 5.3.1, supports the VCE Module, The Role of Exercise in Maintaining Health and Well-Being (Module 7306).
- Module 2866, Section 5.3.2, supports the VCE Module, Mental Health Awareness (Module 7310).
- Module 2867, Section 5.4.3, supports the VCE Module, Health and Social Care Provision for Older People (Module 7300).

1.5 EXCLUSIONS

Candidates who enter for this Advanced Subsidiary GCE specification may not also enter for any other Advanced Subsidiary GCE specification with the certification title Biology or Human Biology in the same examination session.

Candidates who enter for this Advanced GCE specification may not also enter for any other Advanced GCE specification with the certification title Biology or Human Biology in the same examination session.

Every specification is assigned 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 Performance Tables.

The classification code for these specifications is 1010.

1.6 CODE OF PRACTICE REQUIREMENTS

These specifications comply in all respects with the revised Code of Practice requirements for courses starting in September 2003.

2 Specification Aims

2.1 AIMS

The aims of these Advanced Subsidiary GCE and Advanced GCE specifications are to encourage candidates to:

- develop essential knowledge and understanding of the concepts of Human Biology, and the skills needed for the use of these in new and changing situations;
- be aware of the work related relevance of Human Biology;
- develop an understanding of scientific methods and process;
- be aware of advances in technology, including Information Technology, relevant to Human Biology;
- recognise the value and responsible use of Human Biology in society;
- sustain and develop their enjoyment of, and interest in, Human Biology.

In addition, the Advanced GCE specification aims to encourage candidates to:

- show knowledge and understanding of facts, principles and concepts from different areas of Human Biology and to make and use connections between them.

2.2 SPIRITUAL, MORAL, ETHICAL, SOCIAL AND CULTURAL ISSUES

These specifications provide an opportunity for candidates to appreciate:

- 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 moral, ethical, social and cultural issues raised by aspects of Human Biology.

2.3 ENVIRONMENTAL EDUCATION

Teachers may wish to mention aspects of environmental education at appropriate points during the teaching of these specifications. For example:

- energy efficiency;
- sustainable development;
- population control;
- interdependence of living things;
- biodiversity;
- disease;
- ecosystem management and sustainable community practices;
- the conflict between agricultural productivity and conservation.

2.4 EUROPEAN DIMENSION

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. For example, the Human Genome Project and disease transmission and control.

2.5 HEALTH AND SAFETY EDUCATION

Aspects of health education feature throughout these specifications, but the following are explicitly covered:

- safe laboratory practice;
- scientific method;
- the risk factors associated with coronary heart disease;
- smoking and related diseases;
- cancer;
- maternal health and foetal 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;
- conservation issues;
- ethics.

2.6 ECONOMIC AND INDUSTRIAL UNDERSTANDING

These specifications promote understanding of the following:

- genetic engineering;
- stem cell technology;
- the pharmaceutical industry;
- biotechnology;
- conservation.

'Real world' contexts related to, for example, the health and caring professions, sports scientists, technologists and engineers and staff in leisure services are used throughout these specifications.

2.7 AVOIDANCE OF BIAS

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

3 Assessment Objectives

3.1 APPLICATION TO AS/A2

Knowledge, understanding and skills are closely linked. These specifications require that candidates demonstrate the following assessment objectives in the context of the content and skills prescribed. Assessment Objectives AO1-AO3 are the same for Advanced Subsidiary GCE and Advanced GCE; AO4 applies only to the A2 part of the Advanced GCE course.

3.1.1 AO1 Knowledge with Understanding

Candidates should be able to:

- recognise, recall and show understanding of specific biological facts, terminology, principles, concepts and practical techniques;
- draw on existing knowledge to show understanding of the ethical, social, economic, and technological implications and applications of Human Biology;
- select, organise and present relevant information clearly and logically, using appropriate vocabulary.

3.1.2 AO2 Application of Knowledge and Understanding, Analysis, Synthesis and Evaluation

Candidates should be able to:

- describe, explain and interpret phenomena and effects in terms of biological principles and concepts, presenting arguments and ideas clearly and logically, using specialist vocabulary where appropriate;
- interpret and translate, from one form into another, data presented as continuous prose or in tables, diagrams, drawings and graphs;
- apply biological principles and concepts in solving problems in unfamiliar situations including those which relate to the ethical, social, economic, and technological implications and applications of Human Biology;
- assess the validity of biological information, experiments, inferences and statements.

3.1.3 AO3 Investigation

Candidates should be able to:

- devise and plan investigative activities, selecting appropriate techniques;
- demonstrate safe and skilful investigative techniques;
- collect evidence with appropriate precision and record this methodically;
- interpret, explain, evaluate and communicate the results of their investigative activities clearly and logically using biological knowledge and understanding and using appropriate specialist vocabulary.

3.1.4 AO4 Synthesis of Knowledge, Understanding and Skills

Candidates should be able to:

- bring together principles and concepts from different areas of Human Biology and apply them in a particular context, expressing ideas clearly and logically and using appropriate specialist vocabulary;
- use biological skills in contexts which bring together different areas of the subject.

3.1.5 Weighting

The Assessment Objectives are weighted as follows:

	Advanced Subsidiary GCE	A2	Advanced GCE
AO1	42%	24%	33%
AO2	38%	26%	32%
AO3	20%	10%	15%
AO4	0%	40%	20%

3.2 SPECIFICATION GRID

The relationship between the Assessment Objectives and the Units of Assessment in the Advanced GCE specification is shown in the specification grid below.

Unit of Assessment		Level	Percentage of Advanced GCE				Total(%)
			AO1(%)	AO2(%)	AO3(%)	AO4(%)	
2856		AS	9	6	0	0	15
2857		AS	9	6	0	0	15
2858	Component 01	AS	3	7	0	0	10
	Component 02	AS	0	0	10	0	10
2866		A2	6	4	0	5	15
2867		A2	3	7	0	10	20
2868		A2	3	2	5	5	15
		Total	33	32	15	20	100

3.3 QUALITY OF WRITTEN COMMUNICATION

The requirement for all Advanced Subsidiary and Advanced GCE specifications to assess candidates' quality of written communication is met through all four Assessment Objectives. Questions which provide an assessment of quality of written communication are included in question papers for Units 2856, 2857, 2866 and 2867, and in the coursework assessment of Unit 2858 (Component 02) and 2868.

4 Scheme of Assessment

4.1 UNITS OF ASSESSMENT

Candidates take **three** units for Advanced Subsidiary GCE, followed by a further **three** units at A2 if they are seeking an Advanced GCE award.

Level	Unit/ Component No.	Name	Raw Mark Total	Duration	Mode of Assessment	Weighting %	
						AS	A Level
AS	2856	Blood, Circulation and Gaseous Exchange	60	60 mins	Written Exam	30	15
AS	2857	Growth, Development and Disease	60	60 mins	Written Exam	30	15
AS	2858	Case Studies/ Investigative Skills in Human Biology					
	2858/01	Case Studies	45	45 mins	Written Exam	20	10
	2858/02	Investigative Skills	60	–	Coursework	20	10
A2	2866	Energy, Control and Reproduction	90	90 mins	Written Exam		15
A2	2867	Genetics, Homeostasis and Ageing	120	120 mins	Written Exam		20
A2	2868	Extended Investigation in Human Biology	90	–	Coursework		15

In Unit 2858, candidates take Components 01 and 02; both assessment components must be taken in the same examination session.

If candidates retake Unit 2858 within 12 months, they have the opportunity to carry forward the mark for the coursework component (02).

All candidates for Unit 2858 should be entered under this unit code with one of the following option codes:

Option Code	Component to be taken	
A	01 02	Written examination Coursework
B	01 82	Written examination Coursework mark carried forward

4.2 RULES OF COMBINATION

Candidates must take the following combination of Units of Assessment:

Advanced Subsidiary GCE	Candidates take Units 2856, 2857 and 2858;
Advanced GCE	Candidates take Units 2856, 2857, 2858, 2866, 2867 and 2868.

4.3 UNIT AVAILABILITY

There are **two** unit sessions each year, in January and June.

The availability of units is shown below.

Level	Unit	Unit Title	June 2004	Jan 2005	June 2005	Jan 2006	June 2006
AS	2856	Blood, Circulation and Gaseous exchange	✓	✓	✓	✓	✓
AS	2857	Growth, Development and Disease	✓	✓	✓	✓	✓
AS	2858	Case Studies/Investigative Skills in Human Biology	✓	✓*	✓	✓*	✓
A2	2866	Energy, Control and Reproduction		✓	✓	✓	✓
A2	2867	Genetics, Homeostasis and Ageing			✓	✓	✓
A2	2868	Extended Investigation in Human Biology			✓		✓

*Only Option B will be available for Unit 2858 in January i.e. coursework marks may be carried forward from the previous June.

The availability shown for 2006 will apply for subsequent years.

4.4 SEQUENCE OF UNITS

The sequence in which the units should be taken is Units 2856, 2857 and 2858 in the first year of a course of study, leading to an Advanced Subsidiary GCE award, then Units 2866, 2867 and 2868 in the second year leading to the full Advanced GCE award. However, the units may be taken in other sequences.

Candidates may take all units at the end of their Advanced Subsidiary GCE or Advanced GCE course if desired.

4.5 SYNOPTIC ASSESSMENT

Synoptic assessment involves the explicit drawing together of knowledge, understanding and skills learned in different parts of the Advanced GCE course. Assessment Objective AO4 relates specifically to synoptic assessment. It accounts for 20% of the total Advanced GCE marks and is assessed only in A2 Units 2866, 2867 and 2868. The question paper for Unit 2866 will include synoptic questions on the AS modules. The question paper for Unit 2867 will include synoptic questions which may draw from both AS and A2 modules and should normally, therefore, be taken at the end of the course, but this is not a requirement. Coursework assessment in Unit 2868 includes an element of synoptic assessment.

Synoptic assessment:

- requires candidates to make and use connections between different areas of Human Biology, for example, by applying knowledge of two or more areas to a particular situation or context;
- provides opportunities for candidates to use ideas and skills which permeate Human Biology, for example, the analysis and evaluation of empirical data and other information in contexts which may be new to them.

Questions are set in the examination papers for Unit 2866 and Unit 2867 that require candidates to demonstrate these abilities.

During investigative work, synoptic assessment:

- allows candidates to apply knowledge and understanding of principles and concepts of Human Biology in planning investigative work and in the analysis of evidence.

The Extended Investigation that is assessed internally by Centres for the A2 Unit 2868 should draw on the range of experience that the candidate will have acquired during the whole course. It is particularly important that the *Planning* aspect of the investigation should involve an element of research that goes beyond the repetition of a task conducted during the A2 part of the course. Likewise, the assessment of *Analysing evidence and drawing conclusions* must require a candidate to use knowledge and understanding acquired outside the confines of a standard task recently practised. During the process of moderation, evidence is sought that such breadth has been achieved.

Unit 2868, therefore, includes an element of synoptic assessment.

4.6 CERTIFICATION

Candidates may enter for:

- Advanced Subsidiary GCE certification;
- Advanced Subsidiary certification, bank the result, and complete the A2 assessment at a later date;
- Advanced GCE certification.

Candidates must enter the appropriate AS **and** A2 units to qualify for the full Advanced GCE award.

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

4.7 RE-SITS

4.7.1 Re-sits of Units

Candidates are permitted to re-sit units **once only**, before seeking an Advanced Subsidiary GCE or Advanced GCE award, and the better result will count. For further information, see the *Administrative Guide to Unitised Qualifications* (OCR publication).

4.7.2 Re-sits of Advanced Subsidiary GCE and Advanced GCE

Candidates may retake the **whole** qualification more than once.

4.8 QUESTION PAPERS

4.8.1 Advanced Subsidiary

Unit 2856 – Blood, Circulation and Gaseous Exchange (1 hour) (60 marks)
Unit 2857 – Growth, Development and Disease (1 hour) (60 marks)

These written papers are based on the content identified in these modules. They contain questions comprising both structured parts and parts requiring more extended answers. All questions on these papers are compulsory.

Unit 2858 Component 01 – Case Studies in Human Biology (45 mins) (45 marks)

This written examination paper is based on **two** case studies (one based on each of the two AS modules) published to candidates several weeks before the examination as shown on the GCE timetable. The questions require candidates to analyse and interpret the materials they have been given using their knowledge and understanding from the first **two** modules of the course, and information in the case studies themselves. The questions comprise both structured parts and parts requiring more extended answers. All questions are compulsory.

The case studies present data and other information from particular 'real world' contexts connected with Human Biology. They may be based on the work of individuals, or the use of particular techniques, or the case history of a patient, for example. One of the case studies will be the transcript of an interview. Teachers are encouraged to work with their students to understand the information presented so that they are prepared to answer the questions set on the examination paper. Notes may **not** be taken into the examination; copies of the case studies form part of the examination paper. This component (together with the coursework Unit 2858/02) will help candidates to develop the skills that they will need, to complete their own extended investigation in the A2 part of the course. For example, in the Case Studies in Human Biology paper, candidates will be given a transcript of an interview, whereas in the Extended Investigation in Human Biology, they will be required to conduct their own interview.

4.8.2 A2

Unit 2866 – Energy, Control and Reproduction (1 hour 30 minutes) (90 marks)

One third of the marks on this written examination paper are targeted at Assessment Objective AO4, synoptic assessment. The remaining marks are targeted solely at the content identified in this module. The questions comprise both structured parts and parts requiring more extended answers. All questions are compulsory. The synoptic questions require candidates to make connections between the content of this module and that of modules in the AS course, and to use biological skills and ideas that permeate the subject.

Unit 2867 – Genetics, Homeostasis and Ageing (2 hours) (120 marks)

Half of the marks on this written examination paper are targeted at Assessment Objective AO4, synoptic assessment. The remaining marks are targeted solely at the content identified in this module. The questions comprise both structured parts and parts requiring more extended answers. All questions are compulsory. The synoptic questions require candidates to make connections between the content of this module and that of the other AS and A2 modules in the course, and to use biological skills and ideas that permeate the subject.

4.9 COURSEWORK

4.9.1 The Units

Unit 2858/02 – Investigative Skills (60 marks)

Candidates are assessed internally on **four** investigative skills: *Planning; Implementing; Analysing Evidence and Drawing Conclusions; Evaluating Evidence and Procedures*. The mark descriptors for these skills are written to allow them to be used to assess work based on the collection of primary evidence (from candidates' own experimental work) and/or from secondary evidence (collected during a work experience placement or from other secondary sources such as the Internet, for example). OCR externally moderates the work of candidates, by post.

Entries are made for Unit 2858. In this unit, candidates must take **two** components – a written paper (Component 01) and an assessment of Investigative Skills in Human Biology (Component 02).

Both the written paper and the Investigative Skills in Human Biology component **must** be taken in the same examination session.

In Unit 2858, Component 02, marks contribute towards Assessment Objective AO3, Investigation.

Unit 2868 – Extended Investigation in Human Biology (90 marks)

Candidates are required to complete an extended investigation in which they carry out a study of an aspect of Human Biology. They must use their knowledge and understanding of the work they have carried out in other areas of the specification to produce an extended piece of work in which they investigate one area of the subject in detail. The Extended Investigation in Human Biology provides an opportunity to carry out a piece of work with a strong work related bias, though this is not a requirement. The investigation must include the following aspects:

- Producing a report based on a search for relevant background information.
- Interviewing someone whose personal experience or knowledge can contribute to the investigation (such as a health care professional, patient or scientist). It is intended that this should be carried out in person, but it could be completed by correspondence.
- Planning and implementing the collection of primary and/or secondary evidence.
- Analysing the evidence and evaluating the investigative procedures used and the evidence obtained.
- Producing a summary presentation of the whole investigation.

Candidates are assessed internally on **seven** investigative skills: the four used for AS, plus: *Searching for Background Information; Recording an Interview; Making a Presentation*. The mark descriptors for all these skills are written to allow them to be used to assess work based on the collection of primary evidence (from candidates' own experimental work) or from secondary evidence (collected during a work experience placement or from other secondary sources such as the Internet, for example). OCR externally moderates the work of candidates, by post.

In Unit 2868 marks contribute to all four Assessment Objectives, including AO4, Synthesis of Knowledge, Understanding and Skills. There is assessment of AO4 because:

- candidates are required to use biological knowledge and understanding from other modules of the specification in planning their experimental and investigative work, and in analysing evidence and drawing conclusions;
- in the assessment of all seven investigative skills for Unit 2868, normally taken at the end of the course of study, candidates are expected to draw on their experience of such work throughout the course and, in particular, on the Case Studies in Human Biology and Investigative Skills in Human Biology in Unit 2858.

4.9.2 The Skills

Skill P Planning

Candidates should be able to:

- identify and define the nature of a question or problem using available information and knowledge of Human Biology;
- choose effective and safe procedures, selecting appropriate investigative techniques and deciding the extent of the evidence required;
- consider ethical implications in the choice of investigative technique and the environmental and safety aspects of the proposed procedures.

Skill I Implementing

Candidates should be able to:

- use investigative techniques skilfully and with consideration;
- carry out work in a methodical and organised way;
- adopt safe and ethical working practices;
- collect detailed evidence to an appropriate degree of precision.

Skill A Analysing Evidence and Drawing Conclusions

Candidates should be able to:

- communicate biological information and ideas in appropriate ways, including tabulation, line graphs, histograms, continuous prose, annotated drawings and diagrams;
- recognise and comment on trends and patterns in data;
- understand the need for detailed processing of evidence;
- draw valid conclusions by applying biological knowledge and understanding.

Skill E Evaluating Evidence and Procedures.

Candidates should be able to:

- assess the reliability and precision of investigative data and the conclusions drawn from it;
- evaluate the techniques used in the investigative activity, recognising their limitations.

Skill S Searching for Background Information (A2 only)

Candidates should be able to:

- identify relevant sources of information;
- record and organise information in a coherent report.

Skill R Recording an Interview (A2 only)

Candidates should be able to:

- construct a series of questions which assist in the investigation;
- evaluate the questions and record answers clearly and concisely.

Skill M Making a Presentation (A2 only)

Candidates should be able to:

- produce a coherent presentation which summarises the main aspects of the investigation;
- use a well-designed presentational technique.

4.9.3 Internal Assessment of Coursework

Unit 2858 (Component 02) – Investigative Skills (60 Marks)

Skills **P** and **A** are each marked out of eight and Skills **I** and **E** are each marked out of seven. One mark per skill must be awarded for each candidate for AS (Unit 2858, Component 02). Hence, a raw mark out of 30 is initially calculated for this component. The marks are then doubled so that the final marks submitted are out of 60. The descriptors for these skills have been written to provide clear continuity from the assessment of Sc1 in GCSE Science.

The skills may be assessed in the context of separate tasks, although more than one skill may be assessed in any one task. They may also be assessed all together in the context of a single 'whole investigation' in which the task is set by the teacher, or by using individual investigations in which each candidate pursues his or her own choice of assignment.

The skills may be assessed at any time during the course using suitable investigative activities, based on the content of the modules of the AS course. The length of time to be devoted to this component is entirely at the discretion of the teacher. However, it is anticipated that in most cases the report will not exceed 2 000 to 2 500 words (excluding tables and graphs); between five to ten hours of class time should be sufficient.

Unit 2868 – Extended Investigation in Human Biology (90 marks)

Skills **P** and **A** are each marked out of eight and Skills **I** and **E** are each marked out of seven. Skills **S**, **R** and **M** are each marked out of five. One mark per skill must be awarded for each candidate for A2 (Unit 2868). Hence, a raw mark out of 45 is initially calculated for this unit. The marks are then doubled so that the final marks submitted are out of 90.

The skills are assessed all together in the context of a **single** extended investigation in which the task is set by the teacher, or by using individual investigations in which each candidate pursues his or her own choice of assignment. The investigation may be carried out at any time during the course but should be based on the content of the modules of the A2 course, in which the level of demand of the related scientific knowledge and understanding is higher.

For Skills **P**, **I**, **A** and **E**, a similar set of mark descriptors is used for both AS and A2 (see Appendix C). The difference in standard of AS and A2 is a product of the level of demand of the related scientific knowledge and understanding together with the complexity and level of demand of the tasks set. Also, the mark descriptors for Skills **P** and **A** at A2 include synoptic elements (see Appendix B).

The length of time to be devoted to the extended investigation is entirely at the discretion of the teacher. However, it is anticipated that in most cases the report will not exceed 3 000 to 3 500 words (excluding tables and graphs); between 10 to 15 hours of class time should be sufficient.

Notes for Guidance on coursework assessment and submission and examples of possible coursework tasks are given in Appendix B. Mark descriptors are fully detailed in Appendix C.

Further details, including copies of relevant coursework forms, are given in *the AS/A Human Biology Teacher Support : Coursework Guidance Handbook*, copies of which can be ordered from the OCR Publications Department (tel. 0870 870 6622; fax 0870 870 6621).

4.9.4 Assessment and Moderation

Coursework is marked by the teacher and internally standardised by the Centre. Marks are then submitted to OCR by a specified 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 coursework is the same for each Centre, and that each teacher has applied the standards appropriately across the range of candidates within the Centre.

Coursework submissions should be clearly annotated by the Centre to support the marks awarded to the candidates.

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

4.9.5 Minimum Coursework Requirements

If no work is submitted by a candidate for a coursework component or unit, the candidate should be indicated as being absent from that component or unit on the coursework mark sheets submitted to OCR. Any work submitted by a candidate should be assessed according to the mark descriptors and marking instructions and the appropriate mark awarded, which may be 0 (zero).

4.9.6 Authentication of Coursework

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

4.10 SPECIAL ARRANGEMENTS

For candidates who are unable to complete the full assessment, or whose performance may be adversely affected through no fault of their own, teachers and/or examinations officers should consult the Inter-Board Regulations and Guidance Booklet for Special Arrangements and Special Consideration and the OCR Handbook for Centres. In such cases, advice should be sought from OCR as early as possible during the course. Applications for special consideration in coursework components should be accompanied by Coursework Assessment Forms giving the breakdown of marks for each skill.

4.11 DIFFERENTIATION

In the question papers, differentiation is achieved by setting questions which are designed to assess candidates at their appropriate levels of ability and which are intended to allow all candidates to demonstrate what they know, understand and can do.

In coursework, differentiation is by task and by outcome. It is important that candidates undertake assignments which enable them to display positive achievement.

4.12 AWARDING OF GRADES

The Advanced Subsidiary has a weighting of 50% when used in an Advanced GCE award. An Advanced GCE award is based on the aggregation of the weighted Advanced Subsidiary (50%) and A2 (50%) marks.

Both Advanced Subsidiary GCE and Advanced GCE qualifications are awarded on the scale A to E, or U (unclassified).

4.13 GRADE DESCRIPTIONS

The following grade descriptions indicate the level of attainment characteristic of the given grade at Advanced GCE. They give a general indication of the required learning outcomes at each specified grade. The descriptions should be interpreted in relation to the content outlined in the specifications; they are not designed to define that content. The grade awarded will depend, in practice, upon the extent to which the candidate has met the Assessment Objectives overall. Shortcomings in some aspects of the examination may be balanced by better performances in others.

Grade A

Candidates recall and consistently use biological knowledge, facts, principles and concepts from the whole specification, with few significant omissions, and show good understanding of the principles and concepts they use. They select biological knowledge relevant to most situations and present their ideas clearly and logically, making use of appropriate scientific terminology, particularly when referring to specific technical terms and in expressing more general concepts and ideas.

Candidates carry out accurately a range of calculations in a logical manner with little guidance and, where appropriate, support their solutions by logical explanation. They demonstrate good understanding of principles and apply them in familiar and new contexts. They show insight into problems and suggest a number of possible solutions using techniques, arguments, or knowledge and understanding from more than one area of the specification and other areas of experience. Most responses are correct, relevant and logical. In particular, longer questions are answered to an appropriate depth, communicating ideas effectively with coherent and detailed explanations.

In investigative activities, candidates independently formulate a clear and accurate plan. They use a range of investigative techniques safely and skilfully, collecting evidence with appropriate precision. They interpret and describe the trends and patterns shown by evidence presented in tabular or graphical form, indicating, where appropriate, anomalies and inconsistencies. They provide coherent, logical and comprehensive explanations using appropriate biological knowledge and terminology. They comment critically on their evidence, evaluate it and use it to support or reject various hypotheses. They present clearly and concisely both sides of an argument by weighing up the evidence.

Grade C

Candidates recall and show a sound use of biological knowledge, facts, principles and concepts from many parts of the specification and show understanding of some fundamental principles and concepts. They frequently select biological knowledge relevant to a particular situation or context and present their ideas clearly and logically, making use of appropriate scientific terminology.

Candidates carry out a range of calculations, making progress with minimal guidance. They show knowledge of fundamental principles and are often able to apply these in new contexts. They bring together information from more than one area of the specification. Many responses are correct, relevant and logical.

In investigative activities, candidates formulate a plan that may need some modification. They use a range of techniques safely, collecting evidence that is adequate for the task. They interpret and explain their results relating these to scientific knowledge and understanding and, with help, evaluate their results. They comment on their evidence and use selected evidence to support a particular hypothesis. They make choices in sampling and processing evidence.

Grade E

Candidates recall and use biological knowledge, facts, principles and concepts from some parts of the specification and demonstrate some understanding of fundamental principles and concepts beyond that expected of sound GCSE candidates.

Candidates select discrete items of knowledge in response to structured questions and use basic scientific terminology. This may be displayed consistently across the questions set or may vary between quite good and poor on different questions.

Candidates select appropriate facts and principles to solve problems concerning familiar material. Where problems are concerned with unfamiliar material, answers relate to the appropriate subject area even if difficulties are experienced in applying the facts and principles involved.

With some guidance, candidates carry out accurately straightforward calculations involving the rules of number, such as calculations of percentages, making clear the steps in the calculations. They apply knowledge and scientific principles contained within the specification to material presented in a familiar or closely related context.

They make connections between some ideas encountered in different parts of the specification. Their answers show some logic and coherence although they include irrelevant material. They use correctly a limited range of scientific terminology.

In investigative activities, candidates formulate some elements of an investigation when provided with guidance. They carry out frequently encountered procedures in a reasonably skilful manner, recognising the risks in familiar procedures and obtaining some appropriate results. They interpret broad trends shown by evidence presented in tabular or graphical form. They select appropriate facts and principles to produce limited but relevant explanations and make superficial conclusions from their evidence. They may need assistance to relate these to biological knowledge and understanding.

5 Specification Content

There are **four** content modules of equal size; the content is set in 'real world' contexts:

2856: Blood, Circulation and Gaseous Exchange;
2857: Growth, Development and Disease;
2866: Energy, Control and Reproduction;
2867: Genetics, Homeostasis and Ageing.

It is recommended that the modules are taught in this order, since the knowledge, understanding and skills from early modules underpins later modules. Details of these relationships are given in *Recommended Prior Learning* at the start of each module.

The content to be examined is shown in the second column, headed 'Learning Outcomes'. Suggestions for 'real world' contexts such as the biomedical and caring professions, health, alternative medicine, conservation and social issues, research, ethics, and sports and leisure studies are given in the first column. Candidates should know definitions of the terms shown in **bold**.

Human Biology is a science subject and, as such, practical activities and the processes of scientific investigation are an important part of learning and should not simply be limited to the minimum necessary to meet the coursework requirements.

5.1 AS MODULE 2856: BLOOD, CIRCULATION AND GASEOUS EXCHANGE

Recommended Prior Knowledge

Candidates are assumed to have completed a course of study to Foundation or Intermediate Level in Science or Biology.

5.1.1 The Blood

Recommended Prior Knowledge

Candidates should have knowledge of Key Stage 4 Programme of Study Sc2, 1b, 1e and 2b.

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
5.1.1.1 Observing the blood **C3.1b** A study of the cells in the blood can provide valuable information about health and help to diagnose a number of conditions. Blood grouping is essential to ensure the safety of transfusions and to type blood when it is given in donor sessions. Much of this work is conducted in hospital pathology laboratories and the results interpreted by medical staff.	(a) describe how blood samples are taken and blood smears (films) are made; (b) describe the techniques for the differential staining of blood smears to show leucocytes; (c) describe the use of a haemocytometer to count the numbers of blood cells; (d) describe the structure, as seen under the light microscope, of erythrocytes, neutrophils, macrophages, lymphocytes and platelets as specialised cells with particular functions related to their structures; (e) compare the ultrastructure of a leucocyte and a palisade mesophyll cell as seen under 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 ER, ribosomes, mitochondria, chloroplasts, the cell wall, the nucleus and the nucleolus); (f) calculate the linear dimensions and magnification of drawings or photographs of cells; (g) describe the fluid mosaic model of the structure of the cell surface membrane with reference to the red blood cell membrane (limited to phospholipids, intrinsic and extrinsic proteins, and cholesterol, glycolipid and glycoprotein); (h) outline the roles of membranes within and at the surface of cells; (i) understand how blood is grouped using the ABO and Rhesus systems (genetic details are not required); (j) explain how blood is matched for transfusion using the ABO system and outline what would happen if a mismatch occurred.

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
5.1.1.2 Investigating blood chemistry Investigating the chemistry of the blood is a relatively simple way of assessing the health of the individual. E.g. diabetics are encouraged to monitor their own blood glucose concentration and to act on the results by adjusting both their dose of insulin and their diet. Hospital pathology laboratories are able to carry out more detailed tests on the chemical composition of the blood which can be used to diagnose many different diseases and conditions. Medical staff interpret the results of these tests in order to treat any disease appropriately and check that the patient's body is functioning correctly.	(a) outline one manual method of measuring the concentration of haemoglobin in human blood; (b) outline the basic structure of an amino acid and the **condensation reaction** between two amino acids to form a **peptide bond** in a **polypeptide**; (c) outline the molecular structure of haemoglobin as an example of a globular protein formed from polypeptides, including the meaning of the following terms: **primary structure, secondary structure, tertiary structure** and **quaternary structure**; (d) relate the structure of haemoglobin to its role in carrying oxygen (details of oxygen dissociation curves are not required); (e) describe the differences between plasma, serum, tissue fluid and lymph; describe the normal composition of blood plasma; (f) explain the advantage of having water based body fluids; (g) describe the mechanisms of diffusion, facilitated diffusion, osmosis and active transport (of Na+ and K+ ions) with reference to the structure of the red blood cell membrane; (h) describe the meaning of the term **water potential**; (i) explain why the concentration of plasma proteins and glucose will affect the water potential of blood; (j) explain how the concentration of glucose may be measured in human blood; (k) outline the use and importance of isotonic drinks in maintaining the water potential and electrolyte balance of blood; (l) describe the basic structure of **carbohydrates** in terms of **monosaccharides, disaccharides** and **polysaccharides**; (m) describe the structure of the ring form of alpha glucose and outline its role as a respiratory substrate; (n) describe the formation of glycogen by condensation reactions to form **glycosidic bonds**; (o) describe how the structure of the glycogen molecule adapts it to its function as an energy store in liver and muscle.

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
5.1.1.3 Preventing blood loss **C3.1b** It is important for any citizen to learn the first aid procedure to prevent excessive blood loss. First aiders, para-medics, and staff in hospital accident and emergency departments are trained to carry out first aid procedures to prevent blood loss in cases of trauma.	(a) describe the first aid procedure to prevent excessive blood loss; (b) outline the mechanism of blood clotting as an enzyme controlled process (to include the role of platelets and thromboplastin in producing thrombin from prothrombin resulting in the formation of fibrin from fibrinogen); (c) explain how a clot becomes a scab to protect healing tissue; (d) explain that enzymes are globular proteins; (e) explain how the complex three dimensional structure of a globular protein enables enzyme molecules to catalyse specific metabolic reactions (to include the specificity of the **active site**, the formation of an enzyme substrate complex and the lowering of **activation energy**); (f) describe and explain the effects of enzyme and substrate concentration on enzyme action, with reference to the enzymes involved in blood clotting.
5.1.1.4 Preventing and treating deep vein thrombosis Blood clots can cause a number of clinical conditions but the risk of developing deep vein thrombosis can be greatly reduced by some simple measures adopted by individuals who are potentially at risk. Rapid treatment by medical staff with anti-coagulants or 'clot busting' medication, can prevent long term damage in some cases, or prevent re-occurrence resulting in death or permanent damage.	(a) describe the symptoms of deep vein thrombosis and the factors which contribute to its occurrence; (b) describe how deep vein thrombosis may be prevented using pressure socks and by maintaining mobility; (c) describe the role of 'clot busting' enzymes such as streptokinase in the prevention and treatment of deep vein thrombosis; (d) explain the effects of reversible inhibitors (both competitive and non competitive) on the rate of enzyme activity with reference to the enzymes involved in blood clotting.
5.1.1.5 Managing the storage of blood for transfusion **C3.2** 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.	(a) describe the conditions in which blood for transfusion is stored; (b) describe and explain the effects of pH and 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) list the types of blood products stored (to include whole blood, packed red cells and plasma) and outline their use; (e) explain how blood products are screened and treated to prevent the transmission of HIV and hepatitis B and C.

5.1.2 The Heart

Recommended Prior Knowledge

Candidates should have a knowledge of Key Stage 4 Programme of Study Sc2, 2b and 2c.

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.1.2.1 Treating heart disease The structure and function of the heart is studied in the context of the causes and consequences of heart disease and heart defects, and how they can be treated. Heart disease is a major cause of death in developed countries but preventative medicine, surgical techniques and after care of the patient have advanced considerably.	(a) describe 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) describe the function of the coronary arteries; (d) describe the causes and effects of blockage of the coronary arteries in coronary heart disease (CHD); (e) describe the role of aspirin in preventing the formation of blood clots; (f) outline how angioplasty, coronary bypass operations and heart transplants can be used to treat heart disease; (g) outline how open heart surgery is able to treat valve defects and 'holes in the heart'.
5.1.2.2 Monitoring heart function All citizens should be capable of monitoring the pulse to check for heart activity. It is important for health professionals to be able to monitor the action of the heart either through its effects on the circulatory system or by measuring the electrical changes that are taking place. An understanding of heart function is important to athletes who wish to maximize their performance and also to those who wish to remain physically fit throughout life. This topic is studied in depth in A2 Module 2866.	(a) outline how an electrocardiogram (ECG) is used to monitor heart function; (b) with reference to the ECG, explain how heart action is initiated, including the roles of the SA node, AV node and Purkyne (formerly Purkinje) tissue and the myogenic nature of cardiac muscle (excluding nervous and hormonal controls); (c) interpret ECGs showing abnormal heart rhythms: limited to heart block, ventricular fibrillation and bradycardia; (d) with reference to the ECG, describe how the action of the heart can be monitored using a stethoscope; (e) describe the structure of arteries, arterioles, capillaries, venules and veins; (f) define the term **mass transport** and explain the need for a mass transport system in humans; (g) explain the importance of the **closed double circulatory system** in maintaining differences in blood pressure in different parts of the circulatory system; (h) explain the need for blood pressure with reference to the transfer of materials between the cells and capillaries; (i) describe how a sphygmomanometer is used to measure systolic and diastolic blood pressure and how the results are interpreted; (j) explain how changes in stroke volume and heart rate affect cardiac output; (k) describe how the 'pulse' rate is measured and interpreted.

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
5.1.2.3 Treating cardiac arrest **C3.1b** All citizens should be capable of using chest compressions to maintain the circulation. For those in the emergency services, this is an important part of their work. Improvements in technology have led to the development of machines such as defibrillators, which are easier to use. A number of large organisations e.g. leisure and shopping centres are obtaining defibrillators and training employees in their use. Thus more lives may be saved.	(a) describe the possible causes and symptoms of cardiac arrest (including myocardial infarction); (b) outline how a defibrillator is used; (c) describe how chest compressions, as part of CPR (cardiopulmonary resuscitation), are used to maintain the circulation.
5.1.2.4 Maintaining a healthy heart **C3.1a** Many professionals are involved in giving lifestyle advice to improve the health of patients or clients. Recovering heart patients and those clearly at risk are encouraged to make changes in their lifestyle to reduce the risk. This improves the quality of life for the patient and reduces the need for surgical intervention. GPs, specialised clinic nurses and counsellors are involved in this.	(a) discuss the effect on the coronary arteries of excessive intake of dietary saturated fat, resulting in the deposition of cholesterol; (b) describe the formation of **ester** bonds in a triglyceride, by the condensation of three fatty acids with glycerol; (c) describe the structure of a saturated and an unsaturated triglyceride and explain their importance in the body. (d) explain why the measurement of blood cholesterol levels includes a measure of low density and high density lipoprotein as well as total cholesterol. (e) outline the possible effect of excessive salt intake, resulting in hypertension, on the circulatory system. (f) list the risk factors associated with coronary heart disease (CHD).

5.1.3 The Lungs

Recommended Prior Knowledge

Candidates should have a knowledge of Key Stage 4 Programme of Study Sc2, 2d, 2m and 2p.

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.1.3.1 Investigating lung function 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 in training (see also A2 Module 2866). Individuals in the emergency services, workplace, life-guards and all citizens should be able to carry out the correct procedure when faced with cases of respiratory arrest.	(a) 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)**; (b) interpret a spirometer trace; (c) recognise ciliated epithelium, goblet cells and squamous epithelial cells and relate their structure to their function; (d) recognise and interpret light microscope photographs of lung tissue; (e) relate cell size with cell surface area to volume relationships and the exchange of materials with the environment; (f) outline the main features of the gaseous exchange surface of the lungs (limited to the cells in contact with blood capillaries, elastic fibres and the role of surfactant); (g) describe the process of gaseous exchange in the alveoli; (h) describe the possible causes of respiratory arrest; (i) explain how expired air resuscitation should be carried out on adults, children and babies in order to maintain blood oxygen concentration.
5.1.3.2 Preventing lung disease **N3.1** Lifestyle choices and modern living can have an adverse effect on the respiratory system. Advice provided by health professionals and health educators may contribute to a decrease in the prevalence of lung disease.	(a) explain the meaning of the terms **chronic** and **acute disease;** (b) describe the short term and long term effects of smoking on the respiratory system, including bronchitis, emphysema, lung cancer and COPD (chronic obstructive pulmonary disease); (c) outline the possible causes and symptoms of asthma; describe how beta agonists and steroids are used to relieve the symptoms of asthma; (d) outline the symptoms of tuberculosis and its treatment.

5.2 AS MODULE 2857: GROWTH, DEVELOPMENT AND DISEASE

Recommended Prior Knowledge

Candidates are assumed to have completed a course of study to Foundation or Intermediate Level in Science or Biology.

Candidates are assumed to have completed Module 2856 where they will have studied the structure of eukaryotic cells, lung cancer, the structure of carbohydrates, proteins and lipids, the meaning of the terms chronic and acute disease and the symptoms and treatment of tuberculosis..

5.2.1 The Developing Cell

Recommended Prior Knowledge

Candidates should have a knowledge of Key Stage 4 Programme of Study Sc2, 1c, 1d, 4g and 4h.

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.2.1.1 Using stem cell technology **C3.1b C3.3 PS3 LP3** The way in which cells grow and become specialised to form tissues and organs are of great interest to scientists researching stem cell technology. Stem cell technology is one of the fastest developing areas of medical research, as stem cells have the capacity to develop into any tissue. There are numerous uses of these cells which will provide much potential for the treatment of disease in the future. A study of cell growth and reproduction can help us understand how human growth occurs, with an appreciation that stem cells go through recognisable stages of development as they specialise into tissues and organs.	(a) define the term **stem cell**; (b) explain the term **differentiation** with respect to the production of erythrocytes and leucocytes derived from stem cells in the bone marrow; (c) describe how stem cells are cultured and discuss the potential benefits of stem cell technology; (d) discuss the ethical issues relating to stem cell technology; (e) explain the meaning of the terms **tissue** and **organ;** (f) explain the relationship between cells, tissues and organs using squamous epithelial cells in the alveoli of the lung as an example; (g) state that as enzymes are protein, their synthesis and therefore all cell metabolism is controlled by DNA; (h) describe the structure of DNA and explain the importance of base pairing and hydrogen bonding; (i) describe the structure of RNA; (j) explain how DNA replicates semi-conservatively during interphase; (k) describe the main features of DNA which make it the ideal genetic material; (l) state that a gene is a sequence of **nucleotides** that codes for a polypeptide such as those which form the haemoglobin molecule; (m) describe the way in which the nucleotide sequence codes for the amino acid sequence of a polypeptide using the **genetic code**;

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
	(n) describe how the information on DNA is used to construct polypeptides including the role of messenger RNA, transfer RNA and the ribosomes; (o) describe the cell cycle (to include interphase, mitosis and cytokinesis); (p) describe and identify the appearance of the components of the nucleus and cell during the stages of mitosis (excluding the sub-stages of prophase) to include the nuclear membrane, centrioles, spindle fibres, centromere, chromatids and chromosomes; (q) explain the importance of mitosis in producing genetically identical daughter cells for repair and growth; (r) explain the meaning of the terms **haploid** and **diploid** and the need for a reduction division before fertilisation in sexual reproduction. (Details of meiosis are not required.)
5.2.1.2 Detecting and treating cancer A breakdown of cell regulation leads to abnormal cell division and the formation of a tumour. An understanding of a normal cell cycle can help in the study of abnormalities which may lead to cancerous growth. Understanding of the risk factors and symptoms associated with cancer in the general population contribute to early diagnosis and an improvement in both prevention and recovery from cancers. Detection involves skilled professionals who can conduct and interpret the results of the tests. Detection and treatment methods include those carried out in hospitals and pathology laboratories. Treatment and advice involves many health professionals to make patients aware of the progress of the treatment. Complementary therapy is also an option for the treatment of cancer.	(a) explain that cancer is the result of uncontrolled cell division; (b) describe the role of oncogenes and proto-oncogenes in uncontrolled cell division; (c) outline the factors that may increase the risk of developing cancer (to include types of radiation, carcinogens, ageing, viruses and heredity); (d) outline the methods of detecting cancers of the breast and lung to include magnetic resonance imaging, X rays, mammography, thermography, Computerised Tomography scans, ultrasound and PET scans; (e) describe the **prevalence** of breast cancer in post menopausal women compared with the rest of the population; (f) outline the methods used to treat cancers of the breast: tamoxifen therapy, surgery (lumpectomy and mastectomy, removal of lymph nodes), chemotherapy, immunotherapy and complementary therapies; (g) outline methods used to treat cancer of the lungs: surgery, radiation therapy, chemotherapy, immunotherapy and complementary therapies; (h) describe the epidemiological evidence which links lung cancer to smoking; (i) discuss the role of health promotion specialists in preventing deaths from breast cancer and lung cancer.

5.2.2 The Developing Individual

Recommended Prior Knowledge

Candidates should have a knowledge of Key Stage 4 Programme of Study Sc2, 4a, 4c, 4d, and 4f.

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.2.2.1 Investigating foetal development **C3.1b C3.3** Advances in medical technology and an understanding of the development of human life from conception to birth, have improved monitoring of foetal development and any abnormalities can be detected at an early stage. Such techniques are carried out by skilled health specialists who can conduct and interpret the results. Foetal health is monitored at antenatal clinics by a wide range of medical personnel including doctors, midwives, radiographers and cytogeneticists. The human genome project is one of the most exciting developments of the last decade. It provides a potentially enormous insight into the diagnosis and treatment of genetic disease.	(a) 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; (b) describe how human foetal growth can be measured using ultrasound to measure biparietal diameter of cranium and crown-rump length of back; (c) state the role of carbohydrates, lipids, vitamins A & D, folic acid, calcium, iron, phosphorus and proteins in sustaining growth in the embryo and foetus; (d) describe how alcohol and nicotine can affect the growth and well being of the foetus; (e) explain the following **gene (point) mutations** in DNA: deletion, substitution, addition; (f) explain the significance of the degenerate genetic code meaning that a gene (point) mutation may not always alter the primary structure of a polypeptide chain during protein synthesis; (g) explain how substitution of a base may lead to changes in haemoglobin which give rise to sickle cell anaemia; (h) discuss the use of foetal ultrasonography, amniocentesis and chorionic villus sampling (CVS) for detecting genetic disorders and assessing foetal well-being. The advantages and disadvantages of each technique should be outlined, including a named example of a disease which may be diagnosed by each test; (i) outline how a karyotype is produced and used to determine the sex of the foetus and to diagnose **chromosomal mutations**, limited to Turner's and Klinefelter's syndromes; (j) explain why chromosomal mutations may be easier to diagnose than gene (point) mutations in the foetus; (k) discuss the significance of the Human Genome Project to the study of genetic disease, including the social and ethical implications.

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.2.2.2 Investigating infant development **C3.3 N3.2 N3.3** Measurement of infant growth is carried out by specialists on a regular basis to check that all is well. Monitoring growth patterns may indicate problems of development which health specialists can diagnose at an early stage.	(a) investigate methods of measuring infant growth by monitoring changes in weight, height, and head circumference; (b) describe the pattern of growth during the human life cycle; (c) outline the role of carbohydrates, lipids, proteins and inorganic ions in maintaining healthy growth; (d) explain and interpret growth charts for males and females from birth to 18 years of age; (e) distinguish between absolute and relative growth rates; (f) describe the differential growth of lymphatic, reproductive and nervous tissue.

5.2.3 Infectious Disease

Recommended Prior Knowledge

Candidates should have a knowledge of Human Biology Module 2856.

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.2.3.1 Controlling the spread of infectious disease **C3.2** Infectious diseases caused by micro organisms, have a major impact on populations in developing areas of the world. Research continues to produce new antibiotics able to control infection. Antibiotic-resistant micro-organisms can cause problems in hospitals and infection control is becoming increasingly important.	(a) explain what is meant by the term **infectious disease;** (b) outline the structure of the tuberculosis bacillus (as an example of a **prokaryotic** cell) and the human immunodeficiency virus; (c) describe the causes and means of transmission of Tuberculosis (TB) and HIV infection leading to AIDS; (d) outline the use of antibiotics in the treatment of infectious disease; (e) describe how the use of antibiotics leads to the selection of resistant strains adapted to survive in the changed environment with reference to MRSA; (f) outline the precautions which should be taken to reduce the spread of resistant bacteria in hospitals.
5.2.3.2 Immunising against disease The immune system is studied with special reference to the role of vaccination in the control of infectious disease.	(a) outline the programme of vaccination used in the United Kingdom; (b) describe the origin, maturation and mode of action of phagocytes and lymphocytes; (c) explain the meaning of the term **immune response**; (d) distinguish between **active** and **passive** and **natural** and **artificial immunity**; (e) distinguish between the actions of B and T lymphocytes in fighting infection;

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
Vaccination has become a prominent issue in the NHS and many health service professionals advise parents on the issues surrounding the vaccination programme for a young child. Vaccinations are also important for individuals at particular risk of infectious diseases, such as holiday-makers visiting countries where these diseases are endemic.	(f) describe the role of memory cells in long term immunity; (g) relate the general structure of an antibody to its function; (h) describe the use of the Heaf test and the BCG vaccine in the control of tuberculosis; (i) discuss the problems involved in developing and using a vaccine against HIV; (j) describe how individuals are tested for TB and HIV infection; (k) discuss the ethical problems associated with routine screening for HIV infection.
5.2.3.3 Considering the future of infectious disease control **C3.1a C3.2** Epidemiologists monitor the spread and source of outbreaks of disease and use the information to produce strategies for prevention of further spread. As disease causing organisms evolve and adapt to a changing environment new drugs and techniques will be needed to control them. It is important to conserve known resources of useful substances, such as those in the tropical rain forests, which may be developed to produce valuable drugs. The need to grow crops and rear cattle may lead to conflict with conservationists in such an area. The work of specialists in ecology, agriculture and conservation may be important in this context.	(a) assess the global importance of TB and HIV infection; (b) describe the roles of social, economic and biological factors in the prevention and control of TB and HIV; (c) explain the term **notifiable disease**; (d) outline the role of the public health service and the World Health Organisation in controlling the spread of TB; (e) outline the importance of epidemiological data in assessing the incidence and prevalence of infectious disease; (f) outline some of the problems involved in controlling infectious diseases which have recently evolved; (g) discuss the role of conservation in maintaining tropical rain forests, that may be a source of therapeutic drugs; (h) explain the conflict which may exist between productivity and conservation with reference to tropical rain forests.

5.3 A2 MODULE 2866: ENERGY, CONTROL AND REPRODUCTION

Recommended Prior Knowledge

Candidates are assumed to have completed AS Modules 2856 and 2857 where they will have studied the structure of cells which make up tissues, organs and body systems and how they function in these systems in health and disease. Candidates will be aware of risk factors involved in the development of some common diseases, how they may be avoided and health maintained from conception to the adult. They will also have studied how enzymes are synthesised and how they control metabolism.

5.3.1 Energy and Respiration

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.3.1.1 Measuring the efficiency of respiration **C3.3 IT3.2 PS3 LP3** 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 athletes and their coaches to achieve a peak in performance at an appropriate time for competition.	(a) define the term **respiratory quotient** (RQ); (b) describe simple experimental investigations using a spirometer and Douglas bag to determine RQ values; (c) outline the need for ATP in living organisms, as illustrated by anabolic reactions, active transport, movement, and the maintenance of body temperature; (d) describe the structure of ATP as a **phosphorylated nucleotide**; (e) explain the significance of ATP as the main energy carrier; (f) outline glycolysis, emphasising the ATP yield and the production of reduced NAD; (g) outline the link reaction and explain that when oxygen is available, pyruvate (3C) is converted to acetyl (2C) coenzyme A; (h) outline the Krebs cycle, explaining the formation of citrate and its convertion back to oxaloacetate in a series of small steps. The yield of reduced NAD and reduced FAD as the number of carbon atoms is reduced is the only detail required; (i) explain that these processes involve decarboxylation and oxidation by enzyme action in the matrix of the mitochondrion; (j) outline oxidative phosphorylation on the inner membrane of the mitochondrion, including the role of reduced NAD and the importance of oxygen; (k) explain the small yield of ATP from anaerobic respiration and the formation of lactate; (l) describe the breakdown of lactate and release of chemical potential energy; (m) compare the energy efficiency of aerobic and anaerobic respiration; (n) explain the relative energy values of carbohydrate, lipid and protein as respiratory substrates. State where each of the components can enter the various stages of respiration.

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
5.3.1.2 Improving athletic performance **C3.3** The long term effects of exercise on the body and the benefits of maintaining a physically fit body as an aid to health should be considered by 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. Both the biological and ethical issues of enhancing performance need to be addressed by medical staff, sports centre staff and physiotherapists.	(a) explain the meaning of the term **aerobic exercise**; (b) 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; (c) appreciate how much exercise needs to be taken for significant sustained improvement in aerobic fitness; (d) discuss the benefits of carbohydrate loading diets to improve athletic performance; (e) describe and explain the oxygen dissociation curve for haemoglobin; (f) describe and explain the significance of the oxygen dissociation curves of adult oxyhaemoglobin at different levels of carbon dioxide (Bohr effect); (g) describe and explain the difference in affinity for oxygen between haemoglobin and myoglobin; (h) describe and explain the build up of an oxygen deficit and oxygen debt/EPOC (Excess Post-exercise Oxygen Consumption); (i) describe the histology and ultrastructure of skeletal muscle; (j) observe and interpret the structure of muscle under the light microscope or from a photograph and be able to calculate linear dimensions; (k) describe the sliding filament theory of muscle contraction, to include the importance of the power stroke and the role of ATP and calcium ions; (l) describe the difference in structure and function of fast-twitch white fibres and slow-twitch red fibres; (m) describe alternative methods of enhancing performance such as recombinant erythropoeitin (RhEPO), blood doping and creatine monohydrate; (n) explain how altitude training to enhance performance makes use of structural and physiological adaptations to survive in an environment where the oxygen concentration is low; (o) discuss the biological, ethical and social implications of using steroids, hormones and/or painkillers to enhance the physical and mental condition of athletes.

5.3.2 The Nervous System

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.3.2.1 Monitoring visual function The structure and function of the nervous system is studied in the context of its roles in detecting a wide variety of stimuli to enable humans to respond to changes in their environment. The eye is used as a particular example. Optometrists measure eye function and are able to diagnose a number of conditions; reflex actions of the eye are used by medical staff to identify levels of consciousness.	(a) outline the organisation of the central nervous system and peripheral nervous system; (b) describe a sensory receptor as converting a different form of energy into nerve impulses with reference to the rod cell in the retina; (c) outline assessment of receptor activity through routine eye tests (including visual acuity, colour vision and response of pupil); (d) outline the use of blink/iris reflex tests to indicate levels of consciousness; (e) describe the structure of the eye and outline the functions of its parts; (f) describe the structure of the retina (including rods, cones, bipolar cells and ganglion cells).
5.3.2.2 Treating brain and spinal cord injuries There have been major advances in our understanding of how the nervous system functions. This has led to parallel improvements in the way that injuries to the nervous system are treated and has enhanced understanding of the needs of individuals who have damage to the nervous system. Use of neurological examinations, X-rays, CT and MRI scans, angiograms and electroencephalographs have all aided the assessment and diagnosis of brain and spinal injuries. Brain and spinal cord repair is an area of major research – promotion of nerve regeneration, neural transplantation and stem cell transplantation are all areas being developed to treat traumatic brain injury and spinal cord injuries.	(a) describe the gross structure of the mammalian brain and outline the functions of the parts (including the cerebrum, cerebellum and medulla oblongata); (b) outline the organisation of the autonomic nervous system into a sympathetic and parasympathetic system; (c) describe the structure of a sensory neurone, a bipolar neurone and a motor neurone, outlining their functions in a reflex arc; (d) describe and explain the transmission of an action potential in a myelinated neurone; (e) explain the importance of saltatory conduction and the refractory period in the transmission of nerve impulses; (f) describe the structure of a cholinergic synapse, and explain its function; (g) outline the role of synapses with reference to the direction of the nerve impulse and the interconnection of nerve pathways; (h) define the term **traumatic brain injury**; (i) outline how CT and MRI scans and nerve conduction velocity tests, can be used in the assessment of brain and spinal cord damage; (j) explain why damaged neurones are unable to regenerate; reference should be made to inhibitory molecules in scar tissue and poor regenerative response; (k) explain the potential use of stem cells to replace lost or damaged neurones; (l) discuss recent developments in promoting neurone regeneration (including digestion of inhibitory molecules in scar tissue and use of growth factors to enhance regeneration);

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
	(m) describe the effects of strokes on short and long term memory; describe the techniques which may be used to improve memory in stroke patients.
5.3.2.3 Modifying brain function **C3.1a** There are many powerful drugs available for the relief of symptoms and treatment of disease. Drugs that modify brain function are of particular interest and may involve potential abuse. The abuse of drugs affects many individuals in a community and decreases their quality of life, as well as increasing the pressure on social and medical services.	(a) define the term **drug** (to include reference to both therapeutic and abusive aspects); (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; (c) discuss the use of cannabis both therapeutically and recreationally; (d) distinguish between **psychological** and **physical dependency** with reference to heroin and alcohol.

5.3.3 The Control of Human Reproduction

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.3.3.1 Providing advice on fertility **C3.1a** Many professionals including family planning clinics, youth services, and doctors are involved in giving contraceptive advice to patients or clients. An understanding of the processes involved in reproduction and contraception allow an informed decision to be made.	(a) identify and name the parts of the male and female urinogenital systems; (b) describe and interpret photographs and drawings of the ovary and testes, as seen under a light microscope; (c) describe meiosis: interphase, prophase l, metaphase l, anaphase l, telophase l, prophase ll, metaphase ll, anaphase ll, telophase ll (no details of the stages of prophase are required); (d) describe the process and importance of chiasma formation and crossing over, and independent assortment in influencing variation; (e) describe and explain gametogenesis, emphasising the importance of meiosis; (f) describe the role of hormones in the menstrual cycle and gametogenesis; (g) describe the structure of the secondary oocyte and sperm; (h) describe the passage of the sperm from the testis to the oviduct (fallopian tube); (i) describe the importance of fertilisation in restoring chromosome number and leading to variation;

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
	(j) discuss the role of hormones in pregnancy, birth and lactation: oestrogen, progesterone, human placental lactogen (HPL), chorionic gonadotrophin (CG), oxytocin, FSH and prolactin; (k) discuss methods of contraception from the biological and the ethical viewpoint: the birth control pill, condom, diaphragm, Norplant, DMPA (Depo-Provera), tubal ligation and vasectomy; (l) discuss the use of anti-implantation methods such as IUDs and the 'morning after pill' from biological and ethical viewpoints.
5.3.3.2 Helping childless couples **C3.1a** Many professionals in family planning clinics, working in the community and at health centres are involved in giving fertility advice to patients or clients. There have been many major advances in the field of assisted reproduction, raising the demand for techniques which increase fertility for couples who are unable to conceive naturally. Assisted reproduction techniques also raise important ethical issues which health professionals, social workers and other government agencies may have to deal with and advise upon.	(a) outline the causes of both male and female infertility (abnormal sperm, absence of sperm, ovulatory disorders, oviduct (fallopian tube) blockage, endometriosis, and antisperm antibodies; (b) outline the types of fertility treatments available for women: ovulation induction, artificial insemination, IVF, frozen embryo replacement, and gamete intra-fallopian transfer (GIFT); (c) outline the types of fertility treatments available for men: intrauterine insemination, IVF, intracytoplasmic sperm injection (ISCI), donor sperm insemination, and surgical sperm retrieval; (d) describe the maintenance and use of sperm banks including the advantages and potential risks; (e) define the terms **multiple pregnancy** and **multiple birth**; (f) explain how multiple pregnancy may occur; (g) describe the risks associated with a multiple pregnancy, including the strain on mother, miscarriage, 'vanishing twin' syndrome, risk of premature birth and disabilities; (h) outline the problems associated with Rhesus incompatibility when a Rhesus negative mother conceives a Rhesus positive child; (i) outline how monoclonal antibodies can be used in pregnancy testing; (j) discuss the processes of fertility treatment from biological (to include the possible impact on natural selection), ethical and economic viewpoints.

5.3.4 Food, farming and populations

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.3.4.1 Producing food for the human population The flow of energy and the recycling of nutrients through ecosystems influenced by human activity, are of particular interest to ecologists and agriculturists. To assess the impact of human activity, it is important to understand the natural processes that support ecosystems. Conservation issues are attracting attention globally and more effort is being made to take responsibility for human impact on the environment and to take steps to reduce that impact.	(a) distinguish between **intensive** and **extensive** food production; (b) discuss the advantages and disadvantages of intensive and extensive farming with reference to their comparative ability to provide resources in a **sustainable** fashion; (c) define the term **succession** and outline how agriculture can result in a **deflected succession;** (d) discuss the conflict which may exist between agriculture and conservation with reference to intensive farming; reference should be made to the effects of farm waste and hedgerow removal; (e) outline the conversion of light energy into chemical energy in the form of ATP and reduced NADP, in the light dependent stage of photosynthesis (details of cyclic and non-cyclic photophosphorylation are not required); (f) describe in outline the Calvin cycle, involving the light independent fixation of carbon dioxide by combination with a 5C compound to yield two molecules of a 3C compound, and the conversion of the 3C compound into carbohydrates, lipids and amino acids (biochemical details are not required); (g) describe the role of microorganisms in the carbon cycle; (h) describe the effects of human activity on the carbon cycle, to include global warming and deforestation; (i) outline the flow of energy through a food chain involving maize grown as animal feed and beef cattle reared for human consumption, to include a consideration of the efficiency of energy transfers in this food chain; (j) discuss the impact of the rise in human population on the environment; reference should be made to the impact on biodiversity; (k) outline examples of factors which affect the stability of human populations, to include food production, advances in medical technology, disease control and birth rate.

5.4 MODULE 2867: GENETICS, HOMEOSTASIS AND AGEING

Recommended Prior Knowledge

Candidates are assumed to have completed AS Modules 2856 and 2857, in which they will have studied the structure of cells that make up tissues, organs and body systems and how they function in these systems in health and disease. Candidates will be aware of risk factors involved in the development of some common diseases and how they may be avoided and health maintained, from conception to the adult. They will also have studied how enzymes are synthesised and how they control metabolism.

Candidates are also assumed to have studied A2 Module 2866 in which they will have studied the release and capture of energy, maximizing performance, the nervous system, human reproduction and the impact of humans on their environment.

5.4.1 Genetic Disease

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.4.1.1 Investigating the inheritance of human genetic disease Medical genetics is arguably one of the fastest developing areas of medicine. As more and more genetic diseases are diagnosed and studied there is a growing need for specialists and technicians in this area of human biology. Hospitals which have research and treatment units in this speciality employ a wide range of professionals, including doctors, nurses, and clinical and laboratory scientists. There are now many thousands of different genetic diseases named and diagnosed.	(a) explain the terms **gene, allele, locus, phenotype, genotype, dominant** and **recessive** with reference to the inheritance of cystic fibrosis and Huntington's disease; (b) with reference to cystic fibrosis and Huntington's disease, explain how gene mutation may or may not lead to the inheritance of genetic disease; (c) explain **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) explain **sex linkage** with reference to the inheritance of haemophilia; (f) use genetic diagrams to solve problems involving the **monohybrid inheritance** of the diseases named above; (g) explain **autosomal linkage** with reference to the inheritance of nail patella syndrome and the ABO blood groups; (h) use genetic diagrams to solve problems involving **dihybrid inheritance**; (i) explain how **non-disjunction** and **translocation** of chromosomes can result in Down's, Turner's and Klinefelter's syndromes; (j) discuss the ethical issues connected with the occurrence and inheritance of these diseases.

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
5.4.1.2 Treating genetic disease using genetic engineering **C3.2 WO3** The ethical issues involved in the diagnosis and treatment of genetic disease are a matter of considerable public interest. As understanding of genetic disease grows, there is an increasing need and demand for successful procedures which may cure or prevent these diseases.	(a) outline the function of restriction enzymes (restriction endonucleases) in separating specific sections of the genome; (b) describe the formation of **recombinant DNA** in bacterial plasmids; (c) describe the technique of genetic engineering in the synthesis of human growth hormone; (d) discuss the potential use of **gene therapy** in the treatment of genetic disease; (e) discuss the ethical implications of genetic engineering in humans including the consideration of somatic and germ cell therapy; (f) explain how genetic screening, genetic engineering and IVF have the potential to change the frequency of disease-causing alleles in the population; (g) use the Hardy Weinberg equation to illustrate the effects of selection on the frequency of alleles in the population.
5.4.1.3 Counselling individuals on genetic issues **C3.1a** As public awareness of genetic disease grows, more individuals need skilled counselling. Genetic counsellors are employed by NHS Hospital Trusts to help individuals to understand the biosocial issues involved and make appropriate, informed decisions.	(a) explain how pedigree analysis can indicate the probability of genetic disease occurring; (b) describe the role of the genetic counsellor; (c) discuss the ethical issues involved in the work of the genetic counsellor.
5.4.1.4 Using donated organs to treat disease **C3.2** Transplantation is explored by a consideration of genetic and taxonomic relationships. Multi-disciplinary teams are involved in transplant surgery. Doctors treating serious disease are hampered by the lack of organs for transplantation. All citizens should make a personal decision about whether or not to carry a donor card.	(a) explain the significance of genetic compatibility in transplant surgery with reference to the major histocompatibility (HLA) system; (b) outline the genetic significance of taxonomic grouping and define the term **taxonomy**; (c) describe the classification of the species Homo sapiens sapiens into its taxonomic group. (genus, family, order, class, phylum and kingdom); (d) define the term **species** with reference to *Homo sapiens sapiens*; (e) explain why the absence of genetic isolation of populations of *Homo sapiens sapiens* has resulted in no further **speciation**; (f) outline the potential sources of donated organs and the advantages and disadvantages of each; (g) outline the potential of genetic engineering in the use of non-human organs for transplant surgery; (h) discuss the ethical issues involved in transplant surgery.

5.4.2 Homeostasis

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.4.2.1 Diagnosing disturbances in the normal balance **C3.3** Doctors, and other health professionals such as health visitors and paramedics, are involved in the diagnosis and treatment of disturbances in homeostatic mechanisms. These disturbances may be illustrated by considering temperature control. Avoidance of hyperthermia and hypothermia is important for infants, old people and those living, working or taking recreation in extreme environments.	(a) discuss the importance of homeostasis in humans in maintaining a dynamic equilibrium of normal body constants; (b) explain 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) explain the technique for and the importance of measuring core temperature; (f) describe the causes and consequences of **hypothermia** and explain how it is treated; (g) explain how **hyperthermia** may occur.
5.4.2.2 Managing diabetes mellitus **C3.1b** The prevalence of diabetes mellitus is increasing. Health professionals help and advise on techniques for treating the condition, and help patients to manage their condition themselves, staff specialist clinics and work in the community. Paramedics and first-aiders should be aware of the symptoms of hypo and hyperglycaemia and the appropriate action.	(a) describe the cellular structure of an islet of Langerhans from the pancreas and outline the role of the pancreas as an **endocrine gland**; (b) explain how blood glucose concentration is regulated by **negative feedback** control mechanisms with reference to insulin and glucagon; (c) explain what is meant by the terms **hypoglycaemia** and **hyperglycaemia**; (d) describe the symptoms and first aid treatment of hypoglycaemia and hyperglycaemia; (e) describe how the blood is tested to diagnose diabetes mellitus, including fasting blood glucose test and glucose tolerance test; (f) explain the difference between Type 1 and Type 2 diabetes mellitus; (g) describe the genetic and environmental risk factors associated with the development of diabetes mellitus; (h) explain the use of insulin and diet in the treatment of diabetes mellitus.
5.4.2.3 Investigating the chemistry of urine Tests on the chemistry of urine are an important and simple diagnostic tool in giving an early warning of a number of disease conditions. Early diagnosis assists in successful treatment.	(a) define the term **excretion**, and explain the importance of removing nitrogenous waste products and carbon dioxide from the body; (b) describe the gross structure of the kidney and the detailed structure of the nephron with the associated blood vessels; (candidates should be able to interpret the histology of the kidney in section as seen under the light microscope);

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
	(c) describe and explain the process of ultrafiltration and selective reabsorption in the kidney resulting in the production of urine; (d) explain the function of the kidney, hypothalamus and pituitary gland in the control of water balance (using water potential terminology); (e) explain how changes in the chemistry of urine may indicate a malfunction in the control of blood glucose and water balance.
5.4.2.4 Treating kidney disease **C3.1b** Kidney disease has a profound effect on the lives of patients and their relatives. The treatment of kidney disease is costly and time consuming and organs for transplant are scarce. Treatment and advice involves doctors and other health professionals in specialist clinics.	(a) outline the causes of kidney failure and describe how it is diagnosed; (b) outline the alternative treatments to maintain kidney function in kidney disease; (c) outline the mechanisms of haemodialysis and peritoneal dialysis in the treatment of kidney failure; (d) discuss the advantages and disadvantages of the use of kidney transplants as an alternative to dialysis in the treatment of kidney failure; (e) discuss the practical and ethical issues involved in the use of donor organs for kidney transplants.

5.4.3 Ageing

Examples of 'real world' contexts for the learning outcomes specified in each section	Learning Outcomes Candidates should be able to:
5.4.3.1 Advising on the menopause **C3.3** HRT is often prescribed to women for the treatment of the immediate side effects of the menopause. It also has an important protective effect in guarding against a number of diseases which may occur in postmenopausal women as they age. Health professionals including doctors and nurses in specialist clinics may be required to diagnose and advise on the treatment of these conditions. Alternative therapies are also increasing in popularity.	(a) describe the effects of ageing on the reproductive system with reference to the menopause and the risk of prostate cancer; (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; (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, its effect on dementia (Alzheimer's disease), endometrial cancer, heart disease and breast cancer; (f) discuss alternative methods of treating the symptoms of the menopause including the use of phyto-oestrogens and antioxidants; (g) suggest reasons for the evolution of the female menopause, when sperm production in the male is continuous throughout life.

Examples of 'real world' contexts for the learning outcomes specified in each section	**Learning Outcomes** Candidates should be able to:
5.4.3.2 Managing the problems of ageing **C3.1a** As life expectancy increases it becomes important to maintain health so that the quality of life remains good. The demands on the medical and allied professions will increasingly require skills in geriatric medicine. Social and medical services will need to consider appropriate care and treatment to maintain the quality of life in the elderly.	(a) describe the effects of ageing on the brain and peripheral nervous system; (b) describe the symptoms and possible causes of Alzheimer's disease; (c) consider the issues involved in the care of patients with dementia; (d) describe the symptoms, causes and treatment of cataracts; (e) describe the effects of ageing on the skeletal system with reference to osteoarthritis and osteoporosis; (f) outline methods of preventing osteoporosis, reference should be made to calcium, Vitamin D, HRT and exercise; (g) describe the use of bone density tests in the detection of osteoporosis; (h) describe the effects of ageing on the cardiovascular and respiratory systems; (i) discuss the social consequences of ageing.

6 Further Information and Training for Teachers

To support teachers using these specifications, OCR will make the following materials and services available:

- up-to-date copies of these specifications;
- a full programme of In-Service Training (INSET) meetings;
- specimen question papers and mark schemes;
- past question papers and mark-schemes after each examination session;
- teacher support materials, including a Human Biology Coursework Guidance Handbook;
- written advice on coursework proposals;
- individual feedback to each Centre on the moderation of coursework;
- a Report on the Examination, compiled by senior examining personnel, after each examination session.

If you would like further information about the specifications, please contact OCR.

7 Recommended Resources

7.1 GENERAL TEXTS

Author(s)	Title	Publisher	Date	ISBN No.
Jones M and Jones G	*Advanced Human Biology*	Cambridge University Press	(In preparation at the time of writing)	
Boyle M, Indge B and Senior K	*Human Biology*	Collins Educational	1999	000 329 0956
Wright D	*Human Biology and Health*	Heinemann Educational Publishers		0 435 63304 X resource pack: 0 435 63303
Lowrie P and Fosbery R	*Human Health and Disease*	John Murray		
Fullick A	*Human Health and Disease*	Heinemann Educational Publishers	1998	0 435 57091 9
Givens P and Reiss M	*Human Biology and Health Studies*	2nd edition Nelson Thornes Ltd	1992	0 17 490061 0
Jones RN, Karp A and Giddings G	*The Essentials of Genetics*	John Murray	2001	0 7195 8611 9
Vellacott J and Side S	*Understanding Advanced Human Biology*	Hodder and Stoughton	1998	0 340 679115
Cambridge Advanced Science Series:				
Jones M, Fosbery R and Taylor D	*Biology 1*	Cambridge University Press	2000	0 521 78719X
Jones M and Gregory J	*Biology 2*	Cambridge University Press	2001	0 521 79714 4

7.2 USEFUL WEBSITES

A Dictionary of Pharmaceutical Medicine:	www.pharma-lexicon.com
Age Concern:	www.ace.org.uk
Alzheimer's Society:	www.alzheimers.org.uk
Association of the British Pharmaceutical Industry:	www.abpi.org.uk and www.abpischools.org.uk
British Diabetes Association	www.diabetes.org.uk
British Heart Foundation	www.dphpc.ox.ac.uk/bhfhprg
British Medical Journal:	www.bmj.com
Cambridge University Press:	www.cambridge.org
Department of Health:	www.doh.gov.uk
MIND	www.mind.org.uk
NHS Direct:	www.nhsdirect.nhs.uk
OCR	www.ocr.org.uk

Schools Science	www.schoolsscience.co.uk
The Wellcome Trust	www.wellcome.ac.uk
Your Genes	www.yourgenesyourhealth.co.uk

7.3 USEFUL ADDRESSES

The Alzheimer's Society
Gordon House
10 Greencoat Place
London SW1P 1PH

Tel: 020 7306 0606
Fax: 020 7306 0808
E-mail: info@alzheimers.org.uk

Age Concern
1268 London Road
London SW16 4ER

Adviceline: 0808 808 6060
Tel: 020 8765 7200
E-mail: ace@ace.org.uk

The British Diabetic Association
10 Queen Anne Street
London W1M 0BD

Cancer Research UK
PO box 123
London WC2A 3PX

Tel: 020 7269 3662
Fax: 020 7269 2865

MIND
Granta House
15-19 Broadway
London E15 4BQ

Infoline: 0845 660 163
Tel: 020 8519 2122
E-mail: contact@mind.org.uk

National Osteoporosis Society
PO Box 10
Radstock
Bath BA3 3YB

Helpline: 01761 472721
Tel: 01761 471771
Fax: 01761 471104

The Stroke Association
Stroke House
Whitecross Street
London EC1Y 8JJ

Tel: 020 7566 0300
Fax: 020 7490 2686
Advisory service: 020 7566 0330

7.4 SPECIFIC REFERENCES

Association of the British Pharmaceutical Industry:
(these booklets give a clear picture of the causes and current treatments of a variety of diseases)

Target Alzheimer's
Target Cancer
Target Diabetes
Target Depression
Target Osteoporosis
Target Stroke
Prevention is better than cure: how vaccines contribute to health

Association of the British Pharmaceutical Industry
12 Whitehall
London SW1A 2DY

Tel: 020 7930 3477
Fax: 020 7747 1411
E-mail: abpi@abpi.org.uk

Issues series – editor Craig Donnellan, Independence Educational Publishers
(A comprehensive reference source addressing contemporary social issues)

Cancer	(1999)	ISBN 1 86168 094 5
The Cloning Issue	(2002)	ISBN 1 86168 190 9
The Smoking Debate	(2002)	ISBN 1 86168 193 3
Drug Misuse	(2001)	ISBN 1 86168 164 X
Drugs in Sport	(2000)	ISBN 1 86168 129 1
The Abortion Issue	(2000)	ISBN 1 86168 143 7
Healthy Eating	(2001)	ISBN 1 86168 169 0
Alcohol Abuse	(2001)	ISBN 1 86168 181 X
How Fit Are We?	(2000)	ISBN 1 86168 120 8
The Energy Debate	(2001)	ISBN 1 86168 157 7
Heart Disease	(2000)	ISBN 1 86168 119 4
Ageing Matters	(1999)	ISBN 1 86168 092 9

Independence Educational Publishers
PO box 295
Cambridge CB1 3XP

Appendix A: Key Skills

This Appendix offers detailed guidance on the Key Skills evidence that a candidate might produce during their programme of study. It focuses on the evidence required to meet the criteria for the internally assessed Key Skills portfolio. The evidence requirements are reproduced from Part B of the QCA Key Skills specifications. For example, in producing work for assessment as evidence of **C3.2** (Read and synthesise information from **two** extended documents about a complex subject), a candidate is required to:

- select and read material that contains the information you need;
- identify accurately, and compare, the lines of reasoning and main points from text and images;
- synthesise the key information in a form that is relevant to your purpose.

The Key Skills and Evidence Requirements below are quoted from Part B of the QCA Skills specifications and, as such, are addressed to the candidate. The text below the Evidence Requirements is guidance for teachers about how the specification might be used to provide teaching and learning opportunities and/or assessment opportunities for the Key Skill.

For further information, teachers should refer to QCA's Key Skills specifications (for use in programmes of study starting from September 2000).

For further information about the assessment and certification of Key Skills, teachers should contact OCR.

C3 COMMUNICATION (LEVEL 3)

C3.1a Contribute to a group discussion about a complex subject

Evidence requirements

- Make clear and relevant contributions in a way that suits your purpose and situation.
- Listen and respond sensitively to others, and develop points and ideas.
- Create opportunities for others to contribute when appropriate.

Possible opportunities

These Advanced Subsidiary GCE and Advanced GCE Human Biology specifications provide many opportunities for group discussion. The social and ethical implications of many topics are implicit and stated. A useful way of 'breaking the ice' with a new group is to encourage them to bring newspaper and magazine cuttings on ethical issues, discuss them with the class and construct a display for notice boards that may be empty at the start of the year.

The following topics provide many opportunities for group discussion:

Module 2856: links between life style and coronary heart disease supported by articles from a range of sources;
Module 2857: stem cell technology; the social and ethical implications of screening for HIV;
Module 2866: modifying brain function; the ethical aspects of contraception and methods of assisting reproduction;
Module 2867: genetic screening and the role of the genetic counsellor; the effects and implications of ageing.

C3.1b Make a presentation about a complex subject, using at least one image to illustrate complex points

Evidence requirements

- Speak clearly and adapt your style of presentation to suit your purpose, subject, audience and situation.
- Structure what you say so that the sequence of information and ideas may be easily followed.
- Use a range of techniques to engage the audience, including effective use of images.

Possible opportunities

If time allows it is possible to approach any of the topics used for group discussion as a presentation.

The preparation of the task would also cover some of the skills in **IT3**.

Presentations using a variety of presentational techniques, could also be prepared on the following topics:

Module 2856: organelles; resuscitation techniques;
Module 2857: stages of foetal development; chromosomal and gene mutations;
Module 2857: diabetes; kidney disease;
A2 Coursework: Skill M – Making a Presentation.

C3.2 Read and synthesise information from two extended documents that deal with a complex subject. One of these documents should include at least one image

Evidence requirements

- Select and read material that contains the information you need.
- Identify accurately, and compare, the lines of reasoning and main points from texts and images.
- Synthesise the key information in a form that is relevant to your purpose.

Possible opportunities

There are numerous opportunities to fulfil the requirements for **C3.2** when preparing the material for group discussion or presentation in relation to **C3.1a** and/or **C3.1b**. In addition, the following topics provide opportunities to make class notes by extracting relevant information from a variety of sources, or to research information to plan an investigative exercise.

The preparation of the task could also cover some of the skills in IT3.

Module 2856: CD ROMs, recommended text books, data from practical exercises could be used to illustrate the principles of enzyme action with reference to blood storage. The account could be desk top published; use could be made of experimental evidence for the link between cigarette smoking and disease including the Doll study;
Module 2857: use of national newspapers, the internet and scientific journals will provide a wealth of information and images on the spread of human disease;
Module 2867: gene therapy is a topical issue with new techniques recorded in the media and in scientific journals; organ donation; as the population ages more attention is directed to the quality of life for the elderly and therefore to curing diseases associated with ageing;
A2 coursework: Skill S – Searching for Background Information; Skill M – Making a Presentation.

C3.3 Write two different types of documents about complex subjects. One piece of writing should be an extended document and include at least one image

Evidence requirements

- Select and use a form and style of writing that is appropriate to your purpose and complex subject matter.
- Organise relevant information clearly and coherently, using specialist vocabulary when appropriate.
- Ensure your text is legible and your spelling, grammar and punctuation are accurate so your meaning is clear.

Possible opportunities

Any of the activities outlined in **C3.2** could be used to produce an extended free response answer, revision notes or material for submission as a planning exercise. This could be completed in private study time. Additional suggestions which lend themselves to this approach and provide an opportunity to include images and data are given below:

Module 2857: stem cell technology; foetal and infant development;
Module 2866: the efficiency of respiration; improving athletic performance;
Module 2867: diagnosing disturbances in normal balance; osteoporosis and HRT.

N3 APPLICATION OF NUMBER (LEVEL 3)

You must:

Plan and carry through at least **one** substantial and complex activity that includes tasks for **N3.1**, **N3.2** and **N3.3**.

N3.1 Plan and interpret information from two different types of sources, including a large data set

Evidence requirements

- Plan how to obtain and use the information required to meet the purpose of your activity.
- Obtain the relevant information.
- Choose appropriate methods for obtaining the results you need and justify your choice.

Possible opportunities

It may be possible to plan and execute an investigative task that includes all three of the Application of Number skills, and some ideas are suggested in the *AS/A Human Biology Teacher Support: Coursework Guidance Handbook*. However, it is more likely that the majority of tasks will cover only one of **N3.1**, **N3.2** and **N3.3**.

Module 2856: the short and long term effects of smoking on the respiratory system;
AS/A2 Coursework: Skill P – Planning and Skill I – Implementing.

N3.2 Carry out multi-stage calculations to do with amounts and sizes; scales and proportion; handling statistics; rearranging and using formulae

You should work with a large data set on at least **one** occasion.

Evidence requirements

- Carry out calculations to appropriate levels of accuracy, clearly showing your methods.
- Check methods and results to help ensure errors are found and corrected.

Possible opportunities

All the investigative activities used for **N3.1** could be extended to include the use of the calculations listed for **N3.2**. The collection, processing and analysis of data is implicit in the majority of investigative exercises.

Module 2857: investigating infant development;
A2 Coursework: Skill A – Analysing and Skill E – Evaluating.

N3.3 Interpret results of your calculations, present your findings and justify your methods. You must use at least one graph, one chart and one diagram

Evidence requirements

- Select appropriate methods of presentation and justify your choice.
- Present your findings effectively.
- Explain how the results of your calculations relate to the purpose of your activity.

Possible opportunities

These Human Biology specifications provide many opportunities for obtaining evidence of these skills. Data obtained for **N3.1** and **N3.2** will lend itself to the requirements for **N3.3**. The skills are implicit in the analysis and evaluation of all investigative work.

Module 2857: Investigating infant development;
A2 Coursework: Skill A – Analysing and Skill E – Evaluating.

IT3 IT (LEVEL 3)

You must:

Plan and carry through at least **one** substantial activity that includes tasks for **IT3.1**, **IT3.2** and **IT3.3**.

IT3.1 Plan, and use different sources to search for, and select, information required for two different purposes

Evidence requirements

- Plan how to obtain and use the information required to meet the purpose of your activity.
- Choose appropriate sources and techniques for finding information and carry out effective searches.
- Make selections based on judgements of relevance and quality.

Possible opportunities

These will arise during planning for the coursework tasks. Alternatively, there will be opportunities in accessing information for evidence relating to **C3**, when a wide variety of IT skills and resources can be used, such as searching the Internet, or making use of CD-ROMs and other software such as spread sheets.

IT3.2 Explore, develop, and exchange information and derive new information to meet two different purposes

Evidence requirements

- Enter and bring together information in a consistent form, using automated routines where appropriate.
- Create and use appropriate structures and procedures to explore and develop information and derive new information.
- Use effective methods of exchanging information to support your purpose.

Possible opportunities

The specification provides limited opportunities to access the requirements of **IT3.2**, although automated routines are used relatively frequently in investigative work. However, the exchange of data via the Internet and email can be seen as an extension of the normal pooling of class data. Work based assignments provide more opportunities to access the requirements of this skill.

Module 2857: The Human Genome Project.

IT3.3 Present information from different sources for two different purposes and audiences. Your work must include at least one example of text, one example of images and one example of numbers

Evidence requirements

- Develop the structure and content of your presentation using the views of others, where appropriate, to guide refinements.
- Present information effectively, using a format and style that suits your purpose and audience.
- Ensure your work is accurate and makes sense.

Possible opportunities

Most investigative work involves the production of a report using text, the processing of data and, at A2 the use of drawings and images.

Preparatory work for discussion and presentation in **C3.1** also includes these skills. A presentation making more use of IT could be achieved through the use of Microsoft 'PowerPoint' to present the topic on a screen, or on a large screen television. Health statistics from a variety of sources could be presented in this way.

A2 Coursework: Skill M – Making a presentation.

WO3 WORKING WITH OTHERS (LEVEL 3)

You must :

Provide at least **one** substantial example of meeting the standard for **WO3.1**, **WO3.2** and **WO3.3**, (you must show you can work in one-to-one and group situations).

WO3.1 Plan complex work with others, agreeing objectives, responsibilities and working arrangements

Evidence requirements

- Agree realistic objectives for working together and what needs to be done to achieve them.
- Exchange information, based on appropriate evidence, to help agree responsibilities.
- Agree suitable working arrangements with those involved.

Possible opportunities

The suggestions outlined to cover Key Skill **C3.1a** and **C3.1b**, could also be used to access **WO3.1**, **WO3.2** and **WO3.3** as they require the group to work together to produce a coherent and logical presentation of the whole topic. Regular meetings between the subgroups and the whole group to check on progress ensures both monitoring and an exchange of information to improve the final presentation. Records of these meetings should be kept, identifying ways in which the group worked together and ways in which cooperative working could be improved in the future. These records could be in the form of logs kept by the participants, audio-visual tape recordings or minutes of the meetings concerned.

Limited opportunity to access this skill may exist in an initial discussion with the teacher or the workplace supervisor on the topic and approach to the AS or A2 coursework.

WO3.2 Seek to establish and maintain cooperative working relationships over an extended period of time, agreeing changes to achieve agreed objectives

Evidence requirements

- Organise and carry out tasks so you can be effective and efficient in meeting your responsibilities and produce the quality of work required.
- Seek to establish and maintain cooperative working relationships, agreeing ways to overcome any difficulties.
- Exchange accurate information on progress of work, agreeing changes where necessary to achieve objectives.

Possible opportunities

Candidates can be assessed on this skill area whilst preparing work as outlined in W03.1. The presentation of work for the group as a whole provides an obvious check as to the meeting of deadlines and cooperation within the group. Records should be kept of the progress made by the group. These can be similar to those used for **WO3.1**.

Limited opportunity to access this skill may exist in an initial discussion with individuals such as the laboratory technician on the requirements for the AS or A2 coursework.

WO3.3 Review work with others and agree ways of improving collaborative work in the future

Evidence requirements

- Agree the extent to which work with others has been successful and the objectives have been met.
- Identify factors that have influenced the outcome.
- Agree ways of improving work with others in the future.

Possible opportunities

Candidates could be given the opportunity to provide feedback on the presentation that they have prepared. Part of this feedback could include ways in which they could help each other in similar activities in the future. Statements summarising the outcomes of the activity should be included in the reports kept by the participants. They should be encouraged to reflect on the factors that influenced the success of the group and record these and ways in which cooperative work could be improved in the future.

LP3 IMPROVING OWN LEARNING AND PERFORMANCE (LEVEL 3)

You must :

Provide at least **one** substantial example of meeting the standard for **LP3.1**, **LP3.2** and **LP3.3**.

LP3.1 Agree targets and plan how these will be met over an extended period of time, using support from appropriate people

Evidence requirements

- Seek information on ways to achieve what you want to do, and identify factors that might affect your plans.
- Use this information to agree realistic targets with appropriate people.
- Plan how you will effectively manage your time and use of support to meet targets, including alternative action for overcoming possible difficulties.

Possible opportunities

The skills involved in investigation require the candidate to organise the necessary materials and equipment, such as audio-visual and IT equipment and cooperate with others to find an appropriate occasion to carry out an activity. This will also enable the candidate to agree targets, write an action plan and manage the time effectively.

Module 2857: protein synthesis;
AS/A2 Coursework: Skill P – Planning.

LP3.2 Take responsibility for your learning by using your plan, and seeking feedback and support from relevant sources, to help meet targets.

Improve your performance by:

- Studying a complex subject.
- Learning through a complex practical activity.
- Further study or practical activity that involves independent learning.

Evidence requirements

- Manage your time effectively to complete tasks, revising your plan as necessary.
- Seek and actively use feedback and support from relevant sources to help you meet targets.
- Select and use different ways of learning to improve your performance, adapting approaches to meet new demands.

Possible opportunities

Self learning exercises, such as coursework, provide ample opportunity to access **LP3.2** by monitoring the candidate's progress. Candidates should complete a log recording the different approaches they adopted, when they sought feedback and support, how they made use of it and ways in which they revised their plan of action as they progressed.

A2 Coursework: Skill R – Recording an Interview.

LP3.3 Review progress on two occasions and establish evidence of achievements including how you have used learning from other tasks to meet new demands

Evidence requirements

- Provide information on the quality of your learning and performance, including factors that have affected the outcome.
- Identify targets you have met, seeking information from relevant sources to establish evidence of your achievements.
- Exchange views with appropriate people to agree ways to further improve your performance.

Possible opportunities

Candidates could access **LP3.3** by discussing the assessment of their work with the teacher or another appropriate person. Performance could be assessed against targets that are set at the outset. An action plan could be devised in the light of the candidate's performance and this could be used to identify targets for future tasks. This performance review could be part of an on-going process of self review and evaluation by the candidate. Examples of work which show what the candidate has learned from studying a complex subject, such as transcription and translation, or carrying out an investigative activity, should be kept or copied to show evidence of achievement.

PS3 PROBLEM SOLVING (LEVEL 3)

You must:

Provide at least **one** substantial example of meeting the standard for **PS3.1**, **PS3.2** and **PS3.3**.

This skill could be assessed through the Investigative Skills Component in AS and the Extended Investigation in A2. However, as the evidence required for **PS3** requires considerable feedback and support from others it may be advisable to assess the Key Skill on work that is used as a practice exercise and does not form part of the assessment for AS or A2.

For all tasks the candidate should have knowledge of the theory in the appropriate Learning Outcomes. For tasks suitable for assessing investigative skills, the candidate could then follow the criteria for Planning, Implementing, Analysing and Drawing Conclusions and Evaluating Evidence and Procedures as outlined in this specification, whilst at the same time selecting evidence for the Problem Solving Skills as outlined below.

PS3.1 Explore a complex problem, come up with three options for solving it and justify the option selected for taking forward

Evidence requirements

- Explore the problem, accurately analysing its features, and agree with others on how to show success in solving it.
- Select and use a variety of methods to come up with different ways of tackling the problem.
- Compare the main features of each possible option, including risk factors, and justify the option you select to take forward.

Possible opportunities

At least **three** methods should be considered for the exercise chosen and the main features tested and compared. A plan should be drawn up that includes the different approaches to the problem, the timing involved and the apparatus to be used. A risk assessment should always be carried out as part of the exercise. The candidate should choose the best approach to solving the problem and justify that choice.

PS3.2 Plan and implement at least one option for solving the problem, review progress and revise your approach as necessary.

Evidence requirements

- Plan how to carry out your chosen option and obtain agreement to go ahead from an appropriate person.
- Implement your plan, effectively using support and feedback from others.
- Review progress towards solving the problem and revise your approach as necessary.

Possible opportunities

The candidate must have all risk assessments checked and approved by the teacher before beginning any practical work. This inevitably involves approval or possible modification of the proposed method. However, it is implicit in the internal assessment of investigative skills that candidates should not collude with others or receive undue assistance from teachers. However, it may be possible to access **PS3.2** in a workplace-based assignment where the candidate is working in an environment well outside their normal experience. The candidate should be encouraged to carry out a pilot study and modify the method in the light of the results. The candidate should also be encouraged to keep a log book detailing discussions with the teacher and others and recording all feedback received. This would provide useful evidence for assessment.

PS3.3 Apply agreed methods to check if the problem has been solved, describe the results and review your approach to problem solving

Evidence requirements

- Agree, with an appropriate person, methods to check if the problem has been solved.
- Apply these methods accurately, draw conclusions and fully describe the results.
- Review your approach to problem solving, including whether alternative methods and options might have proved more effective.

Possible opportunities

The written report of the coursework task, following the criteria for coursework assessment, particularly for Skill E – Evaluation, should provide evidence to access **PS3.3**. The report could include a record of discussions with the teacher and the laboratory assistant, the feedback obtained and the ways in which changes have been implemented. This record would provide useful evidence for the assessment.

Appendix B: Notes for Guidance on Coursework Assessment and Submission

This Appendix is intended to provide guidance for teachers in assessing Investigative Skills (AS) and the Extended Investigation (A2), but should not exert an undue influence on the methods of teaching or provide a constraint on the investigative work undertaken by candidates. It is not expected that all of the investigative work undertaken by candidates would be appropriate for assessment.

Examples of suitable tasks are given at the end of this appendix. For further advice, teachers should refer to the *AS/A Human Biology Teacher Support: Coursework Guidance Handbook.* Copies can be ordered from the OCR Publications Department.

The investigative skills to be assessed for AS are:

P Planning;
I Implementing;
A Analysing Evidence and Drawing Conclusions;
E Evaluating Evidence and Procedures.

There are **three** additional skills for A2:

S Searching for Background Information;
R Recording an Interview;
M Making a Presentation.

It is expected that candidates will have had opportunities to acquire experience and develop the relevant skills before assessment takes place.

In AS, when a skill has been assessed on more than **one** occasion, the better or best mark for that skill should be submitted. However, Centres are recommended not to assess the skills on more than **two** occasions since this may take up time that might better be devoted to other aspects of the specification.

All coursework is marked by the teacher and internally standardised by the Centre. Marks are then submitted to OCR by a specified 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 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 DEMAND OF AN ACTIVITY

The demand of an activity is an important feature of the assessment. From the bottom to the top of the mark range in a skill area the activity should involve increasing demands of associated scientific knowledge and understanding, manipulation of the evidence, precision, accuracy and complexity.

The difference in standard of the common Skills **P**, **I**, **A** and **E** at AS and A2 is a product of the level of demand of the related scientific knowledge and understanding, together with the complexity and level of demand of the tasks set. Also the mark descriptors for Skills **P** and **A** at A2 include synoptic assessment. Assessment at A2 uses three *additional* skills, **S**, **R** and **M**.

In A2, candidates are required to apply knowledge, understanding and skills from the AS and A2 parts of the specification in planning investigative work and in the analysis of evidence (synoptic assessment). Details of the way in which tasks can be differentiated are given in Section 4.9 and further guidance on setting appropriate tasks is given in guidance material published separately.

Teachers should appreciate that the choice of an activity that is comparatively undemanding (primarily in terms of the level of the scientific knowledge and understanding that can be linked to the activity, and in the range/complexity of the equipment/techniques used) may prevent access to the highest marks.

Teachers should be aware of this feature of the assessment so that, when considering the award of higher marks, the activity should require a sophisticated approach and/or complex treatment. Higher marks must not be awarded for work that is simplistic or trivial.

One of the factors that determine the demand of an activity is the level of guidance given to candidates. The use of a highly structured worksheet, for example, will reduce the number of decisions and judgements required by the candidate and so will limit the range of marks available.

USING SECONDARY DATA

When candidates use secondary data (data they have not themselves collected from practical or investigative work) in coursework, they must process the data themselves if credit is to be available in Skill **A** (not simply copy the analysis completed by others). The data may have been obtained from, for example, local sources, the Internet, scientific papers or be pooled class data, but if candidates are to evaluate the data (and the techniques used to collect it) in Skill **E**, they will need to have available to them details of the procedures originally used. Candidates must provide detailed references to the sources of the data used (or copies of the data if not readily available) to the person marking the work (and to the moderator).

It is recommended that if coursework is based on secondary data, more than one source of data is combined (two or more secondary sources, or secondary and primary). The task is then likely to be of an appropriate demand and candidates will have more opportunities to match the assessment criteria and attain the higher mark levels.

MARKING CANDIDATES' WORK

The descriptors for Skills **P**, **I**, **A** and **E** have been written to provide clear continuity from the assessment of Sc1 for GCSE. This should ensure an effective continuation of the development of candidates' skills from GCSE to Advanced Subsidiary and Advanced GCE.

The mark descriptors within a skill area have been written to be hierarchical. Thus, in marking a piece of work, the descriptors for the lowest defined mark level should be considered first and only if there is a good match should the descriptors for the next level up be considered. Therefore, if a teacher is considering awarding a high mark for a piece of work, the work must have demonstrated a good match to all the lower mark descriptors.

For each skill, the scheme allows the award of intermediate marks (between the defined mark levels). An intermediate mark may be awarded when the work of a candidate exceeds the requirements of a defined mark level but does not meet the requirements of the next higher defined mark level sufficiently to justify its award. Thus, an intermediate mark could be awarded if the work meets only one of the two descriptors at the higher defined mark level, or provides a partial match to both descriptors, or provides a complete match to one and a partial match to the other.

In skills **P** and **A**, a mark above the highest defined mark level should be awarded for work which meets all the requirements of the descriptors for the highest defined mark level, and is judged to be of exceptional merit in terms of originality, depth, flair, or in the use of novel or innovative methods.

A mark of zero should be awarded where there has been an attempt to address the skill but the work does not meet the requirements of the lowest defined mark level.

The marks awarded should be based on both the final written work and on the teacher's knowledge of the work carried out by the candidate. In assigning a mark, attention should be paid to the extent of any guidance needed by, or given to, the candidate.

In defining the various mark descriptors 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 for each defined level are intended to provide guidance to teachers on how to recognise levels of achievement. It is acknowledged that the balance between the statements provided for a particular level of performance will vary with the nature of the activity. Whilst both statements for a particular defined level *must* be considered in awarding the marks, it is clear that teachers will need to judge for themselves the relative weightings they attach to each of the statements.

SYNOPTIC ASSESSMENT

Synoptic assessment involves the explicit drawing together of knowledge, understanding and skills learned in different parts of the Advanced GCE course. Assessment Objective AO4 relates specifically to synoptic assessment and marks from Unit 2868, the extended investigation, contribute to the assessment of AO4.

During investigative work, synoptic assessment:

- allows candidates to apply knowledge and understanding of principles and concepts from different parts of the specification in planning investigative work and in the analysis and evaluation of evidence;
- allows candidates to apply skills and techniques learned during the course.

The extended investigation, assessed internally by Centres for the A2 Unit 2868, should draw on the range of experience that the candidate has acquired during the AS and A2 courses. It is particularly important that an exercise used to assess *Planning* should involve an element of research that goes beyond the repetition of a task conducted during the A2 part of the course. Likewise, the assessment of *Analysing evidence and drawing conclusions* must require a candidate to use knowledge and understanding acquired outside the confines of a standard task recently practised. During the process of moderation, evidence will be sought that such breadth has been achieved.

The assessment descriptors for the skills of Planning (**P**) and Analysing Evidence and Drawing Conclusions (**A**), include statements that relate specifically to synoptic assessment. **These are shown in bold and should be applied only when assessing A2 work.** Thus, in A2, a candidate will not be able to achieve more than 2 marks in each of Skills **P** and **A** without demonstrating aspects of synoptic assessment. Candidates will also bring to the assessment of Skill **I** (Implementing) their experience of practical and investigative work from throughout the course. In Skill **E** (Evaluating Evidence and Procedures), aspects of Skills **P** and **A** are evaluated. Overall, in A2, approximately 15 of the 45 available marks can thus be identified as contributing to an assessment of AO4 (synoptic assessment).

QUALITY OF WRITTEN COMMUNICATION

Coursework must include an assessment of candidates' quality of written communication. At Level 3, candidates are required to:

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

The mark descriptors for Skills **P**, **A** and **M** have been written to include these aspects, and Skills **P** and **A** carry an additional mark each in recognition of this.

ANNOTATION OF CANDIDATES' WORK

Each piece of assessed coursework must be annotated to show how the marks have been awarded in relation to the relevant skills.

The writing of comments on candidates' work can provide a means of dialogue and feedback between teacher and candidate, and a means of communication between teachers during internal standardisation of coursework. However, the main purpose of annotating candidates' coursework should be to provide a means of communication between the teacher and the Moderator, showing where marks have been awarded and why. The sample of work which is submitted for moderation *must* show how the marks have been awarded in relation to the marking criteria.

Annotations should be made at appropriate points in the margins of the text. The annotations should indicate both where achievement for a particular skill has been recognised, and where the mark has been awarded. It is suggested that the minimum which is necessary is that the 'shorthand' mark descriptors (for example, **P**.5a, **I**.3b) should be written at the point in the text where it is judged that the work has met the descriptors concerned.

For Skill **I**, Implementing, more detail is necessary and the Moderator will require evidence concerning candidates' use of investigative techniques and safe/ethical working practice. This evidence could take the form of checklists or written notes. For Skills **R** and **M**, where evidence is ephemeral, evidence must be provided to the Moderator in the form of checklists or written notes to support the marks awarded.

ETHICAL WORKING PRACTICES

Many of the topics covered by these specifications concern issues with complex ethical considerations. It is important that guidance should be given by teachers on the ethical implications of any topic, particularly those considered for coursework. Collection of evidence from individuals including fellow students should be conducted with care and sensitivity. When candidates are planning their own investigative activities, whether in project work or for more routine situations, the teacher or lecturer has a duty to check the plans before investigative work starts and to monitor the activity as it proceeds.

It is the responsibility of the teacher or lecturer to ensure that the guidelines which follow are adhered to.

Candidates *must*:

- understand that ethical guidelines are based on respect and care for the individuals involved;
- appreciate the feelings and reactions of potential subjects to their investigations;
- work with *positive* variables such as healthy eating, athletic performance;
- investigate only legal activities such as the use of data in the public domain;
- make it clear to potential subjects what the investigation involves;
- ask questions only about less sensitive issues (except were the person concerned is a professional in the area);
- maintain anonymity of the subjects.

Candidates *must not*:

- cause or risk any stress, distress or embarrassment;
- cause or risk potential harm to themselves or their subjects;
- engage in or be a party to any illegal activity such as breaching the Data Protection Act, use of controlled drugs;
- use data from a workplace without permission;
- deceive their subjects in any way;
- manipulate a subject's behaviour for the sake of an investigation;
- ask questions about sensitive issues such as suicide, abortion, risk of inherited disease, physical appearance, eating disorders, disease conditions (except where the person concerned is a professional in the area).

HEALTH AND SAFETY

In UK law, health and safety is the responsibility of the employer. For most establishments entering candidates for GCE AS and Advanced GCE this is likely to be the 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 1996 and the Management of Health and Safety at Work Regulations 1992, require that before any activity involving a hazardous procedure or harmful microorganisms 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 in Chapter 4 of *Safety in Science Education* (see below). 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;
Safeguards in the School Laboratory, 10th edition, 1996, ASE ISBN 0 86357 250 2;
Hazcards, 1995, CLEAPSS School Science Service*;
Laboratory Handbook, 1988-97, CLEAPSS School Science Service*;
Topics in Safety, 2nd edition, 1988, ASE ISBN 0 86357 104 2;
Safety Reprints, 1996 edition, ASE ISBN 0 86357 246 4.
Hazardous Chemicals, A Manual for Science Education, SSERC Limited 1997, ISBN 0 95317 760 2

* Note that CLEAPSS publications are only available to members or associates.

(Other publications have sometimes been suggested, e.g. the DES *Microbiology, an HMI Guide for Schools and FE*, but this is now out of print).

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 that 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 these may well lead to the use of novel procedures, chemicals or microorganisms, 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 the CLEAPSS School Science Service (or, in Scotland, SSERC).

When candidates are planning their own investigative activities, whether in project work or for more routine situations, the teacher or lecturer has a duty to check the plans before investigative work starts and to monitor the activity as it proceeds.

EXAMPLES OF POSSIBLE COURSEWORK TASKS

For details of suitable tasks for assessing coursework, teachers should refer to *AS/A Human Biology Teacher Support: Coursework Guidance Handbook*. Copies can be ordered from the OCR Publications Department. The following list is provided to show the wide range of tasks that are possible. Tasks marked with an asterisk are suitable for the use of secondary data only (but do not preclude the use of primary data).

The examples given for A2 provide opportunities for single investigations (covering all **seven** skills). The examples given for AS provide access to **one or more** of the **four** skills to be assessed.

Candidates should be reminded that many of the issues investigated in Human Biology are of a sensitive nature and the Ethical Guidelines given in Appendix B of the specification should be adhered to.

AS

- Semi-quantitative Benedict's test to produce numerical data (e.g. by using a colorimeter) in order to assess the glucose content of foods.
- Effect of temperature on the rates of enzyme catalysed reactions.
- Effect of pH on the rates of enzyme catalysed reactions.
- Effect of enzyme or substrate concentrations on the rates of enzyme catalysed reactions.
- Effect of enzyme inhibitors on the rates of enzyme catalysed reactions.
- Investigating enzyme activity in apple browning, to produce numerical data (e.g. by using a colorimeter).
- Effect of chloride ion concentration on the activity of salivary amylase.
- Effect of factors such as temperature, detergents or solvents on membrane permeability using beetroot or blood.
- Effects of osmosis on various tissues (e.g. blood or liver cells).
- The effect of different solutes of the same concentration on various tissues.
- Investigating the elasticity of the aorta and the vena cava.
- * Epidemiological investigation into the factors associated with coronary heart disease.
- Effect of noise on pulse rate.
- Analysis of spirometer traces to investigate lung function.
- Analysis of the composition of inspired and expired air.
- * Epidemiological investigation into smoking and lung disease.
- Analysis of preparations of slides of mitosis.
- * Epidemiological investigation into the factors associated with cancer.
- Effect of birth time on circadian rhythm.
- * Investigating the factors which affect human growth.
- Effect of hand span or gender on manual dexterity.
- The development of balance in four to five year old children.
- Investigating the effects of, for example, enzyme inhibitors, antibiotics and disinfectants on bacterial growth.
- Investigating growth requirements or growth rates of bacteria.
- * Using epidemiological data to investigate the incidence and prevalence of infectious disease.
- Investigating causes of death or age of death over time.

A2

Skills **P** and **A** are synoptic. Therefore, the task chosen for the A2 Extended Investigation must be based on the A2 content of the specification and must also draw on knowledge and understanding from the AS specification in order to access the higher mark levels.

- Physiological studies on training methods and the improvement of athletic performance.
- The effect of exercise on the body for different age groups.
- A comparison of fitness levels between smokers and non-smokers in the same age group.
- The effect of a fitness programme on the resting blood pressure.
- Investigating memory or learning.
- Investigating the correlation between exercise endurance levels and lung capacity.
- Effect of age on saying tongue twisters/matching playing cards.
- Effect of age on reaction time.
- Effect of age on short term memory.
- An investigation into smell and associative memory.
- Colour preferences of children in relation to age.
- Effect of age on the size of personal space.
- * Studies of the effects of drugs on the brain.
- * Investigating the effectiveness of different methods of contraception.
- * Investigating the factors affecting global warming.
- * Investigating the efficiency of energy transfer through food chains leading to humans.
- * Investigating the occurrence and inheritance of inherited diseases, using pedigree analysis.
- * Investigating the frequency of occurrence of alleles in human populations.
- * Investigating the control of temperature, blood glucose concentrations or water balance in humans.
- The suitability of different snacks for diabetic children.
- * Investigating the effectiveness of HRT in treating the symptoms of the menopause.

Appendix C: Mark Descriptors for Investigative Skills and the Extended Investigation

In defining the various mark descriptors, 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 defined level are intended to provide guidance to teachers on how to recognise levels of achievement.

It is acknowledged that the balance between the statements provided for a particular level of performance will vary with the nature of the activity. Whilst both statements for a particular level must be considered in awarding the marks, it is clear that teachers will need to judge for themselves the relative weightings they attach to each of the statements.

For examples of suitable tasks for assessing practical skills, and for examples of possible individual studies, teachers should refer to *AS/A Human Biology Teacher Support: Coursework Guidance Handbook*. Copies can be ordered from the OCR Publications Department.

Skill P – Planning — Total 8

Mark		Descriptor
		The candidate:
1	**P.1a**	develops a question or problem in simple terms and plans an appropriate investigation, making a prediction where relevant.
	P.1b	chooses appropriate investigative techniques.
2		
3	**P.3a**	develops a question or problem using scientific knowledge and understanding **drawn from more than one area of the specification**; identifies the key factors to vary, control or take account of.
	P.3b	decides on the extent of the evidence (observations/data) needed for the investigation.
4		
5	**P.5a**	uses detailed scientific knowledge and understanding **drawn from more than one module of the specification**, and information from preliminary work or a secondary source, to plan an appropriate strategy to collect evidence, taking into account the need for safe and/or ethical working practices, and justifying any prediction made.
	P.5b	describes a strategy to collect evidence, including choice of investigative techniques, which takes into account the need to produce precise and reliable evidence; produces a clear account and uses specialist vocabulary appropriately.
6		
7	**P.7a**	retrieves and evaluates information from a variety of sources, and uses it to develop a strategy which is well structured, logical and linked coherently to underlying scientific knowledge and understanding **drawn from different parts of the AS and A2 specifications**; uses spelling, punctuation and grammar accurately.
	P.7b	justifies the strategy developed, including the choice of investigative techniques, in terms of the need for precision and reliability.
8		**8 marks** should be awarded if the work meets all the requirements for 7 marks and is judged to be of exceptional merit in terms of its originality, depth, flair, or in the use of novel or innovative methods.

The statements in bold represent additional requirements for Unit 2868. Both statements at a defined level must be satisfied in order that the mark for this level is awarded. From the bottom to the top of the mark range the activity should involve increasing demands of related scientific knowledge and understanding, and complexity.

Skill I – Implementing — Total 7

Mark		Descriptor
		The candidate:
1	**I.1a**	demonstrates confidence in the use of simple investigative techniques and an awareness of the need for safe and/or ethical working practices.
	I.1b	collects and records evidence (observations/data) that is adequate for the investigation.
2		
3	**I.3a**	demonstrates competence in the use of familiar investigative techniques.
	I.3b	collects evidence systematically; records evidence clearly and accurately.
4		
5	**I.5a**	demonstrates competence and confidence in the use of investigative techniques; adopts safe and/or ethical working practices throughout.
	I.5b	collects evidence accurately; records evidence in an appropriate format.
6		
7	**I.7a**	demonstrates skilful and proficient use of all investigative techniques.
	I.7b	collects sufficient evidence to meet all the requirements of the investigation; records evidence in appropriate detail and justifies the degree of precision to which evidence is recorded, in terms of the investigative techniques used.

Both statements at a defined level must be satisfied in order that the mark for this level is awarded. From the bottom to the top of the mark range the activity should involve increasing demands of related scientific knowledge and understanding, and complexity.

Skill A – Analysing Evidence and Drawing Conclusions — Total 8

Mark		Descriptor
		The candidate:
1	**A.1a**	carries out some simple processing of the evidence collected, such as the use of bar charts or histograms, or the calculation of means.
	A.1b	identifies trends or patterns in the evidence and draws simple conclusions.
2		
	A.3a	processes and presents evidence gathered using appropriate graphical and/or numerical techniques.
3	**A.3b**	links conclusions drawn from the processed evidence with associated scientific knowledge and understanding **drawn from more than one area of the specification**.
4		
	A.5a	carries out detailed processing of evidence and analysis including the use of advanced numerical techniques such as, where appropriate, statistics, the plotting of intercepts, the calculation of gradients, or the use of error bars.
5	**A.5b**	draws conclusions that are consistent with the processed evidence and links these with detailed scientific knowledge and understanding **drawn from more than one module of the specification**; produces a clear account that uses specialist vocabulary appropriately.
6		
	A.7a	uses detailed scientific knowledge and understanding **drawn from different parts of the AS and A2 specifications** to make deductions from the processed evidence, with due regard to nomenclature, terminology and the use of significant figures (where relevant).
7	**A.7b**	draws conclusions which are well structured, appropriate, comprehensive and concise, and which are coherently linked to underlying scientific knowledge and understanding **drawn from different parts of the AS and A2 specifications**; uses spelling, punctuation and grammar accurately.
8		**8 marks** should be awarded if the work meets all the requirements for 7 marks and is judged to be of exceptional merit in terms of its originality, depth, flair, or in the use of novel or innovative methods.

The statements in bold represent additional requirements for Unit 2868. Both statements at a defined level must be satisfied in order that the mark for this level is awarded. From the bottom to the top of the mark range the activity should involve increasing demands of related scientific knowledge and understanding, and complexity.

Skill E – Evaluating Evidence and Procedures — Total 7

Mark		Descriptor
		The candidate:
1	**E.1a**	makes relevant comments on the suitability of the investigative techniques used.
	E.1b	makes a relevant comment about the evidence, for example the occurrence of anomalous results.
2		
3	**E.3a**	recognises how limitations in the investigative techniques and/or strategies for collecting evidence may result in sources of error.
	E.3b	comments on the accuracy of the evidence, suggesting reasons for any anomalous results.
4		
5	**E.5a**	indicates the significant limitations of the investigative techniques and/or strategies used, and suggests how they could be improved.
	E.5b	comments on the reliability of the evidence and evaluates the main sources of error.
6		
7	**E.7a**	justifies proposed improvements to the investigative techniques and/or strategies used in terms of increasing the reliability of the evidence and minimising significant sources of error.
	E.7b	assesses the significance of the uncertainties in the evidence in terms of their effect on the validity of the final conclusions drawn.

Both statements at a defined level must be satisfied in order that the mark for this level is awarded. From the bottom to the top of the mark range the activity should involve increasing demands of related scientific knowledge and understanding, and complexity.

Skill S – Searching for Background Information (Unit 2868 only) — Total 5

Mark		Descriptor
		The candidate:
1	**S.1a**	uses, and provides a bibliography for, a minimum of 5 sources related to the investigation, including both digital and written media.
	S.1b	records information clearly and concisely in a report of 500-1 000 words.
2		
	S.3a	selects and uses relevant information from the sources identified and references these accurately within the report.
3		
	S.3b	organises the information selected; uses several different presentational techniques, such as flow diagrams, graphs, drawings, photographs and text.
4		
	S.5a	evaluates information from the sources identified, justifying the selection used.
5		
	S.5b	integrates information from a variety of different sources in a coherent report, using a variety of appropriate presentational techniques.

Both statements at a defined level must be satisfied in order that the mark for this level is awarded. From the bottom to the top of the mark range the activity should involve increasing demands of related scientific knowledge and understanding, and complexity.

Skill R – Recording an Interview (Unit 2868 only) — Total 5

Mark		Descriptor
		The candidate:
1	**R.1a**	devises a set of 10-15 questions linked clearly to the nature of the investigation.
	R.1b	records answers clearly and concisely.
2		
3	**R.3a**	devises well-constructed questions designed to elicit answers that will assist in the planning of the investigation or in the interpretation of the results or in an understanding of the work related relevance of any conclusions.
	R.3b	suggests supplementary questions to investigate areas of interest; evaluates the interview in simple terms, suggesting improvements.
4		
5	**R.5a**	devises a logical sequence of questions all of which clearly relate the nature of the investigation to the experience of the interviewee.
	R.5b	uses supplementary questions that assist in the development of the investigation; evaluates the interview in terms of its contribution to the investigation.

Both statements at a defined level must be satisfied in order that the mark for this level is awarded. From the bottom to the top of the mark range the activity should involve increasing demands of related scientific knowledge and understanding, and complexity.

Skill M – Making a Presentation (Unit 2868 only) — Total 5

Mark		Descriptor
		The candidate:
1	**M.1a**	summarises the main aspects of the investigation: background information, interview, planning, implementing, analysis and evaluation.
	M.1b	uses an appropriate presentational technique such as: an A3 poster, a 10 minute talk with overhead transparencies, a PowerPoint presentation or a 500 word article for a magazine; uses text and/or images that are clear and legible to an audience.
2		
3	**M.3a**	organises the presentation well, dealing with aspects of the investigation in a logical order.
	M.3b	presents information using relevant, carefully selected, text and/or images.
4		
5	**M.5a**	produces a well-structured, coherent presentation in which the key aspects of the investigation are identified.
	M.5b	makes good use of language and scientific vocabulary; produces a well-designed, imaginative presentation.

Both statements at a defined level must be satisfied in order that the mark for this level is awarded. From the bottom to the top of the mark range the activity should involve increasing demands of related scientific knowledge and understanding, and complexity.

Appendix D: Mathematical Requirements

ARITHMETIC AND COMPUTATION

Candidates should be able to:

- recognise and use expressions in decimal and standard form;
- use ratios, fractions and percentages;
- make estimates of the results of calculations (without using a calculator);
- use calculators to find and use x^2, $\frac{1}{x}$, $\sqrt{x}$, $\log_{10}x$.

HANDLING DATA

At AS, candidates should be able to:

- use an appropriate number of significant figures;
- find arithmetic means;
- construct and interpret frequency tables and diagrams, bar charts, pie charts and histograms;
- use a technique for smoothing a set of data;
- interpret and use logarithmic scales.

In addition at A2, candidates should be able to:

- have sufficient understanding of probability to understand how genetic ratios arise;
- understand the principles of sampling as applied to biological data;
- understand the importance of chance when interpreting data;
- understand the terms mean, median and mode;
- understand the use of scatter plots to indicate relationships and correlation coefficients to identify the strength of a relationship between two variables;
- use a simple statistical test, such as χ^2 and the *t*-test.

ALGEBRA

Candidates should be able to:

- understand and use the following symbols: $<$, $>$, Δ, $\approx$, $\propto$;
- understand and use the prefixes: giga (G), mega (M), kilo (k), milli (m), micro (μ), nano (n);
- change the subject of an equation;
- substitute numerical values into algebraic equations using appropriate units for physical quantities.

GRAPHS

Candidates should be able to:

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

Appendix E: Glossary of Terms used in Question Papers

It is hoped that the glossary will prove helpful to candidates as a guide, although it is not exhaustive. The glossary has been deliberately kept brief not only with respect to the number of terms included but also to the descriptions of their meanings. Candidates should appreciate that the meaning of a term must depend in part on its context. They should also note that the number of marks allocated for any part of a question is a guide to the depth of treatment required for the answer.

- *Define (the term[s])...* is intended literally. Only a formal statement or equivalent paraphrase being required.
- *Explain/What is meant by (the terms[s]...)* normally implies that a definition should be given, together with some relevant comment on the significance or context of the term(s) concerned, especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value.
- *Explain…* may imply reasoning or some reference to theory, depending on the context.
- *State…* implies a concise answer with little or no supporting argument, for example, a numerical answer that can be obtained by 'inspection'.
- *List…* requires a number of points with no elaboration. Where a given number of points is specified, this should not be exceeded.
- *Describe…* requires candidates to state in words (using diagrams where appropriate) the main points of the topic. It is often used with reference either to particular phenomena or to particular experiments. In the former instance, the term usually implies that the answer should include reference to (visual) observations associated with the phenomena. The amount of description intended should be interpreted in the light of the indicated mark value.
- *Discuss…* requires candidates to give a critical account of the points involved in the topic.
- *Outline…* implies that only the essential points are required without any supporting detail.
- *Comment…* is intended as an open-ended instruction, inviting the candidates to recall or infer points of interest relevant to the context of the question, taking account of the number of marks available.
- *Deduce/Predict…* implies that candidates are not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answers extracted in an earlier part of the question. Predict also implies a concise answer with no supporting statement required.
- *Suggest…* is used in two main contexts. It may imply either that there is no unique answer, or that candidates are expected to apply their general knowledge to a 'novel' situation, one that formally may not be 'in the specification'.
- *Calculate…* is used when a numerical answer is required. In general, working should be shown.
- *Measure…* implies that the quantity concerned can be directly obtained from a suitable measuring instrument, for example, length using a rule, or angle using a protractor.
- *Determine…* often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula. It may also be used in the context of a procedure that needs to be carried out so that a numerical answer may be obtained. For example, it may be necessary to find the energy absorbed by a plant so that its efficiency may be calculated.

- *Show…* is used when an algebraic deduction has to be made to prove a given equation. It is important that the terms being used by candidates are stated explicitly.
- *Estimate…* implies a reasoned order of magnitude statement or calculation of the quantity concerned. Candidates should make such simplifying assumptions as may be necessary about points of principle and about the values of quantities not otherwise included in the question.
- *Sketch…* when applied to graph work, implies that the shape and/or position of the curve need only be qualitatively correct. However, candidates should be aware that, depending on the context, some quantitative aspects may be looked for, for example, passing through the origin, having an intercept, asymptote or discontinuity at a particular value. On a sketch graph it is essential that candidates clearly indicate what is being plotted on each axis.
- *Sketch…* when applied to diagrams, implies that a simple, freehand drawing is acceptable. Nevertheless, care should be taken over proportions and the clear exposition of important details.