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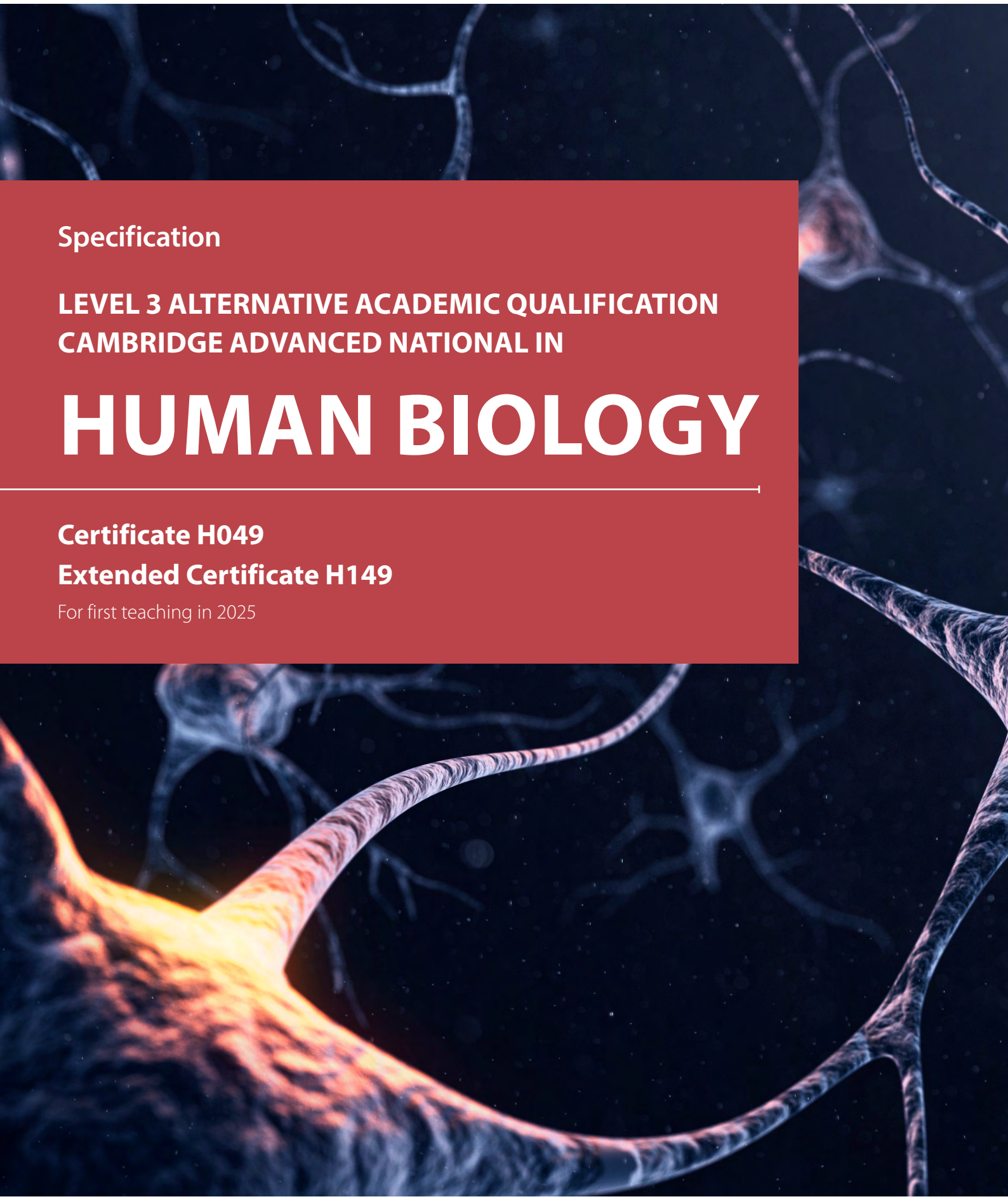

Specification

LEVEL 3 ALTERNATIVE ACADEMIC QUALIFICATION CAMBRIDGE ADVANCED NATIONAL IN

HUMAN BIOLOGY

Certificate H049
Extended Certificate H149

For first teaching in 2025

Version 2.0 (June 2024)

Tell us what you think

Your feedback plays an important role in how we develop, market, support and resource qualifications now and into the future. Here at OCR, we want teachers and students to enjoy and get the best out of our qualifications and resources, but to do that we need honest opinions to tell us whether we're on the right track or not. That's where you come in.

You can email your thoughts to ProductDevelopment@OCR.org.uk or visit the OCR feedback page to learn more about how you can help us improve our qualifications.

Designing and testing in collaboration with teachers and students

Helping young people develop an ethical view of the world

Equality, diversity, inclusion and belonging (EDIB) are part of everything we do

Are you using the latest version of this specification?

The latest version of our specifications will always be on **our website** and may differ from printed versions. We will inform centres about changes to specifications.

Disclaimer

Specifications are updated over time. Whilst every effort is made to check all documents, there may be contradictions between published resources and the specification, therefore, please use the information on the latest specification at all times. Where changes are made to specifications these will be indicated within the document, there will be a new version number indicated, and a summary of the changes. If you do notice a discrepancy between the specification and a resource please contact us at: **resources.feedback@ocr.org.uk**

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1 Contents

1 Why choose OCR?

Choose OCR and you've got the reassurance that you're working with one of the UK's leading exam boards. We've developed our specifications in consultation with teachers, employers, subject experts and higher education institutions (HEIs) to give students a qualification that's relevant to them and meets their needs.

We're part of Cambridge University Press & Assessment. We help millions of people worldwide unlock their potential. Our qualifications, assessments, academic publications and original research spread knowledge, spark curiosity and aid understanding around the world.

We work with a range of education providers in both the public and private sectors. These include schools, colleges, HEIs and other workplaces. Over 13,000 centres choose our A Levels, GCSEs and vocational qualifications including Cambridge Nationals and legacy Cambridge Technicals.

1.1 Our specifications

We provide specifications that help you bring the subject to life and inspire your students to achieve more.

We've created teacher-friendly specifications based on extensive research and engagement with the teaching community. Our specifications are designed to be straightforward to deliver and accessible for students. The design allows you to tailor the delivery of the course to suit your needs.

1.2 Our support

We provide a range of support services to help you at every stage, from preparation to delivery:

- A wide range of high-quality creative resources including resources created by leading organisations in the industry.
- Textbooks and teaching and learning resources from leading publishers. The Cambridge Advanced Nationals page on our website has more information about all the published support for the qualifications that we have endorsed.
- Professional development for teachers to meet a range of needs. To join our training (either face-to-face or online) or to search for training materials, go to the **Professional Development page** on our website.
- **Active Results** which is our free results analysis service. It helps you review the performance of individual students or whole groups.
- **ExamBuilder** which is our free question-building platform. It helps you to build your own tests using past OCR exam questions.
- OCR Subject Advisors, who give information and support to centres. They can help with specification and non examined assessment (NEA) advice, updates on resources developments and a range of training opportunities. They use networks to work with subject communities and share ideas and expertise to support teachers.

1.2.1 More help and support

Whether you are new to OCR or already teaching with us, you can find useful information, help and support on our **website**. Or get in touch:
support@ocr.org.uk
@ocrexams
01223 553998

1.3 Aims and learning outcomes

Our Cambridge Advanced Nationals in Human Biology will encourage students to:

- develop key knowledge, understanding and skills, relevant to the subject
- think creatively, innovatively, analytically, logically and critically
- develop valuable communication skills that are important in all aspects of further study and life
- develop transferable learning and skills, such as refection, planning, presentation and research skills, that are important for progression to HE and can be applied to real-life contexts and work situations
- develop independence and confidence in applying the knowledge and skills that are vital for progression to HE and relevant to the medical science sector and more widely

1.4 What are the key features of this specification?

The key features of OCR's Cambridge Advanced Nationals in Human Biology for you and your students are:

- a simple and intuitive assessment model, that has:
    - externally assessed units, which focus on subject knowledge and understanding
    - applied and practical non examined assessment units (NEA)
    - optional NEA units to provide flexibility
- a specification developed with teachers specifically for teachers. The specification lays out the subject content, assessment criteria, teacher guidance and delivery requirements clearly
- a flexible support package made based on teachers' needs. The support package will help teachers to easily understand the qualification and how it is assessed
- a team of OCR Subject Advisors who directly support teachers
- a specification designed to:
    - complement A Levels in a Post-16 curriculum
    - develop wider transferable skills, knowledge and understanding desired by HEIs. More detail about the transferable skills these qualifications may develop is in **Section 5.3**.

All Cambridge Advanced National qualifications offered by OCR are regulated by Ofqual, the Regulator for qualifications offered in England.

The qualification numbers for OCR's Alternative Academic Qualification Cambridge Advanced Nationals in Human Biology are:

- Certificate: QN 610/3945/7
- Extended Certificate: QN 610/3946/9

1.5 Acknowledgements

We would like to acknowledge the following Higher Education Providers/organisations for their input and support in designing these qualification(s):
Aston University
Cardiff University
Coventry University
Institute of Biomedical Science
Nottingham Trent University
Staffordshire University
Teesside University
University of Bradford
University of East Anglia
University of Gloucester
University of Lincoln
University of Manchester
University of Southampton
University of the West of England

2 Qualification overview

2.1 OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate) at a glance

Qualification number	610/3945/7
First entry date	01 September 2025
Guided learning hours (GLH)	180
Total qualification time (TQT)	225
OCR entry code	H049
Approved age range	16-18, 18+, 19+
Offered in	England only
Performance table information	This qualification is designed to meet the Department for Education's requirements for qualifications in the Alternative Academic Qualifications category of the 16-19 performance tables.
Eligibility for funding	This qualification meets funding approval criteria.
UCAS Points	This qualification is recognised in the UCAS tariff tables. You'll find more information on the **UCAS website**.
This qualification is suitable for students who:	• are age 16-19 and on a full-time study programme • want to develop applied knowledge and skills in human biology • want to progress onto other related study, such as higher education courses in biological sciences, life sciences and human biology
Entry requirements	We recommend that students have achieved a science qualification at Level 2, for example: • GCSEs in science subjects at grade 4 (4-4) or above • a Level 2 vocational qualification such as OCR Level 2 Cambridge Technical in Science We also recommend that: • students have grade 4/grade C or above in Maths and English GCSE • you carry out an initial assessment to make sure students can reach the required standards of the qualification
Qualification requirements	Students must complete three units: • one externally assessed unit • two NEA units

Assessment method/model	Unit F170 is assessed by an exam and marked by us. You will assess the NEA units and we will moderate them. The NEA assignments are live for 2 years. The front cover details the intended cohort. You must make sure you use the live assignment that relates to the student's cohort for assessment and submit in the period in which the assignments are live. For example, a cohort beginning a 2-year course in September 2026 should use the set of assignments marked as being for 2026-2028 so that whatever order assignments are taken in, they will be able to re-submit improved work on the same NEA assignment if they wish to during their study of the qualification. Centres should avoid allowing new cohorts to use assignments which have already been live for a year, e.g. students who start the course in September 2027 using assignments for the 2026-2028 cohorts. Centres must have suitable controls in place to ensure that NEA assignment work is completed by each student independently and must not allow previously completed work for assignments which are still live to be shared as examples with other students.
Exam series each year	• January • June
Exam resits	Students can resit the examined unit twice before they complete the qualification.
NEA submission	There are two windows each year to submit NEA outcomes and request a moderation visit by an OCR Assessor. You must make unit entries for students before you can submit outcomes to request a visit. All dates are on our administration pages.
Resubmission of students' NEA work	If students have not performed at their best in the NEA assignments, they can improve their work and submit it to you again for assessment. They must have your agreement and you must be sure it is in the student's best interests. We use the term 'resubmission' when referring to student work that has previously been submitted to OCR for moderation. Following OCR moderation, a student can attempt to improve their work for you to assess and provide the final mark to us. There is one resubmission opportunity per NEA assignment. All work submitted (or resubmitted) must be based on the assignment that is live for assessment. For information about feedback see **Section 6**. The final piece of work must be completed solely by the student and teachers must not detail specifically what amendments should be made.
Grading	Information about unit and qualification grading is in **Section 5.**

2.2 OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate) at a glance

Qualification number	610/3946/9
First entry date	01 September 2025
Guided learning hours (GLH)	360
Total qualification time (TQT)	450
OCR entry code	H149
Approved age range	16-18, 18+, 19+
Offered in	England only
Performance table information	This qualification is designed to meet the Department for Education's requirements for qualifications in the Alternative Academic Qualifications category of the 16-19 performance tables.
Eligibility for funding	This qualification meets funding approval criteria.
UCAS Points	This qualification is recognised in the UCAS tariff tables. You'll find more information on the **UCAS website**.
This qualification is suitable for students who:	• are age 16-19 and on a full-time study programme • want to develop applied knowledge and skills in human biology • want to progress onto other related study, such as higher education courses in biological sciences, life sciences and human biology
Entry requirements	We recommend that students have achieved a science qualification at Level 2, for example: • GCSEs in science subjects at grade 4 (4-4) or above • a Level 2 vocational qualification such as OCR Level 2 Cambridge Technical in Science We also recommend that: • students have grade 4/grade C or above in Maths and English GCSE • you carry out an initial assessment to make sure students can reach the required standards of the qualification
Qualification requirements	Students must complete six units: • two externally assessed units • four NEA units

Assessment method/model	Units F170 and F171 are assessed by an exam and marked by us. You will assess the NEA units and we will moderate them. The NEA assignments are live for 2 years. The front cover details the intended cohort. You must make sure you use the live assignment that relates to the student's cohort for assessment and submit in the period in which the assignments are live. For example, a cohort beginning a 2-year course in September 2026 should use the set of assignments marked as being for 2026-2028 so that whatever order assignments are taken in, they will be able to re-submit improved work on the same NEA assignment if they wish to during their study of the qualification. Centres should avoid allowing new cohorts to use assignments which have already been live for a year, e.g. students who start the course in September 2027 using assignments for the 2026-2028 cohorts. Centres must have suitable controls in place to ensure that NEA assignment work is completed by each student independently and must not allow previously completed work for assignments which are still live to be shared as examples with other students.
Exam series each year	• January • June
Exam resits	Students can resit each examined unit twice before they complete the qualification.
NEA Submission	There are two windows each year to submit NEA outcomes and request a moderation visit by an OCR Assessor. You must make unit entries for students before you can submit outcomes to request a visit. All dates are on our administration pages.
Resubmission of students' NEA work	If students have not performed at their best in the NEA assignments, they can improve their work and submit it to you again for assessment. They must have your agreement and you must be sure it is in the student's best interests. We use the term 'resubmission' when referring to student work that has previously been submitted to OCR for moderation. Following OCR moderation, a student can attempt to improve their work for you to assess and provide the final mark to us. There is one resubmission opportunity per NEA assignment. All work submitted (or resubmitted) must be based on the assignment that is live for assessment. For information about feedback see **Section 6**. The final piece of work must be completed solely by the student and teachers must not detail specifically what amendments should be made.
Grading	Information about unit and qualification grading is in **Section 5.**

2.3 Qualification structure

Key to units for these qualifications:

M = Mandatory	Students must complete these units.
O = Optional	Students must complete some of these units.
E = External assessment	We set and mark the exams.
N = NEA	We set the assignment. You assess the assignment and we moderate it.

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate)

For this qualification, students must complete three units:

- One mandatory externally assessed unit
- Two mandatory NEA units

Unit no	Unit title	Unit ref no (URN)	Guided learning hours (GLH)	How is it assessed?	Mandatory or optional
F170	Fundamentals of human biology	M/651/0641	80	EA	M
F172	Genetics	T/651/0643	50	NEA	M
F173	Biomedical techniques	Y/651/0644	50	NEA	M

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate)

For this qualification, students must complete six units:

- Two mandatory externally assessed units
- Two mandatory NEA units
- Two optional NEA units

Unit no	Unit title	Unit ref no (URN)	Guided learning hours (GLH)	How is it assessed?	Mandatory or optional
F170	Fundamentals of human biology	M/651/0641	80	EA	M
F171	Health and disease	R/651/0642	80	EA	M
F172	Genetics	T/651/0643	50	NEA	M
F173	Biomedical techniques	Y/651/0644	50	NEA	M
F174	Nutrition and metabolism	A/651/0645	50	NEA	O
F175	Human reproduction	D/651/0646	50	NEA	O
F176	The brain	F/651/0647	50	NEA	O
F177	Drug development	H/651/0648	50	NEA	O

2.4 Purpose statement – Certificate

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate)

Qualification number: 610/3945/7

Overview

Who this qualification is for

The OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate) is for students aged 16-19 years old. It will develop knowledge, understanding and skills that will help prepare you for progression to undergraduate study when taken alongside other qualifications and are relevant to the medical science sector.

You might be interested in this qualification if you want a small qualification to take alongside and enhance your A Level studies, that builds applied or practical skills. You will have the opportunity to apply what you learn to real-life contexts, such as:

- Researching human biology fundamentals.
- Creating and delivering presentations to help patients and health care professionals.
- Planning and performing laboratory investigations involving biomedical techniques.

The qualification will also help you develop independence and confidence in using skills that are relevant to the medical science sector and that prepare you for progressing to university courses where independent study skills are needed. You will develop the following transferable skills that can be used in both higher education and other life and work situations:

- Researching topic areas and recording research sources, then using them to interpret findings and present evidence.
- Problem solving when matching and analysing data.
- Communicating effectively with individuals or groups.

This qualification will complement other learning that you're completing at Key Stage 5. If you are a full-time student, it will be part of your studies along with your A Levels.

What you will study when you take this qualification

Through a combination of theoretical study and hands-on experience, you will develop the necessary knowledge and skills that can support progression to higher education human biology study.

In the examined units, you will study key knowledge and understanding relevant to human biology. In the non examined assessment (NEA) units, you will demonstrate knowledge and skills you learn by completing an applied or practical assignment. More information about the knowledge and skills you will develop is below.

All units in the qualification are mandatory. You must take **all** of these units:

- F170: Fundamentals of human biology

  This unit is assessed by an exam.

  In this unit you will learn about the key topics that are important in human biology. Topics include:

  - Topic Area 1 Human cells and tissues
  - Topic Area 2 Human physiology, organs and systems
  - Topic Area 3 Key concepts in endocrinology, neurobiology and reproduction
  - Topic Area 4 Basics of microbiology

- F172: Genetics

  This unit is assessed by an assignment.

  In this unit you will learn about DNA, cell division and inheritance. Topics include:

  - Topic Area 1 Fundamentals of genetics
  - Topic Area 2 Mode of inheritance
  - Topic Area 3 Genetic counselling and genetic testing
  - Topic Area 4 Gene therapy and genetic engineering

- F173: Biomedical techniques

  This unit is assessed by an assignment.

  In this unit you will plan and carry out an investigation using a variety of laboratory techniques. Topics include:

  - Topic Area 1 What biomedical science is
  - Topic Area 2 Diagnostic techniques: cells and microscopy
  - Topic Area 3 Diagnostic techniques: biological molecules
  - Topic area 4 Planning a clinical investigation
  - Topic area 5 Report writing

The subjects that complement this course

These subjects might complement this qualification:

- A Level Biology
- A Level Chemistry
- A Level Physical Education
- A Level Psychology
- A Level Sociology

The types of courses you may progress to

Both the subject-specific knowledge, understanding and skills, and broader transferable skills developed in this qualification will help you progress to further study in related areas such as:

- Biological Sciences degree
- Human Biology degree
- Life Sciences degree
- Biomedical Science degree

Why you should take the OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate)

There are two qualifications available in human biology these are:

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate) – this is 180 GLH in size

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate) – this is 360 GLH in size

You should take this Certificate qualification because it builds applied knowledge and skills in human biology and is the same size as an AS Level. When taken alongside A Levels, the Certificate helps you to build broader knowledge and skills that are valued in undergraduate study as part of your study programme at Key Stage 5.

More information

More information about the OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate) is in these documents:

- Specification: <<insert link>>
- Sample Assessment Material (SAM) Question Papers:
  - Unit F170: <<insert link>>
- Guides to our SAM Question Papers:
  - Unit F170: <<insert link>>
- SAM Set assignment(s):
  - Unit F172: <<insert link>>
  - Unit F173: <<insert link>>
- Student Guide to NEA Assignments: <<insert link>>

2.5 Purpose statement – Extended Certificate

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate)

Qualification number: 610/3946/9

Overview

Who this qualification is for

The OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate) is for students aged 16-19 years old. It will develop knowledge, understanding and skills that will help prepare you for progression to undergraduate study and are relevant to the medical science sector.

You might be interested in this qualification if you want to develop key theoretical knowledge and understanding of the subject, but also apply what you learn to different situations and contexts and practical tasks, such as:

- Researching health and diseases.
- Planning and performing laboratory investigations involving biomedical techniques.
- Creating and delivering presentations to help patients and health care professionals.
- Creating and delivering nutritional information to individuals with specific needs.

The qualification will also help you develop independence and confidence in using skills that are relevant to the medical science and that prepare you for progressing to university courses where independent study skills are needed. You will develop the following transferable skills that can be used in both higher education and other life and work situations:

- Communicating effectively with individuals or groups.
- Researching topic areas and recording research sources, then using them to interpret findings and present evidence.
- Presenting information, this will involve managing time and identifying aims, purpose, resources, methods.
- Problem solving when matching and analysing data.

The qualification has six units. Each unit has its own assessment and assessment can happen at different points during the year. This unitised, flexible approach to learning and assessment means learning and achievements can be recognised in bite-sized chunks, rather than all at the end of the course. The unitised approach will also be useful preparation if you want to progress to higher education where modular approaches to learning are common.

This qualification will complement other learning that you're completing at Key Stage 5. If you are a full-time student, it will be part of your studies along with A Levels.

What you will study when you take this qualification

Through a combination of theoretical study and hands-on experience, you will develop the necessary knowledge and skills that can support progression to higher education human biology study.

In the examined units, you will study key knowledge and understanding relevant to human biology. In the non examined assessment (NEA) units, you will demonstrate knowledge and skills you learn by completing applied or practical assignments. More information about the knowledge and skills you will develop is below.

The qualification has four mandatory units and two optional units.

These are the **mandatory** units – you must take **all** these units:

- F170: Fundamentals of human biology

  This unit is assessed by an exam.

  In this unit you will learn about the key topics that are important in human biology. Topics include:

  - Topic Area 1 Human cells and tissues
  - Topic Area 2 Human physiology, organs and systems
  - Topic Area 3 Key concepts in endocrinology, neurobiology and reproduction
  - Topic Area 4 Basics of microbiology

- F171: Health and disease

  This unit is assessed by an exam.

  In this unit you will learn about the intriguing and challenging nature of diseases and disorders. Topics include:

  - Topic Area 1 Causes and effects of diseases and disorders
  - Topic Area 2 Curative management and preventative therapies
  - Topic Area 3 The role of immunology
  - Topic Area 4 Techniques for diagnosis and monitoring
  - Topic Area 5 Reporting, research and confidentiality

- F172: Genetics

  This unit is assessed by an assignment.

  In this unit you will learn about DNA, cell division and inheritance. Topics include:

  - Topic Area 1 Fundamentals of genetics
  - Topic Area 2 Mode of inheritance
  - Topic Area 3 Genetic counselling and genetic testing
  - Topic Area 4 Gene therapy and genetic engineering

- F173: Biomedical techniques

  This unit is assessed by an assignment.

  In this unit you will plan and carry out an investigation using a variety of laboratory techniques. Topics include:

  - Topic Area 1 What biomedical science is
  - Topic Area 2 Diagnostic techniques: cells and microscopy
  - Topic Area 3 Diagnostic techniques: biological molecules
  - Topic area 4 Planning a clinical investigation
  - Topic area 5 Report writing

These are **optional** units – you must take **two** of these units:

- F174: Nutrition and metabolism

  This unit is assessed by an assignment.

  In this unit you will carry out practical investigations involving digestive enzymes and study parts of the digestive system using photomicrographs. Topics include:

  - Topic Area 1 Nutrients required for a healthy body
  - Topic Area 2 Diets and disorders
  - Topic Area 3 Metabolic pathways and control mechanisms
  - Topic Area 4 Diagnosis, monitoring and treatment for nutritional/metabolic disorders

- F175: Human reproduction

  This unit is assessed by an assignment.

  In this unit you will explore the development of the zygote, embryo and foetus and the process of pregnancy and antenatal care. Topics include:

  - Topic Area 1 Conception and pregnancy
  - Topic Area 2 Pregnancy (antenatal) care
  - Topic Area 3 Infertility
  - Topic Area 4 Assisted reproduction (AR)

- F176: The brain

This unit is assessed by an assignment.

In this unit you will gain a greater insight into the structure and function of the nervous system, including the spinal cord, brain and nerves. Topics include:

  - Topic Area 1 Structure and function of the nervous system
  - Topic Area 2 Neuron communication and control
  - Topic Area 3 Nociception, neurotransmitters and drugs
  - Topic Area 4 The diagnosis and treatment of brain disorders/injuries
  - Topic Area 5 Monitoring and scanning the brain

- F177: Drug development

This unit is assessed by an assignment.

In this unit you will study the stages in the development of a drug and stages in the discovery of a commercial drug/medicine and pre-clinical and clinical trials. Topics include:

  - Topic Area 1 Pharmaceutical drugs
  - Topic Area 2 Process of drug development
  - Topic Area 3 Factors influencing drug development
  - Topic area 4 Producing a clinical research proposal

The subjects that complement this course

These subjects might complement this qualification:

- A Level Biology
- A Level Chemistry
- A Level Physical Education
- A Level Psychology
- A Level Sociology

The types of courses you may progress to

Both the subject-specific knowledge, understanding and skills, and broader transferable skills developed through these units, will help you progress to further study in related areas such as:

- Biological Sciences degree
- Human Biology degree
- Life Sciences degree
- Biomedical Science degree

Why you should take the OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate)

There are two qualifications available in human biology These are:

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate) – this is 180 GLH in size

OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate) – this is 360 GLH in size

You should take this Extended Certificate qualification because it builds applied knowledge and skills in human biology and is the same size as an A Level. When taken alongside A Levels, the Extended Certificate helps you to build broader knowledge and skills valued in undergraduate study as part of your study programme at Key Stage 5.

More information

More information about the OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate) is in these documents:

- Specification: <<insert link>>
- Sample Assessment Material (SAM) Question Papers:
  - Unit F170: <<insert link>>
  - Unit F171: <<insert link>>
- Guides to our SAM Question Papers:
  - Unit F170: <<insert link>>
  - Unit F171: <<insert link>>
- SAM Set assignment(s):
  - Unit F172: <<insert link>>
  - Unit F173:<<insert link>>
  - Unit F174: <<insert link>>
  - Unit F175: <<insert link>>
  - Unit F176: <<insert link>>
  - Unit F177: <<insert link>>
- Student Guide to NEA Assignments: <<insert link>>

3 About these qualifications

3.1 Qualification size

The size of each qualification is described in terms of Guided Learning Hours (GLH) and Total Qualification Time (TQT).

GLH indicates the approximate time (in hours) you will spend supervising or directing study and assessment activities. We have worked with people who are experienced in delivering related qualifications to determine the content that needs to be taught and how long it will take to deliver.

TQT includes two parts:

- GLH
- an estimate of the number of hours a student will spend on unsupervised learning or assessment activities (including homework) to successfully complete their qualification.

The OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate) is 180 GLH and 225 TQT.

The OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate) is 360 GLH and 450 TQT.

3.2 Availability and language

The Level 3 Alternative Academic Qualification Cambridge Advanced Nationals are available in England only. They are **not** available in Wales or Northern Ireland.

The qualifications and their assessment materials are available in English only. We will only assess answers written in English.

3.3 Prior knowledge and experience

Recognition of prior learning (RPL) is the process for recognising learning that never received formal recognition through a qualification or certification. It includes knowledge and skills gained in school, college or outside of formal learning situations. These may include:

- domestic/family life
- education
- training
- work activities
- voluntary activities.

In most cases RPL will not be appropriate for directly evidencing the requirements of the NEA assignments for the Cambridge Advanced National qualifications. However, if you feel that your student could use RPL to support their evidence, you must follow the guidance provided in our **RPL Policy**.

4 Units

4.1 Guidance on unit content

This section describes what must be taught so that students can access all available marks and meet assessment criteria.

4.1.1 Externally assessed units (F170 and F171)

The externally assessed units contain a number of topic areas.

For each topic area, we list the **teaching content** that must be taught and give information on the **breadth and depth** of teaching needed.

Teaching content

Questions can be asked about anything in the teaching content or breadth and depth columns.

Breadth and depth

The breadth and depth column:

- clarifies the breadth and depth of teaching needed
- indicates the range of knowledge and understanding that can be assessed in the exam
- confirms any aspects that you do not need to teach as 'does not include' statements.

Teaching must cover **both** the **teaching content** and **breadth and depth** columns.

Knowledge and understanding

This is what we mean by knowledge and understanding:

Knowledge	• Be able to identify or recognise an item, for example on a diagram. • Use direct recall to answer a question, for example the definition of a term.
Understanding	• To assess and evidence the perceived meaning of something in greater depth than straight identification or recall. • Understanding will be expressed and presented using terms such as: how; why; when; reasons for; advantages and disadvantages of; benefits and limitations of; purpose of; suitability of; recommendations for improvement; appropriateness of something to/in different contexts.

Students will need to **understand** the content unless the breadth and depth column identifies it as knowledge only.

Any item(s) that should be taught as **knowledge** only will start with the word 'know' in the breadth and depth column.

All other content must be taught as understanding.

Opportunities to cover mathematical skills and how science works concepts and skills are exemplified in two columns in the unit content tables. Further information about the requirements for mathematical skills and how science works concepts and skills can be found in Appendices C and D.

4.1.2 NEA units (F172-F177)

The NEA units contain a number of topic areas.

For each topic area, we list **teaching content** that must be taught and give **exemplification**. The exemplification shows the teaching expected to equip students to successfully complete their assignments.

4.1.3 Command words

Appendix B gives information about the command words that will be used in the external assessments and the NEA assessment criteria.

4.1.4 Performance objectives (POs):

Each Cambridge Advanced National qualification has four Performance Objectives.

PO1	Show knowledge and understanding
PO2	Apply knowledge and understanding
PO3	Analyse and evaluate knowledge, understanding and performance
PO4	Demonstrate and apply skills and processes relevant to the subject

PO1 is assessed in the externally assessed unit only.

PO4 is assessed in the NEA units only.

The weightings of the Performance Objectives across the units in the **Certificate** qualification are:

Performance Objective	**Externally Assessed unit (range)**	**NEA units**	**Overall weighting**
PO1	23.3%-30.0%	n/a	23.3%-30.0%
PO2	10.0%-16.7%	17.5%	27.5%-34.2%
PO3	0.0%	20.0%	20.0%
PO4	n/a	22.5%	22.5%
Overall weighting of assessments	**40.0%**	**60.0%**	**100.0%**

The weightings of the Performance Objectives across the units in the **Extended Certificate** qualification are:

Performance Objective	**Externally Assessed unit (range)**	**NEA units**	**Overall weighting**
PO1	13.3%-20.0%	n/a	13.3%-20.0%
PO2	15.0%-21.7%	18.8%-19.4%	33.8%-41.1%
PO3	5.0%	21.3%-21.9%	26.3%-26.9%
PO4	n/a	18.8%-20.0%	18.8%-20.0%
Overall weighting of assessments	**40%**	**60%**	**100%**

4.2 Externally assessed units

4.2.1 Unit F170: Fundamentals of human biology

Unit aim

Medical science is constantly advancing at a fast rate. This unit provides some of knowledge and understanding relating to the biology behind these exciting medical advances. These may range from range from diagnosis to therapeutics. Studying human biology at Level 3 with other subjects such as A Levels in Psychology and PE, will give you a solid basis to progress onto degree courses in such areas as healthcare professions, sports science, social care and human physiology.

In this unit you will learn about the structure and function of cells, tissues and organ systems and appreciate the physiological links between such systems in the human body. You will be given the knowledge required to evaluate the impact, detection and treatment of non-functioning systems, with a focus on the endocrine, nervous and reproductive systems. An introduction to the basic features of microbiology will give you the opportunity to consider the key features of beneficial microbes (forming the human biome), pathogens (including viruses) and the immune response.

Unit F170: Fundamentals of human biology			
Topic Area 1: Human cells and tissues			
Teaching content	**Breadth and depth**	**Opportunities to cover:**	
1.1 Key features of the cell and methods to observe them		**Maths**	**HSW**
1.1.1 Generalised human cell and cell specialisation □ Definition of the cell	To include:		**HSW1** **HSW8** **HSW11**
□ The structure and function of eukaryotic cells and their components • Cell surface membrane • Cytoplasm • Nucleus • Nucleolus	□ How these features are found in all specialised cells with the exception of the nucleus in the fully-formed erythrocyte		
□ Cell structures and functions: • Cytoplasm • Cell surface membrane • mitochondria • Ribosomes • Smooth and rough endoplasmic reticulum (SER/RER) • Golgi body/apparatus • Vesicles • Lysosomes • Cilium/flagellum • Microvilli	□ The detailed structure and function of cells and all components, including in cell diagrams and photomicrographs □ How ribosomes are located in the cytoplasm and on the surface of the RER and located in the matrix of the mitochondrion □ How vesicles and lysosomes are both formed by the Golgi body/apparatus □ How detailed cell features are seen in electrophotomicrographs using a transmission electron microscope (TEM)		
□ Adult stem cell location, function and cell specialisation	□ Why and where stem cells are located in different regions of the adult body		

□ Stem cells can remain inactive for many years	□ How dormant stem cells are triggered to differentiate by the microenvironment □ How human pluripotent stem cells (PSCs) can be maintained and expanded *in vitro* for long time periods and then induced to differentiate □ How and why the functions of embryonic and adult stem cells differ		
□ Structure and function of highly-specialised cells: • Sperm cell • Egg cell/ovum • Red blood cell or erythrocyte • White blood cells (neutrophil, lymphocyte, eosinophil and monocyte) • Sensory, relay and motor neurons • Hepatocyte (liver cell) • Renal tubule epithelial cells • Rods and cones in the retina • Ciliated epithelial cells lining the trachea and oviduct • Squamous epithelial cells of alveoli • Skeletal/striated, smooth and cardiac muscle cells • Epithelial cells of gastric pits	□ How the abundance and features of key organelles differ in relation to the function of highly-specialised cells		
□ Eukaryotic (human) and prokaryotic (bacterial) cells	□ How eukaryotic (human) and prokaryotic (bacterial) cells compare □ Why the mitochondrion may be considered as a prokaryote existing inside a eukaryotic cell (endosymbiotic theory) □ How ribosomes in eukaryotic and prokaryotic cells differ Does not include: □ Detailed features of other highly-specialised cells		

1.1.2 Observing cells and organelles □ Light/optical (LM) microscope	To include: □ Know the features of the LM microscope □ The advantages and disadvantages of using an LM to study cells	**M1.4** **M1.5** **M2.2** **M4.2**	**HSW2** **HSW4** **HSW5** **HSW6**
□ Preparation of temporary slides □ Use of the stage microtome	□ The steps for preparing a temporary slide for LM observation and the reasons for these steps		
□ Transmission electron microscope (TEM) and scanning electron microscope (SEM)	□ How the features and use of the TEM and SEM can be compared □ The reasons for a TEM or SEM to produce a photomicrograph of a cell or organelle		
□ Calculating the magnification and dimensions of cell components	□ How to use the equation: $\text{magnification} = \frac{\text{image size}}{\text{actual size}}$ □ How to measure the actual size of an image		
□ Units of nm, μm or mm	□ Why different units (nm, μm or mm) for cell/organelle dimensions are used		
□ Use of differential centrifugation for organelle extraction	□ Why different organelles or cell fragments are found in the supernatant and pellet		
□ Use of the haemocytometer	□ The advantages and disadvantages of using a haemocytometer or coulter counter Does not include: □ The physics of the LM and EM		
1.1.3 Link between organelle structure and function including: □ Nucleus □ Nucleolus □ Mitochondrion □ 70S and 80S ribosomes □ SER and RER □ Golgi body/apparatus □ Lysosome	To include: □ How the function of the nucleus and mitochondrion are linked □ Why the functions of the nucleus, ribosome, RER, Golgi body and vesicle/lysosome are linked to complete the process of protein synthesis Does not include: □ Details of transcription and translation □ Chemistry of cellular respiration		**HSW5**

1.1.4 Structure and function of the cell surface membrane □ Fluid mosaic model □ Function of each component of the cell surface membrane □ Processes of endocytosis, exocytosis, simple and facilitated diffusion, active transport and osmosis □ Cell-to-cell recognition □ The role of extrinsic proteins as receptor sites	To include: □ How the phospholipid bilayer, extrinsic and intrinsic proteins, cholesterol and glycoproteins are arranged in a specific way in the fluid mosaic model □ The advantages and disadvantages of cholesterol in the 'free' cell membranes of endothelial cells of blood vessels □ Why cell-to-cell recognition is the basis of transplant tissue/organ rejection Does not include: □ Details of charged, gated protein channels □ Calculations of water potential values in osmosis	**M3.4** **M4.1**	**HSW9**
1.1.5 Mitosis and meiosis □ Structure of the chromosome, chromatid and centromere □ Molecular structure of DNA and genes □ The cell cycle □ Stages in mitosis, including cytokinesis	To include: □ The appearance of chromosomes, chromatids and centromeres when viewed by an LM and EM □ Know how bases are paired within the DNA molecule □ How base-pairing is the basis of genetics and inheritance □ The benefits of the genome project □ Why interphase is an active process □ Highly-specialised cells can lose the ability to complete the cell cycle. This is seen in mature red blood cells (erythrocytes versus erythroblasts) when they lose their nucleus. □ The stages of mitosis, including prophase, metaphase, anaphase and telophase □ Know the significance of cell cleavage/cytokinesis □ How nuclear division differs from cell division	**M0.1** **M1.3** **M4.1**	**HSW9** **HSW10** **HSW11**

□ Stages in meiosis	□ The stages of meiosis, including prophase I, metaphase I, anaphase I, telophase I and prophase II, metaphase II, anaphase II and telophase II.		
□ Mitosis compared to meiosis	□ How mitosis differs from meiosis		
□ Basis of inheritance, including monohybrid and dihybrid crosses in the human	□ Know why crossing-over and random, independent assortment lead to genetic variation □ How to use and interpret the Punnett square		
□ Features of mitochondrial inheritance	□ The advantages and disadvantages of mitochondrial inheritance (via mitochondrial DNA or mtDNA) in the egg cell □ How a baby can have three 'biological parents' due to mitochondrial replacement therapy Does not include: □ Chromosome and gene mutations		
1.2 Tissue structure and function		**Maths**	**HSW**
1.2.1 Definition of a tissue	To include: □ How tissue and organ levels of organisation can be distinguished Does not include: □ Plant/algal tissues		
1.2.2 The link between tissue structure and function □ Epithelial	To include: □ Know the advantages of the basement membrane to epithelial tissue integrity and replacement □ Why the structure of squamous, ciliated and cuboidal epithelial tissues differs in relation to structure	**M0.1** **M0.2**	
□ Muscle	□ Muscle tissues can be either skeletal, smooth or cardiac □ Why skeletal, smooth and cardiac muscle tissues have different structures		
□ Bone, cartilage and connective	□ Why bone and cartilage tissue can be viewed as special types of connective tissue		
□ Nervous	□ Why the three types of neuron (sensory, relay and motor) differ from each other in relation to their functions		

□ Blood	□ Know that blood is a special form of tissue □ How blood is composed of plasma, white blood cells (WBCs), red blood cells (RBCs) and platelets carried in the watery plasma □ Plasma also carries a wide range of molecules and ions Does not include: □ Sliding filament theory		
1.2.3 Use of tissues in research and development □ Creating and maintaining *in vitro* human tissue cultures in a laboratory □ Applications of stem cell cultures □ Organoid use in research	To include: □ Benefits and limitations of using tissues or organoids for research, rather than using the animal model □ How tissue cultures are established and maintained in the laboratory □ The suitability of tissue culture research to the clinical study of humans □ Know the characteristic features of an organoid □ Benefits and limitations of organoids in research and development Does not include: □ Details of novel applications not yet approved by the Medicines and Healthcare Regulatory Agency		**HSW4** **HSW10**
Topic Area 2: Human physiology, organs and systems			
Teaching content	**Breadth and depth**	**Opportunities to cover:**	
2.1 Human physiology		**Maths**	**HSW**
2.1.1 The concept of human physiology	To include: □ How human physiology is the applied study of organ system function □ Know the role of a physiologist in health and social care, general wellbeing clinics and sports settings		**HSW10**
2.1.2 The organ □ Difference between an organ and a system	To include: □ Know that an organ is a group of different tissues sharing a common function	**M0.3** **M3.1** **M3.5**	**HSW1**

□ Structure and functions of the organs in the human body including: • Heart • Blood vessels • Muscle • Bone • Liver • Lungs • Stomach • Intestines • Kidney • Pancreas	□ How the anatomy and histology of the organs relate to their function □ Why all organs have their own blood routes via an artery and vein □ Know that the heart consists of the endocardium, myocardium and pericardium layers, four chambers (right atrium and ventricle and left atrium and ventricle), atrioventricular, pulmonary and cardiac valves and a central septum □ How the cardiac cycle is regulated and maintained □ Know that muscle as an organ consists of muscle tissue, connective tissue, epithelial tissue and is connected to bones by ligaments □ Know that bone is both an organ and a tissue, containing calcified matrix, fibrocytes, collagen/fibres, and different stages of osteocyte development □ How damaged bone has the ability to regrow, involving the migration and activity of fibrocytes and osteocytes and a supply of calcium ions and energy (via glucose molecules) □ How the liver is formed from hepatocytes surrounding blood sinuses and canaliculi □ Why the liver has a double blood supply (hepatic artery and hepatic portal vein) □ Know that the lungs present a large surface area for gaseous exchange via many alveoli, form right and left lobes and are connected to the external environment along the trachea and tracheoles □ How gas exchange occurs at the alveoli □ How the stomach can be sealed using the cardiac and pyloric sphincters, is the site of digestion and absorption and how the gastric wall contains gastric pits for the secretion of hydrochloric acid, enzymes and mucus □ That the small intestine consists of the duodenum and ileum □ How the small intestine carries out digestion and absorption		

	□ Know that the large intestine consists of the caecum, appendix, colon, rectum and anus □ How the large intestine is involved in digestion, including water reabsorption and faeces formation □ How the biome within the large intestine is responsible for different functions □ Know that each kidney is formed from an outer capsule, cortex, medulla, renal pyramids, calyx, ureter and is the site of ultrafiltration, reabsorption and urine formation □ Why the pancreas has both an exocrine and endocrine function Does not include: □ Brain □ Nerve □ Gonads		
2.1.3 Biological basis of disease/failure of organs □ Causes of disease and failure in organs: • Heart defects ○ Ventral septal defect (VSD) ○ Atrial septal defect (ASD) ○ Valve malfunction • Atherosclerosis • Aortic/pulmonary aneurism • Muscle deterioration • Osteoporosis • Liver cirrhosis • Asthma, emphysema, chronic obstructive pulmonary disease (COPD) and lung cancer • Stomach ulcers and cancer • Cancer of the colon and inflammatory bowel disease (IBD) • Kidney failure • Islets of Langerhans/diabetes and pancreatic cancer	To include: □ How the symptoms of disease and organ failure are linked to changes in the structure and function of cells/tissues □ How the appearance of healthy and diseased heart and lung tissues differs □ How osteoporosis can be monitored via DEXA (dual energy X-ray absorptiometry) Does not include: □ Brain disease, malfunctioning reproductive systems		**HSW3** **HSW5**
2.1.4 Transplanted and artificial organs □ Transplants/corrective surgery: • Heart • Liver • Lungs • Stomach • Intestines • Kidney • Bone	To include: □ Why transplanted organs are rejected □ The advantages and disadvantages of artificial organs Does not include: □ Mechanical details of a dialysis machine		**HSW11**

2.2 Systems in the human body		Maths	HSW
2.2.1 The system □ The definition of a system	To include: □ Know that a system is a group of different organs sharing a common function Does not include: □ Plant/algal systems		
2.2.2 Structure and function of different systems □ Blood circulatory □ Lymphatic □ Musculoskeletal □ Homeostatic □ Gastrointestinal □ Excretory □ Respiratory	To include: □ How the blood circulatory and nervous systems support the functioning of the other systems □ That the blood circulatory system is responsible for the transport of blood, circulation of oxygen/carbon dioxide, antibodies, red and white blood cells, molecules including glucose and hormones and for thermoregulation □ How the structure and function of the lymphatic system differs from that of the blood circulatory system □ Know that the musculoskeletal system supports movement and balance and that the bones also act as a calcium storage site and produce blood cells □ How the homeostatic system is responsible for the processes of thermoregulation, plasma glucose regulation and osmoregulation □ Know that the gastrointestinal system consists of the buccal cavity, oesophagus, stomach and small and large intestines □ How the excretory system includes the sweat glands in the skin but also the kidneys for the excretion of urea □ Know that the respiratory system consists of the trachea, tracheoles, lungs, rib cage and intercostal/diaphragm muscles and carries out inspiration and expiration Does not include: □ Nervous and reproductive systems	**M3.6**	

2.2.3 Measuring the activity of systems, including: □ Sphygmomanometer □ Radial pulse readings □ Electrocardiogram (ECG) readings □ Ultrasound scans □ Colonoscopy □ Urinalysis □ Blood glucose levels □ Thermometer □ Spirometry □ Peak flow readings □ Fractional exhaled nitric oxide (FeNO) test	To include: □ How to use each measurement tool □ How each type of measurement tool contributes to the diagnosis of a condition or disease □ The benefits and limitations of using each form of measurement tool □ How to interpret blood glucose levels via the glucose tolerance test □ How to calculate the pulmonary ventilation rate using PVR = breathing rate (breaths min^{-1}) x tidal volume (cm^3) □ The reasons for a change in the pulmonary ventilation rate when undergoing exercise or in response to a heart defect or disease Does not include: □ The physics or mechanics of the tools used	**M0.4** **M1.6** **M2.3** **M2.4** **M3.2**	**HSW4** **HSW10**
Topic Area 3: Key concepts in endocrinology, neurobiology and reproduction			
Teaching content	**Breadth and depth**	**Opportunities to cover:**	
3.1 Key concepts of endocrinology		**Maths**	**HSW**
3.1.1 The endocrine system and homeostasis □ Key features of the endocrine system and hormones: • Adrenaline • Thyroxine • Somatostatin • Erythropoietin • Calcitonin • Insulin • ADH (anti-diuretic hormone) □ Definition and significance of homeostasis □ The homeostasis model	To include: □ Why the endocrine system is generally slower to respond to stimuli but the response is longer lasting than the nervous system □ The endocrine glands/tissues responsible for producing the hormones listed and the action of each hormone □ How synthetic hormones can be used as a form of therapy □ Know that homeostasis is the maintenance of a constant internal body environment □ The steps of the homeostasis model, including receptors, monitoring centre, effectors and negative feedback	**M0.4**	**HSW11**

□ Principles of • Thermoregulation • Osmoregulation • Glucose regulation	□ The principles of hormonal and/or nervous control in relation to thermoregulation, osmoregulation and glucose regulation (avoiding hypoglycaemia and hyperglycaemia) Does not include: □ Sex hormones and neurotransmitters		
3.1.2 Monitoring homeostasis □ Symptoms of malfunctioning endocrine systems: • Thermoregulation • Osmoregulation • Glucose regulation □ Physiological tests used to monitor homeostatic systems: • Core body temperature testing • Blood osmotic potential and pressure testing • Blood-glucose testing	To include: □ The reason for the differences in symptoms of hypothermia and hyperthermia □ How malfunctioning osmoregulation can be offset by adequate body hydration (drinking an appropriate supply of water on a daily basis) □ The causes and symptoms of type 1 and type 2 diabetes □ Know the characteristic features of hypoglycaemia and hyperglycaemia □ The impact of changes in lifestyle to reduce long term effects of type 1 and type 2 diabetes □ The advantages and disadvantages of each physiological test □ Why a fasting period is needed for the glucose tolerance test □ The advantages and disadvantages of non-invasive blood glucose testing technology to monitor and regulate diabetes Does not include: □ Sex hormones	**M1.5** **M3.1** **M3.2**	**HSW10**
3.2 Key concepts of neurobiology		**Maths**	**HSW**
3.2.1 The structure and function of the nervous system □ Central nervous system (CNS) versus autonomic nervous system (ANS) □ The structure and function of neurons, including the myelin sheath and nodes of Ranvier □ Key features of nerve impulse transmission	To include: □ The functional links between the CNS and ANS □ How receptors, sensory, relay and motor neurons and effectors function in the spinal reflex arc □ Know the stages of resting and action potentials and the significance of polarisation, depolarisation and hyperpolarisation	**M3.6**	**HSW7**

	□ The causes and symptoms of multiple sclerosis and the impact of the disease on impulse transmission via a changed saltatory response Does not include: □ Details of ionic exchange during nerve impulse transmission □ Nervous control of metabolism		
3.2.2 Basic features of the brain and spinal cord □ Structure and function of the brain □ Structure and function of the spinal cord	To include: □ How to interpret vertical section (VS) and transverse section (TS) images of the brain and spinal cord □ Know that the brain consists of defined regions including the cerebral hemispheres/cerebrum cerebellum, hypothalamus, pituitary gland and medulla □ Know the location and importance of the meninges and ventricles in the brain □ The reasons for taking samples of cerebrospinal fluid Does not include: □ Details of different parts of the brain and spinal cord □ Detailed histology of structures listed	**M1.4**	**HSW1**
3.3 Key concepts of reproduction		**Maths**	**HSW**
3.3.1 Structure and function of the reproductive system □ Common features of the female system including: • Cervix • Ovaries • Oviducts • Uterus • Vagina • Vulva □ Common features of the male system including: • Testes • Epididymis • Vas deferens • Prostate gland • Seminal vesicle • Urethra • Penis	To include: □ How the different structures work together within the systems □ Why individuals with variations in sex traits (intersex) may have reproductive systems outside of the typical male/female binary □ How to interpret photomicrographs of structures in the reproductive systems Does not include: □ Details of the menstrual cycle		**HSW2**

3.3.2 Hormonal control of gametogenesis □ Role of hormones in reproductive systems • Follicle-stimulating hormone (FSH) • Progesterone • Oestrogen • Luteinising hormone (LH) • Testosterone	To include: □ Why ovulation has evolved to become periodic but sperm production is continuous □ The roles of the hormones in relation to the development of secondary sexual characteristics, gametogenesis, fertilisation, pregnancy and birth □ How variations in sex traits (intersex) can be caused by differences in hormone levels and the impact on secondary sexual characteristics and gametogenesis Does not include: □ Detailed structure of the hypothalamus and pituitary gland	**M1.6**	
3.3.3 Reproductive changes during ageing □ Onset of menopause □ Use of hormones and surgery to delay or reduce the impact of menopause □ Causes and symptoms of structural and functional changes in the male reproductive system	To include: □ The advantages and disadvantages of pregnancy in later life □ The cause and symptoms of menopause, including the effect of different therapies □ Why hypertrophy of the prostate gland affects urination and sperm discharge Does not include: □ Detailed histological changes in the reproductive systems during ageing	**M4.2**	**HSW9**
Topic Area 4: Basics of microbiology			
Teaching content	**Breadth and depth**	**Opportunities to cover:**	
4.1 Key features of microbes		**Maths**	**HSW**
4.1.1 Features of bacteria found in humans □ Structure and function of components of bacterial cells: • Capsule/slime layer • Peptidoglycan cell wall • Cell surface membrane • Cytoplasm • 70S ribosomes • DNA loop • Plasmids • Mesosomes • Rotary-like flagellum	To include: □ Know the functions of the different structures listed for bacterial cells □ How gram positive and gram-negative bacteria differ □ Classification of bacterial cells as coccus, bacillus and spiral Does not include: □ Detailed structure of the cell wall		**HSW5**

4.1.2 Features of fungi found in humans □ Structure and function of fungal components • Cytoplasm • Chitin cell wall • Septum • Hypha • Mycelium • Spores □ Fungi are parasitic or saprophytic • Endoparasitic • Ectoparasitic • Saprophytic fungi □ Characteristics of common fungal diseases in humans • Aspergillosis (*Aspergillus sp.*) • Vaginal candidiasis (*Candida sp.)* • Athlete's foot (*Tenia sp.*)	To include: □ Recognise the key structures of fungi in photomicrographs and drawings □ Link the structure of each component to its function, the cytoplasm for cell shape and site of reactions, to include: • Chitin cell wall for cell shape and protection • Hypha for extracellular digestion and colonisation of substrate • Septum (containing perforations) to enable movement of molecules and ions from 'cell' to 'cell' and isolation of diseased or non-functioning 'cells' • Mycelium as the collection of branching hyphae and spores for reproduction and dispersal □ Know the role and impact of extracellular, hydrolytic enzymes secreted by fungal hyphae □ The characteristics of endoparasitic, ectoparasitic and saprophytic fungi living on or inside the human body □ The differences between parasitic and saprophytic fungi in relation to their lifestyles and impact on the human body Does not include: □ Detailed process of sporulation and sexual reproduction	**M0.1** **M1.1**	
4.1.3 Location of bacteria in the human body and external environment □ Locations of bacteria in the human body: • Skin surface • Conjunctiva • Mucous membranes • Teeth • Gastrointestinal tract (colon) • Reproductive tract • Renal tract	To include: □ How to collect samples, using the aseptic technique □ Advantages and disadvantages of taking bacterial samples from the external environment Does not include: □ Collection of clinical samples from diseased tissue	**M1.7**	**HSW4**

□ Locations of bacteria in the external environment: • Air • Water • Soil • Surface of plants • Surface of other animals			
4.1.4 Reproduction and culture of bacteria □ Binary fission (asexual) □ Sex pili	To include: □ Know that binary fission is a form of asexual reproduction involving mitosis and that the products are identical unless a mutation occurs during the process □ How to interpret data via graphs showing growth of bacterial population □ How to calculate bacterial population growth using, Estimate of bacterial population = $1 \times 2^{\text{number of divisions}}$ □ The features of lag, exponential, stationary and death stages of bacterial populations, in the context of environmental factors and natality/mortality of bacterial cells □ Know the factors promoting reproduction and death of bacterial cells within culture vessels	**M0.5** **M2.5** **M3.6**	**HSW4**
□ Use of agar plates and nutrient broths to culture bacteria	□ How agar is suitable as a growth medium for bacteria in the laboratory □ Know the key features of bacterial cultures when grown in agar dishes or nutrient broth		
□ The aseptic technique	□ The steps of the aseptic technique when obtaining bacterial samples, creating bacterial suspensions in nutrient broth/agar and streaking the surface of an agar plate □ The benefits and limitations of the aseptic technique in the context of personal safety and contamination of cultures □ How to create a health and safety record for carrying out the aseptic technique Does not include: □ Identification of bacteria via colony colour and morphology		

4.1.5 Viruses □ Size of viruses in comparison to bacteria □ Key features of a virus particle: • Protein-based outer coat • Glycoprotein spikes • DNA or RNA core □ Key features of viral reproduction in living cells	To include: □ Why viruses are not classified as living cells □ The unique features of a bacteriophage Does not include: □ Details of the interaction between viral and host cell nucleic acids	**M0.1** **M0.2**	
4.2 Beneficial microbes		**Maths**	**HSW**
□ Key features of the human biome □ Benefits gained from the presence of microbes in the human body □ Maintaining and enhancing the human biome	To include: □ Know that the human biome contains beneficial bacteria and fungi □ Beneficial features of how bacterial activity works, including the production of essential vitamins, destruction of pathogenic bacteria and promotion of the immune response □ How probiotic foods can increase the size and variety of the human biome □ How rectal probiotic implants can be used safely to treat obesity and disorders of the gastrointestinal tract Does not include: □ The classification of bacteria and fungi in the human biome		**HSW11**

Assessment guidance

This unit is assessed by an exam. The exam is 1 hour and 15 minutes and has **60** marks in total. All the questions in the exam are compulsory.

A range of question types will be used in this assessment including:

- Forced choice/controlled response questions – including MCQ
- Short answer, closed response questions (with or without diagrams)
- Short answer with calculation/working
- Extended constructed response with points-based mark scheme

Content will be sampled from all topic areas, with at least one question or part question relating to each topic area.

Content in this exam will have links to the 'How Science Works Concepts and Skills' and 'Mathematical skills for Human Biology'.

This will be conducted under examination conditions. For more details refer to the **Administration area**.

A range of question types will be used in the exam.

The Human Biology **Guide to our Sample Assessment Material** gives more information about the layout and expectations of the exam.

The exam for this unit assesses the following Performance Objectives:

- PO1 – Show knowledge and understanding
- PO2 – Apply knowledge and understanding

Synoptic assessment

This unit allows students to gain underpinning knowledge and understanding relevant to the qualification and sector. The NEA units draw on and strengthen this learning with students applying their learning in an applied or practical way.

The following NEA units have synoptic links with this unit. The synoptic grids at the end of these NEA units show these synoptic links.

- Unit F172: Genetics
- Unit F173: Biomedical techniques
- Unit F174: Nutrition and metabolism
- Unit F175: Human reproduction
- Unit F176: The brain

More information about synoptic assessment in these qualifications can be found in **Section 5.2 Synoptic Assessment.**

4.2.2 Unit F171: Health and disease

Unit aim

The nature of diseases and disorders is always a challenging and intriguing topic. The therapies involved in treating diseases and disorders is ever evolving, aided by ongoing medical research. This unit considers these things, along with the role played by immunology; diagnosis and monitoring in today's healthcare system.

In this unit you will learn about physiological disorders and communicable diseases that can impact on the health of individuals in terms of their causes and effects. You will be given the opportunity to understand the skills needed to review, measure and research this aspect of human biology. You will review the present and future role of immunology in fighting disease. By studying diagnostic and monitoring techniques you will gain an understanding of how disease change can be measured. Finally, you will examine how research is reported with consideration given to patient confidentiality.

Unit F171: Health and disease			
Topic Area 1: Causes and effects of diseases and disorders			
Teaching content	**Breadth and depth**	**Opportunities to cover:**	
1.1 Definitions of health and disease		**Maths**	**HSW**
Definitions of health, wellbeing and disease □ Physical health □ Mental health □ Social health □ Disease □ Medical disorder □ Medical sign □ Medical symptom □ Medical syndrome □ Medical condition	To include: □ Know the World Health Organization definition of health □ Know definitions of the list in 1.1 □ How physical, mental and social health are a measurement of overall health □ How the terms disease and disorder are used interchangeably		**HSW12**
1.2 The nature of physiological disorders/diseases		**Maths**	**HSW**
1.2.1 Physiological disorders/diseases and their effects □ Disorders of the nervous system • Motor neurone disease (MND) • Parkinson's □ Disorders of the circulatory system • Abdominal aortic aneurysm • Hypertension □ Disorders of the respiratory system • Asthma • Chronic Obstructive Pulmonary Disease (COPD) □ Disorders of the digestive system • Crohn's disease • Hiatus hernia □ Disorders of the urinary system • Nephritis • Polycystic Kidney Disease (PKD)	To include: □ The main changes to the relevant physiology of the body systems caused by each disorder/disease □ The main changes to overall body functions caused by each disorder/disease □ Know the main observable signs of each disorder/disease □ Know the main symptoms felt and experienced by individuals with each disease □ How the disorder/disease impacts on the individual, family and society in general Does not include: □ Changes at the cellular level □ Diseases/disorders other than those specified in the teaching content	**M1.2**	**HSW10**

□ Disorders of the musculoskeletal system • Multiple sclerosis • Rheumatoid arthritis □ Cancer in various organ systems • Hodgkin's lymphoma • Melanoma □ Deficiency diseases • Iron deficiency anaemia • Vitamin D deficiency and rickets □ Genetic disorders • Cystic fibrosis • Sickle cell anaemia			
1.2.2 Causes of physiological disorders/diseases □ Autoimmunity □ Diet and exercise □ Environmental □ Infection □ Inherited traits □ Lifestyle choices □ Occupation □ Treatment for other illnesses (polypharmacy) Specified disorders/diseases: □ Air pollution and asthma □ COPD and smoking □ COVID-19 and the pandemic □ Cystic fibrosis and inherited traits □ Hypertension and obesity □ Rheumatoid arthritis and autoimmunity □ Polypharmacy and Adverse Drug Reactions (ADR) □ Sheep farmers and hydatid disease	To include: □ Know that disorders/diseases may be caused by multiple factors □ How the factor(s) may influence the development of the specified disorders/diseases □ What is meant by autoimmunity □ The role of diet and exercise in health and wellbeing □ How environment can affect health and wellbeing □ Why inherited traits influence health and wellbeing □ How occupation is a major contributor to injuries and disease as well as economic loss □ What is meant by polypharmacy □ Benefits and limitations of polypharmacy Does not include: □ Diseases/disorders other than those specified	**M1.3** **M1.6** **M3.6**	**HSW5**
1.3 The nature of communicable diseases		**Maths**	**HSW**
1.3.1 Causes of communicable diseases □ Viruses: • COVID-19 • HIV and AIDS □ Bacteria: • Lyme disease • Methicillin-resistant Staphylococcus aureus (MRSA) • Tuberculosis □ Fungi: • Candidiasis (vaginal thrush) • Histoplasmosis	To include: □ How parasitic adaptations of these groups of organisms, allow transmission and entry into the body □ How preventative measures may reduce the risk of causes and spread of communicable diseases □ Suitability of the role of the following as modes of transmission: • Air • Water	**M1.6**	**HSW9**

□ Protozoans: • Malaria • Toxoplasmosis □ Multicellular parasites: • Fasciolosis (liver fluke) • Hydatid disease (tapeworm)	• Food • Touch • Saliva • Sexual organs • Placenta • Birth canal • Contaminated blood products • Contaminated body fluids • Insects • Flatworms • Roundworms • Ticks and mites □ Appropriateness of respiratory tract; gastrointestinal tract; urinogenital openings; broken skin; as portals of entry □ Know multicellular parasites are usually defined as helminths and ectoparasites Does not include: □ Prion diseases □ Diseases/disorders other than those specified in the teaching content		
1.3.2 Effects of communicable diseases □ Viral diseases: • COVID-19 • HIV and AIDS □ Bacterial diseases: • Lyme disease • Methicillin-resistant Staphylococcus aureus (MRSA) • Tuberculosis □ Fungal diseases: • Candidiasis (vaginal thrush) • Histoplasmosis □ Protozoan diseases: • Malaria • Toxoplasmosis □ Multicellular parasite diseases: • Fasciolosis (liver fluke) • Hydatid disease (tapeworm)	To include: □ Know observable signs of diseases at macroscopic and microscopic level □ Know symptoms felt and experienced □ The advantages and disadvantages of identifying diseases by signs and symptoms Does not include: □ Prion diseases □ Diseases/disorders other than those specified in the teaching content	**M2.2**	**HSW8**

Topic Area 2: Curative management and preventative therapies			
Teaching content	**Breadth and depth**	**Opportunities to cover:**	
2.1 Curative therapies		**Maths**	**HSW**
□ Antimicrobials • Effect of different antibiotics on the growth of bacteria on agar plates • Koch's postulates □ Casts • Fibreglass • Plaster □ Chemotherapy □ Dietary programmes □ Surgery □ Transplants • Gene • Cell • Organ	To include: □ How antibiotic discs/wells can be used to investigate bacterial growth on agar plates, including the use of control discs □ How pathogens are destroyed by antimicrobials □ How misuse of antibiotics may result in them becoming ineffective and lead to resistance □ How Koch's postulates establish whether a particular microorganism causes a particular disease □ How a control in antibiotic investigations helps validate experimental performance □ How antibiotic and bacterial investigations can be made more valid □ How these curative therapies may lead to a cure if the treatment period is completed □ How the use of these curative therapies may be influenced by the health status of the patient and various external factors □ Advantages and disadvantages of different ways to manage diseases/disorders □ Benefits and limitations of different types of plaster casts □ Reasons for introducing dietary programmes □ Suitability of the role of curative surgery and chemotherapy in cancer treatment □ Suitability of the role of organ, cellular and molecular therapies □ Appropriateness of the role of transplants in disease treatment	**M0.4** **M2.1** **M3.6**	**HSW1** **HSW4** **HSW5**
2.2 Management Therapies		**Maths**	**HSW**
Types of management therapies Palliative care □ Types of diseases/disorders that can be managed • Renal disease ○ Nephritis ○ Polycystic Kidney Disease (PKD)	To include: □ Purpose of the role of palliative care at the end of life □ Why some diseases cannot be cured □ How management may relieve symptoms, improve quality of, and extend life	**M1.6** **M3.1** **M3.3**	**HSW10**

• Autoimmune diseases
  ○ Multiple sclerosis
  ○ Rheumatoid arthritis
• Retinal diseases
  ○ Diabetic retinopathy
  ○ Macular degeneration
• Neurodegenerative diseases
  ○ Motor neurone disease (MND)
  ○ Parkinson's
• Digestive diseases
  ○ Crohn's disease
  ○ Hiatus hernia
□ Ways of managing diseases/disorders
• Medication
• Supportive therapies
  ○ Dialysis
  ○ Occupational therapy
  ○ Physiotherapy
  ○ Speech therapy
• Exercise
• Chemotherapy
• Cognitive therapy
• Surgery
	□ Why some diseases may go into remission
	□ The potential that some diseases may be cured in the future		

2.3 Preventative therapies		**Maths**	**HSW**
Types of preventative therapy strategies □ Allergy and food intolerance testing □ Check-ups □ Health promotion/education programmes □ Meal plans □ Patient counselling □ Screenings □ Vaccinations □ Well baby/well child visits	To include: □ How preventive health care aims to improve patient well-being, prevent disease, disability, and death □ Why the detection of pre or early stages of chronic diseases lead to more successful outcomes □ The difference between allergy and intolerance □ Reasons for preventative therapy strategies	**M1.2** **M1.7**	**HSW12**
Topic Area 3: The role of immunology			
Teaching content	**Breadth and depth**	**Opportunities to cover:**	
3.1 The immune system		**Maths**	**HSW**
Lines of Defence □ Innate immunity – first line of defence and non-specific • Physical barriers • Chemical barriers • Cells □ Adaptive immunity - second line of defence and specific • Antibodies • Specialised cells	To include: □ How physical and chemical barriers – skin, mucous membranes and their secretions assist in defence □ Know the role of macrophages, neutrophils, basophils, mast cells □ Know the role of specialised B and T cells □ Know the gamma globulin structure □ The function of antibodies	**M0.1** **M4.1**	**HSW1**

	□ The formation of the antigen-antibody complex and its role in the immune response		
3.2 Immune dysfunction and clinical immunology		**Maths**	**HSW**
3.2.1 Clinical immunology as the study of disease caused by immune system dysfunction □ Immunodeficiency • Primary • Acquired □ Allergies reaction to allergens □ Asthma □ Autoimmune disease □ Cancer □ Transplants	To include: □ How clinical immunology contributes to identifying immune dysfunction, its pathways and origins □ How types of problems with the immune system impair its ability to defend against allergens, infections or against 'self' and the resulting consequences □ How clinical immunology contributes to improvements in healthcare	**M3.6**	**HSW9** **HSW10**
3.2.2 Vaccines □ Inactivated vaccines □ Live attenuated vaccine □ Messenger RNA (mRNA) □ Subunit • Protein • Polysaccharide • Conjugate □ Toxoid vaccines □ Viral vector vaccines	To include: □ How new therapies and treatments can manage or cure a condition by altering the way the immune system works □ How vaccine types differ from each other □ The role of vaccines in priming the immune system and boosting the immune reaction to specific pathogens □ Advantages and disadvantages of vaccine types Does not include: □ The manufacture of vaccines	**M3.5**	**HSW9** **HSW10**
Topic Area 4: Techniques for diagnosis and monitoring			
Teaching content	**Breadth and depth**	**Opportunities to cover:**	
4.1 Diagnostic techniques		**Maths**	**HSW**
Stages in medical diagnosis □ Medical history □ Physical examination • Auscultation • Inspection • Palpation • Percussion □ Initial tests and measurements • Blood pressure values • Body mass index (BMI) • Lung volumes values • Oxygen levels values • Peak flow values • Temperature value	To include: □ How interpersonal skills and general approach of the medical practitioner in establishing the medical history may improve the diagnosis outcome □ How consultation room design may improve the diagnosis outcome	**M0.4** **M1.1**	**HSW2**

□ Further diagnostic investigations • Biopsies • Blood • Cognitive • Mammogram • Urine □ Medical practitioners and the use of interpersonal skills	□ How good practice is achieved in different stages of medical diagnosis □ How to interpret the results of diagnostic techniques □ How to calculate BMI and what the results mean □ Reasons for the different stages of medical diagnosis being performed □ Advantages and disadvantages of different stages of medical diagnosis □ Roles of the medical practitioners in different stages of medical diagnosis Examples of **medical practitioners** may include: □ General Practitioner (GP) □ Nurse □ Pathologist □ Radiologist □ Dermatologist		
4.2 Monitoring techniques		**Maths**	**HSW**
4.2.1 Groups requiring monitoring □ Acute conditions □ Child development □ Chronic conditions □ Employees requiring statutory medicals • Contractual requirements • HSE requirements □ Specialist clinics • Asthma • Diabetes □ Specific group screening • Abdominal aortic aneurysm • Breast • Cervical	To include: □ Reasons for screening particular cohorts □ Appropriateness of techniques for the individual/group/situation □ Why some employees require statutory medicals	**M1.2**	**HSW11**
4.2.2 Methods of monitoring □ Repeat of relevant initial diagnostic tests and measurements □ Clinical scoring systems • Disease Activity Scores (DAS28) • Unified Parkinson's Disease Rating Scale (UPDRS) □ Electronic monitoring □ Reagent strips	To include: □ Advantages and disadvantages of monitoring methods □ How regular monitoring and screening improves the health of an individual/cohort Does not include: □ How the diagnostic tests or electronic devices work	**M1.6** **M1.7**	**HSW3**

Topic Area 5: Reporting, research and confidentiality			
Teaching content	**Breadth and depth**	**Opportunities to cover:**	
5.1 Reporting		**Maths**	**HSW**
5.1.1 Types of health data gathered by □ Healthcare professionals • Clinical trials • Electronic records • Health surveys • Manual records • National databases • Patient disease registries □ Patients • Mobile Apps • Screening tests and dietary monitoring • Social media posts • Wearable devices □ Wider information • Climate and pollution monitoring	To include: □ Benefits of completing health data research □ Benefits and limitations of manual and electronic record gathering □ Reasons for accessing different types of health data □ Advantages and disadvantages of screening tests and dietary monitoring □ How social media may influence people's attitude to health data □ Advantages and disadvantages of apps and wearable devices □ How some wearable devices work in conjunction with mobile apps □ Why climate and pollution monitoring are important from a public health perspective	**M1.3** **M1.7**	**HSW2** **HSW10**
5.1.2 The process of analytics □ Data collection □ Interpretation □ Reporting □ Extraction □ Transformation □ Analysis □ Types of analytics • Descriptive - What happened? • Diagnostic - Why did it happen? • Predictive - What may happen? • Prescriptive - Make it happen?	To include: □ How analytics discover meaningful patterns in data □ The specific order of the process of analytics and what happens at each stage of the process □ Advantages and disadvantages of different types of data analytics in health care Does not include: □ Detailed explanations of the different types of analytics	**M0.3** **M0.4** **M3.1**	
5.2 Research		**Maths**	**HSW**
Approach to research □ Types of research • Qualitative • Quantitative □ Dependent upon • Finance • Practical feasibility • Staffing • Scientific basis □ Research methodology • Clinical • Epidemiological • Experimental	To include: □ How the type of research will determine what methodology and study are used □ The difference between qualitative and quantitative research □ The difference between the stated research methodologies	**M1.6**	**HSW3** **HSW6**

□ Types of study • Case controlled studies • Cohort studies • Randomised control trials (RCTs)			
5.3 Confidentiality		**Maths**	**HSW**
Confidentiality is maintained through □ Data sharing agreements □ Health professional contracts □ Government legislation or case law • Data Protection Act 2018 (DPA) • Common Law Duty of Confidentiality (CLDC) □ Professional codes of conduct or best practice	To include: □ How health professionals can ensure patient confidentiality □ Reasons for and against disclosing health data to a third party □ Know the DPA 2018 covers personal data (Article 6) and health data (Article 9) □ How general disclosure to a third party can be made under CLDC in order to avoid a breach of confidentiality Does not include: □ Details of the above Act, Articles and Common Law		**HSW11**

Assessment guidance

This unit is assessed by an exam. The exam is 1 hour and 15 minutes and has **60** marks in total. All the questions in the exam are compulsory.

A range of question types will be used in this assessment including:

- Forced choice/controlled response questions – including MCQs
- Short answer, closed response questions (with or without diagrams)
- Short answer with calculation/working
- Extended constructed response with points-based mark scheme
- Extended constructed response with levels of response mark scheme

Content will be sampled from all topic areas, with at least one question or part question relating to each topic area.

Content in this exam will have links to the 'How Science Works Concepts and Skills' and 'Mathematical skills for Human Biology'.

This will be conducted under examination conditions. For more details refer to the **Administration area**.

A range of question types will be used in the exam.

The Human Biology **Guide to our Sample Assessment Material** gives more information about the layout and expectations of the exam.

The exam for this unit assesses the following Performance Objectives:

- PO1 – Show knowledge and understanding
- PO2 – Apply knowledge and understanding
- PO3 – Analyse and evaluate knowledge, understanding and performance.

Synoptic assessment

This unit allows students to gain underpinning knowledge and understanding relevant to the qualification and sector. The NEA units draw on and strengthen this learning as students will apply their learning to practical or applied tasks.

The following NEA units have synoptic links with this unit. The synoptic grids at the end of these NEA units show these synoptic links.

- Unit F172: Genetics
- Unit F174: Nutrition and metabolism
- Unit F175: Human reproduction
- Unit F176: The brain
- Unit F177: Drug development

More information about synoptic assessment in these qualifications can be found in **Section 5.2 Synoptic Assessment**.

4.3 NEA Units

4.3.1 Unit F172: Genetics

Unit Aim

Genetics has a central role in the study of Human Biology. Genetics helps to explain what makes us all unique, why family members look alike, why some diseases run in families and how human evolution occurs. By studying the structure and function of our genes, scientists are able to understand how the body works and how we can use this knowledge to benefit individuals and society as a whole. This unit explores the main principles of genetics and inheritance, particularly in relation to genetic disorders. It looks at the emerging roles of genetic testing and the modification of genes to prevent or cure inherited disorders.

In this unit you will build on knowledge of DNA, cell division and inheritance from Unit F170 Fundamentals of human biology. You will learn how to apply and use mathematical techniques to determine probability of inheritance in human genetic disorders. You will also learn the principles of genetic testing how it is used and the importance of genetic counsellors. Finally, you will learn how to investigate recent advances in gene therapy and genetic engineering, and the potential importance of these technologies in the future.

Unit F172: Genetics			
Topic Area 1: Fundamentals of genetics			
Teaching content	**Exemplification**	**Opportunities to cover:**	
1.1 DNA		**Maths**	**HSW**
□ Function of DNA: • Replication • Protein synthesis: ○ Transcription ○ Translation □ Role of telomeres	To include: □ Key features of each process □ The importance of each process to the cell □ The importance of the telomeres □ The effect of ageing on telomeres Does not include: □ Structure of ribosomes □ Structure of mRNA		**HSW1**
1.2 Gene expression		**Maths**	**HSW**
□ Gene expression □ Gene regulation	To include: □ Meaning of gene expression □ How gene expression is measured □ What factors can influence gene expression □ Meaning of gene regulation □ Reasons why gene expression and gene regulation are important		**HSW9**
1.3 Diversity and variation		**Maths**	**HSW**
1.3.1 □ Phenotypic variation can be caused by: • Genotypic variation • Environmental variation	To include:	**M1.3** **M1.6**	**HSW10**

□ Genotypic variation occurs because of: • Genetic recombination • Gene variants	□ The process and key features of recombination □ Why recombination is important □ How the process of recombination has been used to map human genes □ Meaning of the term variant □ How recombination and variants contribute to evolution		
□ Environmental variation	□ What environmental factors can contribute to phenotypic variation in humans □ How environmental factors can alter genes or gene expression		
1.3.2 □ Investigating phenotypic variation in a discrete population	To include: □ How investigations of phenotypic characteristics in a discrete population are carried out □ Why it is important to compare data from investigations with national statistics □ Limitations of comparing data with national statistics: • Effects of age and sex on values • Effects of race on values • Effects of environment on values	**M3.1**	**HSW2**
Topic Area 2: Mode of inheritance			
Teaching content	**Exemplification**	**Opportunities to cover:**	
2.1 Mendelian inheritance		**Maths**	**HSW**
2.1.1 □ Monohybrid inheritance of: • Normal trait • Single gene disorder • Codominance • Incomplete inheritance • Sex-linked trait	To include: □ Monohybrid crosses giving genotypes and phenotypes □ Punnett squares	**M1.3**	
2.1.2 □ Dihybrid inheritance of two non-linked autosomal genes	To include: □ Dihybrid crosses giving genotypes and phenotypes □ How two-trait Punnett squares are used	**M1.1** **M1.3**	
□ Predicting genotypic and phenotypic ratios	□ How chi-squared tests use expected and observed data □ The statistical significance of differences in data and probabilities		

2.2 DNA mutations		**Maths**	**HSW**
2.2.1 Genetic mutations caused by changes in the sequence of DNA: □ Deletion □ Inversion □ Substitution □ Duplication	To include: □ Key features of each way that mutations can occur in DNA □ Representation of each way that the DNA sequence can change using diagrams □ The effect of changes in DNA to which amino acid is expressed, and therefore to proteins that are produced		**HSW1**
2.2.2 Genetic mutations: □ Acquired mutations □ Hereditary mutations	To include: □ Comparison of key features of both types of genetic mutations □ Factors that can cause acquired mutations □ Consequences of genetic mutations, including the effect the mutation can have on: • Genes or Gene expression • Protein production • Physiological processes in the body	**M3.6**	**HSW11**
2.3 Genetic disorders		**Maths**	**HSW**
2.3.1 □ Types of genetic disorders: • Single gene • Chromosomal • Complex (polygenic) □ Types of single gene disorders: • Autosomal dominant • Autosomal recessive gene • X-linked dominant • X-linked recessive □ Human pedigree analysis in single gene disorders	To include: □ Meaning of the term genetic disorder □ Key features of each type of single gene disorder □ Patterns of inheritance of single gene disorders using genetic crosses and Punnett squares □ How human pedigree analysis is used to identify the type of single gene disorder □ How single gene disorders can be tracked through families and risks to future generations predicted Examples of **single gene disorders** may include: □ Cystic Fibrosis □ Sickle cell anaemia □ Huntington's disease	**M3.1**	**HSW7** **HSW9**
2.3.2 □ Chromosomal disorders can be caused by changes in: • The number of chromosomes • The structure of chromosomes	To include: □ How changes in the number and structure of chromosomes can occur □ Identification of chromosome disorders from diagrams	**M1.3** **M1.4**	**HSW1**

	Examples of **chromosomal disorders** may include: □ Down syndrome □ Klinefelter syndrome □ Turner syndrome		
2.3.3 □ Complex genetic disorders (polygenic) caused by a combination of: • Many genes • Lifestyle and environmental factors	To include: □ Why it is harder to track patterns of inheritance for complex genetic disorders □ Meaning of the term genetic predisposition □ How people with a genetic predisposition may be able to reduce their risk Examples of **complex genetic disorders** may include: □ Type 2 diabetes □ Coronary heart disease □ Atherosclerosis	**M3.1**	**HSW12**
Topic Area 3: Genetic counselling and genetic testing			
Teaching content	**Exemplification**	**Opportunities to cover:**	
3.1 Genetic counselling		**Maths**	**HSW**
3.1.1 □ What genetic counselling is □ The role of a genetic counsellor: • Providing information and support • Assessing risk of inheritance	To include: □ Why different individuals might have genetic counselling □ Why individuals might have genetic counselling before or after genetic testing Examples of **the role of a genetic counsellor**: □ Providing information and support about: • Different genetic tests • How to arrange tests • How to understand test results • Support groups for a patient or for a family □ Assessing risk of inheritance**:** • Looking at family medical history • Using a family tree	**M3.1**	**HSW9**
3.1.2 □ Genetic tests: • Molecular tests • Chromosomal tests • Gene expression tests • Biochemical tests	To include: □ How genetic tests are taken □ Key features of each test □ Similarities and differences between the tests □ Reasons for selecting one type of test over another	**M1.3**	**HSW8**

3.2 Different types of genetic tests		**Maths**	**HSW**
3.2.1 □ Genetic tests in adults: • Diagnostic tests • Assessing risk of genetic disorder • Ancestry genetic tests	To include: □ Key features of each type of genetic test in adults □ What information each test provides □ How tests differ from each other		**HSW11**
3.2.2 □ Genetic tests in embryos and babies: • Prenatal tests • New-born screening	To include: □ Why and how tests are carried out □ The advantages and disadvantages of tests □ Which disorders are targeted by both types of test, and why □ Importance of tests □ Reasons why new-born screening is the most common type of genetic testing □ Reasons why there are regional differences in prenatal tests and new-born screening	**M1.6**	**HSW1** **HSW4**
3.2.3 □ Preimplantation tests used in the process of *in vitro* fertilisation (IVF) □ Basic outline of the process of IVF	To include: □ How preimplantation tests are used in IVF □ Advantages and disadvantages of preimplantation testing	**M1.3**	**HSW4** **HSW12**
3.3 Privacy and ethics		**Maths**	**HSW**
3.3.1 □ Privacy and ethical issues in genetic testing: • Confidentiality of personal information • Sharing of information • Storage of DNA information • Consequences of positive genetic test results • Accuracy of results and false results	To include: □ How each issue arises in genetic testing □ Why each ethical issue is important □ How the issues can be solved or minimised	**M1.5**	**HSW9** **HSW10**
3.3.2 □ Concerns about storage of DNA information on a DNA database: • Surveillance • Discrimination • DNA evidence is not always 100% accurate	To include: □ How each concern arises □ Why each concern is important □ How the concerns could be addressed	**M0.4**	**HSW8** **HSW9**

Topic Area 4: Gene therapy and genetic engineering			
Teaching content	**Exemplification**	**Opportunities to cover:**	
4.1 Gene therapy		**Maths**	**HSW**
□ Gene therapy corrects genetic defects by: • Replacing defective genes • Turning off defective genes • Turning on healthy genes • Training the immune system to recognise diseased cells	To include: □ Key features of the different ways that genes can be altered in gene therapy □ Benefits of gene therapy □ Risks and challenges involved in gene therapy □ Examples of the use of gene therapy	**M0.2** **M0.5** **M1.1**	**HSW9**
□ Genes can be altered in: • Somatic cells • Germline cells	□ Key differences between somatic and germline cells and their use in gene therapies		
□ Methods of delivery of gene therapy: • *ex vivo* (*in vitro*) • *in vivo* • *in situ* gene therapies	□ Key features and differences between *ex vivo*, *in vivo* and *in situ* gene therapies □ The advantages and disadvantages of each method of delivery		
□ The use of vectors in gene therapy	□ Why vectors are used in gene therapy □ Best vectors to use □ The advantages of using viruses as vectors in gene therapy		
4.2 Genetic engineering		**Maths**	**HSW**
4.2.1 □ Genetic engineering and recombinant DNA technologies	To include: □ Key features of genetic engineering □ Purpose of genetic engineering □ Comparison of genetic engineering to gene therapy in terms of techniques, purpose and ethics		**HSW9**
4.2.2 □ Genetic engineering in humans	To include: □ Reasons why genetic engineering might be used in humans □ Advantages and disadvantages of genetic engineering in humans □ Ethics of genetic engineering in humans	**M3.1**	**HSW1** **HSW9** **HSW11**
□ CRISPR technology	□ Key features of CRISPR technology □ Potential uses of CRISPR technology in humans □ Benefits, limitations, and ethics of CRISPR technology		

Assessment criteria

Section 6.4 provides full information on how to assess the NEA units and apply the assessment criteria.

These are the assessment criteria for the tasks for this unit. The assessment criteria indicate what is required in each task. Students' work must show that all aspects of a criterion have been met in sufficient detail for it to be **successfully achieved** (see **Section 6.4.1**). If a student's work does not fully meet a criterion, you must not award that criterion.

The command words used in the assessment criteria are defined in **Appendix B**.

Pass	Merit	Distinction
P1: Use research to **summarise** DNA function for someone with the genetic disorder.	**M1:** Use research to **compare** the functioning gene/chromosome to the malfunctioning gene/chromosome for the genetic disorder.	**D1: Assess** how physiological processes are affected by the genetic disorder.
P2: Use research to **explain** how genes determine the signs and symptoms of the genetic disorder.	**M2:** Use research to **describe** how gene expression and gene regulation contribute to the genetic disorder.	
P3: Use research to **describe** how the genetic disorder is caused by type(s) of variation.		
P4: Use research to **describe** the mode of inheritance of the genetic disorder.		
P5: Use research to **describe** how relevant gene therapies are for the genetic disorder.	**M3**: Use research to **describe** the medical benefits and risks of gene therapy for the genetic disorder.	**D2**: **Discuss three** advantages and **three** disadvantages of the potential for genetic engineering for this genetic disorder.
P6: Use research to **describe** how genes are altered through the most relevant gene therapy for this genetic disorder.	**M4: Analyse** the challenges involved with gene therapy for the genetic disorder.	
P7: **Explain** the method of delivery for the most relevant gene therapy for this genetic disorder.		
P8: Use research to **summarise** how a genetic counsellor may be able to assist the patient.	**M5: Explain** how genetic counselling would be beneficial in the case study context.	**D3: Discuss** the relevance of gene therapies in the case study context.
P9: Explain the potential impact of the genetic disorder on the mental health of the patient.		

Pass	Merit	Distinction
P10: Explain how privacy and ethical issues can be addressed for the patient.		
P11: Create diagrammatic representation(s) to show the inheritance of the genetic disorder in the case study context.	**M6: Explain** what the diagrammatic representation(s) means for the patient.	**D4: Discuss** what the diagrammatic representation(s) show about the inheritance of the genetic disorder in the case study context.
P12: Explain the type of genetic test(s) that is appropriate to diagnose the genetic disorder.	**M7: Analyse** the role of genetic test(s) in the case study context.	**D5: Assess three** available options for managing the outcomes of the genetic disorder in the case study context.

Assessment guidance

This assessment guidance gives you information relating to the assessment criteria. There might not be additional assessment guidance for each assessment criterion. It is included only where it is needed.

Assessment Criteria	Assessment guidance
Task 1	• The research element of the criteria in this Task does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criteria.
P1	• Students must use research to summarise DNA function for someone with the genetic disorder. Students must consider the impact on different sexes and at different life stages.
M1	• Students need to compare the functioning gene or chromosome to the malfunctioning gene or chromosome for the genetic disorder. Whether the focus is on ‘gene’ or ‘chromosome’ will depend on the genetic disorder.
Task 2	• The research element of the criteria in this Task does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criteria.
P5	• Students must use research to describe how relevant **at least two** gene therapies are for the genetic disorder. • If at least two gene therapies are **not** relevant then there must be a description of why.
M3	• **M3** is an extension of **P5**.
M4	• Students must analyse the challenges involved with gene therapy for the genetic disorder. • The challenges might be holistic, like financial, practical or ethical considerations, or specific, like the number of genes affecting the genetic disorder, the countries the gene therapy is offered or people’s understanding of the gene therapy.
D2	• Students must discuss **three** advantages and **three** disadvantages of the potential for genetic engineering for this genetic disorder. • This discussion might include, for example, exploring whether genetic engineering would be financially viable, ethical concerns, the complications of research, the impact on those who have the genetic disorder, improvements to quality of life.

Task 3	• In Task 3, where a criterion focuses on 'the patient' then students must focus on the patient. There is no expectation that they discuss the rest of the case study context. • In Task 3, where a criterion focuses on 'in the case study context' then students must include the whole case study context, for example, other family members, potential children, partners.
P8	• The research element of this criterion does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criterion.
P10	• Students explain how at least **two** privacy issues and at least **two** ethical issues can be addressed for the patient. • If at least **two** privacy issues and/or ethical issues are not relevant then there must be an explanation of why.
P11, M6, D4	• For **P11**, **M6** and **D4**, students should include all relevant diagrammatic representations from Topic Area 2.2 DNA mutations as appropriate for the genetic disorder.
M5	• **M5** is an extension of **P8**.
M6	• **M6** is an extension of **P11**.
M7	• **M7** is an extension of **P12**.
D3	• Students must discuss the relevance of gene therapies in the case study context, with part of the discussion potentially being whether gene therapy is the most appropriate option or if there are other treatments available.
D4	• **D4** is an extension of **M6**.
D5	• For **D5**, **three** different options should be assessed, but the number of available options may be more than three depending on the genetic disorder. • Students are **not** required to assess more than three available options. • Options might focus on a range of factors including patient care, patient well-being, treatments and cures.

Synoptic assessment

Some of the knowledge, understanding and skills needed to complete this unit will draw on the learning in Units F170 and F171.

This table details these synoptic links.

Unit F172: Genetics		Unit F170: Fundamentals of human biology	
Topic Area		Topic Area	
1	Fundamentals of genetics	1	Human cells and tissues

Unit F172: Genetics		Unit F171: Health and disease	
Topic Area		Topic Area	
2	Mode of inheritance	1	Causes and effects of diseases and disorders
4	Gene therapy and genetic engineering	3	The role of immunology

More information about synoptic assessment in these qualifications can be found in **Section 5.2 Synoptic assessment.**

4.3.2 Unit F173: Biomedical techniques

Essential resources required for this unit:

□ Science laboratory and relevant equipment (see Teacher/Technician Advice sheet).

Unit Aim

Biomedical techniques are practical techniques used in many medical, industrial and quality control laboratories. Biomedical scientists carry out a range of scientific tests to support the diagnosis of ill health in humans. Many health service departments rely on the information from biomedical scientists to complete their diagnoses and select treatment pathways.

In this unit you will learn how to plan and carry out investigations using a variety of quantitative and qualitative laboratory techniques that can be used to assess and analyse biomolecules and biochemicals. The analysis of these biochemicals can reveal different diseases and disorders from samples. Techniques can include chromatography, urinalysis, microscopy and titration. You will also learn about other laboratory techniques that are available in a biomedical laboratory and how these can be used for diagnosis.

Unit F173: Biomedical techniques			
Topic Area 1: What biomedical science is			
Teaching content	**Exemplification**	**Opportunities to cover:**	
1.1 Role of a Biomedical Scientist		**Maths**	**HSW**
1.1.1 The purpose of biomedical science □ Contributions to research and medicine □ Specific duties and responsibilities □ Diagnosis and monitoring	To include: □ Types of diseases and conditions that biomedical scientists can support physicians to diagnose Examples of **diseases and conditions** may include: □ Diabetes □ Kidney and liver diseases □ Allergies		**HSW2**
1.1.2 Disciplines associated with biomedical science □ Cytopathology □ Cytology □ Clinical Chemistry □ Histopathology □ Haematology □ Immunology □ Medical Microbiology □ Virology □ Transfusion Science	To include: □ The type of analysis conducted by scientists in each discipline □ How each discipline contributes to diagnosis □ The importance of collaboration between disciplines and physicians for diagnosis □ The types of qualitative and quantitative techniques employed by each discipline		**HSW3** **HSW6**
1.2 Handling Specimens		**Maths**	**HSW**
How specimens in biomedical laboratories are: □ Obtained □ Handled □ Transported □ Stored	To include: □ The importance of effective health and safety protocols when handling biohazardous materials □ The importance of sterility when obtaining and handling samples □ The need for specimen preservatives, storage conditions, and when these are required		**HSW3** **HSW4** **HSW9**

	□ The importance of security in laboratory information systems □ The need for effective patient and sample identity protocols		
1.3 Biological variability		**Maths**	**HSW**
Using reference values and population statistics	**To include:** □ The need for reference values in diagnostics □ The limitations of reference values and population statistics, including: • Inter- and Intra- individual variation • Effects of age and sex on values • Effects of environment, such as nutrition, time of day, stress on reference values Examples of **reference values** may include: □ Concentration of glucose in urine □ Red blood cell count □ Ion concentrations	**M0.2** **M1.2**	**HSW10**
Topic Area 2: Diagnostic techniques: cells and microscopy			
Teaching content	**Exemplification**	**Opportunities to cover:**	
2.1 Microscopy		**Maths**	**HSW**
Types of microscopy □ Key features of • Light microscopy (LM) • Electron microscopy • Transmission and Scanning • Fluorescence microscopy • Confocal microscopy □ Use of light microscopes to observe cells and tissues	To include: □ How to select the appropriate type of microscopy to use for different biological samples and purposes □ The advantages and disadvantages of each type of microscopy in biomedical science, including resolution and magnification □ How to measure samples using an eyepiece graticule in eyepiece units and calibrating the units into μm using a stage micrometer □ How to determine sizes of biological specimens □ The difference between wet and dry mounts of specimens and their appropriateness □ How to use a haemocytometer to calculate mean numbers of erythrocytes □ The importance of dilution when using a haemocytometer	**M0.1** **M0.2** **M1.1** **M1.4** **M2.2**	**HSW3** **HSW4** **HSW5**

	□ Common errors, risks and hazards associated with using LM Does not include: □ Detailed understanding of different types of confocal microscopy □ Detailed understanding of how to prepare biological samples for microscopy not available to schools		
2.2 Cytology and histopathology		**Maths**	**HSW**
2.2.1 Cytology □ Collecting the cell samples: • Exfoliative cytology • Intervention cytology □ Visualising cell samples: • Fixation • Staining • Mounting	To include: □ How different cell samples are collected □ The impact of the choice of collection method on the quality of the cell sample □ How to compare healthy specialised cells with abnormal cells □ Potential diseases or disorders indicated by cell abnormalities as seen by LM Examples of **collection techniques** may include: □ Blood draws □ Skin biopsy □ Fine need aspiration □ Techniques available for visualising cell samples □ How to prepare slides for LM with appropriate stains available to schools □ How to identify normal cell structures and morphology using LM and types of abnormality that could be identified □ How to dispose of cytology samples appropriately	**M0.1** **M1.7**	**HSW6** **HSW11**
2.2.2 Histopathology □ Collection of tissue samples □ Visualising tissue samples	To include: □ How different tissue samples are collected □ The impact of the choice of collection method on the quality of the tissue sample □ How to compare healthy tissues with abnormal tissue □ Techniques available for visualising tissue samples □ Potential diseases or disorders indicated by tissue abnormalities	**M1.7**	**HSW3** **HSW6**

	Examples of **collection techniques** may include: □ Core needle biopsy □ Open biopsy □ Fine need aspiration		
2.3 Haematology		**Maths**	**HSW**
□ Blood cell counts □ Blood film preparation □ Staining techniques □ Iron levels □ Blood typing	To include: □ How to select the appropriate analysis to carry out for diagnosis □ The advantages and disadvantages of each type of analysis □ How to carry out research to determine reference values for blood cell counts and iron levels □ How to analyse blood films for abnormalities □ Common errors, risks and hazards associated with each technique □ How to dispose of haematology samples appropriately □ Potential diseases or disorders indicated by blood abnormalities Does not include: □ Haematocrit levels □ Detailed knowledge of how iron levels of blood are determined	**M0.4** **M1.6**	**HSW4** **HSW12**
2.4 Microbiology		**Maths**	**HSW**
□ Culturing bacteria and fungi effectively and safely • Aseptic technique • Preparation of sterile agar plates and nutrient media • Disposal □ The culture of bacteria by the inoculation of agar plates • Streak plates • Lawn plates • Pour plates □ The identification of bacteria and fungi through • Appropriate staining • Microscopy • Colony morphology • Selective and differential media	To include: □ The techniques required for safe culturing and observation of microorganisms □ Sterilisation, disinfection and safe disposal of cultures □ How to select different types of growth media in the culturing and identification of microorganisms □ How to identify bacteria and fungi by cell and colony morphology □ The steps involved in testing for gram-negative and gram-positive bacteria □ The role of different types of growth media in the culturing and identification of microorganisms □ Advantages and disadvantages of different types of culturing technique □ Common errors, risks and hazards associated with microbiological techniques available in schools.	**M4.2**	**HSW2** **HSW3**

	□ Potential diseases or disorders indicated by the presence of bacteria or fungi cultures Does not include: □ Preparation of specialised growth media □ Culturing viruses or parasites		
2.5 Immunological assays		**Maths**	**HSW**
□ Diagnose infectious diseases □ Measure the function of immune cells □ Detection of toxins and drugs	To include: □ The principles of immunological assays and different types of labelling □ The use of assays for qualitative and quantitative assessments □ The types of materials detected by immunoassay in biomedical science □ The advantages and disadvantages of immunological assays in biomedical sciences, including sensitivity □ Potential diseases or disorders monitored and diagnosed by immunological assays Examples of **uses of immunological assays** may include: □ Allergy testing □ Prostate cancer detection □ Pregnancy testing	**M0.4** **M1.6**	**HSW8** **HSW9**
Topic Area 3: Diagnostic techniques: biological molecules			
Teaching content	**Exemplification**	**Opportunities to cover:**	
3.1 Reagent test strips		**Maths**	**HSW**
Qualitative and quantitative analysis of: □ Drugs □ pH □ Glucose □ Proteins □ Ketones □ Hormones □ Antibodies □ Leukocytes □ Other organic and inorganic compounds	To include: □ The type of information available from different reagent test strips □ How they work and how they are used □ The advantages and disadvantages of using reagent test strips, including sensitivity □ Hazards associated with their use and associated control measures, including disposal □ Potential diseases or disorders indicated by reagent test strips	**M3.1** **M3.2**	**HSW6**

3.2 Qualitative tests for inorganic substances		**Maths**	**HSW**
3.2.1 Identification of inorganic substances □ Chemical tests for cations • Al^{3+} • Ca^{2+} • Cu^{2+} • Fe^{2+} • Fe^{3+} • H^{+} • K^{+} • Mg^{2+} • Mn^{2+} • Na^{+} • NH_4^{+} • Ni^{2+} □ Chemical tests for anions • Carbonate (CO_3^{2-}) • Chloride (Cl^{-}) • Hydroxide (OH^{-}) • Iodide (I^{-}) • Nitrate (NO_3^{-}) • Nitrite (NO_2^{-}) • Phosphate (PO_4^{3-}) • Sulfate (SO_4^{2-})	To include: □ How to perform qualitative analysis for the presence (and absence) of the listed anions and cations □ Common errors, risks and hazards associated with tests available in schools □ The advantages and disadvantages of these tests for diagnosis in biomedical sciences, including sensitivity □ Potential diseases or disorders indicated by abnormal presence or absence of anions and cations in blood and urine		**HSW3** **HSW6**
3.2.2 Alternative techniques using instrumentation □ Inductively coupled plasma mass spectrometry (ICP-MS) □ Atomic emission spectroscopy (AES) □ Atomic absorption spectroscopy (AAS)	To include: □ The principles of each instrumental technique and their use to identify ions □ The appropriateness of each technique for different types of material □ The advantages and disadvantages of each technique for diagnosis in biomedical sciences, including sensitivity	**M1.1** **M1.5**	**HSW8**
3.3 Qualitative tests for organic compounds		**Maths**	**HSW**
3.3.1 Chemical tests for organic compounds □ Fehling's test for aldehydes □ Benedict's test for sugars □ Emulsion test for lipids □ Sudan III test for lipids □ Biuret test for proteins	To include: □ How to perform qualitative analysis for the presence of biological organic compounds □ Common errors, risks and hazards associated with tests available in schools □ The advantages and disadvantages of these tests for diagnosis in biomedical sciences, including sensitivity □ Potential diseases or disorders indicated by the abnormal presence of absence of organic compounds in blood or urine	**M0.4** **M3.1**	**HSW3** **HSW5**

3.3.2 Alternative techniques and instrumentation □ Gas Chromatography (GC) □ Liquid Chromatography (LC) □ Mass Spectrometry (MS)	To include: □ The principles of each instrumental technique and their use to identify ions □ How these techniques can be combined to produce quantitative information □ The appropriateness of each technique for different types of material □ The advantages and disadvantages of each technique for diagnosis in biomedical sciences, including resolution power and sensitivity	**M0.2** **M0.5**	**HSW4**
3.4 Separating Techniques for identification		**Maths**	**HSW**
Techniques to separate biological materials □ Centrifugation □ Flow cytometry □ High Pressure Liquid Chromatography (HPLC) □ Paper Chromatography □ Thin Layer Chromatography (TLC) □ Electrophoresis • DNA • Protein • Cell • Ion □ Blot • Northern • Southern • Western	To include: □ The principles of each separation technique and how they are performed □ How to carry out paper and thin layer chromatography □ How to use references and read chromatograms to determine the presence or absence of biological materials □ The use of appropriate stains in paper chromatography and TLC □ The role of polymerase chain reaction (PCR) in DNA electrophoresis □ The appropriateness of each separation technique for different types of material □ The advantages and disadvantages of each technique for diagnosis in biomedical sciences, including resolution power Does not include: □ Detailed knowledge of PCR and cell lysis procedures	**M2.1** **M2.3**	**HSW9** **HSW11**
3.5 Quantitative analysis of a substance in solution		**Maths**	**HSW**
3.5.1 Titration □ Volumetric analysis □ Indicator selection □ Alternative instrumentation for titration • Thermometer • pH meter • Autotitrators	To include: □ How to carry out different types of titration to determine concentration □ How to calculate concentrations determined by titration □ How to identify and prepare the appropriate standard solution to use in a titration □ How to select the correct indicator for a titration	**M0.5**	**HSW3**

	□ How to select the correct type of titration to carry out □ The suitability of different types of equipment in a titration to produce accurate results, and their uncertainties □ Common errors, risks and hazards associated with techniques available in schools □ How to use instrumentation in titration: • Thermometer for thermometric titration • pH meter for monitoring pH change • Autotitrators □ The advantages and disadvantages of each method to determine the concentration of biological molecules, including sensitivity		
3.5.2 Colorimetry and Spectrophotometry □ Blanks and calibration curves □ Wavelength selection □ Serial dilutions	To include: □ How to use a colorimeter and spectrophotometer to determine the concentration of biological molecules □ Types of biological molecules analysed using these methods □ How to select and prepare appropriate blanks to use for calibration and create calibration curves □ How to select the appropriate wavelength for analysing different types of materials □ Common errors, risks and hazards associated with techniques available in schools □ The advantages and disadvantages of each technique to determine the concentration of biological molecules, including sensitivity	**M3.2** **M3.3**	**HSW6**
3.5.3 Biosensors	To include: □ How biosensors are used to determine the presence and concentration of biological molecules □ Types of biological material analysed using biosensors □ How to select the most appropriate biosensor to use for different biological materials	**M1.5**	**HSW4**

	□ The advantages and disadvantages of using biosensors to determine the presence and concentration of biological material, including sensitivity □ Potential diseases or disorders that can be diagnosed using biosensors		
Topic Area 4: Planning a clinical investigation			
Teaching content	**Exemplification**	**Opportunities to cover:**	
4.1 Understanding clinical conditions		**Maths**	**HSW**
Symptoms and reference values	To include: □ How to carry out research to identify a range of potential diseases and disorders based on a patient's symptoms □ The importance of using reliable sources of information □ How to select the most likely diseases or disorders for a patient by taking into account their medical history □ How to carry out research to find reference values for the tests that are used by biomedical scientists □ How to select appropriate reference values to use that are appropriate for a patient	**M1.3**	**HSW11**
4.2 Creating a method for an investigation		**Maths**	**HSW**
4.2.1 Generating a hypothesis	To include: □ How to write a hypothesis and null hypothesis about a patient's diagnosis based on research □ How to explain the hypothesis using scientific knowledge and details acquired through research □ How to accept or reject a hypothesis		**HSW6**
4.2.2 Producing a method □ A method includes decisions about: • Variables • Method • Equipment • Measurements	To include: □ How to choose appropriate tests and techniques to qualitatively accept or reject a null hypothesis □ Why there are limitations for the types of investigations that can be carried out in schools □ How to justify the choice of tests and techniques appropriate for diagnosis □ The difference between independent, dependent and control variables □ How to identify significant variables to control in an investigation	**M1.5**	**HSW3**

	□ How to decide what values to select for the relevant variables in the investigation □ How data of sufficient quality can be collected through equipment choice □ How to determine the uncertainty associated with different measuring equipment and reduce uncertainty □ How to calibrate equipment to reduce errors		
4.2.3 Safe handling of specimens	To include: □ How to create and maintain a sterile environment when carrying out diagnostic tests and techniques □ How to plan to carry out diagnostic tests and technique that reduces contamination □ How to handle specimens to reduce the risk of false positive and negatives □ How to maintain the integrity of samples used in investigations □ How to safely dispose of different types of specimen		**HSW5**
4.2.4 Risk assessment □ Identifying hazardous equipment, chemicals, biological hazards and procedures □ Risks □ Control measures □ Emergency measures	To include: □ How to complete a risk assessment □ How to differentiate between a hazard and risk □ How to identify appropriate risks and hazards for an investigation □ Hazard symbols and what they represent □ How to select and interpret relevant information from chemical safety data sheets □ How to explain control measures using scientific principles □ Why it is important to be aware of emergency measures before carrying out an investigation □ Why it is important to work safely and with due care and attention in a scientific practical investigation	**M3.1**	**HSW4**
4.3 Performing a scientific investigation		**Maths**	**HSW**
□ Types of data available in practical investigations: • Qualitative and quantitative data • Continuous and discrete data	To include: □ Key features of each type of data □ Appropriate units and conventions for each type of data □ The importance of recording all relevant forms of data	**M0.1** **M0.2** **M1.1**	**HSW3**

• Data from observations and measurements (including repeats) □ Recording data in: • Diagrams, images, and video • Results tables • Spreadsheets • Dataloggers	 □ How to select a format for recording data that suits the data being collected □ Use of appropriate column headings and units □ Use of appropriate levels of precision		
Topic Area 5: Report writing			
Teaching content	**Exemplification**	**Opportunities to cover:**	
5.1 Analysis of data		**Maths**	**HSW**
5.1.1 □ Using mathematical skills from Mathematical Skills for Human Biology to analyse data in investigations • Processing data • Using graphical techniques to analyse data	To include: □ How to select which mathematical skills are appropriate to use □ The value of processing raw data for analysis □ How to use appropriate mathematical skills □ How to propagate uncertainties to determine total uncertainty □ How to determine if data is valid	**M1.2** **M3.1** **M3.2**	**HSW6**
5.1.2 □ Types of errors: • Measurement • Systematic □ Outliers and anomalous data	To include: □ Definitions of measurement and systematic error □ How to identify each type of error in an investigation □ How to explain reasons for errors □ The difference between an outlier and an anomalous result □ How to identify outliers and anomalous data in tables and graphs □ Causes and effects of outliers and anomalous data □ How to account for outliers and anomalous data	**M1.8**	**HSW2**
5.2 Drawing conclusions		**Maths**	**HSW**
Conclusions from data: □ Comparing results to established reference values (secondary data) □ Confidence in conclusions □ Answering the research question	To include: □ How to write a concise conclusion(s) from primary data and justify the conclusion □ How to select appropriate data from secondary sources to compare results to □ How to make valid comparisons between primary and secondary data □ What is meant by confidence in conclusions for an investigation		**HSW1** **HSW6**

	□ How to explain the impact of limitations on a conclusion □ How to address the extent to which the hypothesis can be accepted		
5.3 Evaluating results		**Maths**	**HSW**
□ Evaluating the investigation • Equipment • Methods • Outcomes • Sources of information and secondary data	To include: □ How to assess the effectiveness of the methods used to collect data □ How to explain the limitations and sources of error in collected data □ How to determine the reliability of secondary data used in the investigation □ How to suggest improvements for an investigation, considering both the techniques used and those that would be available to a biomedical scientist □ How to decide if the improvements are appropriate and what impact they will have	**M1.7**	**HSW6**

Assessment criteria

Section 6.4 provides full information on how to assess the NEA units and apply the assessment criteria.

These are the assessment criteria for the tasks for this unit. The assessment criteria indicate what is required in each task. Students' work must show that all aspects of a criterion have been met in sufficient detail for it to be **successfully achieved** (see **Section 6.4.1**). If a student's work does not fully meet a criterion, you must not award that criterion.

The command words used in the assessment criteria are defined in **Appendix B**.

Pass	**Merit**	**Distinction**
P1: Use research to **identify** a range of potential diseases that the patients might have.	**M1: Assess two** suspected diseases for **each** patient in terms of potential likelihood given the symptoms.	
P2: Create a method for the investigation including the appropriate tests and techniques to investigate the unidentified samples based on suspected diseases of the patients.	**M2: Explain** the rationale for the tests and techniques chosen based on the suspected diseases identified in **M1**.	**D1: Justify** the choice of appropriate equipment for the chosen tests and techniques.
P3: Complete an appropriate risk assessment for your investigation.		

Pass	Merit	Distinction
P4: Perform the planned investigation safely.	**M3: Explain** how control variables have been managed when undertaking the investigation.	**D2: Collect** sufficient, valid data for all samples with appropriate precision.
P5: Explain how the integrity of the samples is maintained.		
P6: Record the data obtained in appropriate ways using correct conventions and units.		
P7: Use standard mathematical techniques to **process** data.	**M4: Calculate** percentage uncertainties and percentage errors for the investigation.	**D3: Explain** the sources of error and possible reasons for any anomalous data.
P8: Use research to **compare** your data with established value ranges.	**M5: Justify** which patient each sample belongs to.	**D4: Justify** which disease each patient has.
P9: Analyse the results of the investigation in the context of the suspected diseases for the patients from **M1**.		
P10: Explain the limitations of the data collected.	**M6: Evaluate** the sources of information researched in **Task 1** and established value ranges in **Task 3**.	**D5: Justify** suggestions for any improvements that could be made.
P11: Suggest other tests or techniques that could be undertaken to support the diagnosis suggested for the patients.	**M7: Analyse** the strengths of the investigation.	
P12: Assess the effectiveness of the methods used to collect data.		

Assessment guidance

This assessment guidance gives you information relating to the assessment criteria. There might not be additional assessment guidance for each assessment criterion. It is included only where it is needed.

Assessment Criteria	Assessment guidance
P1	• Teachers must discuss with students the research they completed independently to inform their research question, giving students the opportunity to say: o What research they completed o How they completed it o Why they used the research methods they did. • Students must use research to identify a range of potential diseases that each patient might have, based on their symptoms. • Students must identify **at least four** potential diseases that the patients might have. • The research element of this criterion does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criterion.
P2	• Students must provide a step-by-step method for their investigation. It needs to include all the equipment they wish to use, including size, quantities and PPE, as appropriate. • Students should consider the tests and techniques available to them, practical equipment available to them, samples provided and information from **P1**.
P3	• Students must use the risk assessment template provided to complete a risk assessment for their investigation, considering risks and hazards for each test and technique.
M1	• **M1** is an extension of **P1**. • Students must give a reasoned judgement for why **two** diseases are suspected for **each** patient, in terms of the likelihood given the symptoms. • Students must include a hypothesis for the suspected diseases for **each** patient. • The reasoned judgement is informed by relevant facts based on the symptoms given and research completed.
M2	• **M2** is an extension of **P2** and **M1**.
D1	• **D1** is an extension of **M2**. • Students might justify the settings of their equipment as part of the choice for the tests and techniques.
P4	• Students must follow their method safely. • Students must be able to perform the task safely to achieve this criterion. Staff must intervene if safe working practices are not being followed but where this happens the criteria cannot be awarded. • Teachers must complete a 'Teacher Observation Record' for each student to evidence they have met this criterion. Students must also read and sign it. • The teacher observation record form should describe how the student performed the planned investigation safely.
P6	• A results table may be appropriate for most investigations, but qualitative descriptions are also suitable.
D2	• The teacher observation record form could comment on the skilful use of apparatus and the accuracy and precision of data collected.

P7	• Students must use mathematical skills identified in Appendix D of the specification to process their data appropriately. • Students must show **at least one** example of their working out in the written evidence.
P8	• Students must use research to determine the correct established value ranges to compare with their data. • The research element of this criterion does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criterion.
M4	• Students must determine the percentage uncertainty on each piece of equipment used and the combined uncertainty for each repeat. • They must show **at least one** example of their working out in the written evidence.
M5	• **M5** is an extension of **P9**.
D3	• This should be done qualitatively only. • Students who have no anomalous data to explain should clarify this in their written evidence.
D4	• **D4** is an extension of **M5**.
P12	• Students must offer a reasoned judgement of the effectiveness of the methods used to collect data. • Students will inform their judgement with relevant information about how well they were able to collect good quality data with the techniques and equipment chosen during the investigation.
M6	• Students must make reasoned judgements on their confidence in the sources used throughout the investigation, e.g. those used to design the method, create the risk assessment, establish value ranges and the secondary data, with reference to reliability and validity.
D5	• Give valid reasons for improvements to the investigation that would improve the conclusion(s) or help answer the research question. • Processed data should be used to support any recommendations. • If no improvements can be recommended, then this needs to be justified using evidence from the investigation.

Synoptic assessment

Some of the knowledge, understanding and skills needed to complete this unit will draw on the learning in Unit F170.

This table details these synoptic links.

Unit F173: Biomedical techniques		Unit F170: Fundamentals of human biology	
Topic Area		Topic Area	
2	Diagnostic techniques: cells and microscopy	1	Human cells and tissues
		4	Basics of microbiology

More information about synoptic assessment in these qualifications can be found in **Section 5.2 Synoptic assessment.**

4.3.3 Unit F174: Nutrition and metabolism

Unit Aim

Good nutrition is vital for the healthy functioning of the human body. The wrong balance of nutrients in the body's cells can lead to different disorders and long-term effects. When considering 'good nutrition', it's important to understand that different groups of people have different dietary requirements. This unit considers the dietary requirements for specific groups and includes the processes of digestion, absorption and assimilation, the long-term effects of poor diet; and the consequences of being unable to incorporate nutrients into body cells. The unit also explores different metabolic pathways involving nutrients vital to maintaining body functions. The unit is completed by considering the control mechanisms that regulate certain nutrients in the body and how disorders can be diagnosed, monitored, and treated.

In this unit, you will learn to identify biomolecules required for the maintenance of a healthy body and learn how food labels provide a guide for recommended daily intake. You will learn about the dietary needs of different individuals and the health issues associated with poor diet. You will also study the challenging topics of metabolic pathways and how hormones control not only the levels of certain nutrients in the body but also how they are involved with hunger. Finally, you will learn how to be able to research some of the techniques used to diagnose, monitor and treat some of the conditions associated with nutritional disorders.

Unit F174: Nutrition and metabolism			
Topic Area 1: Nutrients required for a healthy body			
Teaching content	**Exemplification**	**Opportunities to cover:**	
1.1 Macronutrients- major food groups		**Maths**	**HSW**
Carbohydrates, proteins and lipids □ Sources of different macromolecules □ Roles of macromolecules in the human body	To include: □ Recall that proteins are formed from amino acids □ Draw the general structure of an amino acid □ Recall that carbohydrates are formed from carbon, hydrogen and oxygen □ Know that starch is formed from long chains of glucose units □ Draw the general structure of glucose □ Know that a triglyceride is formed from fatty acids and a molecule of glycerol □ Which foods are rich in proteins, carbohydrates and lipids □ Why some molecules are considered essential and others non-essential □ Why macromolecules are required in different quantities □ Role of proteins, carbohydrates and lipids in maintaining healthy body	**M1.5** **M4.1**	**HSW12**

	□ How macromolecule amounts may be affected by food processing and storage, including: • Preparation (such as peeling) • Cooking • Freezing and defrosting • Canning Does not include: □ The detailed process of how food processing and storage affects macromolecule amounts		
1.2 Micronutrients		**Maths**	**HSW**
Mineral and vitamin requirements □ Main minerals and vitamins and their sources □ Roles in the human body	To include: □ Which foods provide different minerals and vitamins □ Know vitamins are organic molecules with complex chemical structures □ Know minerals are chemical elements that are required as essential nutrients by organisms □ Why we need to obtain vitamins and minerals from food □ Roles of vitamins and minerals in maintaining a healthy body □ How and why foods may need to be fortified with vitamins and minerals □ How vitamins and minerals amounts may be affected by food processing and storage, including: • Preparation (such as peeling) • Cooking • Freezing and defrosting • Canning Does not include: □ The detailed process of how food processing and storage affects vitamin and mineral amounts	**M0.3** **M3.1**	**HSW10**
1.3 From food to body cells		**Maths**	**HSW**
1.3.1 Importance of digestion □ Mechanical digestion □ Chemical digestion	To include: □ How and why we break down large food pieces to smaller pieces □ How and why we breakdown large food molecules into smaller molecules, including: • Hydrolysis reaction □ How problems with digestion of food can lead to malfunctions	**M0.1** **M2.1** **M4.1**	**HSW9**

	□ How surface area is calculated and impact of change in surface area Does not include □ Details of digestive system		
1.3.2 Importance of absorption and assimilation □ How the body gets nutrients from digestive system into the blood stream □ How the body incorporates nutrients into cells, tissues and organs	To include: □ Adaptations of small intestine □ Role of structures in the small intestine, including villi □ How nutrients become parts of cells such as amino acids being made into new proteins in the cell Does not include: □ Mechanism of absorption □ Details of digestive system other than intestinal wall □ Details of the reactions involved in metabolism in liver		**HSW1**
Topic Area 2: Diets and disorders			
Teaching content	**Exemplification**	**Opportunities to cover:**	
2.1 Dietary requirements		**Maths**	**HSW**
2.1.1 Dietary reference values (DRVs) □ Balanced diet □ Recommended daily intake □ Safe intakes of minerals and vitamins	To include: □ Why a balanced diet is needed for an adequate intake of nutrients for maintaining health □ How DRVs may change dependent on age, gender, activity, pregnancy and lactation □ Calculations to include percentage increases/decreases in nutrients and differences in DRVs	**M0.4** **M1.8** **M3.1**	**HSW11**
2.1.2 Food labels □ Guidance offered by food labels	To include: □ What guidance is offered by food labels with regards to nutritional values □ How the red, amber, green system is used Calculations to include converting actual mass of nutrients into percentages, for example in a 150 g can	**M0.3** **M0.4**	**HSW5**
2.2 Malnutrition		**Maths**	**HSW**
2.2.1 Diet-related nutrient deficiencies □ Problems caused by lack of macronutrients □ Problems caused by mineral and vitamin deficiencies	To include: □ How deficiencies and unbalanced diets may lead to malfunction and disease including symptoms associated with: • Starvation • Kwashiorkor • Rickets • Gum disease (and scurvy)		**HSW6**

	• Night blindness • Spina bifida • Anaemia		
2.2.2 Malabsorption and allergies □ Inability to incorporate nutrients into the body □ Food allergies	To include: □ How inability to digest or absorb nutrients may lead to disorders □ Causes and symptoms of disorders associated with malabsorption or food allergy including lactose intolerance, coeliac disease and anaphylactic shock	**M1.6**	**HSW11**
2.2.3 Nutrients in excess □ Metabolic disorders □ Excess intake	To include: □ Why excess nutrients may result in metabolic disorders □ Causes and symptoms of disorders Examples of **causes and symptoms of disorders** may include: □ Phenylketonuria □ Diabetes □ Obesity □ Non-alcoholic fatty liver disease □ Coronary heart disease □ Hypertension	**M0.1**	**HSW5**
Topic Area 3: Metabolic pathways and control mechanisms			
Teaching content	**Exemplification**	**Opportunities to cover:**	
3.1 Metabolic pathways		**Maths**	**HSW**
3.1.1 Macromolecules in metabolism □ Use of macromolecules in metabolism	To include: □ How different macromolecules release different amounts of energy Does not include: □ Detail of reactions or ATP breakdown	**M0.2** **M0.5**	
3.1.2 Metabolic rates □ Metabolic requirements for energy □ Comparison of metabolic rates	To include: □ Why individuals may have different metabolic rates □ How metabolic rates can be calculated Does not include: □ Detail of pathways or reactions	**M2.3** **M2.4**	
3.2 Role of the liver in metabolism		**Maths**	**HSW**
3.2.1 Metabolism of macromolecules in liver □ Carbohydrate metabolism □ Protein metabolism □ Fat metabolism	To include: □ Role of the liver in maintaining blood glucose levels □ Deamination and transamination of amino acids □ Fatty acid synthesis □ Cholesterol		**HSW10**

	Does not include: □ Detail of reactions		
3.2.2 Storage of nutrients □ Carbohydrate store □ Vitamin and mineral store	To include: □ Glycogen store □ Stores fat-soluble vitamins and minerals Examples of **fat-soluble vitamins and minerals** may include: □ Vitamin A □ Iron Does not include: □ Details of reactions or metabolic pathways		**HSW10**
3.2.3 Detoxification □ Ammonia □ Drugs □ Alcohol □ Bile production	To include: □ How the liver deals with toxins in the diet and waste products of metabolism Examples of **how the liver deals with toxins** include: □ Removal of toxins, for example, alcohol □ Removal of ammonia □ Conversion of medicinal drugs into non-toxic products □ Removal of worn out and damaged red blood cells Does not include: □ Details of reactions □ Details of excretion by kidney		**HSW11**
3.3 Control mechanisms for nutrient metabolism		**Maths**	**HSW**
3.3.1 Regulation of food intake □ Role of hormones in control of hunger	To include: □ How hormones leptin and the 'hunger' hormone ghrelin control appetite □ Why changes to normal levels of these hormones may affect health □ How hormone levels are determined including an evaluation as to accuracy of results Does not include: □ No details of homeostatic mechanism required	**M3.1** **M3.2** **M3.3**	**HSW8**
3.3.2 Regulation of blood glucose □ Role of hormones in control of blood glucose	To include: □ How a negative feedback mechanism results in normal blood glucose levels	**M1.5** **M1.6**	**HSW6**

	□ Why changes to normal levels of these hormones may affect health □ How hormone levels are determined including an evaluation as to accuracy of results		
3.3.3 Osmoregulation □ Regulation of salt intake □ Importance of the kidneys in maintaining water potential of the blood	To include: □ Why sodium chloride (salt) and water potential needs to be controlled □ How changes in salt intake can affect health □ Why salt intake and water potential differs depending on activity and lifestyle □ How to use calculations involving secondary data to compare salt levels of individuals to normal levels Does not include: □ Kidney structure □ Other kidney functions □ Mechanism of osmosis	**M3.4** **M3.6**	**HSW3**
Topic Area 4: Diagnosis, monitoring and treatment for nutritional/metabolic disorders			
Teaching content	**Exemplification**	**Opportunities to cover:**	
4.1 Diagnostic techniques		**Maths**	**HSW**
4.1.1 Clinical assessments □ Data collection	To include: □ Roles of health care staff in obtaining patient information □ How different professionals have different roles to play in gathering information and monitoring individuals For example the **roles to play in gathering information** with regards to: □ Lifestyle □ Family history □ Symptoms □ Dietary information □ Use of surveys	**M1.2** **M1.6**	**HSW8**
4.1.2 Use of scanning techniques □ Endoscopy □ Ultrasound □ Magnetic resonance imaging (MRI) □ X-ray □ Computerised tomography (CT)	To include: □ Advantages and disadvantages of scanning techniques in diagnosing and monitoring gastrointestinal disorders associated with nutritional problems		**HSW11**

4.2 Monitoring		**Maths**	**HSW**
4.2.1 Use of body mass index (BMI) and growth charts	To include: □ Why individuals need to be monitored □ How BMI is calculated □ Why average BMI charts are used for comparison □ How growth charts and percentiles for children are used for comparison □ Advantages and disadvantages of using BMI and growth charts	**M2.1** **M2.4**	**HSW3**
4.2.2 Biomarkers □ Blood sugar □ Cholesterol □ Triglycerides □ Vitamin Levels □ Electrolytes □ Hormones	To include: □ Overview of the techniques used to monitor these biomarkers, for example, • Blood tests • Urine tests • Saliva tests • Tissue biopsies □ Advantages and disadvantages of techniques to monitor biomarkers Does not include: □ Details of chemical reactions involved □ Details of exactly how monitoring tests are carried out		**HSW9**
4.2.3 Biosensors and monitors	To include: □ How these allow self-monitoring and targeted measurement of nutrients, for example, glucose □ Overview of how a biosensor is used to measure blood glucose □ Advantages and disadvantages of biosensors and monitors Does not include: □ Details of chemical reactions involved	**M1.5**	**HSW4**
4.3 Treatments and health care		**Maths**	**HSW**
4.3.1 Types of treatment and medical interventions for: □ Malnutrition □ Diabetes □ Obesity □ Non-alcoholic fatty liver disease	To include: □ How having a healthier, more balanced diet prevents malnutrition □ Why different types of diabetes have different methods for treatment and monitoring □ How lifestyle changes can be part of treatment and diet plans for obesity and non-alcoholic fatty liver disease	**M0.2** **M1.8**	**HSW8**

	□ How medication is used to reduce cholesterol and bariatric surgery are used for treating certain individuals		
4.3.2 Role of governments and health/social care providers □ Clinics □ Support groups □ Food agencies	To include: □ Why specialist clinics and nurses specific to each disorder are important □ How support groups such as weight loss groups can help individuals with treatment and diet plans □ The role of health care professionals in providing education, advice and offering routine check ups □ The importance of communication between professionals when developing food strategies and diet plans for individuals		**HSW11**
4.3.3 Complementary therapies □ Alternative practices to support health and healing	To include: □ Advantages and disadvantages of: • Therapies to promote well-being • Alternative methods Examples of **alternative methods** include: □ Hypnotherapy □ Meditation □ Counselling		**HSW10**

Assessment criteria

Section 6.4 provides full information on how to assess the NEA units and apply the assessment criteria.

These are the assessment criteria for the tasks for this unit. The assessment criteria indicate what is required in each task. Students' work must show that all aspects of a criterion have been met in sufficient detail for it to be **successfully achieved** (see **Section 6.4.1**). If a student's work does not fully meet a criterion, you must not award that criterion.

The command words used in the assessment criteria are defined in **Appendix B**.

Pass	Merit	Distinction
P1: Explain why the individual requires a specialised diet.	**M1:** Use research to **describe** the details of medical guidance given in a similar situation to that in the case study.	**D1: Analyse** the benefits of having a specialised diet for the individual's physical and mental well-being.
P2: Use research to **describe** how the macronutrient requirements for the individual varies from an average person.	**M2: Explain** how the role of metabolism influences the creation of the specialised diet.	
P3: Use research to **describe** how the micronutrient requirements for the individual varies from an average person.		
P4: Create an appropriate specialised diet.	**M3: Explain** the potential risks and side-effects of the specialised diet for the individual.	**D2: Discuss** the advantages and disadvantages of the specialised diet for the individual.
P5: Create appropriate and customisable meal plan(s).	**M4:** Use appropriate calculations to **process** data when creating your meal plan(s).	**D3: Justify** your choice of meal plan(s) for inclusion in the specialised diet.
P6: Explain how the meals in the meal plan(s) need to be prepared and stored.		
P7: Analyse how the physiological health of the individual could be affected by the specialised diet.	**M5**: **Discuss** the use of external providers to support the individual with the specialised diet.	**D4: Assess** how the individual can mitigate the impacts on their health.
P8: Analyse the impact of the specialised diet on the social, emotional and mental well-being needs of the individual.		
P9: Identify appropriate techniques for monitoring the individual on the specialised diet.	**M6: Justify** the monitoring techniques chosen for the individual.	
P10: **Describe** appropriate interventions that may be required based on the monitoring results.		
P11: Summarise additional information that could increase confidence in the suitability of the specialised diet for the individual.	**M7: Analyse** how the additional information from **P11** would have been useful when creating the specialised diet.	**D5**: **Evaluate** the limitations of your meal plan(s) for the individual following the specialised diet.
P12: Suggest why the meal plan(s) may need to be adapted for another individual following the same specialised diet.		

Assessment guidance

This assessment guidance gives you information relating to the assessment criteria. There might not be additional assessment guidance for each assessment criterion. It is included only where it is needed.

Assessment Criteria	Assessment guidance
Task 1	• The research element of the criteria in this Task does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criteria.
P1	• Students need to review information about nutritional requirements that are specific to the needs of the individual in the case study. • They must recognise the needs of the individual in the case study and explain why a specialised diet is required.
P2	• Students must use research to describe the macronutrient requirements of the individual in the case study. • Students must describe how the macronutrient requirements for the individual varies from the average person in terms of the average nutritional requirements and recommended values for daily intake.
P3	• Students must use research to describe the micronutrient requirements of the individual in the case study. • Students must describe how the micronutrient requirements for the individual varies from the average person in terms of the average nutritional requirements and recommended values for daily intake.
M1	• Students must research and describe medical guidance that would be given to an individual in a similar situation (e.g. an endurance event). This should include details of monitoring and treatment of any disorders. • The guidance should be from appropriate medical professionals relevant to the case study context.
P5	• Students must create an appropriate meal plan(s) relevant to the context of the case study. Meal plan(s) should be created to last the timeframe specified in the case study. • The meal plan(s) should be customisable to show relevant substitutions that could be made for at least one meal each day for the duration of the timeframe specified in the case study.
M4	• Students must show evidence of processing data using appropriate calculations for creating the meal plan(s) in **P5**. • The calculation(s) used will depend on the context of the case study but should be relevant and provide information to support the student in creating the meal plan(s). • Students must show **at least one** example of their working out in the written evidence.
D3	• Students must give valid reasons for their choice of meals in the meal plan(s) for the specialised diet, the customisable elements of the meal plan(s), and the preparation and storage requirements.
P9	• The monitoring techniques might focus on how any of the physiological, social, emotional, and/or mental well-being of the individual can be monitored.
M6	• **M6** is an extension of **P9**.
P11	• Students must consider what additional information would have been useful in order to increase the confidence in the suitability of the specialised diet. Students will summarise what additional information they would have wanted.
M7	• **M7** is an extension of **P11**.

Synoptic assessment

Some of the knowledge, understanding and skills needed to complete this unit will draw on the learning in Units F170 and F171.

This table details these synoptic links.

Unit F174: Nutrition and metabolism		Unit F170: Fundamentals of human biology	
Topic Area		Topic Area	
1	Nutrients required for a healthy body	2	Human physiology, organs and systems
3	Metabolic pathways and control mechanisms	3	Key concepts in endocrinology, neurobiology and reproduction
4	Diagnosis, monitoring and treatment for nutritional/metabolic disorders	2	Human physiology, organs and systems

Unit F174: Nutrition and metabolism		Unit F171: Health and disease	
Topic Area		Topic Area	
2	Diets and disorders	1	Causes and effects of diseases and disorders
		2	Curative, management and preventative therapies
4	Diagnosis, monitoring and treatment for nutritional/metabolic disorders	4	Techniques for diagnosis and monitoring

More information about synoptic assessment in these qualifications can be found in **Section 5.2 Synoptic assessment.**

4.3.4 Unit F175: Human reproduction

Unit Aim

Reproduction creates new life. This unit explores the role of the human reproductive system in creating new life and the way in which science can be used to help control this process. Science plays a part in monitoring pregnancy and helping those finding it difficult to conceive.

In this unit you will study how life is created through reproduction. You will explore the development of the zygote, embryo and foetus and the process of pregnancy and antenatal care. You will learn about contraception and how some individuals find it difficult to conceive. You will explore how modern medicine can assist these individuals to have children by identifying the causes of infertility and enabling individuals to receive treatment for their infertility.

Unit F175: Human reproduction			
Topic Area 1: Conception and pregnancy			
Teaching content	**Exemplification**	**Opportunities to cover:**	
1.1 Menstrual cycle		**Maths**	**HSW**
□ Menstrual phase □ Follicular phase □ Ovulation phase □ Luteal phase	To include: □ How hormones regulate the menstrual cycle □ How to determine the 'fertility window' □ How to use results from blood tests to determine whether ovulation is occurring □ How irregular or abnormal ovulation can impact fertility □ How anovulation can be treated with fertility drugs	**M3.4** **M3.5**	**HSW11**
1.2 Fertilisation and implantation		**Maths**	**HSW**
□ Fertilisation □ Zygote formation	To include: □ How the acrosome reaction forms a zygote □ How the cortical reaction prevents the zygote from having an abnormal number of chromosomes □ Comparison between *in vitro* fertilisation (IVF), artificial insemination (IUI) and intracytoplasmic sperm injection (ICSI) □ Use of images to explain medically assisted fertilisation		**HSW9**
1.3 Development from zygote to foetus		**Maths**	**HSW**
□ Development of the zygote into an embryo □ Development of the foetus	To include: □ Key stages of development □ Comparison between IVF, IUI and ICSI treatments		**HSW11**

1.4 Contraception		Maths	HSW
□ Main methods of contraception • Barrier methods ○ Internal and external condoms ○ Cap ○ Diaphragm • Chemical methods ○ Combined pill ○ Progesterone only pill ○ Contraceptive injection and patch ○ Intrauterine system (IUS) ○ Intrauterine device (IUD) • Emergency contraception • Natural methods • Surgical procedures – sterilisation • Use of spermicides	To include: □ Key features of each method □ Impact of contraception methods on fertility and ability to conceive □ Impact of hormonal treatments and other medications on efficacy of contraception methods □ Tubal sterilisation and vasectomy		**HSW5**
Topic Area 2: Pregnancy (antenatal) care			
Teaching content	**Exemplification**	**Opportunities to cover:**	
2.1 First antenatal appointment		**Maths**	**HSW**
□ Information that may be collected during the appointment: • About the foetus' biological parents • Domestic abuse • Female genital mutilation (FGM) • Health issues • Lifestyle • Other pregnancies or children • Physical and mental health • Smoking, alcohol and drug use • Support network □ Tests carried out during the appointment: • Blood pressure • Blood tests for general health, blood group, HIV, syphilis and hepatitis B • Body mass index (BMI) • Urine test for signs of pre-eclampsia	To include: □ How to use the information collected to identify the physical, psychological and personal needs of the patient □ How to use the information collected to assess the health and well-being of the patient and foetus □ How the information collected may have an impact on the physical and psychological health of the patient and foetus □ How to use the results from the tests to assess the physical health and well-being of the patient and foetus □ How to use the information collected to assess and support the personal needs of the patient □ How to use the information collected to provide healthcare advice on promoting and supporting the health and wellbeing needs of the patient and foetus	**M1.1** **M1.5**	**HSW3**

□ Advice and information that may be given about antenatal clinical investigations (tests and scans) and antenatal activities: • Antenatal care • Antenatal classes • A healthy pregnancy diet • Pregnancy exercise • Tests and scans offered during pregnancy □ Role of health professionals involved in antenatal care	□ How to use the information collected to suggest appropriate antenatal clinical investigations and activities to promote and support the health and well-being needs of the patient and foetus □ Key features and advantages of: • Antenatal care • Antenatal classes • A healthy pregnancy diet • Pregnancy exercise • Tests and scans offered during pregnancy □ How the tests and scans offered during pregnancy can be used to monitor the physical health of the patient and foetus □ How information is shared between healthcare professionals □ How to use the information collected to write an antenatal care plan		
2.2 Antenatal care plan		**Maths**	**HSW**
□ Key components • Medical history • Care professionals involved • Care professional roles • Information about further antenatal clinical investigations that may be needed • Information about antenatal activities that may be needed or advised • Any further advice given to the patient to promote the health and wellbeing of the patient and foetus	To include: □ How to write an antenatal care plan □ Importance of including the key components of the care plan □ Advantages and disadvantages of following an antenatal care plan □ Advantages and disadvantages of undertaking the antenatal clinical investigations and activities suggested in the antenatal care plan □ The possible physical, psychological and personal effects of undertaking the antenatal clinical investigations and activities suggested in the antenatal care plan on the patient and foetus □ Communication skills for different audiences		**HSW11**
2.3 Monitoring foetal development		**Maths**	**HSW**
□ Use of techniques to monitor pregnancy and development: • Amniocentesis • Blood tests • Chorionic villus sampling • 3D and colour scan • Nuchal translucency (NT) scan • Ultrasound	To include: □ How techniques can determine: • Age of foetus • Chromosomal abnormalities • Developmental problems • Due date • Pregnancy complications • Size of foetus	**M1.2** **M1.3**	**HSW9**

	□ How to use medical data to assess and explain risks associated with tests and procedures □ The possible physical and psychological effects of the tests and procedures on the mother and foetus □ Advantages and disadvantages of the tests and procedures		
□ Role of health professionals during pregnancy	□ How pregnancy is monitored by health professionals		
2.4 Complications during pregnancy		**Maths**	**HSW**
□ Ectopic pregnancies □ Gestational diabetes □ Multiple pregnancies □ Preeclampsia □ Premature birth	To include: □ Key features of complications □ How to use medical information to assess and diagnose pregnancy complications □ How to use medical information to suggest possible clinical interventions and/or further tests □ The physical and psychological effects of pregnancy complications on the patient and foetus □ How IVF and ICSI may increase pregnancy complications	**M1.3**	**HSW9**
2.5 Legislation and regulatory boards		**Maths**	**HSW**
□ National Institute for Health and Care Excellence (NICE) □ Integrated care board (ICB)	To include: □ How legislation and regulatory boards impact antenatal care and maternity services □ How regulatory boards ensure safe and effective antenatal care		**HSW7**
Topic Area 3: Infertility			
Teaching content	**Exemplification**	**Opportunities to cover:**	
3.1 Diagnosing infertility		**Maths**	**HSW**
□ Information collected during an initial GP assessment: • Age • How long they have been trying to conceive • Lifestyle • Medicines being taken • Previous miscarriages or previous children • Sexual history • Use of contraception	To include: □ Initial physical pelvic examination results and impact on fertility □ How to use initial consultation information to determine possible causes of infertility, including variations in sex traits □ How to use the consultation and medical information collected to identify the physical, psychological and personal needs of the patient(s)	**M3.1**	**HSW11**

□ Risk factors that affect fertility: • Age • Alcohol • Body mass index (BMI) • Drug use • Environmental and occupational exposures • Medications • Sexually Transmitted Infections (STI) • Smoking • Stress □ Referral process to a fertility clinic □ Role of different health professionals in diagnosing infertility	□ How to use the information collected to assess the health and well-being of the patient(s) □ How to use consultation information to write a reproductive health plan □ Impact of a fertility diagnosis on the health and well-being of the patient(s) □ How information is shared between different health professionals □ Communication skills for different audiences		
3.2 Causes of infertility		**Maths**	**HSW**
□ The common causes of infertility : • Autoimmune conditions • Blocked or damaged fallopian tubes • Endometriosis and fibroids • Failure to ovulate as a result of polycystic ovary syndrome (PCOS), thyroid problems and premature ovulation failure • Pelvic inflammatory disease (PID) • Medicines being taken • Previous miscarriages or previous children • Abnormal sperm • Damaged testicles • Hypogonadism • Low sperm count • Sperm immobility	To include: □ How to use blood test results to determine hormone levels and to see if they are within the 'normal' range □ How to use ultrasound images to view the uterus and ovaries to look for: • Scarring • Endometriosis • Ovarian tumours or cysts • Fibroids □ How to use laparoscopy images to examine the uterus, oviducts and ovaries to determine if there are any blockages in the oviducts □ How to use semen analysis to determine sperm count, motility and malformation and see if they are within the 'normal' parameters □ How to use hormone data to determine possible cause of male infertility □ How certain types of medicines can cause infertility	**M0.2** **M1.6** **M3.1**	**HSW6** **HSW9**
3.3 Treatment options		**Maths**	**HSW**
□ Preconception care and advice • Assess any complications from previous pregnancies • BMI • Diet • Exposure to environmental toxins • Folic Acid • Medical conditions • Rubella	To include: □ How preconception care and use of complementary therapies can improve fertility □ Key features of fertility investigations and tests □ How to use consultation and medical information to suggest appropriate healthcare advice and treatment options	**M1.6**	**HSW5**

□ Complementary and alternative therapies • Acupuncture • Nutritional therapy □ Fertility investigation and tests • Hysterosalpingography • Laparoscopy • Hormone profiles • Semen analysis □ Assisted reproduction □ Role of healthcare professionals involved in fertility treatment	□ Advantages and disadvantages of the treatment options □ Comparison of the success rates of the treatment options to improve fertility		
3.4 Reproductive health plan		**Maths**	**HSW**
□ Key components • Medical history • Care professionals involved • Care professional roles • Information and advice given about further fertility clinical investigations and tests • Information and advice given about fertility treatments • Additional advice given to the patient	To include: □ How to write a reproductive health plan □ Importance of including the key components of the health plan □ Advantages and disadvantages of following a reproductive health plan □ Advantages and disadvantages of undertaking the fertility clinical investigations, treatments and advice suggested in the reproductive health plan □ The possible physical, psychological and personal effects of undertaking the fertility clinical investigations, treatments and advice suggested in the reproductive health plan on the patient(s) □ Communication skills for different audiences		**HSW11**
Topic Area 4: Assisted reproduction (AR)			
Teaching content	**Exemplification**	**Opportunities to cover:**	
4.1 Assisted reproduction options		**Maths**	**HSW**
□ Range of options available: • Medical treatment such as clomiphene, tamoxifen, metformin and gonadotrophins for infrequent or lack of ovulation • Surgical procedures to treat endometritis, fibroids and blocked oviducts • IUI • IVF to include the protocols frequently used and the hormones administered • ICSI • Egg and sperm donation	To include: □ Key features of each option □ Advantages and disadvantages of the options available □ How the treatment may overcome infertility □ How the options available depend on the cause of infertility □ How to use consultation and medical information to suggest a suitable AR option □ How medical information is shared and communicated between different audiences	**M1.3** **M3.1**	**HSW9**

□ Role of different health professionals working in the assisted reproduction field			
4.2 Undergoing AR tests and treatment		**Maths**	**HSW**
□ Determining eligibility for fertility tests and treatments □ Success rates of AR techniques	To include: □ How to use patient information and current regulations to determine eligibility for fertility tests and treatment □ Comparison of success rates	**M1.6**	
4.3 Legislation and regulatory boards		**Maths**	**HSW**
□ Regulatory boards: • Human Fertilisation and Embryology Authority (HFEA) • Integrated care board (ICB) • National Institute for Health and Care Excellence (NICE)	To include: □ How legislation impacts on assisted reproduction techniques □ How AR is regulated in the UK □ Role of regulatory boards for patients and clinics □ How to use data provided by HFEA □ Ethical considerations of AR techniques	**M1.6**	**HSW6**

Assessment criteria

Section 6.4 provides full information on how to assess the NEA units and apply the assessment criteria.

These are the assessment criteria for the tasks for this unit. The assessment criteria indicate what is required in each task. Students' work must show that all aspects of a criterion have been met in sufficient detail for it to be **successfully achieved** (see **Section 6.4.1**). If a student's work does not fully meet a criterion, you must not award that criterion.

The command words used in the assessment criteria are defined in **Appendix B**.

Pass	**Merit**	**Distinction**
P1: Create a reproductive health plan containing all key components to meet the needs of the patient(s) in Case Study A.	**M1:** Use research to **explain** the appropriateness of the reproductive health plan for the patient(s) in Case Study A.	**D1: Analyse** the specific roles of the healthcare professionals, legislation, and regulatory boards in relation to their involvement in the reproductive health plan created in **P1**.
P2: Explain possible causes of infertility for the patient(s) in Case Study A.		
P3: Explain the advantages and disadvantages of different treatment options in relation to the context of the patient(s) in Case Study A.	**M2: Evaluate** the eligibility of the patients to receive assisted reproductive technique(s).	
P4: Explain the rationale of the treatment options and further tests chosen for the patient(s) in the reproductive health plan, including the likelihood of success.		

Pass	Merit	Distinction
P5: Create an antenatal care plan containing all key components to meet the needs of the patient in Case Study B.	**M3:** Use research to **explain** the appropriateness of the antenatal care plan for the patient in Case Study B.	**D2: Analyse** the specific roles of the healthcare professionals, legislation, and regulatory boards in relation to their involvement in the antenatal care plan created in **P5**.
P6: Explain possible effects on the mother and the foetus of undertaking the antenatal care plan in Case Study B.		
P7: Explain the advantages and disadvantages of the antenatal care plan for the patient.	**M4: Evaluate** the suitability of the patient to receive the antenatal care plan.	
P8: Explain the rationale of the interventions and further tests identified chosen for the patient in the antenatal care plan.		
P9: Create an appropriate presentation for the **chosen** Case Study, including the fundamentals of the plan.	**M5: Deliver** the presentation effectively, with clear explanations of rationale beyond what is included in the presentation documentation.	**D3: Justify** the content of the **chosen** presentation by detailing the scientific reasoning behind its inclusion.
P10: Explain how the presentation has been focused with the patient(s) as the intended audience.	**M6: Explain** appropriate adaptations to the presentation so that it can be used to communicate to other members of the healthcare team.	
P11: Summarise the feedback received for your **chosen** plan.	**M7: Analyse** the strengths and weaknesses of your **chosen** plan.	**D4: Justify** the content of the **chosen** plan by detailing the scientific reasoning behind its inclusion.
P12: Suggest how the presentation created in **Task 3** could be improved.		**D5: Assess** the impact on the mental well-being of the patient(s) involved in your **chosen** plan.

Assessment guidance

This assessment guidance gives you information relating to the assessment criteria. There might not be additional assessment guidance for each assessment criterion. It is included only where it is needed.

Assessment Criteria	Assessment guidance
P1	• Students must create a logical reproductive health plan which is presented in a clear order and within an appropriate timescale. • Students must include all key components as listed in subtopic area 3.5 Reproductive health plan.
P2	• Students must use the information and background provided in Case Study A to explain possible causes of infertility for the patient(s).

P3	• Students must explain the advantages and disadvantages of different options that **could** be used for the patient.
P4	• Students must explain the rationale of the treatment options and further tests that they have **chosen** for the patient(s) in the reproductive health plan. • Students must include an explanation of the likelihood of the success of each treatment option and test included.
M1	• **M1** is an extension of **P1**. • Students must use research to provide rationale for the appropriateness of the reproductive health plan they have produced for the patient(s) in Case Study A. • Students must apply their research to the information and background provided in Case Study A and the different treatment options available. • The research element of this criterion does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criterion.
D1	• Students must analyse the role of the most appropriate healthcare professionals needed to treat and support the patient(s) (for example, doctor, fertility nurse, embryologist, etc) as appropriate to the reproductive health plan. • Students must analyse the legislation and regulatory boards that uphold the safety and quality of the treatment options identified in the reproductive health plan. • The specific healthcare professionals, legislation and regulatory boards will depend on the case study context. All relevant information must be included.
P5	• Students must create a logical antenatal care plan which is presented in a clear order and within an appropriate timescale. • Students must include all key components as listed in subtopic area 2.2 Antenatal care plan.
P6	• Possible effects might include physical, psychological and personal effects, and might have a positive or negative impact.
M3	• **M3** is an extension of **P5**. • Students must use research to provide rationale for the appropriateness of the antenatal care plan they have produced for the patient in Case Study B. • Students must apply their research to the information and background provided in Case Study B and the different treatment options available. • The research element of this criterion does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criterion.
D2	• Students must analyse the role of the most appropriate healthcare professionals needed to treat and support the patient(s) (for example, doctor, midwife, etc) as appropriate to the antenatal care plan. • Students must analyse the legislation and regulatory boards that uphold the safety and quality of the interventions and/or further tests identified in the antenatal care plan. • The specific healthcare professionals, legislation and regulatory boards discussed will depend on the case study context. All relevant information must be included.

Task 3	• Students can either deliver the presentation to the teacher, peers or a combination of both. If the presentation is delivered to peers only, this must be recorded, so that the teacher can use the recording to complete the Teacher Observation Record for **M5** (you do **not** need to submit this for moderation).
P9	• Students must create a presentation for the patient(s) identified in the chosen case study. The presentation should be in the format they feel is most appropriate, which could include a poster, a PowerPoint presentation, a flow diagram, etc. • There must be sufficient detail in the presentation to demonstrate the key components of the plan appropriate for the patient(s).
P10	• Students must explain how the presentation created for **P9** was focused for the patient(s) as the intended audience. • Students must explain how the presentation was written so that it was relevant and accessible for the patient(s). • Students might choose to consider ways that scientific terminology might be re-phrased, amended or why they would need to use a particular scientific term.
M5	• **M5** is an extension of **P9**. • Teachers must complete a 'Teacher Observation Record' for each student to evidence they have met the criteria. Students must also read and sign it. • The Teacher Observation Record form should describe in detail how the student delivered the presentation effectively, with clear explanations of rationale beyond what is included in the presentation documentation.
M6	• Having created the presentation for the patient(s) in **P9**, students must now consider how it could be adapted for other members of the healthcare team. • Students might choose to create a further presentation to highlight the adaptations needed or they might choose to explain the adaptations in a different format, e.g. a table. • Students must explain the adaptations suggested so that the members of the healthcare team would be able to understand their contribution to the plan. • Students could consider how the scientific terminology used in the presentation might be modified to be communicated to a specialist audience.
D3	• Students must justify the content of the chosen presentation by detailing the scientific reasoning. • Students will use their understanding of the unit content to provide valid reasons for the content's inclusion.
P11	• Students must clearly express the most important points stemming from the feedback received for their treatment plan in a short and clear form. • The feedback for the treatment plan can be provided by the teacher and/or other students.
D4	• Students must justify the content of the chosen plan for the patient(s) by detailing the scientific reasoning. • Students will use their understanding of the unit content to provide valid reasons for the content's inclusion.

Synoptic assessment

Some of the knowledge, understanding and skills needed to complete this unit will draw on the learning in Units F170 and F171.

This table details these synoptic links.

Unit F175: Human reproduction		Unit F170: Fundamentals of human biology	
Topic Area		Topic Area	
3	Infertility	3	Key concepts in endocrinology, neurobiology, and reproduction

Unit F175: Human reproduction		Unit F171: Health and disease	
Topic Area		Topic Area	
2	Pregnancy (antenatal) care	4	Techniques for diagnosis and monitoring
3	Infertility	1	Causes and effects of diseases and disorders

More information about synoptic assessment in these qualifications can be found in **Section 5.2 Synoptic assessment.**

4.3.5 Unit F176: The brain

Unit Aim

The brain is a fascinating organ. The study of the brain involves a number of clinical and laboratory investigations and the analysis of data collected by neuroscientists. We still do not have a complete understanding about the functions of the brain but many advances have been made in the diagnosis and treatment of various disorders.

In this unit you will gain a greater insight into the structure and function of the nervous system, including the spinal cord, brain and nerves. This will involve the study of photomicrographs using online research to produce annotated, biological drawings. You will also explore the complex world of neuron communication and the control of the body. The challenging topics of nociception (sensing nociceptor pain), neurotransmitters and drug control will form the basis of case study analyses. This unit will also enable you to obtain an insight into the interpretation of nerve impulses as shown by electroencephalogram (EEG) recordings. Finally, the diagnosis and treatment of brain disorders and traumatic brain injury (TBI) will be outlined for you to gain an enhanced understanding of the scientific method. You will also learn how to evaluate the communication of science to different audiences.

Unit F176: The brain			
Topic Area 1: Structure and function of the nervous system			
Teaching content	**Exemplification**	**Opportunities to cover:**	
1.1 The brain		**Maths**	**HSW**
Brain anatomy/structure and function □ Skull and meninges □ Cerebrum □ Cerebellum □ Hypothalamic-pituitary-adrenal axis (HPA) □ Brain stem • Pons • Medulla (oblongata) • Midbrain	To include: □ How the location of different parts of the brain as revealed by photographic images (generated by different scanning techniques) and shown in biological drawings for vertical and transverse sections □ The key function(s) of the structures listed □ How to draw, annotated low power plans of the brain from computed tomography (CT)/Magnetic resonance imaging (MRI) images □ How different types of drawings are used to share information about brain anatomy and function to different audiences □ How the brain carries out both central nervous system (CNS) and autonomic nervous system (ANS) functions □ Why the skull and meninges present challenges during brain surgery Does not include: □ Histology of brain tissues		**HSW1** **HSW2**

1.2 The spinal cord		**Maths**	**HSW**
Spinal cord anatomy (transverse section - TS) and function □ Vertebrae □ Meninges □ Grey matter □ White matter □ Central canal □ Dorsal and ventral roots	To include: □ The key function(s) of the structures listed □ How to draw, annotated low power plans of the spinal cord from CT/MRI images □ How different types of drawings are used to share information about spinal cord anatomy and function to different audiences □ How a lumbar puncture can be performed to add drugs/anaesthetics to the CNS and to take samples of cerebrospinal fluid □ Why cervical breaks of the vertebral column/spine are more damaging than lumbar breaks □ Limitations of surgical interventions to regenerate damaged regions of spinal cord Does not include: □ Histology of spinal cord tissues	**M0.1** **M1.1**	**HSW1** **HSW9**
1.3 Nerves		**Maths**	**HSW**
Nerve anatomy (TS) and function □ Cranial and spinal nerves □ Endoneurium, perineurium and epineurium □ Fascicles □ Myelin sheath	To include: □ The key function(s) of the structures listed □ How to draw, annotated low power plans of a nerve from light microscopy (LM) or CT/MRI images □ How different types of drawings may be needed to share information about nerve anatomy and function to different audiences □ Benefits and limitations of using scan images to identify damaged nerves □ How repetitive sports injuries can cause damage to nerves □ How traumatic injury of nerves can lead to loss of motor and sensory functions Does not include: □ Histology of nerve tissues	**M0.1** **M1.1**	**HSW1** **HSW9**

Topic Area 2: Neuron communication and control			
Teaching content	**Exemplification**	**Opportunities to cover:**	
2.1 Neuron communication		**Maths**	**HSW**
2.1.1 Action potentials □ Resting and action potentials □ Depolarisation, polarisation and repolarisation □ Absolute and relative refractory periods	To include: □ How sodium and potassium ions are exchanged across the axon membrane to generate an action potential □ How to interpret the different phases of nerve impulse transmission □ Why myelinated neurons are capable of increasing the speed of neuronal transmission Does not include: □ Cytology of neurons	**M3.3** **M3.4**	
2.1.2 Structure and function of the synapse □ Different types of synaptic connections □ Detailed components of the synapse □ Stages of neuron impulse transmission across the synapse □ Route of neurotransmitter synthesis, release, recognition, reabsorption and re-synthesis	To include: □ How synapses provide a junction between one neuron and the next but also link the nervous system to the effectors, including muscle cells/fibres □ How the nerve impulse is transmitted across the synapse □ What is the relevance of mitochondria in the pre-synaptic knob □ Why pyramidal neurons in the brain have many dendrites □ The advantages and disadvantages of drugs acting as agonists, antagonists, activators and inhibitors Does not include: □ Postsynaptic ionic exchange along the axon of the second neuron		**HSW1**
2.2 Nervous control		**Maths**	**HSW**
2.2.1 Control of movement and balance □ Shared functions of motor cortex and cerebellum in brain □ Significance of proprioceptors	To include: □ How the motor cortex in the cerebrum is involved in conscious control of movement but the cerebellum provides fine control of muscle contraction and balance/posture □ How proprioceptors act as pressure receptors to detect the changes in muscle contraction/relaxation and convey impulses to the motor cortex and cerebellum		**HSW1** **HSW3** **HSW11**

□ Link between visual stimuli and voluntary muscle contraction	□ What are the reasons for poor balance, including brain injuries caused by repetitive sports trauma □ How simple experiments can demonstrate the link between visual stimuli and voluntary muscle contraction □ How different forms of communication may be needed to share information about brain injuries/disorders and their impact on movement and balance to different audiences Does not include: □ Calcium influx and sliding-filament theory		
2.2.2 Control of heartbeat □ Role of midbrain □ Nervous connections with the heart □ Receptors in carotid and aortic nodes	To include: □ How the midbrain, in particular the medulla (oblongata), acts as both the cardiovascular and respiratory centre □ Benefits and limitations of autonomic nervous system (ANS) control of heartbeat □ Why the control of heartbeat and pulmonary ventilation rate is linked □ How the sinoatrial node (SAN) in the wall of the heart is connected to the brain via sympathetic and parasympathetic/vagus nerves to accelerate and decelerate heartbeat rate, respectively □ How the atrioventricular node (AVN) transmits impulses across the wall of the heart via the AVN, bundle of His and Purkyne tissue □ Why impulse transmission from the medulla (oblongata) is affected by sensory impulses received from receptors in the carotid and aortic nodes □ How electrical activity in the heart can be monitored via electrocardiogram (ECG) readings, to show tachycardia, atrial fibrillation and bradycardia □ What is the impact of heart surgery on the bundle of His and Purkyne tissues	**M3.3** **M3.4**	**HSW11**

	□ How different forms of communication may be needed to share information about brain injuries/disorders and their impact on the control of heartbeat to different audiences Does not include: □ Heart and blood vessel defects		
Topic Area 3: Nociception, neurotransmitters and drugs			
Teaching content	**Exemplification**	**Opportunities to cover:**	
3.1 Nociception		**Maths**	**HSW**
3.1.1 Nervous receptors □ Different types of receptors	To include: □ The types of receptors include: • Proprioceptors • Photoreceptors • Chemoreceptors • Touch receptors • Nociceptors/pain receptors □ How that receptors are connected to sensory neurons within the spinal reflex arc □ Why there are different types of receptors at different locations in the body	**M2.1**	**HSW3**
□ Generator and action potentials at the receptor	□ How the all-or-nothing law is linked to stimulus threshold when a receptor is stimulated Does not include: □ Ionic exchange at the receptor		
3.1.2 Sensing pain (nociception) □ Definition of a nociceptor	To include: □ What is the structure and function of a nociceptor	**M2.1**	**HSW5**
□ Sensing nociceptor pain	□ How the sense of pain is closely linked to the activity of nociceptors at the cellular level, including the link between nociceptors, sensory and motor neurons		
□ Locations of nociceptors	□ How nociceptors can detect different levels of pain due to their location in the dermis of the skin, mucosa and cornea of the eye, but also deeper in the body, including at the skeletal muscles/joints, bladder, visceral organs and digestive tract		

□ Pain gate control theory	□ How pain is detected when a stimulus reaches a threshold to break through the 'gates' controlling entry to the brain □ The advantages and disadvantages of using nerve blocks, massage, exercise, transcutaneous electrical nerve stimulation (TENS) and cognitive behavioural therapy (CBT) to control pain □ How different forms of communication may be needed to share information about nociceptor pain to different audiences Does not include: □ Detailed analysis of nociceptor models		
3.2 Neurotransmitters		**Maths**	**HSW**
3.2.1 Different types of neurotransmitter □ Function of different types of neurotransmitter including: • Excitatory • Inhibitory • Modulatory	To include: □ How the antagonistic action of excitatory and inhibitory neurotransmitters functions Does not include: □ The chemistry of neurotransmitters		**HSW11**
3.2.2 Problems with neurotransmitters □ Insufficient or excess quantities released by neurons □ Reabsorbed too quickly □ Readily deactivated by enzymes	To include: □ How reduction in the function of neurotransmitters has a direct effect on neuron activity □ How the loss of neurons in the brain in Parkinson's disease leads to a significant reduction in neurotransmitter activity □ How epilepsy causes seizures resulting from an interruption in neuron activity in the brain □ How different forms of communication may be needed to share information about brain disorders, including Parkinson's disease and epilepsy, to different audiences Does not include: □ Histology of tissues affected by neurotransmitter malfunction		**HSW12**

3.3 Drugs		Maths	HSW
Drugs used to modify function of the brain and nervous system □ Medicinal/therapeutic drugs	To include: □ How drugs can be used for many purposes including medicine/therapies, for recreation and fitness training □ What are the key features of a prescription drug schedule when used for treatment and as a therapy □ Why dopamine injections are used under clinical conditions □ The advantages and disadvantages of using serotonin as an anti-depressant	**M1.6** **M3.1**	**HSW11**
□ Recreational drugs	□ Benefits and harms of recreational drug use		
□ Fitness-enhancing drugs	□ How fitness-enhancing drugs are detected before and after sporting events □ How different forms of communication may be needed to share information about the use of drugs to different audiences Does not include: □ The chemistry of drugs		
Topic Area 4: The diagnosis and treatment of brain disorders/injuries			
Teaching content	**Exemplification**	**Opportunities to cover:**	
4.1 Diagnosis of brain disorders/injuries		**Maths**	**HSW**
Clinical assessment □ Causes of brain disorder and injury	To include: □ The difference between the cause of brain disorders (inherited or age-related development) and traumatic brain injuries (TBI) (physical damage to the head/skull) □ How brain disorders and injuries have a differential impact on the health and wellbeing of patients	**M0.3**	**HSW11** **HSW12**
□ Clinical assessments carried out by a general practitioner (GP) or physician	□ How brain disorders and injuries can be identified by the analysis of scans (CT, MRI and ultrasound) and external symptoms (site of bleeding) □ How disorders can be monitored over time, including Parkinson's disease and epilepsy		

	□ How brain disorders and injuries can present a range of symptoms including necrosis and haematoma □ Why the results of clinical assessments may be referred to neurologists		
□ Use of tissue samples/biopsy	□ How brain tissues can be sampled and observed via biopsy/pathology procedures to detect diseased and necrotic tissue □ How different forms of communication may be needed to share information about brain disorders/injuries to different audiences		
□ Causes and diagnosis of mental health issues	□ How mental health issues can be linked to a variety of causes including: • Traumatic/physical brain injury • Post-traumatic stress disorder (PTSD) • Childhood abuse • Bereavement • Long term chronic condition • Drug/alcohol misuse • Social disadvantage □ How healthcare professionals can diagnose mental health issues □ Why some patients with mental health issues are signposted to other professionals □ Benefits of promoting mental health awareness in the context of wellbeing Does not include: □ fMRI technology when used by neurologists		
4.2 Treatment and care of brain disorders/injuries		**Maths**	**HSW**
4.2.1 Types of treatment □ The key components of a treatment plan including: • Recent medical history of patient • Cause of brain injury/disorder • Emergency treatment given • Medications/drugs given • Surgical procedures carried out	To include: □ How to create a treatment plan □ How a treatment plan consists of a series of components, within a given timescale, designed to meet the physical and psychological needs of a patient and identifying the contributions of healthcare professionals and non-specialists, for example patient and their family/friends	**M1.6** **M1.7**	**HSW11**

• Post-operative drug schedule required • Treatments (physical and psychological) required to aid rehabilitation • Contributions to be made by the healthcare professionals and non-specialists • Potential lifestyle changes needed to aid recovery • Personal support available at home or in a care setting • Other factors influencing recovery	□ Why treatment plans are likely to enable the rehabilitation of the patient □ How different forms of communication may be needed to share information about personalised treatment plans for brain injuries/disorders to different audiences		
□ Brain surgery	□ Why brain surgery is highly-specialised in response to the physical basis of a brain injury or long term disorder □ How brain surgery is generally invasive, requiring the temporary removal of part of the skull and meninges □ How robotic surgery is carried out to enable fine control of techniques □ How ethical decisions must be considered when brain surgery is undertaken, including quality of life		
□ Use of therapeutic drugs	□ How therapeutic drugs can reduce symptom expression and further complications following a brain injury and/or the progress of a brain disorder □ The key features of an effective schedule or regime for the use of therapeutic drugs		
□ Lifestyle modifications	□ How a variety of lifestyle modifications can be used to treat brain disorders/injuries or reduce the impact of symptoms □ Benefits and limitations of managed aerobic exercise, rest periods, awareness of mental and physical wellbeing and the use of medical aids to carry out daily tasks		

□ Therapeutics for neurodegenerative diseases and brain injuries	□ How different therapeutics are applied to slow the progress of neurodegenerative diseases, including the use of L-dopa for Parkinson's Disease Does not include: □ Exercise routines □ Details of wellbeing programmes		
4.2.2 Support via teams of healthcare professionals □ Teams of healthcare professionals, including: • Doctor/neurologist • Physiotherapist • Nurse • Occupational therapist • Health care support worker • Clinical psychologist	To include: □ Benefits and limitations of the support available via a team of healthcare professionals to support patients with brain disorders or injuries □ Why not all types of healthcare professionals are involved in the treatment and support of patients with brain disorders or injuries (affected by the form of treatment/support required) □ How does a team of healthcare professionals work together to provide appropriate support for patients with brain disorders/injuries □ How does a team of healthcare professional share plans and outcomes with the patient and their family		**HSW11**
□ Roles of healthcare professionals within personalised treatment plans for patients with brain disorders/injuries	□ How different healthcare professionals treat and support patients with brain disorders/injuries: • Doctors and neurologists • Physiotherapists • Nurses • Occupational therapists • Healthcare support workers • Clinical psychologists		
□ Different social care settings	□ Why choose care at home for patients with brain disorders/injuries rather than care in a nursing home Does not include: □ Legal aspects of care		

Topic Area 5: Monitoring and scanning the brain			
Teaching content	**Exemplification**	**Opportunities to cover:**	
5.1 Monitoring via electroencephalogram (EEG) readings		**Maths**	**HSW**
Use of EEG readings □ Location of EEG sensors when placed on the patient	To include: □ Know why EEG sensors are placed on different parts of the body	**M3.1** **M3.6**	**HSW1**
□ Appearance of EEG readings	□ How EEG readings are used to detect electrical activity (transmission of nerve impulses) within the brain □ Benefits and limitations of using EEG readings to monitor brain disorders/injuries		
□ Clinical application of EEG readings to analyse sleep patterns	□ How an EEG can be used to analyse sleep patterns including the local brain clock and post-operative recovery rates Does not include: □ The physics of EEG equipment □ The detailed interpretation of EEG readings		
5.2 Scanning techniques		**Maths**	**HSW**
Use of scanning techniques □ Features of CT, MRI, positron emission tomography (PET), X-ray and ultrasound scans	To include: □ The advantages and disadvantages of CT, MRI, PET, X-ray and ultrasound scans when diagnosing/treating various brain disorders or injuries □ How to interpret scanned images □ When is it more effective to choose CT, MRI, PET, X-ray or ultrasound scanning techniques to diagnose a particular form of brain disorder/injury	**M0.1** **M0.2** **M0.3**	**HSW9**
□ Specialised scanning techniques for brain study, including: • Functional MRI (fMRI) • Iron beam scanning electron microscopy (FIB-SEM) • Serial section transmission electron microscopy (TEM) • Analysing scanned images for sports injuries	□ Why some forms of brain injury and conditions require the use of highly-specialised scanning techniques □ How fMRI is used in brain research and in the support of clinical interventions □ How FIB-SEM and serial section TEM techniques are used to observe neuronal connections/circuits in the brain □ How scanned images are used to identify sports injuries to the brain Does not include: □ Physics of scanning equipment		

Assessment criteria

Section 6.4 provides full information on how to assess the NEA units and apply the assessment criteria.

These are the assessment criteria for the tasks for this unit. The assessment criteria indicate what is required in each task. Students' work must show that all aspects of a criterion have been met in sufficient detail for it to be **successfully achieved** (see **Section 6.4.1**). If a student's work does not fully meet a criterion, you must not award that criterion.

The command words used in the assessment criteria are defined in **Appendix B**.

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td>P1: Interpret the scan image to identify those regions of the brain likely to be affected by the TBI.</td><td rowspan="2">M1: Evaluate the advantages and disadvantages of using different scanning techniques for the diagnosis of the TBI in the case study.</td><td rowspan="2">D1: Justify why an EEG should be used to confirm the impact of the TBI on nerve impulse transmission in the patient's brain.</td></tr>
<tr><td>P2: Draw a fully annotated low-power plan diagram to show parts of the brain anatomy affected by the TBI.</td></tr>
<tr><td>P3: Use research to describe how the patient's symptoms relate to the TBI in the case study.</td><td>M2: Describe the wider impact of the patient's injuries on their physical and mental wellbeing.</td><td>D2: Explain whether the spinal cord and nerves are affected by the TBI in the case study.</td></tr>
<tr><td>P4: Use research to describe how a range of relevant potential treatments could be appropriate for the TBI patient.</td><td rowspan="3">M3: Evaluate two physical treatments and two psychological treatments which are needed to aid recovery of the patient.</td><td rowspan="3">D3: Analyse how the options chosen for pain management affect the patient on a cellular level.</td></tr>
<tr><td>P5: Create a logical treatment plan, containing all key components to meet the physical, psychological and personal needs of the patient.</td></tr>
<tr><td>P6: Design a relevant schedule for drug prescription for the TBI patient.</td></tr>
<tr><td>P7: Describe what contributions are required to be made by the specialists and non-specialists involved in the treatment plan.</td><td>M4: Discuss the use of different teams of healthcare professionals to support the patient.</td><td></td></tr>
<tr><td>P8: Create an appropriate presentation of the treatment plan for the specialists identified in Task 2.</td><td>M5: Explain the most appropriate way for scientific terminology used in the presentation for the specialists to be communicated with the non-specialists.</td><td>D4: Justify the content of the presentation by detailing the scientific reasoning behind its inclusion.</td></tr>
</table>

P9: Suggest four adaptations to the presentation so that it can be used to communicate the treatment plan to the non-specialists in the case study effectively.	**M6: Explain** the adaptations suggested to the presentation in **P9** so that the non-specialists in the case study can understand their contribution to the treatment plan.	
P10: Draw a simplified low power plan diagram to show parts of the brain anatomy affected by the TBI for the non-specialists in the case study.		
P11: Summarise the feedback received for your treatment plan.	**M7: Assess** the strengths and weaknesses of the information used in the creation of treatment plan for the TBI patient.	**D5: Justify** any potential improvements to the information used in the creation of treatment plan for the TBI patient.
P12: Analyse the strengths and weaknesses of the materials created to present information to the specialists and suggested adaptations for the non-specialists.		

Assessment guidance

This assessment guidance gives you information relating to the assessment criteria. There might not be additional assessment guidance for each assessment criterion. It is included only where it is needed.

Assessment Criteria	Assessment guidance
P1	• Students need to interpret the scan image shown in the case study for the TBI patient. • Students must recognise the prominent part(s) of the brain damaged at the site of the injury and the part(s) showing signs of damage, as relevant to the scan from the case study.
P2	• The interpretation of the scan image could be written only but to achieve **P2** a diagrammatic model must be included to demonstrate the parts of the brain affected by the TBI. This could be presented via either a vertical section (VS) or transverse section (TS) of brain anatomy.
P3	• The symptoms shown by the TBI patient are outlined in the case study. Symptoms may have been recorded before and/or following surgery. • Students must research how symptoms of TBIs link to brain structure and function. • Students must apply their research to the information from the case study. • The research element of this criterion does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criterion.

M1	• The case study confirms that the image is the product of a scanning technique. The image reveals the site of injury and of damaged tissue. • Students must evaluate the advantages and disadvantages of the scanning technique from the case study. • Students must also evaluate the advantages and disadvantages of using **two other** scanning techniques for the diagnosis of the TBI in the case study.
M2	• Students must describe the wider impact of the patient's injuries on their physical and mental well-being. • The patient's injuries could be considered to be any from the range of symptoms and behaviours shown by the patient in the case study.
D1	• Students need to give valid reasons why some of the symptoms shown by the patient in the case study are the product of a change to nerve impulse transmission. This forms the justification that the change can be confirmed via an EEG.
D2	• Students must explain whether the spinal cord and nerves are affected by the TBI for the patient in the case study. This might involve the link between the spinal cord and the brain, as well as the role of cranial versus spinal nerves.
P4	• Students must identify a range of **at least three** potential physical treatments and **at least three** psychological treatments that could be appropriate for the TBI patient. • For each treatment students must describe how each treatment is appropriate for the TBI patient in the case study. • The research element of this criterion does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criterion.
P6	• Students must design a relevant drug prescription for the TBI patient based on the information in the case study. The drugs prescribed could be to either treat or reduce the symptoms shown by the patient. • An explanation of how drugs affect nerve impulse transmission is **not** expected for this assessment criterion.
P7	• **P7** is an extension of the treatment plan created in **P4**. • Students must describe the contributions of the most appropriate specialists needed to treat and support the patient (for example, doctor, physiotherapist, clinical psychologist, etc) as appropriate to the case study. • Students must describe the contributions of the most appropriate non-specialists needed to support the patient (for example, the patient, family members, carers, etc) as appropriate to the case study.
M3	• **M3** is an extension of **P4**. • Students must evaluate **two** physical treatments and **two** psychological treatments in the context of the patient. The treatments evaluated need to come from those described in **P4**.
M4	• **M4** is an extension of **P7**. • Students must discuss how different teams of healthcare professionals will be used to support the patient. • The specific healthcare teams discussed will depend on the case study context. All relevant healthcare teams should be discussed.

D3	• Students must analyse how the options chosen for pain management, as part of the treatment plan and/or drug prescription schedule, affect the patient on a cellular level.
P8	• Students must create a presentation for the specialists identified in the treatment plan in **Task 2**. The presentation should be in the format they feel is most appropriate, which could include a poster, a PowerPoint presentation, a flow diagram, etc. • There must be sufficient detail in the presentation to demonstrate the key components of the treatment plan appropriate for the specialists.
P9	• Having created the presentation for the specialists, students must consider how it could be adapted to be relevant and accessible for the non-specialists from the case study. • Students might choose to create a further presentation to highlight the adaptations needed or they might choose to suggest adaptations in a different format, for example a table. • Adaptations suggested should focus on the changes to the presentation required, for example different parts of the plan which should be concentrated on, information which could be removed or added, etc. Amendments should not focus on changes to scientific terminology which will be considered in M5.
M5	• Students must explain the most appropriate way for **at least three** examples of scientific terminology used in the presentation for the specialists to be modified to be communicated with the non-specialists. • Students could choose to consider ways the terminology might be scaffolded, re-phrased, amended or why they would need to use a particular scientific term as it is.
M6	• **M6** is an extension of **P9**.
D4	• Students must justify the content of the presentation for the specialists by detailing the scientific reasoning. • Students will use their understanding of the unit content to provide valid reasons for the content's inclusion.
P11	• Students must clearly express the most important points stemming from the feedback received for their treatment plan in a short and clear form. • The feedback for their treatment plan might be provided by the teacher and/or other students.
M7	• The information used in the creation of the treatment plan might include the **case study**, **Task 1** and/or **Task 2**.

Synoptic assessment

Some of the knowledge, understanding and skills needed to complete this unit will draw on the learning in Units F170 and F171.

This table details these synoptic links.

Unit F176: The brain		Unit F170: Fundamentals of human biology	
Topic Area		Topic Area	
1	Structure and function of nervous system	3	Key concepts in endocrinology, neurobiology and reproduction
2	Neuron communication and control	2	Human physiology, organs and systems

Unit F176: The brain		Unit F171: Health and disease	
Topic Area		Topic Area	
4	The diagnosis and treatment of brain disorders/injuries	2	Curative, management and preventative therapies
		4	Techniques for diagnosis and monitoring

More information about synoptic assessment in these qualifications can be found in **Section 5.2 Synoptic assessment.**

4.3.6 Unit F177: Drug development

Unit Aim

There are many different types of diseases and medical conditions and thousands of medicines and drugs that have been produced to help people who need treatment. Medicines are used to treat or prevent disease and have been used for thousands of years. Many different herbs and plants have been used, not only in the past but also now, to provide natural materials from which modern medicines are extracted and developed. Drug manufacture is changing and now drugs are usually made synthetically or semi-synthetically. The process of drug development is long and expensive, and so scientists must carefully consider a variety of factors before moving through each stage.

In this unit you will look at the different properties of pharmaceutical drugs and how these properties influence the development of future drugs. You will learn how the stages in the development of a drug, including pre-clinical and clinical trials are completed. You will consider the importance of clinical trials to determining the efficacy and safety of the potential drug. You will also learn the stages in the development and the discovery of a commercial drug/medicine and how pre-clinical and clinical trials, associated with the safety of the drug, are completed. Finally, you learn how to prepare a presentation for a panel that represents stakeholders who will approve funding for a new drug that is being developed.

Unit F177: Drug development			
Topic Area 1: Pharmaceutical drugs			
Teaching content	**Exemplification**	**Opportunities to cover:**	
1.1 Classification of drugs		**Maths**	**HSW**
The classification of pharmaceutical drugs □ Stimulants □ Depressants □ Hallucinogens □ Cannabinoids □ Opioids	To include: □ Purpose of each type of pharmaceutical drug □ How pharmaceutical drugs are classified Examples of **how pharmaceutical drugs are classified** may include: □ General structure □ Mechanism of action □ Intended therapeutic use □ Potential for abuse Does not include: □ Detailed chemical mechanisms of actions □ Detailed structure		**HSW8** **HSW9**
1.2 Properties of drugs		**Maths**	**HSW**
General properties of drugs □ Pharmacodynamics □ Pharmacokinetics □ Toxicity □ Adverse drug reactions □ Drug-drug interactions	To include: □ How each property needs to be considered when developing a new drug	**M1.6** **M2.1**	**HSW6**

1.3 Actions of drugs		**Maths**	**HSW**
Mechanism of action of drugs □ Receptor activation □ Agonists and antagonists □ Enzyme inhibition □ Transporter inhibition □ Non-specific drug action □ Gene expression modulation	To include: □ The general steps of mechanism of action: • Binding • Activation • Signal transduction • Effect □ Advantages and disadvantages of each drug action Does not include: □ Detailed process of each mechanism of action		**HSW11**
1.4 Drug delivery		**Maths**	**HSW**
Routes of drug delivery: □ Oral □ Rectal □ Injectable □ Transdermal □ Inhalational □ Topical □ Transnasal □ Vaginal □ Intraosseous	To include: □ How the drug travels through the body from each delivery method □ How the method of delivery affects the amount of drug reaching the site of action □ How the chemical properties of the drug affect the permissible drug delivery □ Advantages and disadvantages of each route of drug delivery into the body		**HSW4**
Topic Area 2: Process of drug development			
Teaching content	**Exemplification**	**Opportunities to cover:**	
2.1 The process of drug development		**Maths**	**HSW**
2.1.1 The phases of drug development □ Discovery □ Preclinical Research □ Clinical Research □ Regulatory Approval □ Post market surveillance	To include: □ The purpose of each phase of drug development □ The challenges of drug development Examples of **the challenges of drug development** may include: □ Cost □ Development time □ Failure rate □ Regulatory approval	**M0.3**	**HSW4**
2.1.2 The researchers involved in drug development □ Research Scientist □ Computational Biologist □ Pharmacologist □ Toxicologist □ Clinical Scientist □ Regulatory Affairs specialist □ Medical writer	To include: □ The role of each researcher □ Which phase(s) each researcher is most likely to be involved in		**HSW11**

2.2 Discovery		**Maths**	**HSW**
Discovery of new drugs □ New insights into a disease process and identifying new targets □ Designing new compounds □ Screening natural products □ Existing treatments with unanticipated effects □ New technologies	To include: □ The importance of discovering new drugs □ The use of computer modelling to determine viable potential drug candidates to go onto preclinical research □ The use of cell lines to determine viable potential drug candidates to go onto preclinical research	**M1.1** **M1.2**	**HSW1**
2.3 Preclinical research		**Maths**	**HSW**
The purpose of preclinical research in animals	To include: □ The need for testing drug candidates in animals before humans Examples of **the need for testing drug candidates in animals** may include: □ Best dosage □ Best method of delivery □ Side effects and toxicity □ Potential benefits □ How it is absorbed, distributed, metabolised and excreted	**M1.6**	**HSW12**
2.4 Clinical research		**Maths**	**HSW**
2.4.1 The process of testing drug candidates in humans □ Phase 1: A small number of healthy volunteers □ Phase 2: A larger group of volunteers with the condition □ Phase 3: Several thousand patients with the condition	To include: □ What factors researchers need to consider when designing each phase □ Why it's important to consider these factors when designing clinical research phases □ What researchers need to consider when selecting participants for clinical research Examples of **factors to be considered when designing each phase** may include: □ How long the study will last □ What assessments will be conducted □ What data will be collected and when □ How many participants are needed □ Efficacy and dosage results	**M1.2** **M1.6**	**HSW3**

	Examples of **what needs to be considered when selecting participants** may include: □ Age □ Sex □ Race and ethnicity □ Severity of condition		
2.4.2 Limiting research bias	To include: □ Why it is important to limit research bias □ Methods to limit research bias in clinical research		**HSW3**
2.4.3 Importance of clinical research	To include: □ How researchers determine safe and effective dosages □ The role of clinical research in determining side-effects □ Advantages and disadvantages of each phase of clinical research		**HSW10**
2.5 Regulatory approval		**Maths**	**HSW**
2.5.1 Regulatory approval Purpose of regulatory approval	To include: □ What must be submitted to regulators for a license: • Preclinical data and analyses • All clinical trial data and analyses • Proposed labelling • Safety updates • Drug abuse information • Directions for use		**HSW8**
2.5.2 Legislation □ Medicines Act 1968 □ Human Medicines Regulations 2012 □ Medicines for Human Use (Clinical Trails) Regulations 2004 □ Drug Trafficking Act 1994	To include: □ How each piece of legislation influences drug development □ The role of the Medicines and Healthcare Products Regulatory Agency (MHRA) in relation to legislation □ Key principles that underpin the legislation: • Safety • Efficacy • Quality • Transparency		**HSW7**
2.6 Post market surveillance		**Maths**	**HSW**
Post market surveillance	To include: □ Importance of post-market surveillance □ Benefits and challenges of post-market surveillance		**HSW11**

Topic Area 3: Factors influencing drug development			
Teaching content	**Exemplification**	**Opportunities to cover:**	
3.1 Stakeholders		**Maths**	**HSW**
Stakeholder groups involved in drug development □ Researchers □ Pharmaceutical companies □ Academic institutions □ Regulatory agencies □ Patient advocacy groups □ Healthcare providers □ Funding providers	To include: □ The role of each stakeholder group in drug development □ How these stakeholder groups collaborate to develop drugs □ How to communicate effectively to these different stakeholder groups □ What constitutes success for different stakeholder groups involved in drug development Examples of **stakeholders** may include: □ **Researchers** – pharmacologist, clinical researcher, medical writer □ **Pharmaceutical companies** – Pharmacologists, quality assurance professionals, regulatory affairs professionals □ **Academic institutions –** Research technicians, toxicologists, clinicians □ **Regulatory agencies –** Clinical reviewers, regulatory affairs professionals, □ **Patient advocacy groups –** Policymakers, advocates, patients, legal experts □ **Healthcare providers –** Bioethicists, legal experts, nurses □ **Funding providers –** government agencies, philanthropic organisations, venture capitalists	**M1.7**	**HSW11**
3.2 Ethical considerations		**Maths**	**HSW**
Ethical considerations in drug development	To include: □ What the ethical considerations are when developing drugs □ How each ethical consideration may affect the process of drug development □ How each ethical consideration can be addressed		**HSW9**

	Examples of **ethical considerations** may include: □ Safety of patients □ Efficacy of drugs □ Informed consent of patients □ Fair distribution of drugs □ Use of animals in research □ Payment of research participants □ Marketing of drugs		
3.3 Market considerations		**Maths**	**HSW**
Market considerations affecting decisions around drug development	To include: □ How each market consideration can impact the process of drug development □ The importance of considering market factors when deciding which drugs to develop □ How market factors may affect decisions through the drug development process Examples of **market considerations** may include: □ Size of target market □ Unmet medical need □ Cost of drug development □ Regulatory environment □ Competition □ Reimbursement landscape □ Patient advocacy □ Public Perception	**M1.6**	**HSW9**
Topic Area 4: Producing a clinical research proposal			
Teaching content	**Exemplification**	**Opportunities to cover:**	
4.1 Clinical Research Proposal		**Maths**	**HSW**
□ Producing a pitch □ Communicating the pitch to a range of stakeholders	To include: □ How to write a clinical research proposal □ How to design a presentation of the clinical research proposal that is appropriate for stakeholders involved in drug development □ How to communicate an appropriate clinical research proposal to a variety of drug development stakeholders □ How to assess the quality of a clinical research proposal pitch □ How to obtain appropriate feedback on a research proposal pitch and then summarise the feedback		**HSW11**

Assessment criteria

Section 6.4 provides full information on how to assess the NEA units and apply the assessment criteria.

These are the assessment criteria for the tasks for this unit. The assessment criteria indicate what is required in each task. Students' work must show that all aspects of a criterion have been met in sufficient detail for it to be **successfully achieved** (see **Section 6.4.1**). If a student's work does not fully meet a criterion, you must not award that criterion.

The command words used in the assessment criteria are defined in **Appendix B**.

<table>
<tr><th>Pass</th><th>Merit</th><th>Distinction</th></tr>
<tr><td>P1: Use research to compare the properties of other drugs with a similar aim to the new drug being developed.</td><td>M1: Explain how the properties of the new drug will affect the development process.</td><td></td></tr>
<tr><td>P2: Use research to describe the effects of other drugs with a similar aim as the new drug being developed.</td><td rowspan="2">M2: Use research to summarise the different market factors which may impact on the development of the new drug.</td><td rowspan="2"></td></tr>
<tr><td>P3: Use research to explain three ways that specific legislation will affect the development of the new drug being developed.</td></tr>
<tr><td>P4: Create a written proposal describing the clinical trial phases of the development of the new drug.</td><td rowspan="3">M3: Explain the chosen participation groups in each phase of the clinical trials in terms of their validity and reliability.</td><td>D1: Justify the decisions made in the written proposal with scientific rationale.</td></tr>
<tr><td>P5: Explain how it can be determined whether the suggested dosage is safe and effective during the development of the new drug.</td><td rowspan="2">D2: Evaluate the risk of side effects beyond those identified in pre-clinical trials for the new drug.</td></tr>
<tr><td>P6: Explain how the properties of the new drug influence the purpose of each phase of the clinical trial.</td></tr>
<tr><td>P7: Explain the roles of the various stakeholders involved in the development of the new drug.</td><td>M4: Discuss potential success criteria for the various stakeholders of the new drug.</td><td>D3: Assess the ethical considerations of the development of the new drug.</td></tr>
<tr><td>P8: Create an appropriate presentation which summarises the drug development proposal.</td><td>M5: Explain how the presentation has been tailored to all of the different members of the panel.</td><td>D4: Justify the inclusion and omission of content from the written proposal in the presentation using scientific reasoning.</td></tr>
<tr><td>P9: Deliver the presentation to the intended audience, with explanations of rationale beyond what is included in the presentation documentation.</td><td></td><td></td></tr>
</table>

Pass	Merit	Distinction
P10: Summarise the feedback received for your presentation.	**M6: Discuss** the strengths and weaknesses of your drug development proposal.	**D5: Assess** how your drug development proposal could be improved to provide the greatest chance of success of receiving funding.
P11: Analyse how the presentation of your pitch could be improved.		
P12: Explain how **three** other pieces of information would have been useful when creating the drug development proposal.	**M7: Evaluate** how the information suggested in **P12** might have affected the proposal.	

Assessment guidance

This assessment guidance gives you information relating to the assessment criteria. There might not be additional assessment guidance for each assessment criterion. It is included only where it is needed.

Assessment Criteria	Assessment guidance
Task 1	• The research element of the criteria in this Task does **not** need to be completed under teacher supervised conditions but is necessary in order for students to access the criteria.
P1	• Students must research the properties of other drugs with a similar aim to the new drug being developed. • 'Other drugs with a similar aim' might be, for example, other drugs to treat infections (could be to treat a different area of the body than given in the scenario) or the type of drug (e.g. antimicrobial drugs, antibacterial, antifungal, anti-inflammatory, antiviral). • 'Properties' means different features such as dosage, resistance, routes of administration, strength. • Students must use their research to compare the properties of other drugs with the new drug being developed.
P2	• The competitor drugs focused on in **P2** must be the drugs compared to the new drug in **P1**. • Students must describe the effects of similar drugs on the market - including side-effects.
P3	• Students must use research to explain **three** ways that specific legislation will affect the development of the new drug being developed. • The three different ways could come from one or multiple pieces of legislation.
P4	• The written proposal must cover the clinical trial phases of clinical research, regulatory approval and post market surveillance.
P5	• Students must focus on the specific features of the new drug in the case study to explain how to determine that the suggested dosage given is safe and would fulfil the aim whilst limiting the side-effects given. • Students can use their research from **Task 1**.
M4	• **M4** is an extension of **P7**.
D1	• Students must justify the decisions made in the written proposal using scientific rationale. • Students will use their understanding of the unit content to provide valid reasons for the decisions made.

Task 3	• Presentations will need to be aimed at a length of 5 minutes, but flexibility should be allowed. • Students can either deliver the presentation to the teacher, peers or a combination of both. If the presentation is delivered to peers only, this must be recorded, so that the teacher can use the recording to complete the Teacher Observation Record for **P9** (you do **not** need to submit this for moderation). • The focus of other members of the drug development team is from the scenario. There is no requirement for the presentation to take place in front of a certain number of other students. • Students can create their presentation in the format they feel is most appropriate. This could include a poster, a PowerPoint presentation, a flow diagram, etc.
P9	• Teachers must complete a Teacher Observation Record for each student to evidence they have met the criteria. Students must also read and sign it. • The Teacher Observation Record form should describe in detail how the student delivered the presentation to the intended audience, with explanations of rationale beyond what is included in the presentation documentation. • The intended audience is the panel members given in the scenario.
D4	• Students must apply knowledge and understanding from the unit content learnt to give valid reasons for the inclusion or omission of content from the written proposal in their presentation. This will form their justification.
P10	• Students must clearly express the most important points stemming from the feedback received for their presentation in a short and clear form. • The feedback for the presentation might be provided by the teacher and/or other students.
M7	• **M7** is an extension of **P12**.

Synoptic assessment

Some of the knowledge, understanding and skills needed to complete this unit will draw on the learning in Unit F171.

This table details these synoptic links.

Unit F177: Drug development		Unit F171: Health and disease	
Topic Area		Topic Area	
1	Pharmaceutical drugs	2	Curative management and preventative therapies
2	Process of drug development	5	Reporting, research and confidentiality

More information about synoptic assessment in these qualifications can be found in **Section 5.2 Synoptic assessment.**

5 Assessment and grading

5.1 Overview of the assessment

Entry code	H049
Qualification title	OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate)
GLH	180*
Reference	610/3945/7
Total Units	Has three units: • Mandatory units F170, F172, F173

Entry code	H149
Qualification title	OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate)
GLH	360*
Reference	610/3946/9
Total Units	Has six units: • Mandatory units F170, F171, F172, F173 • and two other units from F174, F175, F176, F177

*the GLH includes assessment time for each unit

Unit F170: Fundamentals of human biology

80 GLH

1 hour 15 minute written exam

60 marks (60 UMS)

OCR-set and marked

Calculators are required in this exam.

The exam has one part and a range of item types will be used in this assessment including:

- Forced choice/controlled response questions - typically 1 mark but a maximum of four marks for a single MCQ.
- Short answer, closed response questions (with or without diagrams) – typically 1 to 4 marks.
- Short answer with calculation/working – typically 1 to 4 marks.
- Extended constructed response with points-based mark scheme – 1 mark per factor or feature to a stated maximum, typically 1 to 4 marks.

Unit F171: Health and disease

80 GLH

1 hour 15 minute written exam

60 marks (60 UMS)

OCR-set and marked

Calculators are not required in this exam.

The exam has one part and a range of item types will be used in this assessment including:

- Forced choice/controlled response questions - typically 1 mark but a maximum of four marks for a single MCQ.
- Short answer, closed response questions (with or without diagrams) – typically 1 to 4 marks.
- Short answer with calculation/working – typically 1 to 4 marks.
- Extended constructed response with points-based mark scheme – typically 1 to 4 marks, 1 mark per factor or feature to a stated maximum.
- Extended constructed response with levels of response mark scheme – one 6 mark question and one 9 mark question.

Unit F172: Genetics
50 GLH OCR-set assignment Centre-assessed and OCR-moderated This set assignment has 3 practical tasks. We have estimated that this assignment will take about 15 hours of supervised time and 12 hours of unsupervised time to complete.

Unit F173: Biomedical techniques
50 GLH OCR-set assignment Centre-assessed and OCR-moderated This set assignment has 4 practical tasks. It should take about 20 hours of supervised time and 5 hours of unsupervised time to complete.

Unit F174: Nutrition and metabolism
50 GLH OCR-set assignment Centre-assessed and OCR-moderated This set assignment has 4 practical tasks. It should take about 15 hours of supervised time and 10 hours of unsupervised time to complete.

Unit F175: Human reproduction
50 GLH OCR-set assignment Centre-assessed and OCR-moderated This set assignment has 4 practical tasks. We have estimated that this assignment will take about 20 hours of supervised time and 4 hours of unsupervised time to complete.

Unit F176: The brain
50 GLH OCR-set assignment Centre-assessed and OCR-moderated This set assignment has 4 practical tasks. It should take about 20 hours of supervised time and 4 hours of unsupervised time to complete.

Unit F177: Drug development
50 GLH OCR-set assignment Centre-assessed and OCR-moderated This set assignment has 4 practical tasks. It should take about 15 hours of supervised time and 10 hours of unsupervised time to complete.

OCR-set assignments for NEA units are on our secure website, **Teach Cambridge**. Each NEA assignment is live for two years. The intended cohort is shown on the front cover. It is important you use the correct NEA set assignment for each cohort, as starting a new cohort of Year 12 students on an NEA set assignment that has already been live for one year will mean that these students will only have one year to work on the assignment.

5.2 Synoptic assessment

Synoptic assessment is a built-in feature of these qualifications. It means that students need to use an appropriate selection of their knowledge, understanding and skills developed across each qualification in an integrated way and apply them to a key task or tasks.

This helps students to build a holistic understanding of the subject and the connections between different elements of learning, so they can go on to apply what they learn from these qualifications to new and different situations and contexts.

The externally assessed units allow students to gain underpinning knowledge and understanding relevant to human biology. The NEA units draw on and strengthen this learning by assessing it in an applied and practical way.

It is important to be aware of the synoptic links between the units so that teaching, learning and assessment can be planned accordingly. Then students can apply their learning in ways which show they are able to make connections across the qualification. **Section 4.3** shows the synoptic links for each unit.

5.3 Transferable skills

These qualifications give students the opportunity to gain broad, transferable skills and experiences that they can apply in future study, employment and life.

Higher Education Institutions (HEIs) have told us that developing some of these skills helps students to transition into higher education.

These skills include:

- Communication
- Creativity
- Critical thinking
- Independent learning
- Presentation skills
- Problem solving
- Referencing
- Reflection
- Research skills
- Self-directed study
- Time management
- Writing for different purposes

5.4 Grading and awarding grades

Externally assessed units

We mark all the externally assessed units.

Each external assessment is marked according to a mark scheme, and the mark achieved will determine the unit grade awarded (Pass, Merit or Distinction). We determine grade boundaries for each of the external assessments in each assessment series.

If a student doesn't achieve the mark required for a Pass grade, we issue an unclassified result for that unit. The marks achieved in the external assessment will contribute towards the student's overall qualification grade, even if a Pass is not achieved in the unit assessment.

NEA units

NEA units are assessed by the teacher and externally moderated by us.

Each unit has specified Pass, Merit and Distinction assessment criteria. The assessment criteria for each unit are provided with the unit content in **Section 4.3** of this specification. Teachers must judge whether students have met the criteria or not.

A unit grade can be awarded at Pass, Merit or Distinction. The number of assessment criteria needed to achieve each grade has been built into each assignment. These are referred to as design thresholds. The table below shows the design thresholds for each grade outcome for the NEA assessments in these qualifications. The unit grade awarded is based on the **total** number of achieved criteria for the unit. The total number of achieved criteria for each unit can come from achievement of any of the criteria (Pass, Merit or Distinction). This is **not** a 'hurdles-based' approach, so students do **not** have to achieve **all** criteria for a specific grade to achieve that grade (e.g. all Pass criteria to achieve a Pass).

To make sure we can keep outcomes fair and comparable over time, we will review the performance of the qualifications through their lifetime. The review process might lead to changes in these design thresholds if any unexpected outcomes or significant changes are identified.

Unit size (GLH)	**50**
Total number of criteria	24
Number of pass criteria	12
Number of merit criteria	7
Number of distinction criteria	5
Total number of criteria needed for a unit pass	10
Total number of criteria needed for a unit merit	15
Total number of criteria needed for a unit distinction	20

If a student doesn't achieve enough criteria to achieve a unit Pass, we will issue an unclassified result for that unit. The number of criteria achieved will be converted into a mark on the Uniform Mark Scale (UMS) and will contribute towards the student's overall qualification grade, even if a Pass is not achieved in the unit assessment. More information about this is in Section below (**Calculating the qualification grades**).

Qualifications

The overall qualification grades are:

- Distinction* (D*)
- Distinction (D)
- Merit (M)
- Pass (P)
- Unclassified (U)

Calculating the qualification grades

When we work out students' overall grades, we need to be able to compare performance on the same unit in different assessments over time and between different units. We use a Uniform Mark Scale (UMS) to do this.

A student's uniform mark for each externally assessed unit is calculated from the student's raw mark on that unit. A student's uniform mark for each NEA unit is calculated from the number of criteria the student achieves for that unit. The raw mark or number of criteria achieved are converted to the equivalent mark on the uniform mark scale. Marks between grade boundaries are converted on a pro rata basis.

When unit results are issued, the student's unit grade and uniform mark are given. The uniform mark is shown out of the maximum uniform mark for the unit (for example, 48/60).

The student's uniform marks for each unit will be aggregated to give a total uniform mark for the qualification. The student's overall grade will be determined by the total uniform mark.

The tables below show:

- the maximum raw marks or number of criteria, and uniform marks for each unit in the qualifications
- the uniform mark boundaries for each of the assessments in each qualification
- the minimum total mark for each overall grade in the qualifications.

Certificate Qualification:

Unit	Maximum raw mark/number of criteria	Maximum uniform mark (UMS)	Distinction* (UMS)	Distinction (UMS)	Merit (UMS)	Pass (UMS)
F170	60	60	-	48	36	24
F172	24	45	-	36	27	18
F173	24	45	-	36	27	18
Qualification Totals	108	150	135	120	90	60

Extended Certificate Qualification:

Unit	Maximum raw mark/number of criteria	Maximum uniform mark (UMS)	Distinction* (UMS)	Distinction (UMS)	Merit (UMS)	Pass (UMS)
F170	60	60	-	48	36	24
F171	60	60	-	48	36	24
F172	24	45	-	36	27	18
F173	24	45	-	36	27	18
F174	24	45	-	36	27	18
F175	24	45	-	36	27	18
F176	24	45	-	36	27	18
F177	24	45	-	36	27	18
Qualification Totals	216	300	270	240	180	120

You can find a marks calculator on the qualification page of the OCR website to help you convert raw marks/number of achieved criteria into uniform marks.

5.5 Performance descriptors

Performance descriptors indicate likely levels of attainment by representative students performing at the Pass, Merit and Distinction grade boundaries at Level 3.

The descriptors must be interpreted in relation to the content in the units and the qualification as a whole. They are not designed to define that content. The grade achieved will depend on how far the student has met the assessment criteria overall. Shortcomings in some parts of the assessment might be balanced by better performance in others.

Level 3 Pass

At Pass, students show adequate knowledge and understanding of the basic elements of much of the content being assessed. They can develop and apply their knowledge and understanding to some basic and familiar contexts, situations and problems.

Responses to higher order tasks involving detailed discussion, evaluation and analysis are often limited.

Many of the most fundamental skills and processes relevant to the subject are executed effectively but lack refinement, producing functional outcomes. Demonstration and application of more advanced skills and processes might be attempted but not always executed successfully.

Level 3 Merit

At Merit, students show good knowledge and understanding of many elements of the content being assessed. They can sometimes develop and apply their understanding to different contexts, situations and problems, including some which are more complex or less familiar.

Responses to higher order tasks involving detailed discussion, evaluation and analysis are likely to be mixed, with some good examples at times and others which are less accomplished.

Skills and processes relevant to the subject, including more advanced ones, are developed in terms of range and quality. They generally lead to outcomes which are of good quality, as well as being functional.

Level 3 Distinction

At Distinction, students show thorough knowledge and understanding of most elements of the content being assessed. They can consistently develop and apply their understanding to different contexts, situations and problems, including those which are more complex or less familiar.

Responses to higher order tasks involving detailed discussion, evaluation and analysis are successful in most cases.

Most skills and processes relevant to the subject, including more advanced ones, are well developed and consistently executed, leading to high quality outcomes.

6 Non examined assessment (NEA) units

This section gives guidance on completing the NEA units. In the NEA units, students build a portfolio of evidence to meet the assessment criteria for the unit.

Assessment for these qualifications **must** adhere to JCQ's **Instructions for Conducting Coursework**. Do **not** use JCQ's Instructions for Conducting Non-examination Assessments – these are only relevant to GCE and GCSE specifications.

The NEA units are centre-assessed and externally moderated by us.

You **must** read and understand all the rules and guidance in this section **before** your students start the set assignments.

If you have any questions, please contact us for help and support.

6.1 Preparing for NEA unit delivery and assessment

6.1.1 Centre and teacher/assessor responsibilities

We assume the teacher is the assessor for the NEA units.

Before you apply to us for approval to offer these qualifications you must be confident your centre can fulfil all the responsibilities described below. Once you're approved, you can offer any of our general qualifications, Cambridge Nationals or Cambridge Advanced Nationals **without** having to seek approval for individual qualifications.

Here's a summary of the responsibilities that your centre and teachers must be able to fulfil. It is the responsibility of the head of centre[1] to make sure our requirements are met. The head of centre must ensure that:

- there are enough trained or qualified people to teach and assess the expected number of students you have in your cohorts.
- teaching staff have the relevant level of subject knowledge and skills to deliver and assess these qualifications.
- teaching staff will fully cover the knowledge, understanding and skills requirements in teaching and learning activities.
- allowed combinations of units are considered at the start of the course to be confident that all students can access a valid route through the qualifications.
- all necessary resources are available for teaching staff and students during teaching and assessment activities. This gives students every opportunity to meet the requirements of the qualification and reach the highest grade possible.
- there is a system of internal standardisation in place so that all assessment decisions for centre-assessed assignments are consistent, fair, valid and reliable (see **Section 6.4.3**).
- there is enough time for effective teaching and learning, assessment and internal standardisation.
- processes are in place to make sure that students' work is individual and confirmed as authentic (see **Section 6.2.1**).

[1] This is the most senior officer in the organisation, directly responsible for the delivery of OCR qualifications, For example, the headteacher or principal of a school/college. The head of centre accepts full responsibility for the correct administration and conduct of OCR exams.

- OCR-set assignments are used for students' summative assessments.
- OCR-set assignments are **not** used for practice. Sample assessment material for each of the NEA units is available on the OCR website. This sample assessment material can be used for practice purposes.
- students understand what they need to do to achieve the criteria.
- students understand what it means when we say work must be authentic and individual and they (and you) follow our requirements to make sure their work is their own.
- students know they must not reference another individual's personal details in any evidence produced for summative assessment, in accordance with the Data Protection Act 2018 and the UK General Data Protection Regulations (UK GDPR). It is the student's responsibility to make sure evidence that includes another individual's personal details is anonymised.
- outcomes submitted to us are correct and are accurately recorded.
- assessment of set assignments adheres to the JCQ **Instructions for Conducting Coursework** and JCQ **AI Use in Assessments: Protecting the Integrity of Qualifications**.
- a declaration is made at the point you're submitting any work to us for assessment that confirms:
    - all assessment is conducted according to the specified regulations identified in the **Administration** area of our website,
    - students' work is authentic.
    - marks have been transcribed accurately.
- centre records and students' work are kept according to these requirements:
    - students' work **must** be kept until **after** the unit has been awarded and any review of results or appeals processed. We cannot consider any review if the work has not been kept.
    - internal standardisation and assessment records must be kept securely for a minimum of three years after the date we've issued a certificate for a qualification.
- all cases of suspected malpractice involving teachers or students are reported (see **Section 6.3.1**).

6.1.2 Health and safety

In UK law, health and safety is primarily the responsibility of the employer. In a school or college the employer could be a local education authority, the governing body or board of trustees. Employees (teachers/lecturers, technicians etc.), have a legal duty to cooperate with their employer on health and safety matters. Various regulations, but especially the COSHH Regulations 2002 (as amended) and the Management of Health and Safety at Work Regulations 1999, 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 carry out a risk assessment. A useful summary of the requirements for risk assessment in school or college science can be found at: https://www.ase.org.uk

For members, the CLEAPSS® guide, PS90, *Making and recording risk assessments in school science*[2] offers appropriate advice.

[2] These, and other CLEAPSS® publications, are on the CLEAPSS® Science Publications website www.cleapss.org.uk. Note that CLEAPSS® publications are only available to members. For more information about CLEAPSS® go to www.cleapss.org.uk

Most education employers have adopted nationally available publications as the basis for their Model Risk Assessments.

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

Such adaptations might include a reduced scale of working, deciding that the fume cupboard provision was inadequate or the skills of the learners were insufficient to attempt particular activities safely. The significant findings of such risk assessment should then be recorded in a *"point of use text",* 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 for each practical activity, although a minority of employers may require this.

Where project work or investigations, sometimes linked to work-related activities, are included in specifications this 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 CLEAPSS®.

6.2 Requirements and guidance for delivering and marking the OCR-set assignments

The assignments are:

- set by us.
- taken under supervised conditions (unless we specify otherwise in the assessment guidance).
- assessed by the teacher.
- moderated by us.

You can find the set assignments on our secure website, **Teach Cambridge**.

The set assignments give an approximate time that it will take to complete all the tasks. These timings are for guidance only, but should be used by you, the teacher, to give students an indication of how long to spend on each task. You can decide how the time should be allocated between each task or part task. Students can complete the tasks and produce the evidence across several sessions. Students' evidence (either hard copy or digital) must be kept securely by the teacher and access to assessment responses must be controlled. Students aren't permitted to access their work in between the assessment sessions.

We will publish a new set assignment each year and they will be live for 2 years(s). Each new set assignment will be released on 1 June. You must check our secure website, **Teach Cambridge**, and use a set assignment that is live for assessment. The live assessment dates will be shown on the front cover alongside the intended cohort. You should use the set assignment released in the same calendar year as the new cohort starts to ensure they have two years for that assignment. Students are allowed one resubmission of work based on the same live assignment.

You must have made unit entries before submitting NEA work for moderation.

Appendix A of this specification gives guidance for creating electronic evidence for the NEA units. Read Appendix A in conjunction with the unit content and assessment criteria grids to help you plan the delivery of each unit.

The rest of this section is about how to manage the delivery and marking of the set assignments so that assessment is valid and reliable. Please note that failing to meet these requirements might be considered as malpractice.

Here is a summary of what you need to do.

You **must**:

- have covered the knowledge, understanding and skills with your students and be sure they are ready for assessment **before** you start the summative assessment. This may include students practising applying their learning and receiving feedback from teachers in preparing to take the assessment.
- use an OCR-set assignment for summative assessment of the students.
- give students the **Student Guide** before they start the assessment.
- familiarise yourself with the assessment guidance relating to the tasks. The assessment guidance for each unit is in **Section 4** after the assessment criteria grids and with the student tasks in the assignments.
- make sure students are clear about the tasks they must complete and the assessment criteria they are attempting to meet.
- students need to be supervised in all 'practical' work to ensure that they are following health and safety protocols.
- in a number of units there are specific criteria which require safe working; where this is the case, the criteria cannot be achieved if staff have to intervene during the assessment to ensure the students' safety. In such instances, staff should assist the student to ensure their safety and so that they can continue with the subsequent assessment tasks, but they cannot be credited for the criteria directly addressing the practical skills where they have had to be helped unless the assessment guidance states otherwise.
- give students a reasonable amount of time to complete the assignments and be fair and consistent to all students. The estimated time we think each assignment should take is stated in the OCR-set assignments. In that time students can work on the tasks under the specified conditions until the date that you collect the work for centre assessment.
- tell the students the resources they can use in the assignment before they start the assessment tasks.
- only give students OCR-provided templates. If they choose to use a different template from a book, a website or course notes (for example, to create a plan) they **must** make sure the source is referenced.
- monitor students' progress to make sure work is capable of being assessed against the assessment criteria, on track for being completed in good time and is the student's own work:
    - NEA work must be completed in the centre under teacher supervision in normal curriculum time:
        - work must be completed with enough supervision to make sure that it can be authenticated as the student's own work. You must be familiar with the requirements of the JCQ document **AI Use in Assessments: Protecting the Integrity of Qualifications** before assessment starts.
        - there may be exceptions to the requirement for supervised conditions if there is work to complete to support the assignment tasks (e.g. research). The assignment and assessment guidance will specify if there are exceptions.

  - Where students are allowed to complete work outside of supervised conditions (e.g. research that may be allowed between supervised sessions) you **must** make sure that they only bring notes relating to the work they are allowed to complete unsupervised into the supervised sessions (e.g. notes relating to the research they have done) and to make sure any work they have done is independent. They must not use unsupervised time as an opportunity to:
    - Create drafts of work for their tasks.
    - Gather information to use in other aspects of their tasks.
  - if you provide any material to prepare students for the set assignment, you must adhere to the rules on using referencing and on acceptable levels of guidance to students. This is in section **6.2.3 and 6.3**.
  - students must produce their work independently (see sections **6.2.1 and 6.3**).
  - you must make sure students know to keep their work and passwords secure and know that they must not share completed work with other students, use any aspect of another student's work or share their passwords.

- complete the **Teacher Observation Record** that is with the assignments for tasks that state it is needed. You **must** follow the guidance given when completing it.
- use the assessment criteria to assess students' work.
- before submitting a final outcome to us, you can allow students to repeat any part of the assignment and rework their original evidence. But any feedback you give to students on the original (assessed) evidence, must:
  - only be generic.
  - be recorded.
  - be available to the OCR assessor.

(See **Section 6.3** on **Feedback** and **Section 6.4.4** on **resubmitting work**).

You **must not**:

- change any part of the OCR-set assignments (scenarios or tasks).
- accept multiple reattempts of work where small changes have been made in response to feedback.
- allow teachers or students to add, amend or remove any work **after** submission for moderation by OCR. This will constitute malpractice.
- give detailed advice and suggestions to individuals or the whole class on how work may be improved to meet the assessment criteria. This includes giving access to student work as an exemplar.
- allow students access to their assignment work between teacher supervised sessions. (There may be exceptions where students are allowed to complete work independently (e.g. research). Any exceptions will be stated in the assignments.)
- practise the live OCR-set assignment tasks with the students.

6.2.1 Ways to authenticate work

You must use enough supervision and complete enough checks to be confident that the work you mark is the student's own and was produced independently.

Where possible, you should discuss work in progress with students. This will make sure that work is being completed in a planned and timely way and will give you opportunities to check the authenticity of the work.

You **must**:

- have read and understood the JCQ document **AI Use in Assessments: Protecting the Integrity of Qualifications**.
- make sure students and other teachers understand what constitutes plagiarism.
- not accept plagiarised work as evidence.
- use supervision and questioning as appropriate to confirm authenticity.
- make sure students and teachers fill in declaration statements.

6.2.2 Group work

Group work is not allowed for the NEA assignments in these qualifications.

6.2.3 Plagiarism

Students must use their own words when they produce final written pieces of work to show they have genuinely applied their knowledge and understanding. When students use their own words, ideas and opinions, it reduces the possibility of their work being identified as plagiarised. Plagiarism is:

- the submission of someone else's work as your own
- failure to acknowledge a source correctly, including any use of Artificial Intelligence (AI).

You might find the following JCQ documents helpful:

- **Plagiarism in Assessments**
- **AI Use in Assessments: Protecting the Integrity of Qualifications**

Due to increasing advancements in AI technology, we strongly recommend that you are familiar with the likely outputs from AI tools. This could include using AI tools to produce responses to some of the assignment tasks, so that you can identify typical formats and wording that these may produce. This may help you identify any cases of potential plagiarism from students using AI tools to generate written responses.

Plagiarism makes up a large percentage of cases of suspected malpractice reported to us by our assessors. You must **not** accept plagiarised work as evidence.

Plagiarism often happens innocently when students do not know that they must reference or acknowledge their sources or aren't sure how to do this. It's important to make sure your students understand:

- the meaning of plagiarism and what penalties may be applied.
- that they can refer to research, quotations or evidence produced by somebody else, but they must list and reference their sources and clearly mark quotations.

- quoting someone else's work, even when it's properly sourced and referenced, doesn't evidence understanding. The student must 'do' something with that information to show they understand it. For example, if a student has to analyse data from an experiment, quoting data doesn't show that they understand what it means. The student must interpret the data and, by relating it to their assignment, say what they think it means. The work must clearly show how the student is using the material they have referenced to inform their thoughts, ideas or conclusions.

We have **The OCR Guide to Referencing** on our website. We have also produced a **poster** about referencing and plagiarism which may be useful to share with your students.

Teach your students how to reference and explain why it's important to do it. At Key Stage 5 they must:

- use quote marks to show the beginning and end of the copied work.
- list the html address for website text and the date they downloaded information from the website.
- for other publications, list:
    - the name of the author.
    - the name of the resource/book/printed article.
    - the year in which it was published.
    - the page number.

Teach your students to:

- always reference material copied from the internet or other sources. This also applies to infographics (graphical information providing data or knowledge).
- always identify information they have copied from teaching handouts and presentations for the unit, using quote marks and stating the text is from class handouts.

Identifying copied/plagiarised work

Inconsistencies throughout a student's work are often indicators of plagiarism. For example:

- different tones of voice, sentence structure and formality across pieces of work.
- use of American expressions, spellings and contexts (such as American laws and guidelines).
- dated expressions and references to past events as being current.
- sections of text in a document where the font or format is inconsistent with other sections.

What to do if you think a student has plagiarised

If you identify plagiarised work during assessment or internal standardisation, you must:

- consider the plagiarism when judging the number of assessment criteria achieved.
    - if the work is part of the moderation sample, it must be included with the other work provided to the OCR assessor. You must add a note on the Unit Recording Sheet to state that there is plagiarism in the work and the number of criteria achieved has been adjusted accordingly.

- report the student(s) for plagiarism in line with the JCQ document **Suspected Malpractice Policies and Procedures**
    - fill in the **JCQ form M1**.

In line with JCQ's policies and procedures on suspected malpractice, the penalties applied for plagiarism will usually result in the work not being allowed or the mark being significantly reduced.

6.3 Feedback

Feedback to students on work in progress towards summative assessment

You can discuss work in progress towards summative assessment with students to make sure it's being done in a planned and timely way. It also provides an opportunity to check the authenticity of the work. You must intervene if there's a health and safety risk (and reflect this in your assessment if the student's ability to operate safely and independently if that is part of the criteria).

Generic guidance to the whole class is also allowed. This could include reminding students to check they have provided evidence to cover all key aspects of the task. Individual students can be prompted to double check for gaps in evidence providing that specific gaps are not pointed out to them.

You can give general feedback and support if one or more students are struggling to get started on an aspect of the assignment or following a break between sessions working on the assignment. For example, if a student is seeking more guidance that suggests they are not able to apply knowledge, skills and understanding to complete their evidence, you can remind them that they had a lesson which covered the topic. The student would then need to review their own notes to find this information and apply it as needed.

If a student needs additional help to get started on an initial task that is critical to accessing the rest of the assessment, you can provide this help if you feel it is necessary, but you must not award the student with any assessment criteria directly associated with the part(s) of the task for which they received help.

With the exception of the specific feedback allowed to help students start a critical task, mentioned above, feedback must not provide specific advice and guidance that would be construed as coaching. This would compromise the student's ability to independently perform the task(s) they are doing and constitutes malpractice. Our assessors use a number of measures to assure themselves the work is the student's own.

Once work has been assessed, you must give feedback to students on the work they submitted for assessment.

Feedback **must**:

- be supportive, encouraging and positive.
- tell the student what has been noticed, not what the teacher thinks (for example, if you have observed the student completing a task, you can describe what happened, what was produced and what was demonstrated).

Feedback **can**:

- identify what task and part of the task could be improved, but not say how to improve it. You could show the student work from a **different** unit that demonstrates higher achievement, but you must not detail to the student how they could achieve that in their work. If you are using another student's work from a different unit as an example, you must anonymise this work and make sure that the potential to plagiarise from this work is minimised. You could remind students that they had a lesson on a specific topic and that they could review their notes, but you must not tell them how they could apply the teaching to improve their work.

- comment on what has been achieved, for example 'the evidence meets the P2 and M2 criteria'.
- identify that the student hasn't met a command word or assessment criteria requirement. For example, 'This is a description, not an evaluation'.
- use text from the specification, assignment or assessment criteria in general guidance to clarify what is needed in the work. For example, 'Research the fundamentals of the genetic disorder and how genes and DNA are affected.'

Feedback **must not**:

- point out specific gaps. For example, you must not prompt the student to include specific detail in their work, such as 'Add the countries the gene therapy is offered in and people's understanding of the gene therapy.'
- be so detailed that it leads students to the answer. For example, you must not give:
    - model answers.
    - step-by-step guidance on what to do to complete or improve work.
    - headings or templates that include examples which give all or part of what students have to write about or produce.
- talk the student through how to achieve or complete the task.
- give detail on where to find information/evidence.

In other words, feedback must help the student to take the initiative in making changes. It must not direct or tell the student what to do to complete or improve their work in a way that means they do not need to think how to apply their learning. Students need to recall or apply their learning. You must not do the work for them.

Neither you nor the student can add, amend or remove any work after the final mark has been submitted for moderation.

Sections 6.4.4 and 6.4.6 give more guidance for students who wish to reattempt or resubmit their work following feedback.

What over-direction might look like

When we see anything that suggests the teacher has led students to the answer, we become concerned because it suggests students have not worked independently to produce their assignment work. The following are examples of what might indicate over-direction by the teacher:

- prompts that instruct students to include specific detail in their work, such as, 'You need to include the aims of the activity. Who is it aimed at? What is the purpose of the activity? How will it benefit the specific group/individual?
- headings or templates that include examples which give all or part of what students have to write about or produce, such as sources of support.

OCR Assessors will report suspected malpractice when they cannot see differences in content between students' work in the sample they are moderating. An exception is when students have only used and referenced technical facts and definitions. If the OCR assessor is in any doubt, they will report suspected malpractice. The decision to investigate or not is made by us, not the assessor.

6.3.1 Reporting suspected malpractice

It is the responsibility of the head of centre to report all cases of suspected malpractice involving teachers or students.

A JCQ Report of Suspected Malpractice form (JCQ/M1 for student suspected malpractice or JCQ/M2 for staff suspected malpractice) is available to download from the **JCQ website**. The form must be completed as soon as possible and emailed to us at **malpractice@ocr.org.uk**.

When we ask centres to gather evidence to assist in any malpractice investigation, heads of centres must act promptly and report the outcomes to us.

The JCQ document **Suspected Malpractice Policies and Procedures** has more information about reporting and investigating suspected malpractice, and the possible sanctions and penalties which could be imposed. You can also find out more on our **website.**

6.3.2 Student and centre declarations

Both students and teachers must declare that the work is the student's own:

- **each student** must sign a declaration before submitting their work to their teacher. A **candidate authentication statement** can be used and is available to download from our **website**. You must keep these statements in the centre until all enquiries about results, malpractice and appeal issues have been resolved. You **must** record a mark of zero if a student cannot confirm the authenticity of their work.
- **teachers** must declare the work submitted for centre assessment is the students' own work by completing a **centre authentication form (CCS160)** for each cohort of students for each unit. You must keep centre authentication forms in the centre until all post-results issues have been resolved.

6.3.3 Generating evidence

The set assignments will tell the students what they need to do to meet the assessment criteria for the NEA units. It is your responsibility to make sure that the methods of generating evidence for the assignments are:

- valid
- safe and manageable
- suitable to the needs of the student.

Valid

The evidence presented must be valid. For example, it would not be appropriate to present an organisation's equal opportunities policy as evidence towards a student's understanding of how the equal opportunities policy operates in an organisation. It would be more appropriate for the student to incorporate the policy in a report describing the different approaches to equal opportunities.

Safe and manageable

You must make sure that methods of generating evidence are safe and manageable and do not put unnecessary demands on the student.

Suitable to the needs of the student

We are committed to ensuring that achievement of these qualifications is free from unnecessary barriers.

You must follow this commitment through when modifying tasks (where this is allowed) and/or considering assessment and evidence generation. If you are modifying tasks and are not sure what is acceptable, **contact us**.

Observation and questioning

The primary evidence for assessment is the work submitted by the student, however the following assessment methods might be suitable for teachers/assessors to use for some aspects of these qualifications, where identified:

- **observation** of a student doing something
- **questioning** of the student or witness.

Observation

The teacher/assessor and student should plan observations together, but it is the teacher's/assessor's responsibility to record the observation properly (for example observing a student undertaking a practical task). More information is in the Teacher Observation Records section.

Questioning

Questioning the student is normally an ongoing part of the formative assessment process and may, in some circumstances, provide evidence to support achievement of the criteria.

Questioning is often used to:

- test a student's understanding of work which has been completed outside of the classroom
- check if a student understands the work they have completed
- collect information on the type and purpose of the processes a student has gone through.

If questioning is used as evidence towards achievement of specific topic areas, it is important that teachers/assessors record enough information about what they asked and how the student replied, to allow the assessment decision to be moderated.

6.3.4 Teacher Observation Records

You **must** complete the Teacher Observation Record form in the OCR-set assignment for:

Unit F173 Biomedical techniques (Task 2, Topic Areas 4 and 5) for each student as evidence of a safely performed planned investigation of unidentified samples. The Teacher Observation Record form must provide evidence of how the student performed the planned investigation safely.

Unit F175 Human reproduction (Task 3, Topic Areas 1, 2, 3 and 4) for each student as evidence of delivering a presentation of the plan created either in Task 1 or Task 2. The Teacher Observation Record form must provide evidence of how the student delivered the presentation effectively, with clear explanations of rationale beyond what is included in the presentation documentation.

Unit F177 Drug development (Task 3, Topic Areas 1, 2, 3 and 4) for each student as evidence of delivering a pitch of the proposal completed in Task 2. The Teacher Observation Record form must provide evidence of how the student delivered the presentation to the intended audience, with explanations of rationale beyond what is included in the presentation documentation.

Teacher observation **cannot** be used as evidence of achievement for a whole unit. Most evidence **must** be produced directly by the student. Teacher observation **must only** be used where specified as an evidence requirement.

Teacher Observation Records must be suitably detailed for each student, to help assessors to determine if the assessment criteria have been met. You must follow the guidance provided in the 'guidance notes' section of the form so that the evidence captured and submitted is appropriate. Both you and the student must sign and date the form to show that you both agree its contents.

Where the guidance has not been followed, the reliability of the form as evidence may be called into question. If doubt about the validity of the Teacher Observation Record form exists, it cannot be used as assessment evidence and marks based on it cannot be awarded. OCR assessors will be instructed to adjust centre marks accordingly.

6.3.5 Presentation of the final piece of work

Students must submit their evidence in the format specified in the tasks where specific formats are given. Written work can be digital (e.g. word processed) or hand-written and tables and graphs (if relevant) can be produced using appropriate ICT.

Any sourced material must be suitably acknowledged. Quotations must be clearly marked and a reference provided.

A completed Unit Recording Sheet (URS) must be attached to work submitted for moderation.

The URS can be downloaded from the qualification webpage. Centres **must** show on the URS where specific evidence can be found. The URS tells you how to do this.

Work submitted digitally for moderation should be on electronic media (for example, on our portal, CD or USB Drive). Work **must** be in a suitable file format and structure. **Appendix A** gives more guidance about submitting work in digital format.

6.4 Assessing NEA units

All NEA units are assessed by teachers and externally moderated by OCR assessors. Assessment of the set assignments must adhere to JCQ's **Instructions for Conducting Coursework**.

The centre is responsible for appointing someone to act as the internal assessor. This would usually be the teacher who has delivered the programme but could be another person from the centre. The assessment criteria must be used to assess the student's work. These specify the levels of skills, knowledge and understanding that the student needs to demonstrate.

6.4.1 Applying the assessment criteria

When students have completed the assignment, they must submit their work to you to be assessed.

You must assess the tasks using the assessment criteria and any additional assessment guidance provided. Each criterion states what the student needs to do to achieve that criterion (e.g. Create an appropriate specialised diet). The command word and assessment guidance provide additional detail about breadth and depth where it is needed.

You must judge whether each assessment criterion has been **successfully achieved** based on the evidence that a student has produced. For the criterion to be achieved, the evidence must show that all aspects have been met in sufficient detail.

When making a judgement about whether a criterion has been **successfully achieved**, you must consider:

- the requirements of the NEA task
- the criterion wording, including the command word used and its definition
- any assessment guidance for the criterion

- the unit content that is being assessed.

You must annotate the work to show where evidence meets each criterion (see **Section 6.4.2**). You can then award the criterion on the Unit Recording Sheet (URS). Assessment should be positive, rewarding achievement rather than penalising failure or omissions.

The number of criteria needed for each unit grade (Pass, Merit or Distinction) is provided in **Section 5**.

You must complete a Unit Recording Sheet (URS) for each unit a student completes. On the URS you must identify:

- whether the student has met each criterion or not (by adding a tick (✓) or X in the column titled **Assessment criteria achieved**)
    - you should also indicate where the evidence can be found if a '✓' is identified.
    - a X indicates that there is insufficient evidence to fully meet the criterion or it was not attempted.
- the total number of criteria achieved by the student for the unit.

You must be convinced, from the evidence presented, that students have worked independently to the required standard.

Your centre must internally standardise the assessment decisions for the cohort **before** you give feedback to students (see **Section 6.4.3**). When you are confident the internal assessment and standardisation process is complete, you can submit work for moderation at the relevant time. You **must not** add, amend or remove any work after it has been submitted to us for final moderation.

6.4.2 Annotating students' work

Each piece of NEA work must show how you are satisfied the assessment criteria have been met.

Comments on students' work and the Unit Recording Sheet (URS) provide a means of communication between teachers during internal standardisation, and with the OCR assessor if the work is part of the moderation sample.

6.4.3 Internal standardisation

It is important that all teachers are assessing work to common standards. For each unit, centres must make sure that internal standardisation of outcomes across teachers and teaching groups takes place using an appropriate procedure.

This can be done in a number of ways. In the first year, reference material and OCR training meetings will provide a basis for your centre's own standardisation. In following years, this, and/or your own centre's archive material, can be used. We advise you to hold preliminary meetings of staff involved to compare standards through cross-marking a small sample of work. After you have completed most of the assessment, a further meeting at which work is exchanged and discussed will help you make final adjustments.

If you are the only teacher in your centre assessing these qualifications, we still advise you to make sure your assessment decisions are internally standardised by someone else in your centre. Ideally this person will have experience of these types of qualifications, for example someone who:

- is delivering a similar qualification in another subject.
- has relevant subject knowledge.

You must keep evidence of internal standardisation in the centre for the OCR assessor to see.

We have a **guide** to how internal standardisation can be approached on our website.

6.4.4 Reattempting work to improve the grade before submitting marks to OCR

As described in Section 6.2, **before** submitting a final outcome to us for external moderation, you can allow students to repeat any element of the assignment and rework their original evidence. We refer to this as a reattempt. A reattempt allows the student to reflect on **internal** feedback, and to improve their work. A reattempt is **not** an iterative process where students make small modifications through ongoing feedback to eventually achieve the desired outcome.
Any feedback **must** be noted by the teacher and a record of this kept in centre. We have provided a feedback form for this purpose, which can be found in the OCR website.

A reattempt must be done before submission for external moderation. When a student submits the work to you as final for external moderation, they cannot complete any further work on any aspect of it.

6.4.5 Submitting outcomes

When you have assessed the work and it has been internally standardised, outcomes can be submitted to us. For the purpose of submission, outcomes will be considered as 'marks'. You will submit the total number of criteria achieved for units as marks. You can find the key dates and timetables on our **website**.

There should be clear evidence that work has been attempted and some work produced. If a student does not submit any work for an NEA unit, the student should be identified as being absent from that unit.

If a student completes any work at all for an NEA unit, you must assess the work using the assessment criteria and award the appropriate number of criteria. This might be zero.

6.4.6 Resubmitting moderated work to OCR to improve the grade

We use the term 'resubmission' when referring to student work that has previously been submitted to OCR for moderation. Following OCR moderation, if you and the student feel they have not performed at their best during the assessment, the student can, with your agreement, improve their work and resubmit it to you again for assessment. You must be sure it is in the student's best interests to resubmit the work for assessment. There is one resubmission opportunity per NEA assignment.

Students can only resubmit work using the same assignment if the assignment is still live. The live assessment dates and intended cohort will be shown on the front cover of the assignment. We will not accept work based on an assignment that is no longer live.

If students wish to resubmit a unit after the live assessment date has passed, they must submit work using the new live assignment.

6.5 Moderating NEA units

The purpose of external moderation is to make sure that the standard of assessment is the same for all centres and that internal standardisation has taken place.

The administration pages of our **website** give full details about how to submit work for moderation.

This includes the deadline dates for entries and submission of marks. For moderation to happen, you must submit your marks by the deadline.

6.5.1 Sample requests

Once you have submitted your marks, we will tell you which work will be sampled as part of the moderation process. Samples will include work from across the range of students' attainment. Copies of students' work must be kept until after their qualifications have been awarded and any review of results or appeals processed.

Centres will receive the final outcomes of moderation when the provisional results are issued. Results reports will be available for you to access. More information about the reports that are available is on our website.

We need sample work to help us monitor standards. We might ask some centres to release work for this purpose. We will let you know as early as possible if we need this from you. We always appreciate your co-operation.

7 Administration

This section gives an overview of the processes involved in administering these qualifications. Some of the processes require you to submit something to OCR by a specific deadline. More information about the processes and deadlines involved at each stage is on our **administration pages**.

7.1 Assessment availability

There are two assessment opportunities available each year for the externally assessed units: one in January and one in June. Students can be entered for different units in different assessment series.

All students must take the exams at a set time on the same day in a series.

NEA assignments can be taken by students at any time during the live period shown on the front cover. It is important you use the set assignment that is released in the same calendar year as the new cohort starts to ensure that students have two years to use the assignment.

There are two windows each year to submit NEA outcomes. Submission of student outcomes will initiate the moderation visit by the OCR Assessor.

You must make unit entries for students before you can submit outcomes to request a visit. All dates relating to NEA moderation are on our administration pages.

Qualification certification is available at each results release date.

7.2 Collecting evidence of student performance to ensure resilience in the qualifications system

Regulators have published guidance on collecting evidence of student performance as part of long-term contingency arrangements to improve the resilience of the qualifications system. You should review and consider this guidance when delivering this qualification to students at your centre.

For more detailed information on collecting evidence of student performance please visit our website.

7.3 Equality Act information relating to Cambridge Advanced Nationals

The Cambridge Advanced Nationals require assessment of a broad range of skills and, as such, prepare students for further study and higher-level courses.

The Cambridge Advanced National qualifications have been reviewed to check if any of the competences required present a potential barrier to disabled students. If this was the case, the situation was reviewed again to make sure that such competences were included only where essential to the subject.

7.4 Accessibility

There can be adjustments to standard assessment arrangements based on the individual needs of students. It is important that you identify as early as possible if students have disabilities or particular difficulties that will put them at a disadvantage in the assessment situation and that you choose a qualification or adjustment that allows them to demonstrate attainment.

If a student requires access arrangements that need approval from us, you must use **Access arrangements (online)** to gain approval. You must select the appropriate qualification type(s) when you apply. Approval for GCSE or GCE applications alone does not extend to other qualification types. You can select more than one qualification type when you make an application. For guidance or support please contact the **OCR Special Requirements Team**.

The responsibility for providing adjustments to assessment is shared between your centre and us. Please read the JCQ document **Access Arrangements and Reasonable Adjustments**.

If you have students who need a post-exam adjustment to reflect temporary illness, indisposition or injury when they took the assessment, please read the JCQ document **A guide to the special consideration process.**

If you think any aspect of these qualifications unfairly restricts access and progression, please email **Support@ocr.org.uk** or call our Customer Support Centre on **01223 553998**.

The following access arrangements are allowed for this specification:

Access arrangement	Type of assessment
Reader/Computer reader	All assessments
Scribes/Speech recognition technology	All assessments
Practical assistants	All assessments
Word processors	All assessments
Communication professional	All assessments
Language modifier	All assessments
Modified question paper	Timetabled exams
Extra time	All assessments with time limits

7.5 Requirements for making an entry

We provide information on key dates, timetables and how to submit marks on our **website**.

Your centre must be registered with us to make entries. We recommend that you apply to become a registered centre with us well in advance of making your first entries. Details on how to register with us are on our **website**.

It is essential that unit entry codes are stated in all correspondence with us.

7.5.1 Making estimated unit entries

Estimated entries are not needed for Cambridge Advanced Nationals qualifications.

7.5.2 Making final unit entries

When you make an entry, you must state the unit entry codes and the component codes. Students submitting work must be entered for the appropriate unit entry code from the table below.

The short title for these Cambridge Advanced Nationals is CAN AAQ. This is the title that will be displayed on our secure website, **Teach Cambridge**, and some of our administrative documents.

You do **not** need to register your students first. **Individual unit entries should be made for each series in which you intend to submit or resubmit an NEA unit or sit an externally assessed examination**.

Make a certification entry using the overall qualification code (see **Section 7.5**) in the final series only.

Unit entry code	Component code	Assessment method	Unit titles
F170	01	Written paper	Fundamentals of human biology
F171	01	Written paper	Health and disease
F172A	01	Visiting	Genetics
F172B	02	Remote	Genetics
F173A	01	Visiting	Biomedical techniques
F173B	02	Remote	Biomedical techniques
F174A	01	Visiting	Nutrition and metabolism
F174B	02	Remote	Nutrition and metabolism
F175A	01	Visiting	Human reproduction
F175B	02	Remote	Human reproduction
F176A	01	Visiting	The brain
F176B	02	Remote	The brain
F177A	01	Visiting	Drug development
F177B	02	Remote	Drug development

7.6 Certification rules

You must enter students for qualification certification separately from unit assessment(s). If a certification entry is **not** made, no overall grade can be awarded. These are the qualifications that students should be entered for:

- OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate) - certification code H049.
- OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate) - certification code H149.

7.7 Unit and qualification resits

Students can resit each unit and the best result will be used to calculate the certification result.

Resit opportunities must be fair to all students and **not** give some students an unfair advantage over other students. For example, the student must not have direct guidance and support from the teacher in producing further evidence for NEA units. When resitting an NEA unit, students must submit new, amended or enhanced work, as detailed in the JCQ **Instructions for Conducting Coursework**.

When you arrange resit opportunities, you must make sure that you do not adversely affect other assessments being taken.

Arranging a resit opportunity is at the centre's discretion. Summative assessment series must not be used as a diagnostic tool and resits should only be planned if the student has taken full advantage of the first assessment opportunity and any formative assessment process.

7.8 Post-results services

A number of post-results services are available:

- Reviews of results - if you think there might be something wrong with a student's results, you may submit a review of marking or moderation.
- Missing and incomplete results - if an individual subject result for a student is missing, or the student has been omitted entirely from the results supplied you should use this service.
- Access to scripts - you can ask for access to marked scripts.
- Late certification - following the release of unit results, if you have not previously made a certification entry, you can make a late request, which is known as a **late certification**. This is a free service.

Please refer to the JCQ **Post-Results Services booklet** and the **OCR Administration page** for more guidance about action on the release of results.

For NEA units the enquiries on results process cannot be carried out for one individual student; the outcome of a review of moderation must apply to a centre's entire cohort.

Appendix A: Guidance for the production of electronic evidence

Structure for evidence

The NEA units in these qualifications are units F172-F177. For each student, all the tasks together will form a portfolio of evidence, stored electronically. Evidence for each unit must be stored separately.

An NEA portfolio is a collection of folders and files containing the student's evidence. Folders should be organised in a structured way so that the evidence can be accessed easily by a teacher or OCR assessor. This structure is commonly known as a folder tree. It would be helpful if the location of particular evidence is made clear by naming each file and folder appropriately and by use of an index called 'Home Page'.

There should be a top-level folder detailing the student's centre number, OCR candidate number, surname and forename, together with the unit code (F172-F177), so that the portfolio is clearly identified as the work of one student.

Each student's portfolio should be stored in a secure area on the centre's network. Before submitting the portfolio to OCR, the centre should add a folder to the folder tree containing the internal assessment and summary forms.

Data formats for evidence

It is necessary to save students' work using an appropriate file format to minimise software and hardware capability issues.

Students must use formats appropriate:

- to their evidence
- for viewing for assessment and moderation.

Formats must be open file formats or proprietary formats for which a downloadable reader or player is available. If a downloadable reader or player is not, the file format is **not** acceptable.

Evidence submitted is likely to be in the form of word-processed documents, presentation documents, digital photos and digital video.

All files submitted electronically must be in the formats listed on the following page. Where new formats become available that might be acceptable, we will give more guidance. It is the centre's responsibility to make sure that the electronic portfolios submitted for moderation are accessible to the OCR assessor and fully represent the evidence available for each student.

Standard file formats acceptable as evidence for the Cambridge Advanced Nationals are listed here.

File type	File format	Max file size*
Audio	.3g2 .3ga .aac .aiff .amr .m4a .m4b .m4p .mp3 .wav	25GB
Compression	.zip .zipx .rar .tar .tar .gz .tgz .7z .zipx .zz	25GB
Data	.xls .xlsx .mdb .accdb .xlsb	25GB
Document	.odt .pdf .rtf .txt .doc .docx .dotx .	25GB
Image	.jpg .png .jpeg .tif .jfif .gif .heic .psd .dox .pcx .bmp .wmf	25GB
Presentation	.ppt .pptx .pdf .gslides .pptm .odp .ink .potx .pub	25GB
Video	.3g2 .3gp .avi .flv .m4v .mkv .mov .mp4 .mp4v .wmp .wmv	25GB
Web	.wlmp .mts .mov-1 .mp4-1 .xspf .mod .mpg	25GB

If you are using **.pages** as a file type, please convert this to a .pdf prior to submission.

*max file size is only applicable if using our Submit for Assessment service.

Submit for Assessment is our secure web-based submission service. You can access Submit for Assessment on any laptop or desktop computer running Windows or macOS and a compatible browser. It supports the upload of files in the formats listed in the table above as long as they do not exceed the maximum file size. Other file formats and folder structures can be uploaded within a compressed file format.

When you view some types of files in our Submit for Assessment service, they will be streamed in your browser. It would help your OCR assessor or examiner if you could upload files in the format shown in the table below:

File type	File format	Chrome	Firefox
Audio	.mp3	Yes	Yes
Audio	.m4a	Yes	Yes
Audio	.aac	No	Yes
Document	.txt	Yes	Yes
Image	.png	Yes	Yes
Image	.jpg	Yes	Yes
Image	.jpeg	Yes	Yes
Image	.gif	Yes	Yes
Presentation	.pdf	Yes	Yes
Video	.mp4	Yes	Yes
Video	.mov	No	Yes
Video	.3gp	Yes	No
Video	.m4v	Yes	Yes
Web	.html	Yes	Yes
Web	.htm	Yes	Yes

Appendix B: Command Words

External assessment

The table below shows the command words that will be used in exam questions. This shows what we mean by the command word and how students should approach the question and understand its demand. Remember that the rest of the wording in the question is also important.

Command Word	Meaning
Analyse	• Separate or break down information into parts and identify their characteristics or elements • Explain the different elements of a topic or argument and make reasoned comments • Explain the impacts of actions using a logical chain of reasoning
Annotate	• Add information, for example, to a table, diagram or graph
Calculate	• Work out the numerical value. Show your working unless otherwise stated
Choose	• Select an answer from options given
Compare	• Give an account of the similarities and differences between two or more items or situations
Complete	• Add information, for example, to a table, diagram or graph to finish it
Describe	• Give an account that includes the relevant characteristics, qualities or events
Discuss (how/whether/etc)	• Present, analyse and evaluate relevant points (for example, for/against an argument) to make a reasoned judgement
Draw	• Produce a picture or diagram
Explain	• Give reasons for and/or causes of something • Make something clear by describing and/or giving information
Give examples	• Give relevant examples in the context of the question
Identify	• Name or provide factors or features from stimulus
Label	• Add information, for example, to a table, diagram or graph until it is final
Outline	• Give a short account or summary
State	• Give factors or features • Give short, factual answers

Non examined assessment (NEA)

The table shows the command words that will be used in the NEA assignments and/or assessment criteria.

Command Word	Meaning
Adapt	• Change to make suitable for a new use or purpose
Analyse	• Separate or break down information into parts and identify their characteristics or elements • Explain the different elements of a topic or argument and make reasoned comments • Explain the impacts of actions using a logical chain of reasoning
Assess	• Offer a reasoned judgement of the standard or quality of situations or skills. The reasoned judgement is informed by relevant facts
Calculate	• Work out the numerical value. Show your working unless otherwise stated
Classify	• Arrange in categories according to shared qualities or characteristics
Compare	• Give an account of the similarities and differences between two or more items, situations or actions
Conclude	• Judge or decide something
Describe	• Give an account that includes the relevant characteristics, qualities or events
Discuss (how/whether/etc)	• Present, analyse and evaluate relevant points (for example, for/against an argument) to make a reasoned judgement
Evaluate	• Make a reasoned qualitative judgement considering different factors and using available knowledge/experience
Examine	• To look at, inspect, or scrutinise carefully, or in detail
Explain	• Give reasons for and/or causes of something • Make something clear by describing and/or giving information
Interpret	• Translate information into recognisable form • Convey one's understanding to others, e.g. in a performance
Investigate	• Inquire into (a situation or problem)
Justify	• Give valid reasons for offering an opinion or reaching a conclusion
Research	• Do detailed study in order to discover (new) information or reach a (new) understanding
Summarise	• Express the most important facts or ideas about something in a short and clear form

We might also use other command words but these will be:

- commonly used words whose meaning will be made clear from the context in which they are used (e.g. create, improve, plan)
- subject specific words drawn from the unit content.

Appendix C: How Science Works Concepts and Skills

The concepts and skills set out in this section are intended to develop learners as critical and creative thinkers, and to enable learners to solve problems in a variety of contexts. The concepts and skills are set out as references and associated statements.

The concepts and skills in this section will be assessed in the examined assessment (EA) and non-examined assessment (NEA) units where appropriate.

Terms associated with measurement and data analysis are used in accordance with their definitions in the Association of Science Education publication *The Language of Measurement (2010).*

How Science Works Reference	How Science Works Statement	To include understanding of:	Areas of the specification covering the HSW concepts and skills
HSW1	Use theories, models, and ideas to develop scientific explanations	• Peer review • Use of a variety of models (representational, spatial, descriptive, computational, and mathematical) to solve problems • Hypotheses and predictions	**F170:** 1.1.1, 2.1.2, 3.2.2 **F171:** 2.1, 3.1 **F172:** 1.1, 2.2.1, 2.3.2, 3.2.2, 4.2.2 **F173:** 5.2 **F174:** 1.3.2 **F176:** 1.1, 1.2, 1.3, 2.1.2, 2.2.1, 5.1 **F177:** 2.2
HSW2	Use knowledge and understanding to pose scientific questions, define scientific problems, present scientific arguments and ideas	• Use of online and offline research skills • Correctly citing sources of information • How to present reasoned explanations, including relating data to hypotheses	**F170:** 1.1.2, 3.3.1 **F171:** 4.1, 5.1.1 **F172:** 1.3.2 **F173:** 1.1.1, 2.4, 5.1.2 **F176:** 1.1
HSW3	Use appropriate methodology, including information and communication technology (ICT) to answer scientific questions and solve scientific problems	• Experimental design, including to solve problems in a practical context • Control variables, dependent variables, and independent variables • Appropriateness of an experimental method to meet expected outcomes • Importance of scientific quantities and how they are determined • How to determine an appropriate sample size and/or range of values to be measured	**F170:** 2.1.3 **F171:** 4.2.2, 5.2 **F173:** 1.1.2, 1.2, 2.1, 2.2.2, 2.4, 3.2.1, 3.3.1, 3.5.1, 4.2.2, 4.3 **F174:** 3.3.3, 4.2.1 **F175:** 2.1 **F176:** 2.2.1, 3.1.1 **F177:** 2.4.1, 2.4.2

How Science Works Reference	How Science Works Statement	To include understanding of:	Areas of the specification covering the HSW concepts and skills
HSW4	Carry out experimental and investigative activities, including appropriate risk management, in a range of contexts	• How to use the apparatus, techniques and procedures correctly, skilfully and safely • Apply investigative approaches and methods to practical work	**F170:** 1.1.2, 1.2.3, 2.2.3, 4.1.3, 4.1.4 **F171:** 2.1 **F172:** 3.2.2, 3.2.3 **F173:** 1.2, 2.1, 2.3, 3.3.2, 3.5.3, 4.2.4 **F174:** 4.2.3 **F177:** 1.4, 2.1.1
HSW5	Use data to provide evidence, and recognise correlations and causal relationships	• Appropriate units for measurements (this already exists as part of Maths skills) • How to present observations and data in an appropriate format • How to process data using appropriate prefixes (e.g. tera, giga, mega, kilo, centi, milli, micro and nano) and powers of ten for orders of magnitude • How to distinguish between a correlation and a cause-effect link • How to translate data from one form to another • How to identify the presence/absence of a mechanism as reasonable grounds for accepting/rejecting a claim that a factor is a cause of an outcome	**F170:** 1.1.2, 1.1.3, 2.1.3, 4.1.1 **F171:** 1.2.2, 2.1 **F173:** 2.1, 3.3.1, 4.2.3 **F174:** 2.1.2, 2.2.3 **F175:** 1.4, 3.3 **F176:** 3.1.2
HSW6	How to evaluate methodology, evidence and data, and resolve conflicting evidence	• How to interpret and make judgments and draw conclusions from qualitative and quantitative experimental results (including observations and graphs) • Anomalies and outliers in experimental measurements • How to use appropriate maths skills for analysis of quantitative data • Limitations in experimental procedures • Precision, accuracy, repeatability, reproducibility, and validity of measurements and data, including margins of error, percentage errors and uncertainties in apparatus • How to refine experimental design by suggestion of improvements to the apparatus, procedures, and techniques • Confidence in a prediction or hypothesis	**F170:** 1.1.2 **F171:** 5.2 **F173:** 1.1.2, 2.2.1, 2.2.2, 3.1, 3.2.1, 3.5.2, 4.2.1, 5.1.1, 5.2, 5.3 **F174:** 2.2.1, 3.3.2 **F175:** 3.2, 4.3 **F177:** 1.2

How Science Works Reference	How Science Works Statement	To include understanding of:	Areas of the specification covering the HSW concepts and skills
HSW7	How scientific knowledge and understanding develops over time	• How theories have developed over time and been modified when new evidence has become available • Problems that science cannot currently answer	**F170:** 3.2.1 **F172:** 2.3.1 **F175:** 2.5 **F177:** 2.5.2
HSW8	How to communicate information and ideas in appropriate ways using appropriate scientific terminology	• Use of diagrammatical, graphical, numerical and symbolic forms in communication • Paper based and electronic forms of presentation • Accurate representation and labelling of objects observed	**F170:** 1.1.1 **F171:** 1.3.2 **F172:** 3.1.2, 3.3.2 **F173:** 2.5, 3.2.2 **F174:** 3.3.1, 4.1.1, 4.3.1 **F177:** 1.1, 2.5.1
HSW9	Consider applications and implications of science and evaluate their associated benefits and risks	• Examples of technological applications of science that have made significant positive differences to people's lives • Risks that have arisen from new scientific or technological advances • Perceived and calculated risk in relation to data and consequences	**F170:** 1.1.4, 1.1.5, 3.3.3 **F171:** 1.3.1, 3.2.1, 3.2.2 **F172:** 1.2, 2.3.1, 3.1.1, 3.3.1, 3.3.2, 4.1, 4.2.1, 4.2.2 **F173:** 1.2, 2.5, 3.4 **F174:** 1.3.1, 4.2.2 **F175:** 1.2, 2.3, 2.4, 3.2, 4.1 **F176:** 1.2, 1.3, 5.2 **F177:** 1.1, 3.2, 3.3
HSW10	Consider impact of science and technology on humans, other organisms, and the environment	• Reasons why different decisions on the same issue might be appropriate in view of differences in personal, social, economic or environmental context, and be able to make decisions based on the evaluation of evidence and arguments	**F170:** 1.1.5, 1.2.3, 2.1.1, 2.2.3, 3.1.2 **F171:** 1.2.1, 2.2, 3.2.1, 3.2.2, 5.1.1 **F172:** 1.3.1, 3.3.1 **F173:** 1.3 **F174:** 1.2, 3.2.1, 3.2.2, 4.3.3 **F177:** 2.4.3
HSW11	How to evaluate the role of the scientific community in validating new knowledge and ensuring integrity	• Reasons why scientists should communicate their work to a range of audiences	**F170:** 1.1.1, 1.1.5, 2.1.4, 3.1.1, 4.2 **F171:** 4.2.1, 5.3 **F172:** 2.2.2, 3.2.1, 4.2.2 **F173:** 2.2.1, 3.4, 4.1 **F174:** 2.1.1, 2.2.2, 3.2.3, 4.1.2, 4.3.2 **F175:** 1.1, 1.3, 2.2, 3.1, 3.4 **F176:** 2.2.1, 2.2.2, 3.2.1, 3.3, 4.1, 4.2.1, 4.2.2 **F177:** 1.3, 2.1.2, 2.6, 3.1, 4.1
HSW12	How to evaluate the ways in which society uses science to inform decision making	• How to distinguish between questions that could be answered using a scientific approach, from those that could not	**F171:** 1.1, 2.3 **F172:** 2.3.3, 3.2.3 **F173:** 2.3 **F174:** 1.1 **F176:** 3.2.2, 4.1 **F177:** 2.3

Appendix D: Mathematical skills for Human Biology

In order to be able to develop their skills, knowledge and understanding in OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology, students need to have acquired competence in the mathematical skills listed in the table of coverage.

Students will be required to apply their knowledge and understanding of these mathematical skills to the examined assessment (EA) and non-examined assessment (NEA) units where appropriate.

A minimum of 10% of the marks available in the externally assessed units will be for the assessment of mathematical skills. These skills will be applied in the context of Human Biology.

Mathematical skill to be assessed		**Exemplification of the mathematical skill in context**	**Areas of the specification which exemplify the mathematical skill (assessment is not limited to the examples below)**
M0 – Arithmetic and numerical computation			
M0.1	Recognise and make use of appropriate units in calculations	e.g. converting μm to mm as part of cell size calculations	**F170:** 1.1.5, 1.2.2, 4.1.2, 4.1.5 **F171:** 3.1 **F173:** 2.1, 2.2.1, 4.3 **F174:** 1.3.1, 2.2.3 **F176:** 1.2, 1.3, 5.2
M0.2	Recognise and use expressions in decimal, ordinary and standard form	e.g. carrying out calculations using numbers expressed in standard form, such as use of magnification	**F170:** 1.2.2, 4.1.5 **F172:** 4.1 **F173:** 1.3, 2.1, 3.3.2, 4.3 **F174:** 3.1.1, 4.3.1 **F175:** 3.2 **F176:** 5.2
M0.3	Use ratios, fractions and percentages	e.g. calculating surface area to volume ratios	**F170:** 2.1.2 **F171:** 5.1.2 **F174:** 1.2, 2.1.2 **F176:** 4.1, 5.2 **F177:** 2.1.1
M0.4	Estimate results	e.g. estimating effect of changing experimental parameters on measurable values	**F170:** 2.2.3, 3.1.1 **F171:** 2.1, 4.1, 5.1.2 **F172:** 3.3.2 **F173:** 2.3, 2.5, 3.3.1 **F174:** 2.1.1, 2.1.2
M0.5	Use calculators to find and use power functions	e.g. estimating the number of bacteria grown over a certain length of time	**F170:** 4.1.4 **F172:** 4.1 **F173:** 3.3.2, 3.5.1 **F174:** 3.1.1
M1 – Handling data			
M1.1	Use an appropriate number of significant figures	e.g. reporting calculations to an appropriate number of significant figures given raw data quoted to varying numbers of significant figures	**F170:** 4.1.2 **F171:** 4.1 **F172:** 2.1.2, 4.1 **F173:** 2.1, 3.2.2, 4.3 **F175:** 2.1 **F176:** 1.2, 1.3 **F177:** 2.2
M1.2	Understand the terms mean, median and mode	e.g. calculating or comparing the mean, median and mode of a set of data such as height or mass of a group of organisms	**F171:** 1.2.1, 2.3, 4.2.1 **F173:** 1.3, 5.1.1 **F174:** 4.1.1 **F175:** 2.3 **F177:** 2.2, 2.4.1

M1.3	Understand simple probability	e.g. understanding probability in context of monohybrid crosses	**F170:** 1.1.5 **F171:** 1.2.2, 5.1.1 **F172:** 1.3.1, 2.1.1, 2.1.2, 2.3.2, 3.1.2, 3.2.3 **F173:** 4.1 **F175:** 2.3, 2.4, 4.1
M1.4	Make order of magnitude calculations	e.g. making order of magnitude calculations in relation to magnification	**F170:** 1.1.2, 3.2.2 **F172:** 2.3.2 **F173:** 2.1
M1.5	Uncertainties in measurements and use of simple techniques to determine uncertainty when data are combined by addition, subtraction, multiplication, division and raising to powers	e.g. calculate percentage error where there are uncertainties in measurement	**F170:** 1.1.2, 3.1.2 **F172:** 3.3.1 **F173:** 3.2.2, 3.5.3, 4.2.2 **F174:** 1.1, 3.3.2, 4.2.3 **F175:** 2.1
M1.6	Frequency tables and diagrams, bar charts, line graphs, scatter plots, pie charts, and histograms	e.g. interpret data for a variety of graphs such as electrocardiogram traces	**F170:** 2.2.3, 3.3.2 **F171:** 1.2.2, 1.3.1, 2.2, 4.2.2, 5.2 **F172:** 1.3.1, 3.2.2 **F173:** 2.3, 2.5 **F174:** 2.2.2, 3.3.2, 4.1.1 **F175:** 3.2, 3.3, 4.2, 4.3 **F176:** 3.3, 4.2.1 **F177:** 1.2, 2.3, 2.4.1, 3.3
M1.7	Understand the principles of sampling as applied to scientific data, including representative sampling	e.g. how to ensure sampling is representative in a population	**F170:** 4.1.3 **F171:** 2.3, 4.2.2, 5.1.1 **F173:** 2.2.1, 2.2.2, 5.3 **F176:** 4.2.1 **F177:** 3.1
M1.8	Understand measures of dispersion, including standard deviation and range	e.g. understanding why standard deviation might be a more useful measure of dispersion for a given set of data, such as where there is an outlying result	**F173:** 5.1.2 **F174:** 2.1.1, 4.3.1
M2 – Algebra			
M2.1	Understand and use the symbols: =, <, >,<<, >>, ∝, ~	e.g. calculating surface area to volume ratios	**F171:** 2.1 **F173:** 3.4 **F174:** 1.3.1, 4.2.1 **F176:** 3.1.1, 3.1.2 **F177:** 1.2
M2.2	Change the subject of an equation, including non-linear equations	e.g. carrying out magnification and cell size calculations	**F170:** 1.1.2 **F171:** 1.3.2 **F173:** 2.1
M2.3	Substitute numerical values into algebraic equations using appropriate units for physical quantities	e.g. carrying out pulmonary ventilation rate calculations	**F170:** 2.2.3 **F173:** 3.4 **F174:** 3.1.2
M2.4	Solve algebraic equations	e.g. solving equations in a biological context, such as pulmonary ventilation rate	**F170:** 2.2.3 **F174:** 3.1.2, 4.2.1
M2.5	Understand power, exponential and logarithmic functions	e.g interpreting a graph of bacterial growth	**F170:** 4.1.4

M3 – Graphs			
M3.1	Translate information between graphical, numerical, and algebraic forms	e.g. interpreting and analysing spectra	**F170:** 2.1.2, 3.1.2 **F171:** 2.2, 5.1.2 **F172:** 1.3.2, 2.3.1, 2.3.3, 3.1.1, 4.2.2 **F173:** 3.1, 3.3.1, 4.2.4, 5.1.1 **F174:** 1.2, 2.1.1, 3.3.1 **F175:** 3.1, 3.2, 4.1 **F176:** 3.3, 5.1
M3.2	How to plot two variables from experimental or other data	e.g. plotting calibration curves	**F170:** 2.2.3, 3.1.2 **F173:** 3.1, 3.5.2, 5.1.1 **F174:** 3.3.1
M3.3	Understand that $y = mx + c$ represents a linear relationship	e.g. interpreting the effect of stroke volume and heart rate on cardiac output	**F171:** 2.2 **F173:** 3.5.2 **F174:** 3.3.1 **F176:** 2.1.1, 2.2.2
M3.4	The slope and intercept of a linear graph	e.g. reading off and interpreting rate of diffusion	**F170:** 1.1.4 **F174:** 3.3.3 **F175:** 1.1 **F176:** 2.1.1, 2.2.2
M3.5	Rate of change from a graph showing a linear relationship	e.g. calculating diffusion rate	**F170:** 2.1.2 **F171:** 3.2.2 **F175**: 1.1
M3.6	Sketch relationships for graphs	e.g. sketching the relationship between exercise and breathing rate	**F170:** 2.2.2, 3.2.1, 4.1.4 **F171:** 1.2.2, 2.1, 3.2.1 **F172:** 2.2.2 **F174:** 3.3.3 **F176:** 5.1
M4 – Geometry and trigonometry			
M4.1	Visualise and represent two-dimensional representations of 3D objects	e.g. drawing biological molecules	**F170**: 1.1.4, 1.1.5 **F171**: 3.1 **F174**: 1.1, 1.3.1
M4.2	Circumferences and areas of circles, surface areas and volumes of rectangular blocks, cylinders, and spheres	e.g. calculating the surface area or volume of a cell	**F170:** 1.1.2, 3.3.3 **F173:** 2.4

The questions and tasks across all units that are used to target mathematical skills will be at a level of demand that is appropriate to Level 3 Alternative Academic Qualification Cambridge Advanced Nationals in Human Biology. The questions that assess mathematical skills will not be of a lower demand than that of questions and tasks in the assessment for Level 1/Level 2 GCSE (9-1) in Mathematics.

The list of examples provided in the table is not exhaustive and is not limited to Level 2 examples. These skills could be developed in other areas of the specification content from those indicated.

Students will not be expected to memorise mathematical formulas. Any necessary mathematical formulas will be provided in the examination paper.

Mathematical skills should be taught using both theoretical and practical contexts.

Appendix E: Units in science

It is expected that learners will show and be able to apply understanding of the physical quantities and corresponding units, and SI base units and derived units listed below. The tables also include symbols commonly used for these quantities; use of symbols by learners is optional. Learners will be able to use them in qualitative work and calculations.

Physical quantity	**Common symbol(s) (use of these symbols is optional)**	**SI base unit**	**Unit abbreviation**
Length	d – diameter h – height (e.g. height raised above ground level to calculate gravitational potential energy) l – length (e.g. of a wire) s – displacement (e.g. displacement of a force) x – extension (e.g. of a spring) or distance travelled (e.g. for attenuation of X-rays through a medium) λ (lambda) – wavelength	metre	m
Mass	m	kilogram	kg
Time	t t_E – effective half-life $t_{1/2}$ – physical half-life t_B – biological half-life T – time period	second	s
Temperature	T – for Kelvin temperature ΔT – for change in Kelvin temperature	kelvin	K
Amount of a substance	n	mole	mol

The following table includes SI derived or SI accepted units for quantities which will be commonly used across the qualification:

Physical quantity	**Common symbol(s) (use of these symbols is optional)**	**SI derived / accepted unit**	**Unit abbreviation**
Area	A	squared metre	m^2
Concentration	c	mole per cubic decimetre gram per cubic decimetre	$mol\,dm^{-3}$ $g\,dm^{-3}$
Temperature	θ (theta) – for Celsius temperature $\Delta\theta$ (theta) – for change in Celsius temperature	degree Celsius	°C
Volume	V	cubic metre; litre; cubic decimetre; cubic centimetre	m^3; L; dm^3;cm^3

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