Cover image © Speedking / Shutterstock

Pearson Level 3
Alternative Academic Qualification BTEC National in

L3

Medical Science (Extended Certificate)

Planning and Teaching Guide

First teaching from September 2025

First certification from 2027

Qualification Number: 610/3958/5

About Pearson

We are the world's leading learning company operating in countries all around the world. We provide content, assessment and digital services to students, educational institutions, employers, governments and other partners globally. We are committed to helping equip students with the skills they need to enhance their employability prospects and to succeed in the changing world of work. We believe that wherever learning flourishes so do people.

References to third-party material made in this Planning and Teaching Guide are made in good faith. Pearson does not endorse, approve or accept responsibility for the content of materials, which may be subject to change, or any opinions expressed therein. (Material may include textbooks, journals, magazines and other publications and websites.)

All information in this Guide is correct at time of publication.

Contents

1. Introduction

This Planning and Teaching Guide complements your Pearson Level 3 Alternative Academic Qualification BTEC National in Medical Science (Extended Certificate) specification, Pearson Set Assignment Briefs (PSABs), Sample Assessment Materials (SAMs) and the Pearson BTEC Level 3 National Alternative Academic Qualification Administrative Support Guide. This Planning and Teaching Guide provides:

- an overview of dates and deadlines for key events and activities relevant to qualification delivery – from registration to assessment and review of marking – throughout the academic year
- suggestions for planning and delivering your course including induction and unit sequencing
- creative and realistic teaching and learning ideas as well as links to resources for each unit to support and inspire you in creating a dynamic learning environment to keep your students engaged and motivated to learn.
- wider delivery support such as guidance on study programme planning and descriptions and links to qualification resources and materials.

The guide was designed and written in collaboration with current practitioners to ensure that the planning and delivery suggestions and teaching and learning ideas are feasible, pedagogically sound and appropriate for the vocational area and the purpose of the qualification.

We recognise that delivery contexts will vary from one centre to the next and that practitioners are the best decision-makers for what works best for them and their students. Therefore, teachers can tailor the suggestions and ideas proposed in this guide to meet the specific needs of their students and the available resources in their centre. There are, however, requirements that have to be met in relation to assessment plans and to teaching and learning preceding assessment, which will be clarified/covered in this guide.

We hope you will find this guidance relevant and useful, and you enjoy teaching this this qualification!!

What's new

When creating these BTEC Nationals, in addition to ensuring the sector technical content was current and up-to date, we have also focused on developing the skills and personal attributes students need to navigate the future. We have worked with many higher education providers, professional bodies, colleges and schools to ensure these qualifications also meet their needs. Employers are looking for future employees with a thorough grounding in the latest industry requirements and work-ready skills such as critical thinking and problem solving. Higher education needs students who have experience of research, extended writing and meeting deadlines to be successful on their undergraduate programmes.

We have addressed these requirements by:

- Facilitating and guiding the development of transferable skills through the design and delivery of the qualifications, using a holistic and practical framework which is based on recent research into the most critical skills needed to navigate the future. A Transferable Skills framework has been used to embed transferable skills in the qualifications where they naturally occur and to signpost opportunities for delivery and development as a part of the wider BTEC learning experience. Please refer to the BTEC Transferable Skills Guide for Teachers for further information on this framework, its relevance and how it has been implemented in the qualifications.
- Supporting the delivery of Sustainability Education and development of Digital Skills naturally through the content design of the qualifications. Mapping is provided in the specification to identify where these opportunities for teaching and learning exist.
- Updating sector-specific content to ensure it is current, relevant and future-facing.
- Implementing a consistent approach to assessment with a balanced combination of internal and external assessments to better engage students, make the qualifications more accessible for them and more manageable for centres to deliver.

We are providing a wealth of support, both resources and people, to help ensure that you and your students have the best possible experience during their course. Please see the section *on* Pearson Qualification Support and resources on page 145 for details of the available resources and support with links to access these.

Notes:

The qualification specification provides the content that must be taught and what must be assessed. This planning and teaching guide provides suggestions and ideas for how the content could be delivered. The suggestions given in this guide link with the Pearson Set Assignment Briefs provided by Pearson, which are mandatory for internal assessment and cannot be amended or contextualised by centres.

2. BTEC Calendar of Key Dates

Each academic year there are some key dates and deadlines in the delivery of BTEC qualifications that teachers need to be aware of, and act on appropriately, to ensure:

- the smooth running of learner registration, assessment and the quality assurance process, and
- effective timetable planning to fully prepare students for assessments and ensuring timely completion of administrative tasks.

Here is an overview of the key dates and deadlines for this qualification.

The specific date for each activity or event will vary each academic year and so only the month is provided. For the specific dates for the current academic year, please go to our webpage: Exam timetables | Pearson qualifications

Month	General related dates	Internal Assessment related dates	External Assessment related dates
September	Student registration		
October		Lead IV identified and completion of team standardisation	Entry deadline for January external assessment
November	Late student registration fee		
December	Late student registration fee Deletion deadline: delete student registrations for any student withdrawn from the qualification		
January		Standards Verification Window opens	January External Assessment Series
February			

Month	General related dates	Internal Assessment related dates	External Assessment related dates
March			Restricted release of results to centres Release of results to students Entry deadline for Summer external assessments Review of Marking
April			Review of Marking
May		Standards Verification for first sample closes	Summer External Assessment
June		Standards Verification for second sample closes (if required)	
July	Deadline for full qualification claim for summer certification		
August			Restricted release of results to centres Release of results to students Review of marking

3. Planning the Delivery of your Course

Planning your course ensures a coherent and logical approach to teaching that helps students to connect concepts effectively and build their knowledge progressively.

Effective assessment planning is also essential to allow for timely evaluation of student progress and adjustment of teaching strategies or interventions as needed.

This section offers recommended approaches to support practitioners with planning and implementation of this qualification

Induction

Students

An induction period at the start of the course is recommended to help students understand and prepare for the demands of their chosen course, as well as familiarise them with the BTEC ethos and methodology. This induction aims to not only equip students with the necessary knowledge and skills but also to create a welcoming environment where they feel safe, supported and gain a sense of belonging as they begin their course in a new setting.

Centres will have their own induction programmes, and to support this, Pearson have provided a range of adaptable resources that can be integrated into this existing programmes. These resources cover areas such as welcome activities and information to include in the induction, with supporting slides. As we believe that every opportunity should be taken to develop transferable skills across the wider BTEC learning experience, we have also provided guidance on which transferable skills could be delivered as a part of the induction process including Managing Own Learning, Continuous Learning, goal setting and personal strength and resilience. The resources are designed to help students develop the relevant transferable skills through learning how to manage their course workload, completing their assessments successfully and meeting deadlines whilst also building their confidence and ability to thrive on their BTEC journey.

Tutors/Teachers

In addition to the annual standardisation training that all BTEC teaching staff are required to complete at the beginning of each academic year using the Pearson provided materials, an induction period for new tutors is also recommended. This will help new tutors familiarise themselves with the specific demands and expectations of the BTEC curriculum, equipping them with the necessary knowledge and skills to effectively plan and support their students from the outset.

Overview of Assessment Availability

Internal Assessments

Pearson Set Assignments (PSABs) are provided by Pearson for all internally assessed units and must only be used for summative assessment.

These are available for the lifetime of the qualification and are accessible through our website. Teachers with a Pearson online account can log in through the sign-in portal to access them. Any teacher with students registered for this qualification can create a Pearson online account.

For mandatory unit 3 Practical Microbiology and Infectious Diseases, and all available optional units you are provided with multiple versions of the PSAB. It is expected that you will rotate through all the available versions before repeating a previous version. The order in which the PSAB versions are completed is at your discretion. For further information around PSAB conditions and administration please refer to the administration guide.

External Assessments

External assessments are available in two series each academic year as shown below:

Dates	Jan	Mar	May/June	Aug
Assessment	External Assessments Series 1 *Not available in Jan 2026	External assessment Series 1 Results	External assessment Series 2	External Assessment Series 2 Results

Delivery and Assessment Planning

Clear unit planning and understanding is essential for a successful qualification delivery. This helps students to build on prior learning and reinforce concepts to develop a deeper understanding of the unit content and progressively develop their knowledge, understanding and skills throughout the course delivery.

We have produced a sample delivery plan showing how the **BTEC National AAQ in Medical Science (Extended Certificate) could** be delivered over **two** years, highlighting ordering of units and assessment milestones.

This plan is intended to be used as guidance.

Key

Del = Unit content delivery

PSAB = Pearson Set Assignment Brief

Rev = Revision for External assessment

Ext = External assessment

Resit Ext = Resit External assessment opportunity

Sequence of delivery

Year One

Unit	Unit Title	GLH	Assessment method	Term 1	January exam series	Term 2	Term 3	Summer exam series
1	Principles of Human Physiology, Anatomy and Pathology	90	Ext	Del & Rev		Del & Rev	Del & Rev	Ext
2	Health Issues and Scientific Reporting	120	Ext			Del	Del	

Unit 1: is an externally assessed mandatory unit and gives the underpinning knowledge of how the human body functions at a cellular and tissue level. Students will gain an understanding of the various organ systems that comprise the human body – nervous, endocrine musculoskeletal, cardiovascular, respiratory, renal and digestive systems – and how factors, such as temperature, diet, exercise, affect health. To allow adequate time for delivery and revision of the content, the external assessment would take place in the summer exam series, allowing a resit opportunity in the second year.

This unit would be appropriate to deliver first as it contains underpinning knowledge on basic biological molecules, human body systems and associated disorders that would benefit the understanding of specialist human body systems in optional units or associated diagnostic techniques for health conditions in unit 2. Additionally, the content of cell structure would be beneficial in exploring practical applications in infectious diseases in unit 3. Therefore, it would therefore be suitable to teach this unit from the start of the course.

Unit 2: is an externally assessed mandatory unit and will further develop their understanding of medical science through learning about contemporary health issues, alongside developing knowledge about scientific analysis, evaluation and reporting. Students will gain an understanding of diagnostic techniques, before focusing on the human immune system alongside associated initiatives including, cancer and various aspects of immune dysfunction, to the increasingly important world of genetics. Students will draw upon their knowledge of biological molecules, the functionality of human organs, and the association between human body systems from unit 1. Therefore, it is suggested that the unit is begun in term 3 of year one, with the intention to continue delivery in the second year.

Year Two

Unit	Unit Title	GLH	Assessment method	Term 1	January exam series	Term 2	Term 3	Summer exam series
1	Principles of Human Physiology, Anatomy and Pathology	90	Ext	Del & Rev	Resit Ext			
2	Health Issues and Scientific Reporting	120	Ext	Del & Rev	Ext			
3	Practical Microbiology and Infectious Diseases	90	Int	Del			Del & PSAB	
4 5 6	Diseases, Disorders, Treatments and Therapies OR Biomedical Science OR Human Reproduction and Fertility	60	Int			Del	Del & PSAB	
2	Health Issues and Scientific Reporting	120	Ext				Del & Rev	Resit Ext

Unit 2: continuation in delivery of this unit is suggested in term one of the second year of this qualification, with associated revision taking place to allow for a January window external assessment opportunity, allowing, if required, an opportunity to resit in the summer exam series.

There is also an opportunity throughout the first term of year two to undertake further revision activities for unit 1 should a resit opportunity be required in the January external assessment window.

Unit 3: is an internally assessed mandatory unit with an associated PSAB which is composed of 4 tasks and has an approximate guide time of 19 hours. Students will have the opportunity to explore ideas around the classification of prokaryotic organisms and how they may cause disease. They will understand the way in which infectious diseases can be transmitted and how the associated infectious disease can be treated. Students will investigate the effect of antimicrobial agents on the growth of microorganisms, by selecting and applying knowledge of microorganisms and infectious diseases. They will draw on their understanding of cell structure, basic biological molecules and human body systems from unit 1. Students will also utilise their knowledge and understanding of the immune system from unit 2. Therefore, the recommendation here would be that unit 3 is delivered after both unit 1 and unit 2, hence the suggestion to deliver this unit and associated PSAB in term two of year two.

Students complete and achieve 1 optional unit.
Delivering the optional unit in year 2 allows students to draw on all previous knowledge and skills associated with the previous units. The optional units allow students to follow a more specialist route associated with their progression pathway. Each optional unit has an associated PSAB.

Unit 4: is an internally assessed optional unit with an associated PSAB composed of 3 tasks and an approximate guide time of 11 hours. This unit utilises the knowledge of biological molecules from unit 1, and how these may be disrupted to give symptoms. It also considers ideas of the immune system from unit 2 and how this may relate to treatment and therapies for physiological diseases and disorders. Finally, this unit draws upon ideas of disease transmission from unit 3 to consider the application of drug development and the associated ethical issues.

Unit 5: is an internally assessed optional unit with an associated PSAB composed of 3 tasks and an approximate guide time of 18 hours. This unit facilitates understanding in three key areas of biomedical science: haematology, health screening, histology/cytology, and urinalysis. It will draw upon knowledge of cell and tissue structures from unit 1, alongside the practical skills developed in unit 3 to explore the principles of diagnostic tests used in modern medicine. The analytical and diagnostic testing carried out in these three areas supports other health professionals in screening, diagnosing, monitoring disease progression and treatment.

Unit 6: is an internally assessed optional unit with an associated PSAB composed of 4 tasks and an approximate guide time of 11 hours. In this unit, students will use their knowledge and understanding of human body systems from unit 1 to consider human anatomy used in reproduction. Students will explore reproductive processes and how they are controlled through body mechanisms and the associated causes of infertility. Students will utilise their knowledge of the endocrine system from unit 1 to investigate the hormonal control of human reproduction and the medical and social effects if the system malfunctions in humans.

Centres may deliver the qualification over a one-year period if required to provide flexibility to meet student or centre qualification planning needs.

4. Qualification Unit Delivery Guides

This section contains support for delivery of all the units in this qualification. The focus of these guides is on structuring and supporting the teaching and learning process. You will find ideas for activities and guidance on how best to use the activities to develop students understanding of the topics in each unit. This section also includes activities and information on how to deliver transferable skills which are embedded or signposted in the qualification.

Unit 1: Principles of Human Physiology, Anatomy and Pathology

Unit overview

Unit 1: Principles of Human Physiology, Anatomy and Pathology	
Assessment type: External	
Content Area	**Topics**
A: Biological molecules, cells and levels of organisation	A1 Carbohydrates A2 Proteins A3 Lipids A4 Nucleic acids and their derivatives A5 Cell ultrastructure A6 Transport of substances into and out of cells A8 Levels of organisation
B: The Nervous and endocrine systems	B1 The nervous system B2 The endocrine system B3 Homeostasis
C: The musculoskeletal system	C1 The skeleton C2 Joints, tissues and muscles C3 Disorders of the musculoskeletal system
D: The cardiovascular and respiratory systems	D1 The cardiovascular system D2 The respiratory system
E: The renal and digestive systems	E1 The renal system E2 The digestive system
Assessment overview	

The unit will be assessed through one examination of 80 marks lasting 1 hour and 30 minutes. Students will be assessed through a number of short- and long-answer questions. The questions will assess knowledge and understanding of the underpinning principles of human physiology, anatomy and pathology, as well as the ability to apply your knowledge to new situations and will also test the skills of analysing and interpreting data and information from graphs, diagrams or text.

The assessment availability is twice a year in January and May/June. The first assessment availability is May/June 2026.

Sample assessment materials will be available to help centres prepare students for assessment.

Common student misconceptions

Below are some common misconceptions related to the content of this unit by students and ideas for how you can help your students to avoid and overcome these.

What is the misconception?	How to help students overcome it
Cells in a multicellular organism have the same DNA and are therefore identical	Cells differentiate when they express specific genes that characterise a particular cell type and only express the genes that produce the proteins characteristic for that type of cell. For example, nerve cells and muscle cells have different structures and roles, even though they originate from the same genetic material.
Mitosis is the same as the cell cycle	Explore the whole cell cycle, comparing mitosis and meiosis. Mitosis is just one part of the cell cycle. The cell cycle also includes interphase (G1, S, and G2 phases), where the cell grows and DNA is replicated, and cytokinesis, where the cell splits into two daughter cells.
The cell cycle is the same for all cells and cells can divide indefinitely	Different types of cells can have variations in their cell cycles. For example, rapidly dividing cells (like those in the skin or intestinal lining) go through the cycle much faster than cells that divide less frequently, such as nerve cells. Normal cells have a limit to how many times they can divide, known as the Hayflick limit. This is because each time a cell divides, the telomeres get shorter. When they become too short, the cell can no longer divide and will enter senescence or die.
Homeostasis means no change	Students think homeostasis is about keeping everything constant. Homeostasis involves dynamic equilibrium, where internal conditions fluctuate within

	a narrow range to remain stable. Homeostasis often involves multiple systems working together to gradually restore balance.
Each organ system functions independently	Understanding the collaboration between organ systems is essential for a complete picture of how our bodies function- e.g. The nervous system controls muscle movements and coordination, while the musculoskeletal system provides the structure and mechanism for movement.

Learning Activities and Resources

This section offers a starting point for delivering the unit by outlining a logical sequence through the unit topics and suggesting practical activities and teacher guidance for covering the main areas of content during guided learning time. Transferable skills are integrated into various activities, with those embedded in a unit indicated by an acronym in square brackets. The acronym combines the letters from the broad skill area and the specific transferable skill, e.g., **[IS-WC]**.

Please note the activities provided below are suggestions and not mandatory. Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate.

Learning Topic	Activities and guidance for unit content delivery	Resources
A: Biological molecules, cells and levels of organisation		
A1 Carbohydrates	• **Small group Activity – Structure of carbohydrates** Use sweets (such as midget gems) or other modelling materials to demonstrate the chemical bonding and structures of carbohydrates. Each learner will need at least six black jelly sweets (carbon atoms), six red jelly sweets (oxygen atoms) and twelve white/yellow jelly sweets (hydrogen atoms) and approximately 25 cocktail sticks (these can be broken in half or quarters to provide bonds). Alternatively, molymods could be used. ○ The students use the sweets/ molymods to create the structures. Students should show monosaccharides, disaccharides and polysaccharides using the modelling materials. ○ They could use glucose or cellulose as examples focusing on the differences in structure and how that could relate to the molecule's properties.	**Behindthebiologylessons** contains Information about carbohydrate chemical bonding and structure https://behindthebiologylessons.wordpress.com/2023/04/27/biological-molecules-carbohydrates/

A2 Proteins	• **Whole class and individual activity - Protein models** Build proteins using pipe cleaners and coloured beads for amino acids Assign each coloured bead a specific amino acid. You can use different shapes or colours to represent the 20 standard amino acids. Provide a reference chart so students can easily identify which bead represents which amino acid. Instruct students to string beads onto a pipe cleaner to represent a sequence of amino acids (the primary structure of a protein). ○ Alpha Helices: Demonstrate how to twist a pipe cleaner with beads into a helical shape to represent an alpha helix. Explain the hydrogen bonding pattern that stabilises the alpha helix. ○ Beta Strands: Show students how to create a straight or slightly zig-zagged pipe cleaner with beads to represent a beta strand. Explain how beta strands can align side-by-side to form beta sheets, stabilised by hydrogen bonds. ○ Combine the alpha helices and beta strands to create more complex protein structures (tertiary structures). ○ If possible, demonstrate how multiple tertiary structures can come together to form quaternary structures (e.g., haemoglobin). Use additional pipe cleaners to connect and stabilise the structures. ○ Students should photograph or draw their models. They should label the protein structures that they have created, including labels for the bonds within the molecule, and any other significant features.	**Scienceandmathwithmrslau.com** have instructions about using beads, pipe cleaners to teach monomers and polymers. https://www.scienceandmathwithmrslau.com/2014/09/hands-on-biochemistry-beads-pipe-cleaners-and-the-clearest-way-to-teach-monomers-and-polymers/

A3
Lipids

- **Whole class teaching and learning - Properties of lipids**
  - Students could complete a table of the properties of triglyceride, phospholipids, and cholesterol to summarise which of the following applies to each molecule
    - Contains only the elements carbon hydrogen and oxygen
    - Insoluble in water
    - Contains glycerol
    - Contains ester bonds
    - Important in membrane structure
    - Contains fatty acids

	triglyceride	phospholipid	cholesterol
Contains only the elements carbon hydrogen and oxygen	✓		✓
Insoluble in water	✓	✓	✓
Contains glycerol	✓	✓	
Contains ester bonds	✓	✓	
Important in membrane structure		✓	✓
Contains fatty acids	✓	✓	

- **Small group Activity – Structure of lipids**
  Produce paper models of lipids- highlighting key parts, such as bonding, glycerol, fatty acids, phosphate groups.
  - Glycerol Backbone- Cut out a small rectangle or circle from coloured paper to represent the glycerol molecule. Label the glycerol backbone.
  - Fatty Acid Chains- Cut out long, narrow strips of coloured paper to represent the fatty acid chains. Attach these strips to the glycerol backbone using glue or tape. Use different colours for saturated and unsaturated fatty acids, and label them accordingly.
  - Phosphate Group (for Phospholipids)- Cut out a small shape from coloured paper (e.g., a circle or square) to represent the

Behindthebiologylessons has a resource about Using lipids as the basis of a synoptic lesson, provides a resource to make paper models and a PowerPoint about lipids, https://behindthebiologylessons.wordpress.com/2023/12/27/using-lipids-as-the-basis-of-a-synoptic-lesson/

Medicine LibreTexts has information about Functions of Lipids, Medicine LibreTexts/ 5.3functions of lipids

Behindthebiologylessons has a resource about using lipids as the basis of a synoptic lesson https://behindthebiologylessons.wordpress.com/2023/12/27/using-lipids-as-the-basis-of-a-synoptic-lesson/

	phosphate group. Attach the phosphate group to the glycerol backbone in place of one of the fatty acid chains. Label the phosphate group. ○ Ester Bonds- Use markers or coloured pencils to draw ester bonds between the glycerol and fatty acid chains or phosphate group. Label the ester bonds. • **Whole class teaching and learning – Function of lipids** ○ Students should produce an infographic about the function of lipids. ○ Students to research the following functions of lipids - Energy storage - Insulation – thermal and electrical - Form membranes - Protect organs - Source of steroid hormones - Source of vitamin D - Waterproofing • **Whole class activity – Class discussion about reindeers** Why would cells in reindeer hooves have more unsaturated fatty acids in their membranes compared to those found in their upper legs? Key questions as prompts ○ Where would fatty acids be found within a membrane? ○ What is the difference between saturated and unsaturated fatty acids? ○ How does the level of saturation affect the packing ability of the chains? ○ What is the difference in environment between the hoof & upper leg of a reindeer?	

A4 Nucleic acids and their derivatives	• **Whole class teaching and learning – Introduction to nucleic acid** ○ Divide students into small groups. ○ Instruct each group to research key milestones and figures in the discovery of DNA and produce an A3 summary with a clear heading, date, illustration and description. The posters will then be displayed on a washing line to create a discovery of DNA timeline: - 1869: Friedrich Miescher discovers "nuclein" (later known as DNA). - 1909-1919: Phoebus Levene identifies the components of DNA (phosphate, sugar, bases). - 1944: Oswald Avery, Colin MacLeod, and Maclyn McCarty demonstrate that DNA carries genetic information. - 1950: Erwin Chargaff discovers base pairing rules (A=T and C=G). - 1951-1952: Rosalind Franklin and Maurice Wilkins produce X-ray diffraction images of DNA. - 1953: James Watson and Francis Crick propose the double helix structure of DNA. ○ Students could discuss Rosalind Franklin's role and possible controversy over the discover of DNA ○ Provide a detailed account of Rosalind Franklin's contributions to the discovery of DNA, including her X-ray diffraction images (Photo 51) and their significance. ○ Discuss the controversy surrounding her recognition and the Nobel Prize awarded to Watson, Crick, and Wilkins in 1962. ○ Encourage students to consider questions such as:	**Nature:** What Rosalind Franklin truly contributed to the discovery of DNA's structure https://www.nature.com/articles/d41586-023-01313-5 **Illumina.com-** Virtual lab stimulation to visual the structure of DNA https://www.illumina.com/content/dam/illumina-marketing/apps/dnaday/index.html **YouTube:** Video about making a DNA model with sweets https://www.youtube.com/watch?v=5-f1ja_xn1U **Futurelearn.com** has instructions for the method for the DNA extraction from fruit. https://www.futurelearn.com/info/courses/biochemistry/0/steps/21618 **NHS** has information about galactosaemia, PKU, coeliac disease and lactose intolerance https://www.nhs.uk/conditions/ **Coeliac UK-** information about coeliac disease https://www.coeliac.org.uk/home/

	- Why was Rosalind Franklin's contribution initially overlooked? - How did her work impact the discovery of DNA's structure? - What lessons can we learn about collaboration and recognition in science? • **Whole class and individual activity - DNA model** Create a 3D double helix model from molymods/sweets or from a DNA paper chain- Students should use their models to discuss mutations and the consequences Example: Use liquorice sticks or gummy ropes (to represent the sugar-phosphate backbone) and colourful candies (e.g., gummy bears, jellybeans) in four different colours (to represent the nucleotide bases: Adenine (A), Thymine (T), Cytosine (C), Guanine (G)) ○ Use two liquorice sticks or gummy ropes to represent the sugar-phosphate backbones. Place them parallel to each other. ○ Use toothpicks to attach pairs of colourful candies between the liquorice sticks, representing the nucleotide base pairs. ○ Pair the candies as follows: Adenine (A) with Thymine (T), and Cytosine (C) with Guanine (G). ○ Once all the base pairs are attached, gently twist the liquorice sticks to form the double helix shape. • **Laboratory Activity - Extract DNA from fruit** An experiment highlighting how DNA can be isolated from cells.	

	Students should consider the purpose of each step of the method, i.e. why is the fruit mashed? Brief method: ○ Mash the fruit: e.g. one strawberry or half a banana ○ Mix the extraction solution: In a small container, mix 2 teaspoons of dish soap with 1/2 teaspoon of salt and 1/2 cup of water. Stir the solution gently until the salt dissolves. ○ Add the solution to the fruit: gently stir the mixture for 2-3 minutes to further break down the cell walls and release the DNA. ○ Filter the mixture: Pour the fruit mixture through the filter to separate the solid parts from the liquid. Collect the filtered liquid in a test tube. ○ Tilt the container slightly and slowly pour cold alcohol down the side of the container, creating a layer on top of the filtered liquid. You should add about an equal volume of alcohol as the filtered liquid. ○ Allow the test tube to sit undisturbed for a few minutes. You will start to see a white, stringy substance forming at the interface between the alcohol and the filtered liquid. This is the DNA. ○ Gently dip a toothpick or skewer into the test tube where the DNA is forming. Swirl it around to collect the DNA strands. • **Whole class and individual activity - Conditions associated with metabolism of biological molecules** ○ Students could produce informative leaflets for a doctor's surgery about a condition associated with the metabolism of biological molecules	

	- Galactosaemia - PKU - coeliac disease - lactose intolerance ○ Students should include - Name of condition - How the condition is caused (e.g. details of inheritance or environment factors) - Biological molecule(s) affected - Symptoms of the condition - How the biological molecule causes the symptoms	
A5 Cell ultrastructure	• **Laboratory Activity – Using a microscope and preparing slides** ○ Students should carry out practical work to practice preparation of microscope slides and how to use microscopes. ○ Students should develop techniques for focusing and image and taking measurements. Good drawing technique and opportunity to practice skills will be required ○ Students use a microscope and examine prepared slides of animal (e.g. cheek cells stained with methyl blue) ○ Students to draw what they see, noting the distinct features of each cell type. ○ Calculate the size of cells using 'I AM' calculations from direct viewing using an optical microscope, using the microscope eyepiece graticule. ○ Students can then compare their observations to identify similarities and differences.	**Stem.org** contains a library of resources, including cell (suitable for home teaching) which can be used as an introduction to cell organelles. https://www.stem.org.uk/resources/elibrary/resource/34589/cell-suitable-home-teaching **The Royal Society of Biology, Nuffield Foundation** has a collection of experiments that demonstrate biological concepts and processes https://practicalbiology.org/cells-to-systems **The National Human Genome Research Institute** gives information about the cell membrane (plasma membrane), https://www.genome.gov/genetics-

	• **Whole class teaching and learning -Fluid mosaic model** ○ Make a 3D poster of the fluid mosaic model of a cell surface membrane including - phospholipids - glycoproteins, - channel proteins, - glycolipids - cholesterol - channel proteins. ○ Students could use a range of recyclable materials- such as plastic bottles or craft materials including a large poster board or foam board, coloured paper or cardstock in various colours for different components), pipe cleaners (for flexible structures) and small beads or pom-poms (for proteins and other molecules) • **Laboratory Activity – Surface are to volume ratio of Agar cubes** ○ Students can investigate the relationship between surface area to volume ratio using multilink cubes or nets of boxes. ○ By measuring the length, width and height the total surface area and the volume can be calculated. ○ Students could carry out a practical investigating into the effect of surface area to volume ratio using phenolphthalein agar cubes and an acid ○ Cut the phenolphthalein agar into cubes of different sizes, such as: - 1 cm x 1 cm x 1 cm (surface area to volume ratio = 6:1) - 2 cm x 2 cm x 2 cm (surface area to volume ratio = 3:1) - 3 cm x 3 cm x 3 cm (surface area to volume ratio = 2:1)	glossary/Cell-Membrane-Plasma-Membrane **Nuffield Foundation** outlines the agar cell diffusion practical https://nuffieldfoundation.org/sites/default/files/files/effect-of-size-on-uptake-by-diffusion-student-notes-21%20(1).docx **Exploratorium.edu** outlines the agar cell diffusion practical https://www.exploratorium.edu/sites/default/files/stem/AgarCellDiffusion.pdf

	○ Ensure you accurately measure and record the dimensions of each cube. ○ Place each agar cube in a separate beaker. ○ Add the hydrochloric acid or vinegar to each beaker until the agar cubes are fully submerged. ○ Start the stopwatch as soon as the acid is added. ○ Observe the agar cubes as the acid diffuses into them. The phenolphthalein will change colour (e.g., from pink to colourless) as it reacts with the acid. ○ Record the time taken for the acid to completely diffuse into each cube, causing the colour to disappear entirely from the centre. ○ Compare the time taken for diffusion to occur in each cube size. ○ Calculate the surface area to volume ratio for each cube and analyse how this ratio affects the rate of diffusion.	
A6 Transport of substances into and out of cells	• **Laboratory activity- Investigating Osmosis** Investigate the process of osmosis using beetroot and a colorimeter in various salt concentration. (This links to using a colorimeter in Unit 4). Brief method: ○ Use a cork borer or knife to cut the beetroot into uniform cylindrical pieces, approximately 1 cm in diameter and 2 cm in length. ○ Rinse the beetroot pieces thoroughly under running water to remove any excess pigment released during cutting. ○ Prepare beakers or test tubes with the different salt concentrations (e.g., 0%, 0.5%, 1%, 2%, 3%).	**iu.pressbooks.pub** has an online human physiology textbook with a chapter on transport mechanisms, https://iu.pressbooks.pub/humanphys/chapter/transport-mechanisms/ **YouTube-** Practicals and Revision Biology Tutor outlines the practical method for investigating osmosis using beetroot and colorimetry, https://www.youtube.com/watch?v=Hc3Mg0Yc7kI

	○ Place one beetroot piece into each beaker or test tube containing the different salt solutions. ○ Ensure the beetroot pieces are fully submerged in the solutions. ○ Allow the beetroot samples to sit in the salt solutions for a set period, such as 30 minutes. ○ Observe any changes in the colour of the solutions, as the beetroot pigment (betacyanin) will diffuse out of the beetroot cells in response to osmosis. ○ After the incubation period, use a pipette to transfer a small sample of the solution from each beaker or test tube into a colorimeter cuvette. ○ Measure the absorbance of each solution using the colorimeter. Record the absorbance values for each salt concentration. ○ Compare the absorbance values to determine the extent of pigment diffusion at each salt concentration. Higher absorbance indicates more pigment diffusion, which suggests greater osmotic pressure. **OR** Investigate osmosis using eggs with the shells removed (using vinegar) placed into high glucose solution or coloured water to see the effect of diffusion across cell membranes. Brief method: ○ Submerge and soak eggs in vinegar for 24-48 hours. The acetic acid in the vinegar will dissolve the calcium carbonate	**YouTube-** The Sci Guys (Science at Home, The naked Egg and osmosis) demonstrates osmosis using eggs, https://www.youtube.com/watch?v=SrON0nEEWmo

	in the eggshells, leaving the semi-permeable membrane intact. ○ Prepare a high glucose solution ○ Prepare a coloured water solution by adding a few drops of food colouring to water ○ Place one egg in the high glucose solution and another egg in the coloured water solution. Make sure the eggs are fully submerged in the solutions. ○ Allow the eggs to sit in the solutions for 24 hours. ○ Observe and record any visible changes in the size and appearance of the eggs. Measure the changes in weight and size using a scale and measuring tape. ○ In the high glucose solution, the egg may shrink due to water moving out of the egg (osmosis). ○ In the coloured water solution, the egg may swell and take on the colour of the water due to water moving into the egg (osmosis).	
A7 The cell cycle	• **Whole class teaching and learning – Cell division** Provide each learner or group with pop-it beads and magnetic centromeres (if available)- the beads represent chromosomes Students could produce a stop motion animation of cell division or a series of photographs to represent the key stages of mitosis/meiosis ○ Prophase: Start with a cell with a set number of chromosomes (e.g., 4 chromosomes, two homologous pairs). Use different colours to represent chromosomes from each parent.	**bio.libretexts.org** has an activity of modelling mitosis and meiosis, using pop-it beads, https://bio.libretexts.org/Bookshelves/Biotechnology/Bio-OER_(CUNY)/07%3A_Cell_Division/7.03%3A_Modeling_Mitosis_and_Meiosis_(Activity) **byjus.com** outlines the procedure for the study of mitosis in onion root tip cells

	○ Metaphase: Align the chromosomes at the centre of the cell (equator). ○ Anaphase: Separate the chromatids and move them to opposite poles of the cell. ○ Telophase: Form two new nuclei around the separated chromatids. ○ Cytokinesis: Divide the cell into two daughter cells, each with a complete set of chromosomes. Alternatively, a card sort can be used to incorporate gamification ○ Students can be given key information about mitosis and meiosis on separate cards and then sort the cards into two piles for comparison ○ Cards should include: - virtual representations of cells undergoing meiosis and mitosis. - Number of divisions - Chromosome pairs - Presence or absence of recombination/cross-over - Number of resulting daughter cells - If the daughter cells are identical to the somatic cell - Type of nucleus- haploid or diploid • **Laboratory Activity – Observing Mitosis** Use microscopes to observe cells in different stages of the cell cycle. ○ Use onion root tips, which have a high frequency of cells undergoing mitosis. ○ With a scalpel or razor blade, cut 1-2 cm of the actively growing root tips and place them in a Petri dish.	https://byjus.com/biology/study-of-mitosis-in-onion-root-tip-cells/ **The human genome project** outlines the cell cycle https://www.genome.gov/genetics-glossary/Cell-Cycle **International society for stem** Articles about stem cell research https://www.isscr.org/

	○ Fix the root tips in a fixative solution (e.g., 3:1 ethanol: acetic acid) for 10-15 minutes to preserve the cell structures. ○ Rinse the root tips with water and place them in a few drops of staining solution (e.g. toluidine blue) for 10-15 minutes. This will help to highlight the chromosomes and cell structures. ○ Rinse the stained root tips gently with water to remove excess stain. ○ Prepare Slides: - Place a small drop of water on a microscope slide. - Using forceps, place the stained root tip on the slide. - Cover the root tip with a cover slip and gently press down to squash the tissue. This will spread the cells into a single layer, making it easier to observe individual cells. - Place the slide on the microscope stage and start with the lowest magnification to locate the root tip. Once the root tip is in view, gradually increase the magnification to observe individual cells. ○ Look for cells in different stages of the cell cycle: - Interphase: Cells with a distinct nucleus but no visible chromosomes. - Prophase: Chromosomes condense and become visible, but the nuclear membrane is still present. - Metaphase: Chromosomes line up along the metaphase plate. - Anaphase: Chromosomes are pulled apart towards opposite poles.	

	- Telophase: Chromosomes reach the poles, and the nuclear membrane starts to reform. - Cytokinesis: The cytoplasm divides, resulting in two separate daughter cells. ○ Draw and label the different stages of the cell cycle observed under the microscope. Note any significant features or differences between cells in various stages. ○ Use a microscope camera or phone camera adapter to take photographs of the cells in different stages of the cell cycle. • **Whole class and individual activity - Cell cycle flipbook** ○ Learner could create flipbooks that illustrate the stages of the cell cycle. This helps reinforce the sequence and events that occur in each phase. ○ Students should also consider what can happen if the cell cycle is disputed and define cell death and the Hayflick Limit. • **Whole class teaching and learning – Stem cells** Provide the class with recent news articles about stem cell research as a stimulus for discussion. Students should prepare notes for the discussion, including: ○ Properties of Stem Cells - Self-Renewal: The ability to divide and produce identical stem cells. - Differentiation: The potential to develop into various specialised cell types. ○ Types of Stem Cells	

	- Embryonic Stem Cells: Found in embryos and can differentiate into any cell type. - Adult Stem Cells: Found in tissues and organs; they repair and replace damaged cells. - Induced Pluripotent Stem Cells (iPSCs): Adult cells reprogrammed to an embryonic-like state. o Applications in Medicine - Regenerative Medicine: Using stem cells to repair or replace damaged tissues and organs. - Gene Therapy: Correcting genetic defects by introducing healthy stem cells. - Drug Testing: Testing new drugs on stem cells to predict their effects on human tissues. o Ethical Considerations - Embryonic Stem Cell Research: Raises ethical concerns about the use of human embryos. - Regulations: Vary by country; it's crucial to understand the ethical and legal framework. o Future - Advancements in Research: Potential for breakthroughs in treating diseases like Parkinson's, Alzheimer's, and diabetes. - Challenges: Scientific, ethical, and logistical hurdles need to be addressed.	

A8 Levels of organisation	• **Small group Activity - Smoking tobacco.** ○ Students should undertake research into respiratory and cardiovascular diseases due to smoking tobacco. Students should research and present their findings back to the class in five-minute presentations. ○ The presentations should include information about: - Respiratory Diseases, such as lung cancer, chronic obstructive pulmonary disease (COPD), asthma, chronic bronchitis, pneumonia, etc - Cardiovascular Diseases, such as coronary heart disease (CHD), stroke, peripheral artery disease (PAD), arrhythmias - Mechanisms, such as toxins in tobacco smoke, inflammation and oxidative stress: - Public Health Impact, including second-hand smoke, economic burden and mortality - Prevention and Treatment, including public awareness campaigns • **Whole class teaching and learning – Anatomy of the lungs** Demonstrate a pluck to illustrate the macro structure of the lungs including inflation of the lung to show the action of ventilation. Brief method: ○ Place the pluck on the dissection tray and secure it with pins. Observe the external features and compare them with the diagram. ○ Locate the heart, lungs, and liver.	**Bitesizebio.com** has a history of cell biology https://bitesizebio.com/166/history-of-cell-biology/#:~:text=The%20history%20of%20cell%20biology,by%20Anton%20van%20Leeuwenhoek%20in **NHS** for information about cardiovascular disease https://www.nhs.uk/conditions/cardiovascular-disease/ **National Institutes of Health** for information about CVD https://www.nhlbi.nih.gov/research/coronary-heart-disease **Stem.org.uk** has a resource library with instructions and a video of a pluck dissection https://www.stem.org.uk/resources/elibrary/resource/34598/pluck-dissection **Bio.libretexts** gives information about the tissues and outline the method for observing the tissues under a microscope, https://bio.libretexts.org/Bookshelves/Human_Biology/Human_Anatomy_Lab/03%3A_Histology/3.01%3A_Examining_epithelial_tissue

	○ Start by making a small incision in the trachea (windpipe). You will notice that it is held open by rings of cartilage. ○ Continue cutting down the trachea until you reach the bronchi, which branch into the lungs. ○ Carefully cut through the bronchi to expose the lungs. ○ Observe the lobes of the lungs (usually three on the right and two on the left). You can inflate the lungs by inserting a tube into the bronchi and gently blowing air into them. This helps to see the internal structure. ○ Make an incision to open the heart and observe its chambers (atria and ventricles) and valves. You can also trace the major blood vessels (aorta, pulmonary arteries, and veins). ○ Finally, examine the liver. Observe its lobes and texture. You can also look at the blood vessels entering and leaving the liver. ○ Students should take notes on the structure, texture, and connections of each organ. Compare your observations with a textbook diagram and discuss the functions of these organs in relation to the respiratory and circulatory systems. • **Laboratory Activity - Squamous and columnar epithelial tissue** Allow students to observe pre-prepared slides of squamous and columnar epithelial tissue under optical microscopes and drawing of biological diagrams to reflect the differences and similarities.	**BBC bitesize** has information on the structure and function of blood vessels https://www.bbc.co.uk/bitesize/guides/z9n6sg8/revision/2
B: The Nervous and endocrine systems		
B1 The nervous system	• **Small group Activity - The nervous system** ○ Students could be given ECG traces and draw conclusions from the trace about the health of the patient.	**Life in the fast lane** has a library of ECG traces, litfl.com,

	○ Common findings in ECG traces could include: - Sinus Rhythm: Normal heart rhythm with a rate of 60-100 bpm. - Atrial Fibrillation: Irregularly irregular rhythm with no distinct P-waves. - Bradycardia: Heart rate less than 60 bpm. - Tachycardia: Heart rate greater than 100 bpm. - ST Elevation: Can indicate a myocardial infarction (heart attack). ○ Learner should consider: Heart Rate - Regular Rhythm: Count the number of large squares between R-R intervals and divide 300 by this number to get the heart rate (e.g., 4 large squares = 75 bpm). Irregular Rhythm - Count the number of QRS complexes in a 10-second strip and multiply by 6 (e.g., 10 complexes = 60 bpm). Heart Rhythm - Regular: Check if the R-R intervals are consistent. - Irregular: Determine if the irregularity is regular (patterned) or irregular (completely random). P-Wave and PR Interval - P-Wave: Should precede every QRS complex - PR Interval: Measure the time from the start of the P-wave to the start of the QRS complex (normal range: 120-200 ms).	**Sleep Foundation** has information about circadian rhythms https://www.sleepfoundation.org/circadian-rhythm **European Biological Rhythms Society (EBRS)** has information about circadian rhythms https://www.ebrs-online.org/ **Faculty.washington.edu** has a section about reflexes and some practical ideas to investigate reflexes in human volunteers https://faculty.washington.edu/chudler/chreflex.html

	QRS Complex - Duration: Measure the QRS duration (normal range: 80-120 ms). - Morphology: Check for any abnormal shapes or patterns. ST Segment and T-Wave - ST Segment: Should be at the baseline; deviations can indicate ischemia or injury. - T-Wave: Should be upright in most leads; inverted or abnormal T-waves can indicate electrolyte imbalances or ischemia. • **Whole class teaching and learning – circadian rhythms** Explain what circadian rhythms are—24-hour cycles that regulate various physiological processes, such as sleep, feeding, and hormone production. Use real-world examples like sleep patterns, jet lag, and shift work. o Students could conduct experiments to observe circadian rhythms in action. For example, students can track their own sleep patterns, record light exposure, and analyse how these factors affect their alertness and mood. • **Laboratory activity - Reflex arc** Reflex Arc Relay Race: Students act out the reflex arc in a relay race format. Each student represents a different part of the reflex arc and must "pass the signal" to the next student in line.	

	○ Conduct simple reflex tests in the classroom, such as the knee-jerk reflex (patellar reflex) or pupil dilation. ○ Students can pair up to test each other's reflexes and record their observations.	
B2 The endocrine system	• **Whole class teaching and learning - Introduction** On an outline of a human body (this could be A4 or life-sized) students could draw and label the endocrine glands, including: ○ Hypothalamus ○ pituitary gland ○ pineal gland ○ thyroid gland ○ parathyroid glands ○ adrenal glands ○ pancreas ○ ovaries ○ testes • **Whole class teaching and learning – Hormones** Students to create a fact file about a hormone. They should include: ○ Hormone Name ○ The gland or organ where the hormone is produced ○ Chemical Structure: ○ Main functions and roles of the hormone in the body/ specific processes or systems it regulates ○ Secretion and Regulation: ○ Target Cells/Organs: ○ Mechanism of Action:	**Society for Endocrinology** provides expert information about hormones and hormone-related conditions, https://www.yourhormones.info/ **Johns Hopkins Medicine** provides comprehensive information on hormones and the endocrine system, including their roles and how they affect the body, https://www.hopkinsmedicine.org/health/wellness-and-prevention/anatomy-of-the-endocrine-system **Diabetes.co.uk** has a how to test your blood glucose video guide, https://www.diabetes.co.uk/blood-glucose/how-to-test-blood-glucose-levels.html **Diabetes.org.uk** have a diabetes menu planner Students could also bring in a selection of food packets to use to create a healthy 7-day meal plan for a diabetic person, with around 1200 calories

	○ Effects: ○ Disorders or conditions associated with excess or deficiency of the hormone. ○ Diagrams and Illustrations ○ References • **Guest Speaker- Diabetes** Prepare questions for a guest speaker to include: ○ the importance of a balanced diet for managing diabetes. ○ how physical activity affects blood sugar levels ○ how different types of activities impact glucose levels. Invite a healthcare professional or someone living with diabetes to share their experiences and answer students' questions. If possible, demonstrate blood sugar monitoring- show students how to use a glucometer to check blood sugar levels. You can use a demonstration glucometer and test strips to illustrate the process.	https://www.diabetes.org.uk/living-with-diabetes/eating/recipes?gad_source=1 **Science buddies.org** outline a procedure for investigating the effect of exercise on blood sugar. (blood sugar balancing act: how exercise tips the scales) https://www.sciencebuddies.org/science-fair-projects/project-ideas/HumBio_p039/human-biology-health/blood-sugar-exercise N.B. This is a 4-week practical investigation with human volunteers and blood testing and so unlikely to be feasible with the GLH and health and safety restrictions but can be the basis of the discussion. The practical method can also be considered for validity and ethical concerns.
B3 Homeostasis	• **Laboratory activity – Keep a constant temperature** ○ Students can try to keep a beaker of water at a specific temperature using only ice and a Bunsen burner so that they can appreciate the feedback mechanisms involved in their bodies to maintain a constant internal temperature OR ○ Students could use a simulation (like the Body control centre from PBS learning media) to maintain constant conditions	**Wedmd.com** has a-z guides, including "what is homeostasis" https://www.webmd.com/a-to-z-guides/what-is-homeostasis **PBS learning media** has a body control simulation https://www.pbslearningmedia.org/resource/tdc02.sci.life.reg.bodycontrol/body-control-center/

	• **Small group Activity – Discussion about homeostasis** After research time, students should discuss a "big question"- questions could be differentiated for the groups Examples of questions include: ○ Discuss temperature regulation- what happens when you are too hot/ too cold? ○ Why do we not have to think about heartbeat and breathing when we are asleep? ○ How and why can we survive extreme internal (because of extreme activity) and external (because of factors like environmental temperatures) conditions?	**YouTube-** the amoeba sisters channel has a video, homeostasis and negative/positive feedback that could be used as a stimulus for discussion, https://www.youtube.com/watch?v=Iz0Q9nTZCw4
C: The musculoskeletal system		
C1 The skeleton	• **Whole class teaching and learning - Skeleton** ○ Label a model skeleton with the names of bones. ○ This could be done as a "race" or a team relay task • **Small group Activity – Basic structure of bones** ○ Provide students with a set of bone replicas and have them sort and identify each one. OR ○ Show students real or simulated X-rays and have them identify different bones.	**Innerbody.com** has an interactive 3D anatomy model of the skeletal system, https://www.innerbody.com/image/skelfov.html
C2 Joints, tissues and muscles	• **Whole class teaching and learning/ Laboratory Activity –Structure and function of muscles** Chicken wing dissection Brief method:	**assist.asta.edu.au** has instructions of a STANDARD OPERATING PROCEDURE: Performing a chicken wing dissection, https://assist.asta.edu.au/sites/assist.asta.edu.au/files/SOP%20Performing%20a%20chicken%20wing%20dissection.pdf

	○ Place the uncooked chicken wing on the dissection tray and wear gloves. Pin the wing down to keep it stable. ○ Carefully use a scalpel or scissors to cut through the skin at the shoulder end. Peel back the skin to expose the muscles underneath. ○ Observe the different muscles in the wing. Notice how they attach to the bones at the joints. ○ Look for the tendons that connect the muscles to the bones. You may see white, fibrous tissues at the ends of the muscles. ○ Gently pull on the muscles to see how they contract and move the wing. This will help you understand how muscles work in pairs to move the joints. ○ Observe the joints where the bones meet. Note the cartilage and any ligaments that support the joints. ○ Students should take notes and draw diagrams of their observations. They should take a photograph or make a detailed drawing and label the muscles, tendons, and joints. • **Whole class and individual activity - neuromuscular junctions** ○ Students could research the action of neurotransmitters at neuromuscular junctions ○ Students could summarise information about neuromuscular junctions in 100 words or less, with one image.	**YouTube-** Teach PE has a channel with a video of the types of muscle fibres- fast twitch, slow twitch (GCSE PE), https://www.youtube.com/watch?v=8x8H-GFtwyU **biologydictionary.net** has a chapter on neuromuscular junction, including a multiple-choice quiz, https://biologydictionary.net/neuromuscular-junction/

C3 Disorders of the musculoskeletal system	• **Whole class teaching and learning – bones and joints** Use models of bones and joints to demonstrate common disorders like arthritis, osteoporosis, and fractures. Students can manipulate the models to see how these disorders affect movement. • **Individual activity – living with a musculoskeletal disorder** Ask students to write a story from the perspective of someone living with a musculoskeletal disorder, focusing on daily challenges and coping strategies.	**NHS** has information about disorders of the musculoskeletal system, https://www.uhsussex.nhs.uk/sussex-trauma-network/rehabilitation/conditions/musculoskeletal-disorder/ **World Health Organization (WHO)** has fact sheets and resources on musculoskeletal health, including the impact of these conditions on mobility and quality of life, https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions
D: The cardiovascular and respiratory systems		
D1 The cardiovascular system	• **Laboratory activity– Anatomy of the heart** ○ Students could be given a heart to dissect ○ Fresh sheep, cow, and ox or pig hearts purchased from a butcher or abattoir • **Whole class and individual activity - Effect of exercise on heart rate** ○ Students could measure their heart rate at rest and after exercise to understand how the cardiovascular system responds to physical activity. • **Laboratory activity- Thrombocytes and clotting** ○ Divide students into small groups, each assigned a specific part of the clotting cascade: - Group 1: Platelet activation and plug formation - Group 2: Coagulation factors and the role of fibrin	**BBC bitesize** has information on the structure and function of blood vessels, https://www.bbc.co.uk/bitesize/guides/zvjkbdm/revision/1 **Assist.asta.edu.au** has instructions for the STANDARD OPERATING PROCEDURE: Performing a heart dissection , https://assist.asta.edu.au/sites/assist.asta.edu.au/files/SOP%20Performing%20a%20heart%20dissection.pdf **Royal society of biology Nuffield Foundation** has a collection of experiments that demonstrate biological concepts and processes, such as

	- Group 3: The conversion of prothrombin to thrombin ○ Students then create a flowchart or diagram ○ Groups present their section in a 2-minute summary using their diagrams ○ Groups can then connect their stages, building the full clotting cascade step-by-step. • **Laboratory activity - blood clotting** ○ Students can investigate coagulation by making a semisolid (gelatinous) ball using a solution of sodium alginate (dyed with food colouring) and a calcium chloride solution. ○ Explain that sodium alginate mimics fibrin, and calcium chloride represents calcium ions, which are key in activating clotting factors. ○ Discuss how anticoagulants (e.g. heparin) prevent blood clotting by removing calcium ions. ○ Students should compare and contrast the model to real blood clotting, such as an explanation of how calcium ions contribute to both this model and real blood clotting.	Observing the effects of exercise on the human body, https://practicalbiology.org/control-and-communication/control-of-heart-rate/observing-the-effects-of-exercise-on-the-human-body
D2 The respiratory system	• **Whole class teaching and learning - Introduction** ○ Students should recap the process of breathing- including the role of the diaphragm, rib cage and intercoastal muscles. ○ The distinction between breathing and respiration should be made clear.	**YouTube** Ted-Ed has a channel with a video about how lungs work, https://www.youtube.com/watch?v=8NUxvJS-_0k **Salters-Nuffield Advanced Biology Resources** has a core practical sheet of INVESTIGATING BREATHING,

	• **Whole class activity – spirometer traces** ○ Students should be provided with spirometer traces and make calculations of breathing rate, respiratory minute volume, oxygen consumption and maximum flow rate from the data provided • **Whole class teaching and learning – disorders associated with the respiratory system** ○ Students could create posters explaining specific respiratory disorders, including - symptoms - causes - treatments - prevention strategies.	https://mrsjonesbiology.weebly.com/uploads/3/1/8/4/31847531/a_level_biology_a_core_practical_17_-_investigating_spirometer_traces.pdf **NHS** has information about disorders associated with the respiratory system https://www.nhsinform.scot/illnesses-and-conditions/lungs-and-airways/ **Asthma +Lung UK** has information about disorders associated with the respiratory system https://www.asthmaandlung.org.uk/ **World Health Organisation (WHO)** has information about disorders associated with the respiratory system https://www.who.int/health-topics/chronic-respiratory-diseases#tab=tab_1
E: The renal and digestive systems		
E1 The renal system	• **Laboratory activity - The kidney** ○ Students could be given a kidney to dissect ○ Fresh sheep, cow, and ox or pig hearts purchased from a butcher or abattoir ○ External Examination of the renal hilum (locate the indented area where the renal artery, renal vein, and ureter enter and exit the kidney) and renal capsule (note the tough, fibrous outer covering of the kidney).	**Stem.org.uk** has a resource library which included "let's dissect- the kidney", https://www-dev.stem.org.uk/resources/elibrary/resource/31240/let%E2%80%99s-dissect-%E2%80%93-kidney **YouTube** has videos about the structure of the nephron, ultrafiltration and selective reabsorption in the kidney

	○ Make a longitudinal cut through the kidney from the outer edge to the renal hilum. Be careful to make a smooth, even cut to expose the internal structures. ○ Use forceps and scissors to carefully separate and examine the structures. - Cortex: Observe the outer region just beneath the renal capsule. It appears lighter in colour. - Medulla: Note the darker, inner region containing renal pyramids. - Renal Pyramids: Identify the cone-shaped structures within the medulla. - Renal Pelvis: Locate the funnel-shaped area where urine collects before entering the ureter. ○ Students should take notes and draw diagrams- labelling the parts of the kidney to reinforce your understanding of its anatomy. • **Laboratory activity – Filtration Simulation** Use simple materials like coffee filters, gravel, and coloured water to simulate the filtration process in the kidneys. This demonstrates how the kidneys filter waste from the blood. Brief method: ○ Fill one beaker with water and add a drop or two of red food colouring (if desired). Add a spoonful or two of sand to the water. This represents your blood, with the sand symbolizing waste products. ○ Place a coffee filter or paper towel over the top of the second beaker and secure it with a rubber band. This represents the nephrons in the kidneys, which filter waste from the blood.	https://www.youtube.com/watch?v=nKSHkmwBz1I **Kidney.org** outlines the method for the filtration simulation https://www.kidney.org/sites/default/files/ykayth_nkf_kidney_filtration_demo_instructions.pdf

	○ Carefully pour the contents of the first glass (with the red solution and sand) into the second glass. Watch how the coffee filter captures the sand (waste products). ○ After all the liquid has filtered through, you will see clean liquid in the bottom glass, representing filtered blood that gets sent back to the body. The coffee filter will have the sand (waste products), which in the kidneys would be sent to the bladder as urine.	
E2 The digestive system	• **Whole class teaching and learning – organs of the digestive system** Label a diagram (either A4 or life-sized) of the digestive system. Students should know the pathway through the digestive system and key information about each organ, including ○ which enzyme- substrate interaction(s) occurs, ○ change in conditions for enzyme action, ○ mechanical or chemical digestion, ○ absorption of products • **Laboratory activity - explore how enzyme activity changes in different conditions.** A series of practical's could be carried out – or a carousel of practical's could be completed, or each group of students could investigate one factor and then use "science fair" style display boards to share their findings. ○ Investigate the effect of pH on amylase activity ○ Investigating effect of temperature on the activity of lipase ○ Investigating the effect of concentration on the activity of trypsin	**YouTube** Cognito GCSE Biology channel has a video that discusses what the digestive system does, how it works, the organs involved, and how the villi are adapted for absorbing nutrients https://www.youtube.com/watch?v=vMI46qGQMDw **Royal Society of Biology, Nuffield Foundation** outlines the methods for practical's investigating factors affecting enzyme activity, https://practicalbiology.org/bio-molecules/factors-affecting-enzyme-activity

	○ Investigating an enzyme-controlled reaction: catalase and hydrogen peroxide concentration	

Delivering signposted transferable skills

Signposted transferable skills are not mandatory for the delivery of the unit, and it is therefore your decision to deliver these skills as a part of the qualification. Below we have provided some ideas of teaching and learning activities that you could use to deliver these skills if you chose to.

Transferable skills	Ideas for delivery

SP-CT – Critical Thinking	• **Whole class teaching and learning – demonstrating critical thinking skills**
	• Explain to students the concept of critical thinking using examples from research around disorders associated with the respiratory system. Students would need to demonstrate;
	  ○ Questioning relevance of information
	  ○ Challenging own biases
	  ○ Breaking information into parts and identifying relationships and connections
	  ○ Identifying strengths or weaknesses of information and why information is significant
	  ○ Drawing conclusions supported by structured reasoning
	• Students would also need to consider arguments from other perspectives where this was applicable.

Resources

This section has been created to provide a range of links and resources that are publicly available that you might find helpful in supporting your teaching and delivery of this unit in the qualification. We leave it to you, as a professional educator, to decide if any of these resources are right for you and your students, and how best to use them.

Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate. We'd also suggest that you bookmark useful websites and consider enabling students to access them through the school/college intranet.

Websites

The Biologist – Royal Society of Biology

Student magazine exploring recent developments in Biology, with features, interviews and opinion articles.

Practical Biology – Royal Society of Biology

Practical procedures and related real-life contexts, inclusive of guidance for technicians.

Homepage - Science & Plants for Schools – Science and Plants for Schools

Practical procedures and related real-life contexts, inclusive of guidance for technicians.

| STEM – STEM Learning Big Picture

Big Picture magazine is aimed at post 16 students to explore contemporary issues in biology and medicine. It contains articles, activity sheets and presentations.

16+ ABPI – Interactive Resources for Schools

Including resources by topic, with diagrams and interactive activities.

Home | Wellcome – Wellcome Trust

Offers 5-minute articles associated with modern medicine and science topics for developing a wider application of the specification.

Human Biology - SchoolScience.co.uk School Science Human Biology

Poster, set of teaching materials, quizzes and classroom activities for human biology topics.

Higher Human Biology | My Site Higher Human Resources

Teaching resources, summary notes, revision support and bitesize quizzes.

eChalk: biology resources Biology resources

Interactive diagrams, quizzes, worksheets, to support teaching and learning

Textbooks

Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V., and Orr, R., Campbell Biology 12th Edition, Pearson, 2020

Boyle, M., Senior, K., Collins Advanced Science Human Biology 3rd Edition, WordUnited, 2008

NEDU., Biology Made Easy., NEDU LLC., 2021

DK., The Concise Human Body Book: An illustrated guide to its structure, function and disorders, DK., 2019.

Chiras., D.D., Human Biology., 9th Edition, Jones & Bartlett Learning, 2018

Pearson paid resources also available

- Pearson Student book
- ActiveBook (a digital version of the Student Book, via ActiveLearn Digital Service)
- Digital Teacher Pack (via ActiveLearn Digital Service)

Unit 2: Health Issues and Scientific Reporting

Unit overview

Unit 2: Health Issues and Scientific Reporting	
Assessment type: External	
Content Area	**Topics**
A Diagnostic techniques	A1 Basic methods, normal range, unit of measurement and interpretation of the results as an indication of a patient's health A2 Diagnostic tests for genetic and chromosomal conditions during pregnancy
B: Immune response and dysfunction	B1 Immune response B2 Immune dysfunction
C: Genetics and Health	C1 Gene expression C2 Genetic conditions and genetic screening
D: Cancer	D1Development of cancer D2Cancer screening and diagnosis D3 Cancer treatment
E: Interpretation, analysis and evaluation of scientific information	E1 Quantitative and qualitative evidence E2 How factors affect validity and reliability of quantitative and qualitative data sources and conclusions E3 Conducting data analysis
Assessment overview The unit will be assessed through one examination of 80 marks lasting 2 hours. Students will be assessed through a number of short- and long-answer questions. Students will need to explore and relate to contexts and data presented. The questions will assess understanding of health issues and associated initiatives and reporting. The assessment availability is twice a year in January and May/June. The first assessment availability is May/June 2026. Sample assessment materials will be available to help centres prepare students for assessment.	

Common student misconceptions

Below are some common misconceptions related to the content of this unit by students and ideas for how you can help your students to avoid and overcome these.

What is the misconception?	How to help students overcome it
That chorionic villus sampling is linked to the villi in the small intestine	Explain that villus is a term used to describe a projection in the human body. Just like there are finger-like projections in the small intestine, there are also finger-like projects appear on the trophoblast after implantation. These projections are called chorionic villi that are surrounded by the tissues of the uterus and blood of the mother.
Selecting incorrect alleles when constructing genetic diagrams	Provide students with plenty of worked examples to allow them to practice constructing Punnett squares and familial pedigrees
Confusing the terms benign and malignant.	Ensure students are clear on the meaning of these terms when delivering learning aim D

Learning Activities and Resources

This section offers a starting point for delivering the unit by outlining a logical sequence through the unit topics and suggesting practical activities and teacher guidance for covering the main areas of content during guided learning time. Transferable skills are integrated into various activities, with those embedded in a unit indicated by an acronym in square brackets. The acronym combines the letters from the broad skill area and the specific transferable skill, e.g., **[IS-WC]**.

Please note the activities provided below are suggestions and not mandatory. Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate.

Learning Topic	Activities and guidance for unit content delivery	Resources
A1.1 Diagnostic technique for heart rate	• **Whole class teaching and learning – Introduction** Recap on prior knowledge of heart structure and function from unit 1. ○ Show students video of a patient undergoing an ECG. ○ Compare normal and abnormal ones. ○ Discuss each stage of the trace and how it can vary from the normal • **Small group activity – Researching disorders affecting heart rate** ○ Split class into groups and assign one of the following disorders to each group. - arrhythmia	**British heart foundation** - A short video clip describing what ECGs are and how they are performed. https://www.bhf.org.uk/informationsupport/tests/ecg **Geeky Medics** – A detailed video Interpreting an ECG trace https://geekymedics.com/how-to-read-an-ecg/ **YouTube** – interpreting an ECG trace https://www.youtube.com/watch?v=l8LHCQZCuLM

	- atrial fibrillation - tachycardia - bradycardia. ○ Each group to research and prepare a presentation on one of the four issues that result in abnormal heart rate. ○ They should include - What the abnormality is and how it manifests itself medically. - How it is diagnosed – what would constitute an abnormal result - An ECG trace showing how the disorder presents and how it compares to a normal ECG trace. - How it is treated • **Paired activity – exam technique practice** ○ Use past examination questions for pairs to discuss and formulate an agreed response. ○ Provide mark scheme and discuss key marking points. • Whole class teaching and individual activity	**NHS –** information about arrhythmia https://www.nhs.uk/conditions/arrhythmia/ **British Heart Foundation** – Information about atrial fibrillation https://www.bhf.org.uk/informationsupport/conditions/atrial-fibrillation **Patient –** Information about Bradycardia https://patient.info/heart-health/palpitations-leaflet/bradycardia

	○ Demonstrate how an ECG trace can be used to calculate heart rate. Provide students with some examples for them to complete individually	
A1 Basic methods, normal range, unit of measurement and interpretation of results as an indication of patient health. A1.2 Diagnostic technique for blood pressure	• **Whole class teaching and learning – Introduction to topic.** ○ Show video clips of different types of blood pressure measurement (e.g. manual and electronic sphygmomanometer, ambulatory BP monitoring) ○ Discuss advantages and disadvantages of each type ○ Include discussion on normal blood pressure readings • **Small group activity – measuring blood pressure** ○ Provide students with an electric sphygmomanometer cuff and a set of instructions on taking blood pressure. ○ Students have their blood pressure taken by another student in the group ○ Record each blood pressure reading ○ Collate blood pressure readings and discuss whether are within the expected range. ○ Discuss possible issues in measurement/factors that might affect the result.	**YouTube** – NHS video overview of blood pressure including demonstrating how to measure blood pressure electronically https://www.youtube.com/watch?v=ZzRW70uc-EU **YouTube** – Drugs.com video demonstrating how to measure blood pressure manually https://www.youtube.com/watch?v=lpvyCGPsVDU **YouTube** – video showing ambulatory blood pressure measurement https://www.youtube.com/watch?v=cvHY1gYTgAw

	• **Individual activity – Researching medical conditions and communicating information appropriately** ○ Half the class research hypertension and half research hypotension ○ Students prepare an informative leaflet for patients who have been recently diagnosed with these conditions. ○ Students will need to include - What the condition is - What causes it - Why it is a problem - How it is diagnosed – including information on the tests used. - Treatments and how they work to control the condition - How it is monitored - Prognosis ○ Pair students who have researched hypertension with students who have researched hypotension. Students to present their leaflet to their partner.	**Patient UK –** Facts on hypertension and hypotension https://patient.info/heart-health/high-blood-pressure-hypertension https://patient.info/heart-health/low-blood-pressure **British Heart foundation** – facts on hypertension and hypotension https://www.bhf.org.uk/informationsupport/risk-factors/high-blood-pressure https://www.bhf.org.uk/informationsupport/risk-factors/high-blood-pressure/low-blood-pressure
A1 Basic methods, normal range, unit of measurement	• **Whole class teaching and individual activity** ○ Show visual aids/video clips of methods used to observe respiratory rate (Spirometry, peak flow)	**YouTube –** How a spirometry test is performed https://youtu.be/UyS6ByEgJws

and interpretation of results as an indication of patient health. A1.3 Diagnostic technique for respiratory rate:	○ Discuss advantages and disadvantages of each method ○ Students find definitions for key terms used in spirometry and peak flow measurement. ○ Give students a range of peak flow readings and a graph of normal range of measurements for peak flow. Students should be given case studies which include peak flow and spirometry measurements. Students should use normal values to identify any abnormalities. • **Small group activity – poster for a doctor's surgery/hospital** ○ Each group to research a disease that affects respiratory function (e.g. COPD or asthma ○ Students construct an informative poster for a doctor's/hospital waiting room about their chosen disorder. ○ The poster should include - What the condition is and what causes it - How the condition is diagnosed - Normal vs abnormal test results - Treatments for the condition and how they work to control it - How it is monitored	**NHS –** Information about spirometry https://www.nhs.uk/conditions/spirometry/ **Geeky medics –** Information about peak flow measurement including video https://geekymedics.com/peak-expiratory-flow-rate-pefr/ **Patient UK** – Chart showing normal values for peak flow in men and women https://patient.info/news-and-features/peak-flow-diary **British lung foundation –** information and normal values for respiratory rate tests. https://www.asthmaandlung.org.uk/sites/default/files/Section%202.1%20-%20tests%20to%20measure%20your%20breathing.pdf

	- Steps the patient can take to manage their condition - Reference list • **Paired activity – looking at case studies** ○ Provide each pair with a selection of case studies ○ Students to discuss each case study and suggest diagnoses and treatment for each patient.	
A1 Basic methods, normal range, unit of measurement and interpretation of results as an indication of patient health. A1.4 Diagnostic technique for core body temperature:	• **Whole class teaching – different types of thermometers** ○ Use visual aids to show the students the different types of thermometers used to measure body temperature ○ Discuss the different methods that can be used to measure body temperature and identify some advantages and disadvantages of each. ○ Identify the best methods for investigating body temperature in a scientific setting ○ Students could devise a practical to compare measuring temperature using a forehead thermometer and an ear thermometer. ○ Students could research the different types of thermometers including: - How temperature is recorded - Accuracy of readings	**YouTube** – NHS video summarising measuring body temperature https://www.youtube.com/watch?v=UxE6J9YBxqs **Healthline** – different methods of measuring body temperature https://www.healthline.com/health/types-of-thermometers

	- Normal results for each method - Advantages and disadvantages of each method • **Individual activity – researching abnormalities in body temperature** ○ Students could produce a written report of causes of abnormal temperature readings (e.g. infection, hyperthermia, hypothermia).	
A1 Basic methods, normal range, unit of measurement and interpretation of results as an indication of patient health. A1.5 Diagnostic technique for tissue perfusion A1.6 Diagnostic technique for blood oxygen saturation:	• **Whole class teaching and learning** ○ Discuss ways that tissue perfusion and blood oxygen saturation can be measured (CRT, pulse oximetry and arterial blood gases) ○ Show students how to perform a capillary refill test and how to measure blood oxygen levels using an oximeter. ○ Discuss how this is done and what normal measurements should be. • **Practical activity – Measuring tissue perfusion and blood oxygen saturation** ○ Students could measure CRT and blood oxygen and use their results to identify whether their results are in the normal range.	**YouTube –** video demonstrating how to measure capillary refill https://www.youtube.com/watch?v=n--wFoZFklg **GP Notebook** – How to measure capillary refill time including normal measurements https://gpnotebook.com/pages/paediatrics/capillary-refill-time **Patient.co.uk** - Arterial blood gases information including normal readings. https://patient.info/treatment-medication/arterial-blood-gases **Geeky medics** – interpreting arterial blood gases

	• **Individual activity – researching causes of abnormal tissue perfusion and oxygen saturation** ○ Learner's research the following conditions - dehydration - poor blood flow to tissues - hypoxemia - lung disease ○ Students should use their research to write a fully referenced report which includes the following information - What each condition is - how each condition could affect tissue perfusion and/or oxygen saturation - An example of a disease that cases the condition **EL-SRS**	https://geekymedics.com/abg-interpretation/
A1 Basic methods, normal range, unit of measurement and interpretation of results as an indication of patient health.	▪ **Whole class teaching and learning – Introduction to the nervous system** ○ Show summary video on the structure of the nervous system ○ Discuss areas where things could go wrong in the nervous system what the potential effects on a person might be.	**YouTube** – structure of the nervous system https://www.youtube.com/watch?v=btdVcSLTfDk

A1.7 Diagnostic technique for the assessment of nervous system function	▪ **Paired activity – investigating diagnostic tests for nerve conduction speed.** o Students to research a method of testing nerve conduction speed. o Each pair should create an informative presentation on their diagnostic test. o This should include - What the test is used for - How the test is performed including a diagram of the equipment used - A brief explanation of what a normal and abnormal result would look like ▪ **Visit/Guest speaker – Clinical neurophysiology department** o Students could visit the clinical neurophysiology department of the local hospital. o Students could listen to a talk from a clinical neurophysiologist about the types of tests they carry out. ▪ **Peer teaching – diseases affecting nerve conduction speed** o In groups of 4, students take one of the following four disorders: multiple sclerosis, peripheral	

	neuropathy, spinal cord injury, neuromuscular conditions e.g. motor neurone disease ○ Students should include the following in their teaching - Symptoms - Causes - Diagnosis (including specific tests) - Treatments - Prognosis ○ Each learner should present their chosen disorder to the other members of their group. ▪ **Whole class activity – researching diseases that affect nerve conduction** ○ Set up several stations around the room each representing a disease that affects nerve conduction speed e.g. multiple sclerosis, peripheral neuropathy, spinal cord injuries, neuromuscular condition(s) ○ Students should record key information about each disorder including: - Symptoms - Causes - Diagnosis (including specific tests)	

	- Treatments - Prognosis ○ Students use the information to make revision flash cards	
A2 Diagnostic tests for genetic and chromosomal conditions during pregnancy A2.1 Amniocentesis A2.2 Chorionic villus sampling:	• **Guest speaker – midwife/pre-natal health care professional** ○ Invite a midwife to talk about prenatal tests for genetic and chromosomal conditions during pregnancy and why they are carried out. • **Whole class and individual activity – Produce a leaflet about prenatal screening for genetic and chromosomal conditions** ○ Students to produce an information leaflet on pre-natal tests for pregnant women. ○ Students should include chorionic villus sampling and amniocentesis. ○ They should include - What the test is for and why it is carried out - How it is carried out (include diagrams if appropriate) - When the test is carried out - What the results mean - Any ethical considerations related to the tests	**YouTube –** Performing an amniocentesis test https://www.youtube.com/watch?v=aDH0XR_Ko-U **NHS** – Performing an amniocentesis test https://www.nhs.uk/conditions/amniocentesis/ **NHS –** Amniocentesis factsheet leaflet https://www.uhs.nhs.uk/Media/UHS-website-2019/Patientinformation/Pregnancyandbirth/Amniocentesis-QF-PCR-test-2829-PIL.pdf **NHS** – Video showing how a CVS test is performed https://www.nhs.uk/conditions/chorionic-villus-sampling-cvs/

Learning Topic	Activities and guidance for unit content delivery	Resources
B: Immune response and dysfunction		
B1.1 Types of innate, non-specific physical defences B1.2 Types of innate, non-specific chemical defences B1.3 Innate biological defences	• **Whole class teaching and learning – physical and chemical defences (innate nonspecific)** ○ Ask learners how the body prevents microorganisms entering the body. Produce a spider diagram of responses. Discuss whether they are physical or chemical responses. ○ Watch short video introducing blood clotting, scab formation and inflammation as non-specific defences against pathogens • **Small group activity – researching and presenting innate, non-specific responses** ○ In small groups, allocate each group one of the following innate, nonspecific defences to research. - Skin and mucous membranes - Blood clotting and scab formation - Enzymes in tears and saliva - Stomach acid and Gut microbiota - Inflammatory response ○ They should prepare a presentation to give to the class. The presentation should include the following: - Type of barrier (chemical/physical/both) - An overview of the barrier and its involvement in the immune response - How the barrier protects the body (include diagrams where appropriate) - What happens if the barrier doesn't work	**Wellcome trust** - A selection of resources for teaching the immune system https://www.stem.org.uk/rx34vg **YouTube** – Video on blood clotting, scabbing and inflammation https://www.youtube.com/watch?v=UTz9sPfAro0 **YouTube** – Innate immunity overview video https://www.youtube.com/watch?v=GIJK3dwCWCw&t=488s

	○ Each group should present their work to the class. Other groups should make notes about each barrier and how it works. • **Individual activity – Researching innate biological defences** ○ Learners could research the role of each of the following white blood cells and their role in innate biological immune response. - Mast cells - Phagocytes - Basophils - Eosinophils - Natural killer T cells • **Individual activity** ○ Use assessment material from past exams/Pearson exam wizard to consolidate knowledge on innate nonspecific defences	

B1.4 Adaptive primary immunity Cell mediated response Humoral response	• **Whole class teaching and learning and individual activity – Recognising of self and nonself antigens** ○ Introduce the concept of cell surface antigens and their role in the body in recognising cells as 'self' and 'non-self'. ○ Provide reference material and ask learners to identify ways in which cells carrying nonself antigens might get into the body. (Include pathogens, transplants, abnormal body cells, toxins) ○ Introduce the idea of phagocytosis as a nonspecific response. Provide learners with unlabelled diagrams showing the steps of phagocytosis. Learners should annotate these diagrams. The annotations should include the role of pseudopodia, vacuole formation, role of hydrolytic enzymes. • **Whole class teaching and individual activity** ○ Introduce the concept of specific cell mediated response ○ Provide reference material on T lymphocytes and their role in cell mediated response. ○ Learners could produce an annotated flow chart showing the cell mediated response to an antigen. ○ Learners could work in small groups to produce a fully referenced academic poster explaining the cell mediated response. - What the cell mediated response is - The role of antigen presenting cells - The role of T cells including clonal selection - Types of T cell including cytotoxic T cells and helper T cells • **Whole class teaching – the humoral response** ○ Show audio visual material which provides an overview of the	**YouTube** – Video summarising recognising self and nonself cells https://www.youtube.com/watch?v=2aAZ13zC3lY **ABPI** – Specific immune response – cell mediated response https://www.abpischools.org.uk/topics/pathogens-and-the-immune-system/specific-immune-system-cell-mediated-response/

	humoral response. ○ Learners could produce a revision sheet / flash cards for their peers including - How B lymphocytes are activated - Annotated flow chart showing the humoral response ○ Learners could produce a table to compare the cell mediated and humoral responses. • **Whole class teaching and learning and individual activity -** ○ Show learners how plasma cells and memory cells are formed ○ Provide stimulus material about plasma cells and give learners some prepared activities to complete. These should include information on monoclonal antibodies, antigen-antibody complexes, immunoglobulins and agglutination **MY-PS&R**	**ABPI** – Humoral response https://www.abpischools.org.uk/topics/pathogens-and-the-immune-system/the-specific-immune-system-humoral-response/

B1.5 Adaptive secondary immunity Memory cells	• **Paired activity – Role of memory cells in the secondary immune response** ○ Learners produce a presentation on the production and role of memory B cells including - When and how they are formed (link to humoral response) - The role of memory cells in long term immunity - How they work, including speed of response - Limitations of the secondary immune response (antigen variability) ○ Learners produce a table to compare the primary and secondary immune responses in terms of speed, specificity ○ Provide learners with a graph showing primary and secondary immune responses showing antibody concentration against time. Learners should explain what is happening at each stage. ○ Learners could research the similarities and differences between memory B cells and memory T cells and produce a table to summarise their findings **IS-WC**	**Nursing hero** – Diagram showing the primary and secondary immune responses in relation to antibody production after initial and secondary exposure to an antigen https://www.nursinghero.com/study-guides/microbiology/overview-of-specific-adaptive-immunity

B1.5 Adaptive secondary immunity Vaccinations	• **Whole class and individual activity- vaccinations** ○ Class discussion on what vaccinations are and how they work to protect against disease. ○ Show stimulus material showing how different vaccinations work. ○ Provide learners with questions or diagrams for annotation which demonstrate how immunity is developed through vaccinations ○ Provide past examination questions using data showing the effectiveness of vaccinations over time • **Group activity** ○ SWOT analysis on different UK vaccination programmes - MMR - Covid - HPV - Shingles - RSV - Influenza **IS-V&NC**	**Wellcome trust** – Immunity and vaccinations fact sheet https://www.stem.org.uk/resources/elibrary/resource/460254/immunity-and-vaccination#&gid=undefined&pid=1 **ABPI** – Animation showing how vaccinations work https://www.abpischools.org.uk/topics/infectious-diseases-immunity/vaccination-and-immune-memory/ **British society for immunology** – Information about vaccines https://www.immunology.org/public-information/vaccine-resources/childhood-vaccines/vaccine-infographics
B1.6 Passive immunity – Passive versus active immunity	• **Whole class and individual activity** ○ Show a video clip/animation comparing active and passive immunity. ○ Learners could complete a table comparing active and passive immunity. They could compare the following features - Production of antibodies - Time before antibodies appear in the blood - Cells involved ○ Learners could carry out individual research into the following	**NICE –** Information about active and passive immunity https://bnf.nice.org.uk/treatment-summaries/vaccination-general-principles/ **BBC bitesize** – Level 2 information about active and passive immunity https://www.bbc.co.uk/bitesize/guides/zcmhxfr/revision/4 **Immunology.org** – Neonatal immunology

	examples of passive immunity. - Mother via placenta or breast milk - Use of monoclonal antibodies in treating disease • Overview of what they are • How they work • Benefits • Risks **EL-SRS**	https://www.immunology.org/public-information/bitesized-immunology/immune-development/neonatal-immunology **ABPI -** Uses of monoclonal antibodies https://www.abpischools.org.uk/topics/infectious-diseases-immunity/monoclonal-antibodies/
B2.1 Autoimmune diseases	• **Whole class teaching and learning** o Recap what an autoimmune disease is and how it might be diagnosed. • **Project based learning – preparing an academic poster** o Students should work in small groups and each group should be allocated - Multiple sclerosis - Crohn's disease - Rheumatoid arthritis o Students should include - Theoretical causes - Symptoms - Impact on function - Treatment	**NHS** - Information about multiple sclerosis https://www.nhs.uk/conditions/multiple-sclerosis/ **NICE -** Information about multiple sclerosis https://cks.nice.org.uk/topics/multiple-sclerosis/ **MS Society -** Information about multiple sclerosis https://www.mssociety.org.uk/ **NHS -** Information about Crohn's disease https://www.nhs.uk/conditions/crohns-disease/ **Crohns.org -** Information about Crohn's disease https://crohns.org.uk/ **NICE** - Information about Crohn's disease https://cks.nice.org.uk/topics/crohns-disease/ **NHS** - Information about rheumatoid arthritis https://www.nhs.uk/conditions/rheumatoid-arthritis/

		NICE - Information about rheumatoid arthritis https://cks.nice.org.uk/topics/rheumatoid-arthritis/ **Arthritis action** – Information about rheumatoid arthritis https://www.arthritisaction.org.uk/living-with-arthritis/what-is-arthritis/rheumatoid-arthritis/
B2.2 Primary and secondary immunodeficiency diseases	• **Whole class teaching and learning** ○ Discuss what these diseases are ○ Ask learners to compare them to autoimmune diseases. ○ Learners could produce a table which highlights the key differences between autoimmune and immunodeficiency diseases. • **Project based learning** ○ Students are trainee healthcare assistants and have been asked to produce a patient fact sheet for the following immunodeficiencies - Severe combined immunodeficiency disease - HIV - Effect of chemotherapy on the immune system (Chemotherapy induced immunodeficiency) - Effect of organ transplants on immunity (Immunodeficiency due to organ transplants) ○ Students will need to include - An overview of the immunodeficiency and the areas of the body affected - Causes of the immunodeficiency - Symptoms of the immunodeficiency	**Immunology.org** - Organ transplant immunology https://www.immunology.org/policy-and-public-affairs/briefings-and-position-statements/transplant-immunology **Great Ormond Street hospital** – Information about SCID https://www.gosh.nhs.uk/conditions-and-treatments/conditions-we-treat/severe-combined-immunodeficiency-scid/ **British society for immunology** – HIV and immunity https://www.immunology.org/public-information/bitesized-immunology/pathogens-disease/human-immunodeficiency-virus-hiv **Cancer research UK** – How chemotherapy

	- How the immunodeficiency is diagnosed/monitored (including tests and their results) - Any treatments and how they work ○ Learners complete a swot analysis on each other's fact sheets. **EL-CL**	affects the immune system https://www.cancerresearchuk.org/about-cancer/what-is-cancer/body-systems-and-cancer/the-immune-system-and-cancer **British society for immunology** – Transplant immunology https://www.immunology.org/policy-and-public-affairs/briefings-and-position-statements/transplant-immunology
B2.3 Allergies and allergens	▪ **Whole class teaching and learning** ○ Discuss what allergies are and identify some common allergies and what causes them. ○ Discuss how allergies might be managed and why this might be problematic. ▪ **Small group activity** ○ Set up information stations with factsheets, data, textbooks research papers etc about the following conditions ▪ Allergy induced asthma ▪ Anaphylaxis ▪ Dermatitis ○ Provide a fact sheet template for the learners to find out the following information about each condition ▪ Causes ▪ Symptoms ▪ Effects on function ▪ How it is treated ▪ Prognosis ▪ **Paired activity**	**NHS** – Information about allergies https://www.nhs.uk/conditions/allergies/ **Patient.info** – Information about allergies https://patient.info/allergies-blood-immune/allergies **Allergy uk** – Information about asthma induced allergies https://www.allergyuk.org/types-of-allergies/asthma-respiratory/ **NHS** – Information about asthma https://www.nhs.uk/conditions/asthma/causes/ **NHS** – Information about anaphylaxis https://www.nhs.uk/conditions/anaphylaxis/ **Anaphylaxis UK** – Information on anaphylaxis https://www.anaphylaxis.org.uk/fact-sheet/anaphylaxis-signs-and-symptoms/

	○ Alternatively, learners could produce an informative podcast about allergies based on one of the three examples above. ○ Podcasts could be presented to the class, and learners could provide constructive feedback on each other's work. ▪ **Individual activity** ○ Use assessment material from past exams/Pearson exam wizard to consolidate knowledge on innate nonspecific defences	**NHS** – Information about dermatitis https://www.nhs.uk/conditions/contact-dermatitis/symptoms/
C: Genetics and Health		
C1 gene expression C1.1 structure and function of nucleic acids	▪ **Whole class teaching and learning** ○ Teacher presentation about the structure and function of DNA including chromosomes, genes, triplet codes. Introns and exons ▪ **Whole class and individual activity** ○ Show structure of RNA and discuss how it differs from DNA. Learners to produce a table showing the main differences between DNA and RNA ○ Learners complete annotated diagrams of tRNA, mRNA and rRNA molecules	**BBC bitesize** – Structure of DNA https://www.bbc.co.uk/bitesize/guides/z36mmp3/revision/1 **BBC bitesize** – DNA replication https://www.bbc.co.uk/bitesize/guides/zrwhrj6/revision/1 **BBC Bitesize** – Gene expression and structure of RNA revision https://www.bbc.co.uk/bitesize/guides/zgrccdm/revision/1 **ABPI** – DNA and RNA https://www.abpischools.org.uk/topics/chemistry-of-life/dna-and-rna/
C1 gene expression C1.2 Transcription of DNA to RNA	• **Whole class and individual activity** ○ Use animated sequence to show the stages of transcription. ○ Learners to produce a flow diagram showing each stage and include the role of the following enzymes in transcription - DNA Helicase	**YouTube** – Transcription and translation video https://www.youtube.com/watch?v=Z6n7CWyoqFU&t=10s **BBC bitesize** – Transcription and translation

	- RNA Polymerase **EL-MOL**	revision https://www.bbc.co.uk/bitesize/guides/zvsmd6f/revision/6
C1 gene expression C1.3 Editing mRNA	• **Whole class and individual activity** o Use animated sequence to show the three stages of splicing of RNA. Provide diagrams for learners to annotate. Ask learners to include the following in their annotations - Introns - Exons - Spliceosomes ▪ **Paired activity** o Provide application-based questions for learners to complete in pairs. o Provide mark schemes for learners to check and expand on their responses **EL-CL**	**BBC bitesize** – Splicing https://www.bbc.co.uk/bitesize/guides/zgrccdm/revision/3
C1 gene expression C1.5 Types of gene mutation during DNA replication	▪ **Whole class and individual activity** o Use audio visual media to introduce the topic of mutations. Discuss where mutations occur and the three types of mutation that can occur during DNA replication o Learners should find information about each type of mutation listed below. - Base Deletion (frameshift mutation) - Base Addition/insertion (frameshift mutation) - Base substitution (point mutation) o For each mutation learners need to include - Identify the type of mutation (Point or frameshift)	**YouTube** – Overview of mutations https://www.youtube.com/watch?v=3jwDl7nYBPM&t=69s

C1.6 Effects of mutation on gene expression dependent on location	- Locations where the mutations can occur - Effects that the mutation will have on the protein that the DNA is coding for ▪ Learners could complete a series of exam style questions on the different types of mutation including the effects the mutation might have on the following: o Start codon, stop codon, control gene, oncogene, tumour suppressor gene **MY-TPR**	**BBC Bitesize** - Effect of mutations in non-coding regions of DNA https://www.bbc.co.uk/bitesize/guides/zc499j6/revision/1
C1 gene expression C1.7 Hereditary (Germline) mutations	• **Whole class teaching** o Show audiovisual media to introduce hereditary and acquired mutations and highlight the key differences between the two types. o Learners could produce a table comparing the characteristics of hereditary and acquired mutations • **Project based learning** o Learners complete a research project which includes the following information including examples given in the unit specification: - Characteristics of hereditary mutations - Causes of hereditary mutations - Possible effects of hereditary mutations **EL-MOL**	
C1 gene expression C1.8 Acquired mutations (somatic	• **Project based learning** o Learners produce an academic poster which includes the following information including examples given in the unit specification	

mutations)	- Characteristics of acquired mutations - Causes of acquired mutations - Possible of acquired mutations • **Individual activity** o Learners could research different mutagenic agents e.g. radiation and chemical (alkylating agents) and feedback to the class on their findings **EL-SRS**	
C2 genetic condition and genetic screening C2.1 Definitions of genetic terms	▪ **Whole class teaching and individual activity** o Recap the terms used in genetics, the use and interpretation of genetic diagrams and information on diagnostic tools used in genetic disorders. o Learners could complete a card sort activity to recap the meanings and functions of the following genetic terms - Gene; allele; dominant; recessive; genotype; phenotype; heterozygous; homozygous; sex linkage; carrier; affected/sufferer; non affected/ non sufferer ▪ **Individual activity** o Set questions on understanding and interpreting inheritance information/ familial pedigrees. **EL-MOL**	**BBC bitesize** – Punnett square practice https://www.bbc.co.uk/bitesize/guides/z2rm3k7/revision/6
C2.2 Interpretation of genetic diagrams	▪ **Whole class teaching and individual activity** o Use visual examples of familial pedigrees and Punnett squares and demonstrate how to construct and interpret them. o Provide learners with information and ask them to construct Familial pedigrees and Punnett squares illustrating using the information given.	

	○ Provide case studies so learners can practice constructing and interpreting genetic diagrams. ○ Learners could complete some past exam questions. Provide mark schemes so they can review their answers **EL-MOL**	
C2.3 Inheritance of genetic and chromosomal conditions C2.4 Effect of genetic and chromosomal conditions	▪ **Project based learning** ○ Learners produce a group poster on a given genetic or chromosomal condition. Learners present their posters to the class - Cystic fibrosis - Huntington's disease - Haemophilia - Downs syndrome ○ **Posters should include the following details.** - Whether it is a genetic or chromosomal condition - How it is inherited - A genetic diagram which illustrates how it is inherited - The symptoms of the condition - Management of the condition - Prognosis **EL-SRS**	**NHS** – Cystic fibrosis information https://www.nhs.uk/conditions/cystic-fibrosis/ **Cystic fibrosis trust** – Cystic fibrosis information https://www.cysticfibrosis.org.uk/what-is-cystic-fibrosis **NHS** – Huntington's disease information https://www.nhs.uk/conditions/huntingtons-disease/ **NHS** - Haemophilia https://www.nhs.uk/conditions/haemophilia/ **Patient.info** – Haemophilia https://patient.info/allergies-blood-immune/haemophilia **Patient.info –** Downs syndrome https://patient.info/childrens-health/downs-syndrome-leaflet
C2.5 Methods and limitations of obtaining DNA samples	• **Whole class teaching - Introduction to genetic testing** ○ Discuss ways in which genetic issues may be identified. Introduce the idea of testing DNA. Discuss ways in which DNA might be collected and sampled - Oral/buccal swabs	Visual aids/video clips of methods of DNA collection

	- Body Fluids - Plucked hair ○ Learners produce a table describing each technique and how it is carried out • **Guest speaker** ○ Arrange for a guest speaker whose work involves taking DNA samples (e.g. forensic scientist) • **Visit** ○ Arrange a visit to a forensics laboratory so learners have an opportunity to look at some of the techniques used.	
C2.6 Use of DNA sequencing techniques to determine genetic conditions or predispositions C2.7 Ethical considerations of genetic screening C2.8 Ethical considerations of acquisition, management and regulatory frameworks of genome sequencing and genetic screening	▪ **Whole class teaching** ○ Use audio visual media to explain what whole genome sequencing is and how it is done. Discuss any possible benefits and drawbacks to whole genome sequencing ○ Learners could carry out their own research into the benefits and drawbacks of whole genome sequencing and produce a newspaper article outlining their findings ▪ **Individual task - uses of DNA sequencing** ○ Provide learners with different source materials. Learner's research the role of genomic sequencing techniques in identifying and treating genetic conditions - What is genomic sequencing - Reasons why it may be done including the following - Whole genome sequencing in newborns - Benefits and drawbacks that might arise from genetic	**Genomics education programme** – A video explaining what a genome is What is a Genome? - Genomics Education Programme **Nuffield Council on Bioethics** – A document about whole genome sequencing in newborns https://cdn.nuffieldbioethics.org/wp-content/uploads/Whole-genome-sequencing-of-babies.pdf **Nuffield Council on Bioethics** - Genetic profiling case study activity https://www.stem.org.uk/rxvpn

data	screening in each scenario ○ Research the regulatory frameworks that cover genomic testing in the UK. Provide a brief overview of their role and what they do. ▪ **Whole class teaching and individual activity** ○ Ask learners to discuss the risks and benefits of using DNA sequencing techniques for Pre employment genetic screening. Include impact on the applicant and employer in your discussion. ○ Discuss the benefits and drawbacks that might arise from genetic screening – e.g. data storage and protection, usage etc ○ Learners produce a written summary of the benefits and drawbacks of genetic screening **IS-V&NC**	
D: Cancer		
D1 development of cancer D1.1 Causes of cancer	▪ **Whole class teaching and learning** ○ Teacher led discussion about what cancer is and what causes it. Produce a spider diagram of key points discussed including what it is, different types of cancer, causes, risk factors. ○ Show video showing the process of carcinogenesis and that this can be triggered by different factors ▪ **Group activity** ○ Split learners into groups of 4. Assign each learner one of the four causes of cancer to research. - Chemical mutagens – acquired - Radiation exposure – acquired - Mutations in tumour suppressor genes – hereditary	**YouTube** – Carcinogenesis summary video https://www.youtube.com/watch?v=NO0eKiIUcBg

	- Oncogenes - hereditary ○ Learners should find out how their given cause leads to the development of cancer and produce an illustrated flow chart of the stages. Each 'expert' should then deliver a short presentation to their group on their findings	
D1.2/D1.3 Characteristics of benign and malignant tumour growth	• **Whole class teaching and individual activity** ○ Discuss the meaning of benign and malignant in relation to tumour growth. ○ Learners to research and produce a table identifying the main differences between benign and malignant tumour growth • **Paired Activity** ○ Discuss the article on benign and malignant tumours. Identify the main differences between benign and malignant tumour growth and summarise in a table. **EL-SRS**	**BBC Bitesize** – Benign and malignant tumours https://www.bbc.co.uk/bitesize/guides/znbp2sg/revision/8 **Cancer research UK –** Article on benign and malignant tumours https://news.cancerresearchuk.org/2020/03/02/science-surgery-are-benign-tumours-different-from-cancerous-tumours/
D2 Cancer screening and diagnosis D2.1 Types of cancer screening and diagnosis methods D2.2 Cancer screening programmes D2.3 Benefits of cancer screening	▪ **Whole class teaching and learning** ○ Introduce the different cancer screening programmes available in the UK and discuss the advantages and disadvantages of each ▪ **Project based learning** ○ Learners to produce an academic presentation on one of the following cancer screening programmes. They should use published data to support their work. Presentations should be fully referenced. - Bowel cancer screening - Breast cancer screening - Cervical cancer screening	**Cancer research UK**– information on cancer screening https://www.cancerresearchuk.org/about-cancer/cancer-symptoms/spot-cancer-early/screening/what-is-cancer-screening **NHS** – Cancer screening programmes in the UK https://www.england.nhs.uk/cancer/early-diagnosis/screening-and-earlier-diagnosis/ **NHS data –** Links to data about cancer screening programmes in the UK https://www.england.nhs.uk/statistics/statistical-work-areas/screening/

D2.4 Risks and limitations of cancer screening	○ Provide journal articles /data showing the uptake of cancer screening programmes. Suggest reasons why people may people may refuse cancer screening. ○ Learners could research one of the cancer screening programmes in detail to include, - History - When it is offered - How it is carried out - What the benefits of screening are for the cancer (early detection, effects on treatment etc) - What the risks of screening are (eg false positives, false negatives, different methods of screening used, any barriers to screening) ○ Look at the pros and cons of each of the screening programmes/complete a SWOT analysis of each programme to identify any possible benefits, drawbacks and improvements that could be made - Paired activity - Provide case studies on the uptake rates of each type of screening. Learners should identify the benefits and drawbacks of screening based on the case study. They should discuss how any drawbacks could be addressed. **IS-T**	
D3 Cancer treatment D3.1 Process of cancer treatment	▪ **Guest speaker** ○ Arrange for a speaker to come in and talk about the different types of treatment for cancer ▪ **Individual activity** ○ Learners could produce a patient friendly leaflet for cancer patients about one of the treatments for cancer mentioned in	**Cancer research UK** – List of cancer treatments https://www.cancerresearchuk.org/about-cancer/treatment

	the unit content - Surgery - Chemotherapy - Radiotherapy - Hormone therapy ○ They should include the following information in their leaflets - Characteristics of each treatment – how it is carried out - Any side effects – short and long term - Types of cancer that treatment is used for - Success rates of treatment method ○ Learners could present their findings to the rest of the group. ▪ **Paired activity** ○ Learners could research the treatment of a cancer of their choice and present their findings. ○ They could present their findings to the group. **IS-V**	
E: Quantitative and qualitative evidence		
E1 Quantitative and qualitative evidence E1.1-1.3 Overview of quantitative and qualitative evidence	• **Whole class teaching and learning** ○ Show examples of the quantitative and qualitative evidence and ask learners to identify type and ask for their reasoning. • **Paired activity** ○ Provide learners with different examples of quantitative and qualitative evidence. Ask them to categorise each example. ○ Discuss what the differences are between the data types. Ask learners to suggest possible conclusions that could be made from the data presented	**Study Rocket** – Notes on validity and reliability https://studyrocket.co.uk/revision/level-3-applied-human-biology-btec/interpret-analyse-and-evaluate-scientific-information/validity-and-reliability **Science ready** – Validity, reliability and accuracy explained https://scienceready.com.au/pages/validity-accuracy-and-reliability

	○ Discuss the advantages and disadvantages of quantitative and qualitative data	
E1.4 Methods of Collection of data	• **Group activity** ○ Research the different methods of collecting data mentioned in the unit specification. And compile a written summary of each method. The summary should include the following information. - A description of what each method is. - The type of studies the method might be used in. - The benefits and drawbacks of each method - Types of data that might be collected using the method - Examples of the method • **Individual/paired activity** ○ Provide examples of different types of study. Ask learners to identify types of data collected and methods of collection • **Guest speaker** ○ Invite a researcher from a local university to come in and talk about the different methods used when collecting data **SP-CT**	
E1.5 Methods of processing quantitative and qualitative data Processing data	• **Whole class teaching and learning** ○ Explain that once data is collected and presented, it is necessary to process it to draw appropriate conclusions. ○ Provide a range of different studies and ask learners to identify the type of data collected and the techniques used to process it. • **Guest speaker** ○ Invite a researcher from a local university to come in and talk	**YouTube** – How to do a chi squared test https://www.youtube.com/watch?v=Dh9fa3FAq58&t=49s **YouTube** – How to do a t-test https://www.youtube.com/watch?v=Y_MuVFTuk-Q

	about the importance of data analysis when processing data. ▪ **Project based learning** o Learners could research different methods of processing data and present their findings to the group - Types of average (including mean, median, mode and range) - Standard deviation (including the formula and error bars - Statistical significance (including hypotheses, null hypotheses, significance) - Chi Squared test - T- test - Spearmans rank - Errors in measurement (need to include uncertainty, calculating percentage error and identifying and dealing with anomalous results) o They should include - An explanation of what they are - When they are used - How they are calculated - A worked example - Some practice questions for the group with mark schemes OR ▪ **Whole class teaching and individual activity** o Introduce each of the methods of processing data. Complete a worked example together and provide practice questions for each	**YouTube –** Using standard deviation https://www.youtube.com/watch?v=fxzgEgwl41w

	MY-TPR	
E1.6 Methods of presenting quantitative and qualitative evidence	• **Whole class teaching and individual activity** o Show different examples of the following and discuss the pros and cons of each evidence presentation method. Learners - Infographics - Graphs - Uncertainty tables - Uncertainty written conclusions o Learners produce a table showing the features of each of the formats - Type of data they are used for - Benefits - Drawbacks o Provide examples of journal articles that use each method and ideally a combination of the methods and ask learners to complete a SWOT analysis for them. **EL-CL**	
E2 How factors affect validity and reliability of quantitative and qualitative data	• **Whole class teaching and individual activity** o Recap the meaning of accuracy, validity and reliability in terms of data. Discuss the factors learners would look for when assessing whether scientific information is valid and reliable. o Provide learners with various written examples of reliability and validity. Ask learners to identify if the example relates to validity or reliability.	
E2 How factors affect validity and reliability of	• **Small group activity** o Provide a range of articles based on topics covered in learning aims A-D. Learners should review their evidence and write a	

quantitative and qualitative data Sample size Peer review Funding source Author	written report on the validity and reliability of their article based on the following factors. ○ **Author** - What is their expertise in research - Is there evidence that they could they be biased towards a particular point of view ○ **Sample size** - How many results were obtained - Any evidence of a sample size calculation - How will this impact on the reliability and validity of the evidence ○ **Peer review** - Where is the study published - Is it likely to have been peer reviewed - How do these factors impact on the reliability and validity of the evidence ○ **Funding source** - Who has funded the research - Any conflict of interest - How will this impact on the reliability and validity of the evidence	
E2 How factors affect validity and reliability of quantitative and qualitative data	• **Whole class teaching** ○ Introduce the different organisations/groups/individuals outlined in the unit specification and discuss how they might influence specific health issues from LA A-D.	

Influence of organisations and individual on health issues	• **Small group activity** o Provide each group with an organisation from the list below and supply relevant resources. Learners should produce a short presentation on the influence of the organisation on a chosen health issue covered in the learning aims A-D. o Influence of organisations and individuals on health issues - WHO - NHS - Health education England - Patients - Universities and research groups - Pharmaceutical companies - Charities and trusts • **Paired activity** o Provide learners with a scientific article on a health issue from the unit specification. They are to complete a typical assessment question on the influence of organisations/individuals on this issue. o Provide a copy of the mark scheme and ask learners to provide feedback on how the other learners could improve their answers. • **Individual activity** o Learners could select an organisation they are interested in and write a short summary of the influence of the organisation on the health issue covered in learning aims A-D.	
E2 How factors affect validity and reliability of quantitative and qualitative data	• **Whole class teaching and individual activity** o Introduce the term bias and explain what it means. Ask learners to consider the stages of a research study. What stages might bias arise during a research project. Produce a spider diagram based on responses. o Learners could write a short report on bias in research including	

Bias	the following: - What is bias - Types of bias in research - Things to consider when assessing bias • **Paired activity** o Provide learners with examples of case studies displaying bias and ask learners to identify any examples of bias. Discuss findings as a group	
E2 How factors affect validity and reliability of quantitative and qualitative data Data	▪ **Whole class teaching** o Show examples of data that display different types of bias. These may include inappropriate extrapolation, extracting or misquoting data. Explain that data can also contain other errors ▪ **Individual activity** o Research the different sources of error in data that are listed in the unit content. Produce a short presentation to give to the class • **Paired activity** o Provide learners with a journal article based on one of the topics from learning aims A-D o What data has been presented	
E2 How factors affect validity and reliability of quantitative and qualitative data Use of secondary	▪ **Whole class and individual activity** o Discuss the similarities and differences between primary and secondary data sources o Learners could produce a table comparing the benefits and drawbacks of using primary and secondary sources of evidence	

data/sources	in research. ▪ **Paired/group activity** o Provide learners with a journal article based on one of the topics from learning aims A-D o Ask learners to identify secondary sources of data used in the article. Ask them to select three secondary sources of information to review. They should identify the following - Date of publication of the secondary - Author (Who they work for, are they affiliated with any organisations) - Sources of information (e.g. Journal, media, online etc.) o They should produce a written report commenting on how each of these factors might affect the validity and reliability of the evidence.	
E3 Conducting data analysis	▪ **Whole class teaching and individual activity** - Calculating averages o Complete worked examples of how to calculate mean, median and mode from data sets. o Provide example questions for learners to complete ▪ **Whole class teaching and individual activity -** Calculating percentage changes o Complete worked examples of how to calculate percentage change from data sets. o Provide example questions for learners to complete ▪ **Whole class teaching and individual activity -** Drawing and interpreting lines of best fit	

	○ Complete worked examples of how to construct lines of best fit from data sets. ○ Provide example questions for learners to complete	

Delivering signposted transferable skills

Signposted transferable skills are not mandatory for the delivery of the unit, and it is therefore your decision to deliver these skills as a part of the qualification. Below we have provided some ideas of teaching and learning activities that you could use to deliver these skills if you chose to.

Transferable skills	Ideas for delivery
EL – SRS Secondary Research Skills	• Individual activity – researching causes of abnormal tissue perfusion and oxygen saturation • Encourage students to research using a variety of articles and sources (newspaper articles from different sources, social media reports, Wikipedia, scientific journals, news broadcasts), • Allow students to consider the following points: ○ Are the articles accurate? ○ Are the articles reliable? ○ Are the resources relevant?

EL- PRS
 	
Primary Research Skills
	• Practical activity – Measuring tissue perfusion and blood oxygen saturation
	• Students could measure CRT and blood oxygen and use their results to identify whether their results are in the normal range.
	• Allow students to record results, and consider the following points:
	  ○ How are results presented?
	  ○ How accurate results are?
	  ○ How valid results are?
	  ○ Relevant statistical analysis.

Resources

This section has been created to provide a range of links and resources that are publicly available that you might find helpful in supporting your teaching and delivery of this unit in the qualification. We leave it to you, as a professional educator, to decide if any of these resources are right for you and your students, and how best to use them.

Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate. We'd also suggest that you bookmark useful websites and consider enabling students to access them through the school/college intranet.

Websites

Association of the British Pharmaceutical Industry – Interactive science resources for schools: https://www.abpischools.org.uk/age-groups/age-16plus/

British Heart Foundation – British charity raising money for research into heart and circulatory diseases: https://www.bhf.org.uk

British Society for Immunology – Society that supports the immunology community in driving scientific discovery and making a positive impact on Home | British Society for Immunology

Cancer Research UK – One of the first comprehensive cancer charities based in the UK Facts and figures about our research funding | Cancer Research UK

Department of Health and Social Care – Government department leading the nation's health and social care: https://www.gov.uk/government/organisations/department-of-health-and-social-care

Geeky Medics – Global medical education platform and a leading producer of high-quality educational resources: https://geekymedics.com/

Health Education England – A UK agency that aims to ensure the NHS workforce in England has the knowledge, skills, values and behaviours they need to deliver compassionate, high-quality health and care to the public NHS England Workforce, Training and Education | NHS England | Workforce, training and education

NHS Data Hub – The statutory custodian for health and care data for England Data

National Health Service – Free health service based in the UK NHS England

Patient Info – Website providing health information, and advice to help UK people get a better understanding of their health Patient.info: Health Information and Symptom Checker

STEM Learning – An organisation committed to STEM education STEM Learning

UK Health Security Agency – UK government agency that prevents, prepares for and responds to infectious diseases, and environmental hazards UK Health Security Agency - GOV.UK

World Health Organisation – Global agency that promotes worldwide health World Health Organization (WHO)

Pearson paid resources also available

- Pearson Student book
- ActiveBook (a digital version of the Student Book, via ActiveLearn Digital Service)
- Digital Teacher Pack (via ActiveLearn Digital Service)

Unit 3: Practical Microbiology and Infectious Diseases

Unit overview

Unit 3: Practical Microbiology and Infectious Diseases	
Assessment type: Internal	
Learning Aim	**Topics**
A Understand the classification and nature of microorganisms	A1 Characteristics of different microorganisms A2 Methods of pathogenicity A3 Classification strategies
B Examine the transmission and treatments of infectious diseases	B Examine the transmission and treatments of infectious diseases B1 Classification overview of infectious diseases B2 Transmission of infectious agents B3 Infectious diseases, signs, symptoms and progression B4 Prevention and treatment of infectious diseases
C Explore the application of techniques to culture and identify microorganisms	C1 Health and safety C2 Microscopy and staining techniques C3 Culture of microorganisms C4 Quantitative analysis of microbes
Assessment overview This unit is Internal assessed through a Pearson-Set Assignment Brief (PASB). Pearson sets the assignment for the assessment of this unit. The PSAB will take approximately 19 hours to complete. The PSAB will be marked by centres and verified by Pearson. The PSAB will be valid for the lifetime of this qualification.	

Common student misconceptions

Below are some common misconceptions related to the content of this unit by students and ideas for how you can help your students to avoid and overcome these.

What is the misconception?	How to help students overcome it
Antibiotics can combat diseases caused by microorganisms other than bacteria - particularly viruses.	Emphasise (particularly in learning aim A) that the structure and characteristics as well as the pathogenicity of microorganisms differ significantly from one another. What is designed to inhibit the growth and development of one type will not work for another.
All micro-organisms have negative effects or cause disease	Raise awareness that whilst some micro-organisms are harmful, some are beneficial for us e.g. mushrooms are a type of food, microbes are essential for a healthy gut microbiome.

Learning Activities and Resources

This section offers a starting point for delivering the unit by outlining a logical sequence through the unit topics and suggesting practical activities and teacher guidance for covering the main areas of content during guided learning time. Transferable skills are integrated into various activities, with those embedded in a unit indicated by an acronym in square brackets. The acronym combines the letters from the broad skill area and the specific transferable skill, e.g., **[IS-WC]**.

Please note the activities provided below are suggestions and not mandatory. Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate..

Learning Topic	Activities and guidance for unit content delivery	Resources
Introduction to the unit	• **Small group Activity – Microorganism Identification** ○ Ask the students to identify diseases commonly associated with the main types of microorganisms ○ Ask them to summarise their findings through making notes ○ Groups will then analyse the information collected and create a presentation to share their findings with the class. ○ Encourage interactive discussions where students share any experiences they may have had in relation to infectious diseases.	**Healthline** Examples of common pathogenic microorganisms What is a Pathogen? 4 Types and How They Spread Disease
A: Understand the classification and nature of microorganisms		
A1 Characteristics of different	• **Whole class teaching and learning – Characteristics of Different Microorganisms**	**Eukaryotes and Prokaryotes** https://www.bbc.co.uk/bitesize/guides/ztmktv4/revision/4

microorganisms	○ Using visual aids along with a PowerPoint presentation discuss the physical characteristics of prokaryotes, eukaryotes and acellular microorganisms ○ Encourage students to appreciate that bacteria fall into the category of prokaryotes and are always part of unicellular organisms; protists and fungi are eukaryotes, while viruses and prions are acellular ○ Encourage them to recognise that prions are misfolded proteins that can cause fatal brain disease in humans and animals • **Small group/Laboratory activity – Identifying Characteristics Visually** ○ Ask each group to look at slides which have been previously prepared and/or photographic images of prokaryotic and eukaryotic cells and note the key characteristics ○ Extend the previous activity to include viruses ○ Ask each learner to produce a diagram illustrating the characteristics of the various microorganisms in terms of the type of cell wall (Gram positive/negative bacteria), the main organelles present as well as other relevant features ○ Following on from the previous activity ask the students to cut the diagrams into jig-saw pieces, scramble and pass around the class for to reassemble. • **Whole class teaching and learning – Growth Characteristics of Microorganisms**	Acellular organisms https://study.com/academy/lesson/what-is-an-acellular-organism-definition-examples.html Useful videos: **Structure and function of a prokaryote cell** https://www.youtube.com/watch?v=jpGMbcSbb0E **Morphology of bacteria** https://www.youtube.com/watch?v=wEvW1ZF7if4&t=37s **Eukaryotic cells** https://www.youtube.com/watch?v=uTYQ0zH7IoU **Viruses** https://www.youtube.com/watch?v=RIRLNGWx_qQ **What are acellular organisms?** https://www.youtube.com/watch?v=lD8ifNWOZ5s

	○ Using visual aids along with a PowerPoint presentation discuss the growth characteristics of prokaryotes, eukaryotes and acellular microorganisms ○ Encourage students to appreciate the importance of growth curves for predicting bacterial growth and the effect of factors such as temperature and enzyme activity. ○ Encourage them to appreciate the relationship between life cycle/reproductive strategy of eukaryotes and their survival in a host. ○ Encourage them to appreciate that viral reproduction/replication depends on its ability to take over the host cell ○ Discuss methods of prion transmission and potential consequences in humans and animals • **Small group activity – Illustrating Growth and Development Characteristics** ○ Ask each group to create a poster on the reproductive strategy or life cycle of an assigned microorganism ○ Alternatively, or as an extension to the previous activity, each group could build 3D models of microorganism cells using various materials like Styrofoam balls, pipe cleaners, and toothpicks, allowing them to visualise the arrangement of organelles ○ For the growth characteristics of microorganisms, students could produce an animated cartoon show e.g. showing the log/lag/stationary phases of bacterial growth, viral replication etc.	

	○ Groups then place their poster on the wall or set their models out for display and share the information with the class. • **Paired activity** ○ Ask students in pairs to spend some time researching prokaryotic, eukaryotic and acellular microorganisms and collecting additional information for their notes. ○ Following on from the previous activity, ask them to produce Venn diagrams showing the organelles and other characteristics which are shared by different microorganisms and unique to some	
A2 Methods of Pathogenicity	• **Small group activity – pathogenicity of microorganisms** ○ Using visual aids along with a PowerPoint presentation discuss the mechanisms by which microorganisms such as bacteria, viruses, protists and fungi cause disease in the host ○ Ask each group to identify areas in their centre where there is a potential risk of microorganisms to be spread through easy access to hosts (this should apply to all 3 categories of microorganism listed in the unit content) ○ Students to produce a leaflet explaining what risks of infection are greater in certain areas e.g. salmonella in food areas, airborne viruses such as influenza and covid in crowded areas, athlete's foot ○ Students consider actions by individuals that can further enhance access of microorganisms to hosts	**How infectious agents cause disease** https://www.ncbi.nlm.nih.gov/books/NBK27114/ https://pmc.ncbi.nlm.nih.gov/articles/PMC7158287/ **Pathogenicity vs. virulence** https://www.youtube.com/watch?v=jieJklfNnM4 **Viral pathogenesis** https://www.youtube.com/watch?v=MshVLocqj-Q **Fungal pathogens** https://www.youtube.com/watch?v=PzAXbxftGR8

	○ Activities involving liquid exchange or use of glitter can help students understand how microorganisms such as bacteria can spread in the classroom • **Whole class and individual activity – Overcoming the Immune System** ○ Discuss the immune system with the class and how microorganisms can evade it • **Small group activity** ○ Ask students to produce a cartoon strip showing how the body defences and the immune system combat pathogens ○ Extend the previous activity to show how the immune system can be overcome by pathogenic microorganisms ○ Alternatively, students could produce an animated cartoon film on the computer showing the immune system being overcome by invading pathogens • **Paired activity – Damage to Host Cells and Tissues** ○ Ask students in pairs to research how an assigned pathogenic microorganism causes damage to the cells and tissues of the host and can evade the immune system of the host ○ Ask each pair to provide a brief outline of their findings to the class as a whole ○ Follow this by asking them to produce a table which shows the body tissues and organs that are mainly affected by the different pathogenic microorganisms	**Malaria** https://www.youtube.com/watch?v=aGWP3Xbk0OY

	○ By sharing their findings from activities which involve researching topics, students can engage in a continuous learning process	
A3 Classification Strategies	• **Whole class teaching and learning – classification of microorganisms** ○ Using visual aids along with a PowerPoint presentation, outline the main methods of classifying microorganisms ○ Students can revisit activities carried out for A1 and A2 to understand how the characteristics and pathogenicity of microorganisms helps to determine the classification strategy • **Small group activity/Laboratory activity** ○ Ask each group to look at slides which have been previously prepared and/or photographic images (including electron micrographs) to identify features of the different classes of microorganism ○ Ask the students to note the key characteristics and differences ○ Students can devise a card game e.g. which involves matching different microorganisms to their classification (e.g. salmonella to rod shaped, Gram negative etc.) • **Paired activity and Peer Teaching** ○ Ask students in pairs to research an assigned microorganism and collect more detailed information as to how it would be classified ○ Then ask each pair to provide a brief outline of their findings to the class as a whole	**Classification of bacteria** https://microbenotes.com/classification-of-bacteria/ **Protista** https://byjus.com/biology/protista/ **Viruses** https://byjus.com/biology/virus/ **Identification and classification of bacteria** https://www.youtube.com/watch?v=8IJRzcPC9wg&t=169s **Virology and viral classification** https://www.youtube.com/watch?v=lADC0C_WeH0

	• **Individual activity** ○ Ask the students to summarise what they have understood regarding the classification and nature of microorganisms ○ This can again be followed up by an activity such as a quiz to check understanding ○ Students can access and complete online quizzes/tests such as 'Kahoot' or other similar sites ○ Students could devise their own quiz/test and mark scheme on the physical and growth characteristics as well as the pathogenicity of an assigned microorganism and pass this around the class	
B: Examine the transmission and treatments of infectious diseases		
B1 Classification overview of infectious diseases	• **Small group activity – Infectious diseases** ○ Using visual aids along with a PowerPoint presentation, recap the classification strategies for microorganisms covered in learning aim A ○ Students can revisit some of the activities carried out in order to fully identify the organs and tissues targeted by certain microorganisms • **Whole class and individual activity – Damage to Host Tissues and Organs** ○ Students can undertake a bingo game whereby they can identify microorganisms against the organs and tissues targeted ○ A 'full house' is when all the criteria listed on the board for a named microorganism have been called out	

	• **Visiting speaker – A Professional Overview of Infectious Disease within the Community** ○ An appropriate healthcare professional from a Hospital, Care Home or other healthcare premises who is involved with Infection control can be invited to speak to the students about the risk of infectious disease in their establishment ○ Students should be encouraged to prepare relevant questions which they can ask the speaker ○ The latter can be used to obtain information regarding the main infectious diseases encountered, transmission, areas and individuals at risk, prevention measures and treatment	
B2 Transmission of infectious agents	• **Whole class teaching and learning – Transmission of infectious Disease** ○ Using visual aids along with a PowerPoint presentation, outline the different methods by which infectious agents can be transmitted ○ Students should appreciate that breaking the chain of infection is key to preventing the transmission of an infectious agent • **Small group activity – Spread of Infection** ○ Firstly, ask students to pass around an object which has been covered in a germ simulating gel/powder and which will fluoresce under UV light ○ They will appreciate that microorganisms will rapidly spread in a similar fashion	**UKHSA** Information regarding recent outbreaks of infectious disease UKHSA data dashboard **National Library of Medicine** Information on historical outbreaks of infectious disease Pandemics: Risks, Impacts, and Mitigation - Disease Control Priorities: Improving Health and Reducing Poverty - NCBI Bookshelf

	○ Ask students to identify areas in their centre where there is the potential for infectious disease to be spread ○ Each group can focus on the risks within a particular area e.g. assembly hall, canteen, washrooms/changing areas, classrooms etc. ○ Students will assess which diseases pose the highest risk in each area, what enhances the transmission and what steps can be taken to minimise the risks ○ Ask students to produce a flow chart showing how an infectious microorganism can be spread through a community ○ Alternatively, they could produce an animated show of the agent's spread as well as how the spread can be halted • **Paired activity and Peer teaching – Historical Outbreaks of Infectious Disease** ○ Ask students in pairs to research historical incidences of an infectious disease (e.g. cholera, Typhoid, TB etc.) ○ Students identify measures which have contributed to reducing the outbreaks of such diseases ○ Each pair discusses their findings with the class as a whole. (This could perhaps involve compiling a case study involving an individual or family affected by an outbreak of disease) ○ Each pair can then research a more recent outbreak of an infectious disease (e.g. Covid, Influenza, Noravirus etc); identifying the infectious agent, mode of transmission, signs/symptoms, treatments/cures	

	○ Again, each pair discusses their findings with the class as a whole (EL-CL) • **Individual activity – Lessons Learned from History** ○ Ask students to make comparisons between historical outbreaks of infectious disease and more recent ones ○ They could use a Venn Diagram to make comparisons ○ They could also construct a Globally Significant Disease Matrix which identifies which infectious diseases are most prevalent, where, the mortality rate, interventions in place to deal with outbreaks etc.	
B3 Infectious diseases, signs, symptoms and progression	• **Whole class and individual activity – Signs, Symptoms and Progression of Infectious Disease** ○ Using visual aids along with a PowerPoint presentation, outline the signs and symptoms of different infectious diseases ○ Students can undertake a card game whereby they can match the signs, symptoms etc. of listed infectious diseases • **Small group activity – Impact of Infectious Disease on Patients, Communities and Services** ○ Ask students to research a fairly recent outbreak of an infectious disease (from the categories listed) and collect relevant data ○ They could include the symptoms experienced by patients, hospitalisations, fatalities, duration/timing of the outbreak etc. ○ Each group can then discuss their findings with the class and compare the different diseases	**Slide Share:** Communicable diseases https://www.slideshare.net/slideshow/communicable-diseases-181932871/181932871

B4 Prevention and treatment of infectious diseases	• **Whole class teaching and learning – Prevention and Treatment of Infectious Disease**
	  ○ Using visual aids along with a PowerPoint presentation, outline the different methods for the prevention and treatment of infectious diseases
	
	• **Small group activity – Vaccination and Medication**
	  ○ Students can revisit activities carried out for other topics such as information from research into historical and contemporary outbreaks, visiting speaker etc.
	  ○ Provide students with a list of commonly used medication/treatments which are given to patients for to combat infectious diseases. Ask them to make a table which characterises the type of treatment and identifies the infectious agent targeted.
	  ○ They should be encouraged to assess how advances in technology and medicine have decreased the impact of modern-day infectious diseases
	  ○ Likewise, they should assess current issues (e.g. antibiotic resistance, variants cultural/social considerations etc.) which may impact on prevention and treatment strategies
	  ○ Students can use an 'Observation-Inferences Chart' to record their ideas
	
	• **Paired activity and Peer teaching – Local and Global Policies for Tackling Infectious Diseases**
	  ○ Ask students in pairs to research local and international policies and programmes aimed at preventing and treating infectious disease
		NHS prevention and Treatment National Infection Prevention and Control
		https://www.england.nhs.uk/publication/national-infection-prevention-and-control/
		
		IPC Resource for Adult Social care
		https://www.gov.uk/government/publications/infection-prevention-and-control-in-adult-social-care-settings/infection-prevention-and-control-resource-for-adult-social-care
		
		NHS Vaccinations and when to have them
		https://www.nhs.uk/vaccinations/nhs-vaccinations-and-when-to-have-them/
		
		Global Vaccine Schedules
		https://vaccineknowledge.ox.ac.uk/vaccination-schedules-other-countries
		
		WHO Immunisation Coverage
		https://www.who.int/news-room/fact-sheets/detail/immunization-coverage

	○ Students identify standard practices aimed at preventing the spread of disease ○ Students appreciate how vaccination programmes have contributed to preventing and controlling infectious disease globally • **Individual activity** ○ Ask the students to summarise what they have understood regarding the transmission and treatment of infectious disease ○ This can again be followed up by an activity such as a quiz to check understanding ○ Students can access and complete online quizzes/tests such as 'Kahoot' or other similar sites ○ Students could devise their own quiz/test and mark scheme on the transmission, symptoms, prevention and treatment of an assigned microorganism and pass this around the class	
C: Explore the application of techniques to culture and identify microorganisms		
C1 Health and Safety	• **Visit – Standard Operating Procedures for microbiological analysis** ○ Students accompanied by their tutor and other appropriate staff visit a microbiology laboratory (if it is not possible to make a physical visit, an alternative may be a 'virtual tour' via a suitable online platform) ○ This could be attached to a hospital, university or a private organisation where microbiological analysis is essential	

	○ Students will note and record the Standard operating procedures (SOPs) and measures in place to comply with the relevant legislation ○ Students will also observe and note the techniques applied for the safe cultivation, identification and enumeration of cultures • **Small group activity** ○ Students could use a card sort activity to match a description from a piece of legislation to its title (e.g. HSWA, COSSH etc.) ○ A similar activity could be used for identifying key SOPs associated with microscopy, the cultivation of microorganisms as well as their identification and enumeration ○ Following on from this, the students could devise a worksheet or checklist for a particular activity • **Paired activity – Risk Assessment and Ensuring Safe Working Practice** ○ Students can firstly carry out a card activity where they can match SOPS to the various practical techniques ○ This can be followed by them carrying out risk assessments for their own practical activities ○ This can include separate RAs for each of the practical activities including microscopy staining the aseptic technique, enumeration as well as the investigation of antimicrobial agents (LA D)	

C2
Microscopy and staining techniques
	• **Whole class teaching and learning – Microscopy and staining techniques**
	  ○ Using visual aids along with a PowerPoint presentation, recap on how some microorganisms can be identified through their characteristics
	  ○ Students will appreciate that Gram staining relates to the nature of bacterial cell walls while methylene blue and India Ink staining relates to capsules around bacteria and yeast cells
	  ○ They will also recognise the importance of cell morphology and growth characteristics in broths for microbial identification
	
	• **Small group/Laboratory activity – Using the Light Microscope**
	  ○ Students (under tutor supervision) are introduced to using the light microscope and use available cultures to demonstrate appropriate staining techniques and growth characteristics.
	  ○ Students discuss the relevance of the microscopic techniques for illustrating characteristics of microorganisms
	
	• **Paired/Laboratory/activity – Applying Microscopic and Staining Techniques**
	  ○ Students carry out the appropriate risk assessment for carrying out a particular microscopic technique under minimal supervision
	  ○ Each pair could initially undertake a particular microscopic technique (e.g. either Gram staining, Methylene blue, morphology etc)
		Differential Staining techniques
		https://milnepublishing.geneseo.edu/suny-microbiology-lab/chapter/differential-staining-techniques/
		
		Identifying bacteria through look, growth, stain and strain
		https://asm.org/articles/2020/february/identifying-bacteria-through-look,-growth,-stain
		
		Growth characteristics in broths
		https://studyrocket.co.uk/revision/level-3-applied-human-biology-btec/microscopy-and-staining-techniques/growth-characteristics-in-broths
		
		Gram Staining technique
		https://www.youtube.com/watch?v=OOFJyw0EYBU
		
		Methylene Blue Staining technique
		https://www.youtube.com/watch?v=CcQndDoO-Ng
		
		India ink Staining technique
		https://www.youtube.com/watch?v=HGXZGo1qk30
		
		Identifying Yeasts and Moulds

	○ Each pair should aim to have covered sufficient microscopic technique in preparation for the assessment requirements of learning aim C ○ Students should discuss the usefulness of the microscopic techniques and how well they have undertaken them • **Individual activity** ○ Ask the students to summarise what they have understood regarding microscopy and staining techniques ○ Students can undertake a bingo game whereby they can identify microorganisms against certain microscopic and staining techniques ○ A 'full house' is when all the techniques listed on the board have been matched to a particular microorganism	https://www.youtube.com/watch?v=30oFh2f-TnU
C3 Culture of Microorganisms	• **Whole class teaching and learning – Cultivation of Microorganisms** ○ Using visual aids along with a PowerPoint presentation, students discuss the cultivation of microorganisms involving the aseptic technique ○ Students will appreciate that the medium used to culture microorganisms provides conditions necessary for their growth and development ○ They will also understand that selective media can be used to grow specific microorganisms ○ Students will recognise that plating and broth cultures are the main methods of growing microorganisms	**Aseptic techniques:** https://practicalbiology.org/standard-techniques/aseptic-techniques **Aseptic technique simulation** Aseptic Technique: Culture your sample without contamination | Labster Virtual Labs **Aseptic technique** https://www.youtube.com/watch?v=bRadiLXkqoU

	• **Small group activity – Researching the Aseptic Technique** ○ Students in groups research the cultivation of microorganisms using the aseptic technique ○ Each group can then draw up a schedule for carrying out a particular aseptic technique (e.g. spread plate, smear slide and pour plate to grow appropriate bacterial and fungal cultures) ○ The schedules can be passed around the class so that all students have a copy of all the aseptic practical activities to be carried out ○ The students could carry out a simulated activity on the computer whereby they prepare a pure culture to identify an infectious microorganism, using the aseptic technique in a safe manner • **Small group/Laboratory activity – Applying the Aseptic Technique** ○ Students (under tutor supervision) are introduced to using the aseptic technique for the cultivation of microorganisms ○ Students will appreciate the importance of risk assessment prior to carrying out the activity, ensuring that all SOPs and safety procedures are adhered to; including the use of PPE (it would be particularly useful to complete a checklist) ○ Each group could initially focus on a particular method (streak plate, spread plate, pour plate etc.) ○ Students will appreciate the need to avoid cross-contamination during the platting procedure	https://www.youtube.com/watch?v=c6v84FQ36kM https://www.youtube.com/watch?v=g6ifvs4Cyl0

	○ They will also appreciate the need to prepare the incubator in order to ensure it reaches the optimum temperature ○ Students can discuss which method is best suited to particular microorganisms • **Paired Laboratory activity – Development of Practical Skills** ○ Each pair could initially undertake a particular aseptic technique (spread plate, pour plate etc.) to grow their particular microorganism ○ Students should aim to have covered sufficient aseptic techniques in preparation for the assessment requirements of learning aim C ○ Students should discuss the effectiveness of the aseptic techniques to cultivate microorganisms and how well they have undertaken them ○ They should consider how they might make improvements to their technique	
C4 Quantitative analysis of microbes	• **Small group activity – Enumeration of Microorganisms** ○ Using visual aids along with a PowerPoint presentation, discuss the different ways that microorganisms can be counted ○ Students will appreciate that enumerating the concentration of microorganisms in a sample may require it to be diluted until it's easier to count ○ Students could practice simple enumerative techniques using cardboard replicas of plates containing colonies of microorganisms	**Enumeration techniques for microbes** https://www.slideshare.net/slideshow/enumeration-techniques-for-microbes-250072165/250072165 **Serial dilution and enumeration** https://www.youtube.com/watch?v=Lpqn_BUVltk **Counting colonies**

	• **Paired Laboratory activity – Practical Counting of Microorganisms** ○ Ask students to count the colonies on the plates from their previous practical activities relating to the aseptic technique ○ Students could be given additional cultures prepared by the laboratory technician to count in order to explore a wider range of enumeration techniques • **Small group activity – Advances in the Enumeration of Microbes** ○ Ask students to research contemporary methods for enumerating microorganisms ○ This should highlight technological advances, particularly in relation to the quantitative analysis of microbial cells which are otherwise difficult to enumerate by conventional counting ○ Students will appreciate the role of rapid testing in microbiological analysis • **Individual activity** ○ Ask the students to how they have applied the techniques to culture and identify microorganisms ○ Each learner could use a simulated exercise to demonstrate how they have undertaken a particular technique in terms of applying the correct SOPs in a safe and hygienic manner	https://www.youtube.com/watch?v=pHpMF9hvvh4 **Using a haemocytometer** https://www.youtube.com/watch?v=pP0xERLUhyc
D: Investigating the effect of antimicrobial agents on the growth of microorganisms		
D1 Investigating the substances that inhibit the	• **Visiting speaker** ○ Someone from an establishment that is involved in research and development relating to the effectiveness of	**How do antibiotics work?**

growth of microorganisms	antimicrobial agents (e.g. a pharmaceutical plant, a cleaning material/disinfectant manufacturer, appropriate university research department etc.) can be invited to speak to the students ○ Students should be encouraged to prepare relevant questions which they can ask the speaker ○ The latter can be used to obtain information regarding substances that will inhibit the growth of microorganisms • **Small group activity – Researching Antimicrobial Agents** ○ Using visual aids along with a PowerPoint presentation, discuss how numerous substances can inhibit microbial growth ○ Students will recall that their action will involve attacking aspects of cell structure ○ Students will appreciate that the effectiveness of a substance to inhibit microbial growth will be related to factors/variables such as temperature, concentration, pH etc. ○ Students could undertake a card game whereby they can identify the most effective substances for certain conditions/situations (e.g. antibiotics for a bacterial infection, a fungicide to inhibit mould growth etc.) • **Small group/Laboratory activity – Preparation for Practical Investigation** ○ Students (under tutor supervision) are introduced to applying the aseptic technique to investigate the	https://www.reactgroup.org/toolbox/understand/antibiotics/how-do-antibiotics-work/ **Antimicrobial Factsheet** https://npic.orst.edu/factsheets/antimicrobials.html **Antiviral drug** https://en.wikipedia.org/wiki/Antiviral_drug **Fungicides** https://www.britannica.com/science/plant-disease/Definitions-of-plant-disease **Chemical disinfectants** https://www.cdc.gov/infection-control/hcp/disinfection-sterilization/chemical-disinfectants.html **How to measure zones of inhibition** https://www.youtube.com/watch?v=LzmEwpL2_zI

	effectiveness of substances that will inhibit the growth of microorganisms ○ Students will understand that an inhibitive substance will produce a zone of inhibition (i.e. an area where there is no microbial growth in the plate culture) around a paper disc which has been soaked with the substance. ○ They will appreciate that the area of the zone of inhibition produced will relate to the effectiveness of the inhibitive substance ○ Students should recognise that the spread or pour plate would likely produce more accurate results for this investigation ○ Ask students to practice measuring areas representing zones of inhibition using cardboard replicas of platted cultures with inhibitive substances • **Paired Laboratory activity – Practical Investigation of the Effectiveness of Antimicrobial Agents** ○ Each pair could investigate the effectiveness of a particular substance (e.g. different concentrations of bleach or disinfectant, a ring containing a suitable selection of antibiotics etc.) ○ Students will have the opportunity to further develop their skills and apply the SOPs and safe practices for the aseptic technique ○ Students should aim to have covered sufficient aseptic techniques in preparation for the assessment requirements of learning aim D	

	○ Students should discuss the effectiveness of their investigations and be encouraged to suggest how they might make improvements	
D2 Interpretation, analysis and evaluation	• **Paired activity – Evaluation of the effectiveness of Antimicrobial Substances** ○ Students can process the results from their practical investigations of the effect of various antimicrobial agents on the growth of microorganisms ○ They will understand that this involves measuring the radius of the zones of inhibition and calculating the area (i.e. using the formula $\prod r^2$) ○ The students will have recorded all of the relevant data in an appropriate table or spreadsheet ○ They can then compile a report on the results, presenting the findings in suitable forms (e.g. graphs), identifying trends and patterns, commenting on any anomalies, limitations and sources of error as well as drawing conclusions from the investigation. ○ Each pair can present their report to the class as a whole and provide students with an opportunity to further evaluate the investigations [SP-CT] • **Small group activity – Current Developments regarding Antimicrobial Agents** ○ Ask students to research contemporary strategies for how the evaluation of antimicrobial agents is carried out in an industrial situation (e.g. pharmaceutical or bleach/disinfectant manufacture).	**Testing the effectiveness of antimicrobials** https://courses.lumenlearning.com/suny-microbiology/chapter/testing-the-effectiveness-of-antimicrobials/ **Fungicide efficacy screening** https://pmc.ncbi.nlm.nih.gov/articles/PMC9959339/ **Antiviral and Antimicrobial Testing** https://www.criver.com/products-services/discovery-services/pharmacology-studies/infectious-disease-models-assays/antiviral-and-antimicrobial-testing?region=3696

	○ Each group could focus on a particular type of antimicrobial ○ Students present their findings to the class, identifying common limitations and potential areas for further research and development [SP-CT] • **Individual activity** ○ Students can undertake activities (similar as for other learning aims) to further confirm knowledge and understanding with regard to the methods and approaches for testing the efficiency of antimicrobial agents	

Delivering signposted transferable skills

Signposted transferable skills are not mandatory for the delivery of the unit, and it is therefore your decision to deliver these skills as a part of the qualification. Below we have provided some ideas of teaching and learning activities that you could use to deliver these skills if you chose to.

Transferable skills	Ideas for delivery
MY – TPR Taking Personal Responsibility	• **Visiting speaker** ○ A visit by the students to a professional/industrial microbiological laboratory will allow them to see how an effective investigation complies with the relevant legislation. Students should also note how the SOPs are followed in a safe and hygienic manner. ○ Following on from this the students can undertake activities that will prepare them to undertake the practical work required for the learning aim (e.g. in relation to compliance with the appropriate legislation, following the correct SOPs). They should be able to produce risk assessments for all of the practical activities required. ○ Simulated activities could initially be used to help students prepare for undertaking practical work; following procedures given to set up ○ Prepare growth media, inoculate plates and incubate the cultures. This can be followed by groups under close supervision, carrying out the actual activity. ○ Through working in pairs, students should be given the opportunity to develop their skills to include a range of aspects of the aseptic technique such as streak plate, spread plate, pour plate as well as different microorganisms including bacteria, yeasts and moulds.
EL – PRS Primary Research Skills	• **Paired activity – Evaluation of the effectiveness of Antimicrobial Substances** ○ Students will have the opportunity to apply numerical and mathematical skills to measuring the radii of the zones of inhibition produced and calculating the area of each. ○ Students can also apply statistics to processing the results in order to observe trends and patterns and compare the effectiveness of different antimicrobial agents. ○ Students should be encouraged to compile a report for their investigations, including the raw data (i.e. in tabular form), graphs/bar charts, highlighting anomalies and potential sources of error and conclusions from their findings. It would be useful to also compare the data and findings with that from other sources e.g. other classes or cohorts who may have undertaken similar investigations.

Resources

This section has been created to provide a range of links and resources that are publicly available that you might find helpful in supporting your teaching and delivery of this unit in the qualification. We leave it to you, as a professional educator, to decide if any of these resources are right for you and your students, and how best to use them.

Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate. We'd also suggest that you bookmark useful websites and consider enabling students to access them through the school/college intranet.

Websites

16.4: Testing the Effectiveness of Antiseptics and Disinfectants - Biology LibreTexts Bio Libretexts – Testing the effectiveness of antiseptics and disinfectants:

2.3: Examples of Bacterial Growth Characteristics in Broths, Slants and Plates - Biology LibreTexts Bio Libretexts – Examples of Bacterial Growth Characteristics in Broths, Slants, and Plates

7 Creative Ways to Teach Microbiology without Lecturing Labster – Explore the application of techniques to culture and identify microorganisms

Methods to Study Viruses - PMC NIH National Library of Medicine – Methods to study viruses

Textbooks

Case Studies in Infectious Disease 2nd Edition – Lydyard P., Cole M., Holton J., Irving W., Porakishvili N., Venkatesan P., and Ward K. (CRC Press 2023) ISBN 9780367696399

Comprehensive Review of Infectious Diseases, 1st Edition – Spec A. Escota G., Chrisler C. and Davies B. (Elsevier 2019) ISBN 9780323568661 (Covers the most frequently encountered concepts and conditions in infectious diseases)

Control and Prevention of Infectious Diseases – Leo G. (Independently published 2024) ISBN 9798345450055 (A simple guide on infection treatment, strategies for managing and stopping infectious disease, proactive approaches, and effective solutions)

Essential Microbiology – Hogg S. (Wiley-Blackwell 2005) ISBN 9780471497547 (An overview of the field of microbiology)

Laboratory Practices in Microbiology – Erkmen O. (Academic Press 2021) PB ISBN 9780323910170 eB ISBN 9780323900157 (Provides updated insights on methods of microbiological techniques)

Topical Antimicrobial Testing and Evaluation – Poulson D. (CRC Press 1999) ISBN 9780367399795 (Presents and reviews techniques for testing antibacterial compounds)

BTEC Level 3 National Applied Science Student Book – Musa I. and Sorenson J. (Pearson 2010) ISBN 9781846906800 (Units related to microbiology and disease)

Vaccination Programmes Epidemiology, Monitoring, Evaluation 1st Edition – Hahné S., Bollaerts K. and Earington P. (Routledge 2021) ISBN 9781138054851 (Discusses how epidemiologic methods can be used to study, in real life, their impacts, benefits and risks)

Pearson paid resources also available

- Pearson Student book
- ActiveBook (a digital version of the Student Book, via ActiveLearn Digital Service)
- Digital Teacher Pack (via ActiveLearn Digital Service)

Unit 4: Diseases, Disorders, Treatments and Therapies

Unit overview

Unit 4: Diseases, Disorders, Treatments and Therapies	
Assessment type: Internal	
Learning Aim	**Topics**
A Examine biological molecules and pathways and their effect on the body	A1 Roles of proteins and lipids in maintaining health A2 The relationships between changes to molecules and the impacts these have on biological pathways and processes
B Understand the effects of physiological diseases and disorders and associated treatments	B1 Physiological diseases and disorders B2 Treatments for physiological diseases and disorders B3 Effects on the individual
C Examine the development of innovative and future types of treatment for physiological diseases and disorders	C1 Drug and medicine discovery and development C2 Innovative treatments C3 Ethical, legal and moral issues
Assessment overview This unit is Internal assessed through a Pearson-Set Assignment Brief (PASB). Pearson sets the assignment for the assessment of this unit. The PSAB will take approximately 11 hours to complete. The PSAB will be marked by centres and verified by Pearson. The PSAB will be valid for the lifetime of this qualification.	

Common student misconceptions

Below are some common misconceptions related to the content of this unit by students and ideas for how you can help your students to avoid and overcome these.

What is the misconception?	How to help students overcome it
Biological molecules or pathways have single, isolated, linear functions (i.e. one molecule- one outcome).	Biological molecules and pathways do not operate in isolation. They are part of integrated systems that communicate and coordinate with each other to maintain homeostasis and respond to changes in the environment.
All diseases can be cured	In many cases, especially with chronic conditions, management rather than a cure is the goal. This involves ongoing treatment and lifestyle adjustments to maintain quality of life.

Physiological diseases and disorders have a specific single factor cause and therefore have identical symptoms and treatments	Most conditions are multifactorial. While genetics can predispose someone to certain conditions, lifestyle choices (such as diet, exercise, and stress management) can significantly influence the onset and progression of these conditions. Therefore, symptoms and treatment options can vary widely between individuals
Drug development is a quick and straightforward process.	Students should consider the stages of drug development and the regulatory hurdles, such as clinical trials, and therefore the number of potential drugs that do not receive regulatory approval.
Innovative treatments are always better and safer than traditional treatments	While innovative treatments can offer new and effective options, they are not without risks and limitations. Students should use literature reviews about new treatments to consider the advantages and disadvantages over existing treatments, e.g. testing, cost, side effects, effective, etc
Biological molecules or pathways have single, isolated, linear functions (i.e. one molecule- one outcome).	Biological molecules and pathways do not operate in isolation. They are part of integrated systems that communicate and coordinate with each other to maintain homeostasis and respond to changes in the environment.

Learning Activities and Resources

This section offers a starting point for delivering the unit by outlining a logical sequence through the unit topics and suggesting practical activities and teacher guidance for covering the main areas of content during guided learning time. Transferable skills are integrated into various activities, with those embedded in a unit indicated by an acronym in square brackets. The acronym combines the letters from the broad skill area and the specific transferable skill, e.g., **[IS-WC]**.

Please note the activities provided below are suggestions and not mandatory. Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate.

Learning Topic	Activities and guidance for unit content delivery	Resources
A: Examine biological molecules and pathways and their effect on the body		
A1: Roles of proteins and lipids in maintaining physiological health	• **Whole class and individual activity - Protein models** Build proteins using pipe cleaners and coloured beads from amino acids Assign each coloured bead a specific amino acid. You can use different shapes or colours to represent the 20 standard amino acids. Provide a reference chart so students can easily identify which bead represents which amino acid. ○ Instruct students to string beads onto a pipe cleaner to represent a sequence of amino acids (the primary structure of a protein). ○ Alpha Helices: Demonstrate how to twist a pipe cleaner with beads into a helical shape to represent an alpha helix. ○ Explain the hydrogen bonding pattern that stabilizes the alpha helix. ○ Beta Strands: Show students how to create a straight or slightly zig-zagged pipe cleaner with beads to represent a beta strand.	**Science and math with mrs lau** has instructions about Hands-on Biochemistry: Beads, Pipe Cleaners, and the clearest way to teach monomers and polymers, https://www.scienceandmathwithmrslau.com/2014/09/hands-on-biochemistry-beads-pipe-cleaners-and-the-clearest-way-to-teach-monomers-and-polymers/ **Behindthebiologylessons** has a resource about using lipids as the basis of a synoptic lesson, providing a resource to make paper models and a PowerPoint about lipids,

	○ Explain how beta strands can align side-by-side to form beta sheets, stabilized by hydrogen bonds. ○ Combine the alpha helices and beta strands to create more complex protein structures (tertiary structures). ○ If possible, demonstrate how multiple tertiary structures can come together to form quaternary structures (e.g., haemoglobin). Use additional pipe cleaners to connect and stabilize the structures. ○ Students should photograph or draw their models. They should label the protein structures that they have created, including labels for the bonds within the molecule, and any other significant features. • **Small group Activity – Structure of lipids** ○ Produce paper models of lipids- highlighting key parts, such as bonding, glycerol, fatty acids, phosphate groups. - Glycerol Backbone- Cut out a small rectangle or circle from coloured paper to represent the glycerol molecule. Label the glycerol backbone. - Fatty Acid Chains- Cut out long, narrow strips of coloured paper to represent the fatty acid chains. Attach these strips to the glycerol backbone using glue or tape. Use different colours for saturated and unsaturated fatty acids, and label them accordingly. - Phosphate Group (for Phospholipids)- Cut out a small shape from coloured paper (e.g., a circle or square) to represent the phosphate group. Attach the phosphate group to the glycerol backbone in place of one of the fatty acid chains. Label the phosphate group.	https://behindthebiologylessons.wordpress.com/2023/12/27/using-lipids-as-the-basis-of-a-synoptic-lesson/ **Medicine LibreTexts** has information about Functions of Lipids, https://med.libretexts.org/Courses/Metropolitan.State_University_of_Denver/Introduction_to_Nutrition_(Diker)/05%3A_Lipids/5.3%3A_Functions_Of_Lipids **Nature** has an article about what Rosalind Franklin truly contributed to the discovery of DNA's structure https://www.nature.com/articles/d41586-023-01313-5

	- Ester Bonds- Use markers or coloured pencils to draw ester bonds between the glycerol and fatty acid chains or phosphate group. Label the ester bonds. • **Whole class teaching and learning – Function of lipids** o Students should produce a leaflet advertising the function of lipids. o Learner should research and include the following functions of lipids: - Energy storage - Insulation – thermal and electrical - Form membranes - Protect organs - Source of steroid hormones - Source of vitamin D - Waterproofing • **Whole class teaching and learning – Introduction to nucleic acid** o Divide students into small groups. o Instruct each group to research key milestones and figures in the discovery of DNA and produce an A3 summary with a clear heading, date, illustration and description. The posters will then be displayed on a washing line to create a discovery of DNA timeline - 1869: Friedrich Miescher discovers "nuclein" (later known as DNA). - 1909-1919: Phoebus Levene identifies the components of DNA (phosphate, sugar, bases). - 1944: Oswald Avery, Colin MacLeod, and Maclyn McCarty demonstrate that DNA carries genetic information. - 1950: Erwin Chargaff discovers base pairing rules (A=T and C=G).	

	- 1951-1952: Rosalind Franklin and Maurice Wilkins produce X-ray diffraction images of DNA. - 1953: James Watson and Francis Crick propose the double helix structure of DNA. ○ Students could discuss Rosalind Franklin's role and possible controversy over the discover of DNA ○ Provide a detailed account of Rosalind Franklin's contributions to the discovery of DNA, including her X-ray diffraction images (Photo 51) and their significance. ○ Discuss the controversy surrounding her recognition and the Nobel Prize awarded to Watson, Crick, and Wilkins in 1962. ○ Encourage students to consider questions such as: ○ Why was Rosalind Franklin's contribution initially overlooked? ○ How did her work impact the discovery of DNA's structure? ○ What lessons can we learn about collaboration and recognition in science?	
A2: The relationships between changes to molecules and the impacts these have on biological pathways and processes.	• **Individual Activity - effects of disruption to biological processes** ○ Students to produce revision cards to summarise the biological pathways that have been affected by the following: - Sickle cell - Lactose intolerance - Atherosclerosis ○ Students should include: - The cause of the condition - The symptoms of the condition - The molecules that have been changed in the condition - The biological pathway/process that has been affected by the condition - The treatment for the condition	**NHS** has information about the conditions https://www.nhs.uk/conditions/ **Sickle cell society** for information about the sickle cell disease http://www.sicklecellsociety.org/about-us **heart UK** for information about atherosclerosis https://www.heartuk.org.uk/ **Diabetes.co.uk** has a how to test your blood glucose video guide,

	• **Whole class teaching and learning – diabetes (diabetes mellitus types 1 and 2)** ○ Invite a healthcare professional or someone living with diabetes to share their experiences and answer students' questions. ○ If possible, demonstrate blood sugar monitoring- show students how to use a glucometer to check blood sugar levels. ○ You can use a demonstration glucometer and test strips to illustrate the process. ○ Students should consider the importance of a balanced diet for managing diabetes. You can include activities like reading food labels, planning a diabetes-friendly meal, and understanding carbohydrate counting. ○ Explain how physical activity affects blood sugar levels. Discuss how different types of activities impact glucose levels. • **Whole class activity – neurological conditions** ○ Use diagrams and models to illustrate the brain, spinal cord, and peripheral nerves. ○ If possible, dissecting a sheep's brain (if appropriate and ethical) or using virtual dissection tools to explore brain anatomy. • **Small group Activity – neurological conditions** ○ Individually or in pairs, students should be assigned one of the neurological conditions (dementia anxiety disorders and mood disorders, Parkinson's disease and Multiple Sclerosis) to produce a PowerPoint presentation about the symptoms and diagnosis of the condition	https://www.diabetes.co.uk/blood-glucose/how-to-test-blood-glucose-levels.html **Diabetes.org.uk** have a diabetes menu planner Students could also bring in a selection of food packets to use to create a healthy 7-day meal plan for a diabetic person, with around 1200 calories https://www.diabetes.org.uk/living-with-diabetes/eating/recipes?gad_source=1 **Science buddies.org** outline a procedure for investigating the effect of exercise on blood sugar. (blood sugar balancing act: how exercise tips the scales) https://www.sciencebuddies.org/science-fair-projects/project-ideas/HumBio_p039/human-biology-health/blood-sugar-exercise **YouTube,** The Amoeba sisters have a YouTube channel which includes a video about the cell cycle and cancer https://www.youtube.com/watch?v=QVCjdNxJreE

	○ Students should include relevant images, diagrams, and charts to illustrate key points and use bullet points and headings to organise information clearly, rather than producing slides of prose. ○ Students should structure their presentation slides as follows: - Title Slide: Title of the presentation, names of group members, and the assigned condition. - Introduction: Brief overview of the neurological condition. - Causes and Risk Factors: Explanation of what causes the condition, and the risk factors associated with it. - Symptoms and Description of the symptoms and - Diagnosis: how the condition is diagnosed, such as imaging techniques (e.g., MRI, CT scans), and other diagnostic tests. - Conclusion: Summary of key points and any final thoughts. - References: List of sources used for research.	**Biology LibreTexts** has instructions for a sheep brain dissection https://bio.libretexts.org/Bookshelves/Human_Biology/Human_Anatomy_Lab/11%3A_The_Central_Nervous_System_(Brain)/11.07%3A_Sheep_Brain_Dissection **YouTube-** the Great diseases channel has a video of sheep brain dissection- centre for science education https://www.youtube.com/watch?v=-fDWH4_5DhI **National institute of neurological disorders and stroke** has details on the neurological conditions https://www.ninds.nih.gov/ **Alzheimer's.org** for information about the condition https://www.alzheimers.org.uk **Mind** for information about anxiety disorders, http://www.mind.org.uk **Parkinsons.org** for information about the condition http://www.parkinsons.org.uk

		MS society for information about multiple sclerosis http://www.mssociety.org.uk
B: Understand the effects of physiological diseases and disorders, and associated treatments		
B1: Physiological diseases and disorders	• **Small group Activity - Physiological diseases and disorders** ○ Students should use a paper roll to draw a life-sized body. ○ Labels should then be added to the body in appropriate places to show how organs are affected by physiological diseases and disorders. ○ Students may want to use a different colour for each disease/disorder so that the scope of the effects can be seen, and which organs are affected can be seen. • **Whole class and individual activity - Physiological diseases and disorders** ○ An A4 human body outline could be provided for the students to create labelled diagrams for each disease/disorder, e.g. there is an example of the effects of anxiety on the body on the healthline.com website • **Whole class teaching and learning – Mental health impact** ○ Use videos, documentaries, or podcasts that explore the mental health aspects of medical diagnoses. These can provide diverse perspectives and deepen understanding.	**healthline.com** shows the effects of anxiety on the body on a body outline https://www.healthline.com/health/anxiety/effects-on-body **YouTube** cancer support community there is an hour-long live webinar about What You Need to Know About Mental Health and Cancer. https://www.youtube.com/watch?v=UxsTpcNCAGY **Please be advised this video discusses sensitive issues including depression, anxiety, and suicide**.

B2: Treatments for physiological diseases and disorders B3: Effects on the individual	• **Small group Activity – Virtual hospital** ○ Use simulation games or apps that allow students to manage a virtual hospital or clinic so that students can consider the range of treatments for psychological diseases and disorders and consider some of the limiting factors. Games like "Bio Inc." could be used ○ Divide students into small groups and assign each group a specific scenario or role within the virtual hospital or clinic. Provide instructions on how to play the game, including how to manage resources, diagnose and treat patients, and make decisions. ○ After gameplay, facilitate a group discussion where students can share their experiences and challenges faced during the game. ○ Encourage students to discuss the decisions they made and the outcomes of those decisions. ○ Ask guiding questions such as: ○ What strategies did you use to manage resources effectively? ○ How did you prioritize patient care? ○ What challenges did you encounter and how did you overcome them? • **Whole class teaching and learning Activity** ○ Learner could create infographics about different treatment options for a specific disease/ disorder from the specification. They can use online tools like Canva to design visually appealing and informative graphics. - Outline of the treatment - Positive effects (advantages and benefits)	**YouTube-** The Princess Margaret Cancer centre has a video "about cancer, how is cancer treated?" as an introduction to cancer treatments https://www.youtube.com/watch?v=GPGj-cK5DT4 **NHS** has information about cancer treatments https://www.nhs.uk/conditions **Macmillan Cancer Support** has information about cancer treatments https://www.macmillan.org.uk/cancer-information-and-support/treatment/types-of-treatment **Cancer Research UK** has information about cancer treatments https://www.cancerresearchuk.org/about-cancer/treatment **Prostate Cancer UK** has information about cancer treatments https://prostatecanceruk.org/prostate-information-and-support/treatments

	- Negative effects - Risks associated with the treatment - Mental health impacts ○ The students could present their infographics at a mock health fair/ medical conference. ○ Tables could be set up with the infographic on display and any other relevant anatomical model or materials One learner from the group always stays with the table to be the "booth manager" and answer questions about their disease/ disorder. The other members of the group "visit" the other tables to learn about the disease/ condition. Encourage attendees to ask questions and engage with the booth managers. ○ If possible, invite healthcare professionals or patients with the conditions to also have a table at the health fair/medical conference to answer questions from the students.	**National Cancer Institute** has information about Stem Cell Transplants for Cancer https://www.cancer.gov/about-cancer/treatment/types/stem-cell-transplant
C: Examine the development of innovative and future types of treatment for physiological diseases and disorders		
C1: Drug and medicine discovery and development	• **Small group Activity – Drug development** ○ Assign students research projects on specific drugs or therapeutic areas. They can investigate the history, development process, clinical trials, and current status of the drug. ○ Drugs that could be researched include: - Penicillin - Insulin - Chemotherapy drugs - L-Dopa - Lecanemab	**BBC bitesize** has information about drug definitions https://www.bbc.co.uk/bitesize/articles/zg982nb **Alzheimers.org-** has articles about new drugs for Alzheimer's disease, such as Lecanemab https://www.alzheimers.org.uk/blog/what-lecanemab **Gov.uk** gives examples of applications for a clinical trial and the

	○ New drugs are being developed and are at various points of clinical trials and so selection of the specific drugs for this activity should reflect current developments where possible. • **Whole class activity – Mock clinical trial** ○ Students could design a mock clinical trial, including - objectives, - participant selection - methodology, - details about placebos - randomised controlled trails - double blind, - considering the pros and cons of the approach - endpoints.	information that must be included in the UK https://www.gov.uk/guidance/clinical-trials-for-medicines-apply-for-authorisation-in-the-uk
C2: Innovative treatments	• **Whole class and individual activity - Gene therapy** Use online simulators like CRISPR Cas9 to let students experience gene editing in a virtual lab environment. They can design and execute experiments to correct genetic mutations. • **Whole class and individual activity- innovative treatments** Inquiry-Based Learning: Students should conduct their own research on innovative treatments. ○ Students should select one innovative treatment and produce a piece of prose/article about the treatment with a 1,000 word-count. ○ Learner should include:	**labxchange.org** has an interactive introduction to Gene Editing: CRISPR-Cas9 https://www.labxchange.org/library/items/lb:LabXchange:b1057265:lx_simulation:1 **National human genome research institute** could be used for information https://www.genome.gov/ **Nature** could be used for journal articles about gene therapy https://www.nature.com/gt/

	- Name of the innovative treatment being researched. - The specific medical conditions or diseases that the treatment is designed to address. - Patient populations that may benefit from the treatment (e.g., age groups, severity of condition). - Explanation of what makes the treatment innovative or different from traditional methods. - History of the treatment's development, including key milestones and breakthroughs. - Any relevant clinical trials or studies that have been conducted. - Explanation of how the treatment works at the molecular or cellular level/ the biological pathways or processes targeted by the treatment. - Efficacy and Safety- Information on the safety profile of the treatment, including potential side effects and adverse reactions - Benefits and advantages of the innovative treatment over traditional methods. - Any limitations or disadvantages associated with the treatment. - Consideration of cost-effectiveness and accessibility. - Ethical issues related to the development and use of the treatment (e.g., patient consent, genetic manipulation). - Social implications, such as the impact on patient quality of life and public perception.	**Royal Papworth Hospital NHS Foundation Trust** details new heart laser procedure https://royalpapworth.nhs.uk/our-hospital/latest-news/michael-our-first-patient-benefit-new-heart-laser-procedure **NHS England** details laser beam surgery to prevent epileptic seizures https://www.england.nhs.uk/2022/10/nhs-launches-laser-beam-brain-surgery-to-treat-epilepsy/

C3: Ethical, legal and moral issues	• **Whole class and individual activity - animal testing** Provide students with case studies of real-world scenarios involving animal testing. ○ The students should analyse the ethical, scientific, and societal implications from the scenario/ case study and present their findings to the class • **Whole class and individual activity - Ethical, social, and professional rules** Simulate an ethics committee meeting where students review and discuss hypothetical cases. This helps them understand the decision-making process in a clinical setting. ○ Assign each student a specific role on the ethics committee. ○ Roles may include: - Chairperson: Leads the meeting and ensures all voices are heard. - Scientist: Provides expertise on the scientific aspects of the proposal. - Ethicist: Evaluates the ethical considerations. - Layperson: Represents the perspective of the general public. - Legal Expert: Ensures compliance with legal and regulatory requirements. ○ One student (acting as the principal investigator) presents an overview of the research proposal, highlighting key aspects such as objectives, methodology, and potential impacts. ○ Each committee member provides their feedback and raises questions or concerns about the proposal. ○ Discussion points may include:	**University College London (UCL) and University of Oxford** have a range of case studies on animal testing, www.understandinganimalresearch.org.uk **Ethics Unwrapped-** Examples of hypothetical cases https://ethicsunwrapped.utexas.edu/case-studies **Centre for Practical Bioethics-** Examples of hypothetical cases https://www.practicalbioethics.org/resources/ **Ada Lovelace Institute-** Examples of hypothetical cases https://www.adalovelaceinstitute.org/

	- Scientific validity: Is the research methodologically sound. - Informed consent: Are participants fully informed and voluntarily consenting? - Risk-benefit analysis: Do the potential benefits outweigh the risks? - Confidentiality: Are participant privacy and data protection measures in place? - Vulnerable populations: Are there considerations for vulnerable groups involved in the study? o The chairperson ensures that all members have the opportunity to speak, and that the discussion is balanced. o The chairperson summarizes the key points of the discussion and any significant concerns raised by the committee members. o Committee members vote on the proposal, and the decision is recorded. o Each individual student should then summarise the discussion and write a short paragraph about their ethical opinion on the proposal, including any recommendations for modifications or additional safeguards.	

Delivering signposted transferable skills

Signposted transferable skills are not mandatory for the delivery of the unit, and it is therefore your decision to deliver these skills as a part of the qualification. Below we have provided some ideas of teaching and learning activities that you could use to deliver these skills if you chose to.

Transferable skills	Ideas for delivery
SP – C&I Cultural and Social Intelligence	• **Whole class and individual activity- innovative treatments** ○ Inquiry-Based Learning: Students should conduct their own research on innovative treatments. ○ Students should select one innovative treatment and produce a piece of prose/article about the treatment with a 1,000 word-count. Students to consider innovative and creative approaches to treatments and drug developments throughout the unit

Resources

This section has been created to provide a range of links and resources that are publicly available that you might find helpful in supporting your teaching and delivery of this unit in the qualification. We leave it to you, as a professional educator, to decide if any of these resources are right for you and your students, and how best to use them.

Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate. We'd also suggest that you bookmark useful websites and consider enabling students to access them through the school/college intranet.

Websites

16.4: Testing the Effectiveness of Antiseptics and Disinfectants - Biology LibreTexts Bio LLactose intolerance - NHS Information on lactose intolerance including symptoms, treatments and causes.

Resources - Secondary STEM Learning resources including gene technology and modern analytical techniques.

Teachers Royal Society of Biology teacher resources, including practical support and professional development resources.

Resource Hub - Institute of Biomedical Science Institute of Biomedical Sciences Resource Hub providing resources, activities and case studies.

About Cancer | Cancer Research UK Cancer Research UK Information about research into Cancer, treatments and case studies.

About — Sickle Cell Education Series Sickle Cell Education Series a free educational platform providing teaching resources for Sickle Cell Disease

Diabetes UK - Know diabetes. Fight diabetes. | Diabetes UK Diabetes UK offering information on Type 1 and Type 2 Diabetes.

Heart health questions, information and support - BHF British Heart Foundation provides information about various heart conditions.

Information and support | Parkinson's UK Parkinsons UK providing information on symptoms, diagnosis and treatments and therapies.

Downloadable resources - Mental Health UK Mental Health UK offers downloadable resource packs.

Welcome to UK Stem Cell Foundation UK Stem Cell Foundation providing information about Stem Cell research areas.

ABPI Interactive Resources for Schools ABPI provides resources including animations, diagrams and activities for schools.

Climate change and sustainability teaching resources | RSC Education RSC education resources around green chemistry.

Learning resources | Wellcome Collection Wellcome Trust themed learning resources

Pearson paid resources also available

- Pearson Student book
- ActiveBook (a digital version of the Student Book, via ActiveLearn Digital Service)
- Digital Teacher Pack (via ActiveLearn Digital Service)

Unit 5: Biomedical Science

Unit overview

Unit 5: Biomedical Science	
Assessment type: Internal	
Learning Aim	**Topics**
A Understand the principles of haematology and its use in medical diagnosis	A1 The components of blood A2 Changes to blood components and composition A3 Diagnostic techniques used in haematology
B Examine the use of, histology, cytology and disease screening	B1 Tissue and cellular investigations B2 Screening tests B3 Implications of the results of tissue and cellular investigations and screening
C Examine the use of urinalysis as an analytical and diagnostic tool	C1 Urine composition C2 Urinalysis
Assessment overview This unit is Internal assessed through a Pearson-Set Assignment Brief (PASB). Pearson sets the assignment for the assessment of this unit. The PSAB will take approximately 18 hours to complete. The PSAB will be marked by centres and verified by Pearson. The PSAB will be valid for the lifetime of this qualification.	

Common student misconceptions

Below are some common misconceptions related to the content of this unit by students and ideas for how you can help your students to avoid and overcome these.

What is the misconception?	How to help students overcome it
Many students believe that arterial (oxygenated) blood is red, while venous (deoxygenated) blood is blue.	Human blood is always red due to the presence of haemoglobin, although it is a brighter red when oxygenated
There's a common belief that blood is just a liquid	Discuss the composition of blood – blood consists of cells (red blood cells, white blood cells, and platelets) suspended in plasma.
Students often think that blood's only function is to transport oxygen.	Discuss the functions of blood- Blood also carries nutrients, waste products, hormones, and helps regulate body temperature and pH balance.
There is sometimes a misunderstanding about what urine contains, with some believing it consists only of water.	Discuss the composition of urine. While urine is primarily water, it also contains urea, creatinine, and other waste products the body needs to expel.

Some students might not realise that changes in urine colour, odour, or frequency can indicate health issues.	Discuss the changes to normal values of the constituents of urine in the presence of diseases. Urine tests are a valuable tool in diagnosing various medical conditions.
Many students believe that arterial (oxygenated) blood is red, while venous (deoxygenated) blood is blue.	Human blood is always red due to the presence of haemoglobin, although it is a brighter red when oxygenated

Learning Activities and Resources

This section offers a starting point for delivering the unit by outlining a logical sequence through the unit topics and suggesting practical activities and teacher guidance for covering the main areas of content during guided learning time. Transferable skills are integrated into various activities, with those embedded in a unit indicated by an acronym in square brackets. The acronym combines the letters from the broad skill area and the specific transferable skill, e.g., **[IS-WC]**.

Please note the activities provided below are suggestions and not mandatory. Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate.

Learning Topic	Activities and guidance for unit content delivery	Resources
A1 The components of blood	• **Whole class teaching and learning** ○ Display an image of haemoglobin and ask: "What do you already know about proteins and their structure?" ○ Students should research the structure of haemoglobin, linking it to protein structure (primary, secondary, tertiary, and quaternary). ○ They will also explore how its structure relates to its function in oxygen transport. • **Laboratory activity - Components of blood** ○ Students should examine prepared blood smears under a microscope to identify the different components of blood (red blood cells, white blood cells, and platelets). ○ Students set up and focus their microscopes at low power before switching to high power. ○ They should identify red blood cells, white blood cells, and platelets using their shapes, sizes, and staining characteristics. ○ They should then sketch each type of cell and label key features.	**Biologicmodels.com**- 3D model and video of the structure of oxygenated haemoglobin, https://biologicmodels.com/project/oxygenated-hemoglobin-hb/ **Great scopes.com -** information about "observing blood", health and safety should be considered if human blood is used, prepared slides could be used, https://www.greatscopes.com/act012.htm **Fuse School on YouTube** - video about white blood cells https://www.youtube.com/watch?v=qWSWWPZYGHU

	○ They should record qualitative observations (e.g., relative size, shape, nucleus presence). ○ Students should discuss their findings in small groups and present one key observation to the whole class. • **Whole class activity – White blood cells** ○ Production of cartoon strip on the action of the different white blood cells when encountering pathogens. ○ Students could personify different types of white blood cells and through drawings and/or speech bubbles demonstrate their understanding of white blood cells, e.g. a fat phagocyte that eats everything it sees. • **Laboratory activity- Thrombocytes and clotting** ○ Divide students into small groups, each assigned a specific part of the clotting cascade: - Group 1: Platelet activation and plug formation - Group 2: Coagulation factors and the role of fibrin - Group 3: The conversion of prothrombin to thrombin ○ Students then create a flowchart or diagram ○ Groups present their section in a 2-minute summary using their diagrams ○ Groups can then connect their stages, building the full clotting cascade step-by-step.	**Royal Society of Biology, Nuffield Foundation-** method to model effect of aspirin on blood clots https://practicalbiology.org/health-and-disease/how-medicines-work/modelling-effect-of-aspirin-on-blood-clots
A2 Changes to blood components and composition	• **Whole class teaching and learning – Blood parasites (malaria)** ○ Provide each pair of students with a case study related to a different aspect of the malaria health issue.	**BBC bitesize-** A case study about Malaria, https://www.bbc.co.uk/bitesize/guides/z9bmn39/revision/5

	○ These could include the effects of malaria on the body, the spread of malaria, the effects of malaria on populations and the strategies involved in managing development and health in the 21st century. ○ Students should then be able to present the major points of their case studies to the rest of the class. • **Laboratory activity - erythrocytic diseases** ○ Invite a haematologist or a healthcare professional to give a talk or Q&A session on erythrocytic diseases. ○ Ask students to design patient education leaflet that explains erythrocytic diseases in simple terms. ○ The leaflets should include information about the cause(s) of the disease, symptoms of the disease, and how to manage the disease to maintain good health.	**Medicalnewstoday.com-** an article about the definition and types of red blood cell disorders https://www.medicalnewstoday.com/articles/red-blood-cell-disorders-types-causes-and-symptoms
A3 Diagnostic techniques used in haematology	• **Whole class and individual activity - Diagnostic techniques** ○ Students should produce a list of diagnostic techniques used in haematology with a brief description of each technique, including a brief step by step guide to the procedure and the purpose of the test ○ Diagnostic techniques include: - haemoglobin tests/analysis for iron deficiency - antibody testing - bone marrow aspiration	**NHS Foundation Trust, Gloucestershire hospital -** normal ranges for a full blood count (FBC) https://www.gloshospitals.nhs.uk/our-services/services-we-offer/pathology/tests-and-investigations/full-blood-count-fbc/ **Johns Hopkins medicine -** diagnostic techniques used in haematology https://www.hopkinsmedicine.org/health

	• **Laboratory activity - blood typing** ○ Students could use a monoclonal antibody kit or simulated Neo/Blood and sera samples, (for example) to determine the blood types of artificial blood samples. ○ This introduces antigen-antibody interactions and links to clotting by explaining agglutination and its role in transfusion compatibility. ○ Explain that agglutination (clumping) occurs when antibodies bind to matching antigens—linking to the clotting cascade. ○ Students should write a short explanation of how monoclonal antibodies work in blood typing and their medical applications, e.g. "Why is matching blood type important for transfusions?" • **Laboratory activity - blood clotting** ○ Students can investigate coagulation by making a semisolid (gelatinous) ball using a solution of sodium alginate (dyed with food colouring) and a calcium chloride solution. ○ Explain that sodium alginate mimics fibrin, and calcium chloride represents calcium ions, which are key in activating clotting factors. ○ Discuss how anticoagulants (e.g. heparin) prevent blood clotting by removing calcium ions. ○ Students should compare and contrast the model to real blood clotting, such as an explanation of how calcium ions contribute to both this model and real blood clotting.	/treatment-tests-and-therapies/hematology **Stemlibrarylab.org -** simulating blood typing, https://stemlibrarylab.org/lesson-plan/whats-your-blood-type/ **Sciencebuddies** - investigating artificial blood clotting, https://www.sciencebuddies.org/science-fair-projects/project-ideas/HumBio_p037/human-biology-health/blood-clotting
B1 Tissue and cellular investigations	• **Whole class teaching and learning - Introduction** ○ Discussion: what is informed consent? Explore the ethical, legal, and practical importance of informed consent in healthcare, emphasising how it builds trust and fosters patient-centred care.	**The National library of medicine -** article about Informed consent, updated October 2024, https://www.ncbi.nlm.nih.gov/books/NBK430827/

	○ The discussion will also address situations where patients cannot give informed consent, such as children or individuals with impaired decision-making capacity. ○ Discussion Prompts: - "What does informed consent mean to you?" - Define informed consent as the process where a patient is given clear, relevant information about a medical procedure or treatment, enabling them to make a voluntary and informed decision. ○ Highlight the three key elements: - Capacity – The patient must be able to understand and process the information. - Information – The patient must receive sufficient details about risks, benefits, and alternatives. - Voluntary– The decision must be made without coercion or pressure. ○ Why is informed consent important in healthcare? - Builds trust between patients and healthcare providers. - Respects patient autonomy and right to make decisions about their own body. - Helps avoid legal and ethical dilemmas. - Ensures patient-centred care by involving individuals in their treatment. ○ What happens when trust is broken? - Patients may feel exploited or disrespected. - Reduced likelihood of compliance with treatment. - Leads to medical negligence cases and lawsuits. - Impacts public perception of healthcare systems.	**Study.com -** a video about autopsies, https://study.com/academy/lesson/what-is-an-autopsy-definition-procedure-results.html **The Australian Museum-** a virtual autopsy that could be used if mock autopsy reports are not suitable/ available https://australian.museum/learn/teachers/learning/virtual-autopsy/ **Broadcastmed-** a video of Skin Punch Biopsy Procedure https://www.broadcastmed.com/neurology/5225/videos/skin-punch-biopsy-procedure-johns-hopkins-cutaneous-nerve-laboratory

	• Students could write a short reflection on a key ethical dilemma in informed consent. E.g. ○ Scenario 1: A 5-year-old child needs urgent surgery. Who gives consent? - Discuss parental/guardian consent. - Role of healthcare professionals in acting in the child's best interests. - At what age can children give consent? ○ Scenario 2: An unconscious patient arrives in the emergency department. How do doctors proceed? - The principle of implied consent in life-threatening emergencies. - Ethical dilemmas in making decisions without prior patient input. ○ Scenario 3: A patient with dementia refuses treatment. Should their wishes be respected? - Role of advance directives or lasting power of attorney (LPA). - Best interest decisions under the Mental Capacity Act. • **Whole class teaching and learning – Autopsy Simulation** ○ Provide students with an autopsy simulation. ○ Students could simulate the autopsy process, considering each step, from external examination to internal examination and sample collection. ○ Virtual reality (VR) platforms, 3D anatomical models, high-quality video recordings of real autopsies, interactive digital simulations, and detailed anatomical charts can be used to allow students to	

	virtually experience the process of an autopsy and learn about different pathologies and organ systems. ○ Have each group present their findings and conclusions (how they relate to the cause of death) to the class. ○ Encourage questions and discussions to compare different approaches and deepen understanding. • **Laboratory activity – biopsied tissues** ○ Provide students with pre-prepared microscope slides of biopsied tissue samples. ○ Students should carefully observe the slide, noting key features such as the overall tissue structure, cell type present, and any abnormalities or pathological features. ○ Students should document their observations by making detailed sketches or notes. This might include labelling different cell types, noting staining patterns, and describing any notable features or abnormalities. • **Whole class teaching and learning activity - surgical removal of tissues for disease identification** ○ Ask students to design patient education leaflets that explain the biopsy procedure in simple terms. ○ The leaflets should include information on what to expect before, during, and after the procedure, and how to manage any potential side effects.	

B2 Screening tests	• **Whole class teaching and learning – screening for cancers of the bowel and cervix** ○ Show videos or animations that demonstrate how bowel cancer screenings (e.g., colonoscopy, faecal occult blood test) and cervical cancer screenings (e.g., Pap smear, HPV test) are performed. ○ Students should produce a summary of the screening methods- this could be prose or a table and include - name of screening method - brief outline of the process - key information- e.g. national screening programme, particular age group, time between screenings, etc - benefits - risks - limitations • **Whole class teaching and learning - screening for aortic aneurysm** ○ Discuss what an aortic aneurysm is, its risks, and the importance of early detection. ○ Explain how ultrasound technology is used to screen for aortic aneurysms. ○ If possible, demonstrate the use of an ultrasound machine on a model or volunteer (with their consent). ○ Divide students into small groups and provide each group with a case study or patient scenario. ○ Students should discuss the case, identify the signs and symptoms of an aortic aneurysm, and determine whether screening is necessary. ○ Have each group present their findings and recommendations to the class.	**Macmillan Cancer support - Cancer** Information and Support https://www.macmillan.org.uk/cancer-information-and-support **NHS –** Information about health, healthcare and social care https://www.nhs.uk/conditions/cancer/ **Cancer research -** Cancer Information and Support https://www.cancerresearchuk.org/about-cancer/type **Nuffield trust-** research, policy analysis, and commentary on various healthcare issues in the UK. https://www.nuffieldtrust.org.uk/news-item/cancer-1 **The National Library of Medicine-** article about "Morbidity and mortality from surgical treatment of unruptured cerebral aneurysms at Research Institute for Brain and Blood Vessels", https://pubmed.ncbi.nlm.nih.gov/15670370/

B3 Implications of the results of tissue and cellular investigations and screening	• **Whole class and individual activity** ○ Organise a debate on the ethical implications of tissue and cellular screening, based on Wilson and Jungner classic screening criteria, WHO 1968 ○ Topics can include: - patient consent, - privacy issues, - the impact of early detection on patient outcomes. - quality of life for individuals and their families after prognosis - financial implications ○ Students should be given time to research and prepare. • **Small group Activity – False results** Using journal articles, research false positive and false negative results ○ Consider the likelihood of a false outcome ○ Consider the possible implications of a false positive- are further, more invasive tests required? ○ Consider the possible implications of a false negative- how do false negative effect the trustworthiness of the test and therefore uptake in national screening programmes, for example?	**The National Library of Medicine -** Information about Wilson and Jungner classic screening criteria, WHO 1968 can also be found at https://pmc.ncbi.nlm.nih.gov/articles/PMC2647421/ **NHS-** Information about specific screening processes https://www.nhs.uk/conditions/nhs-screening/ **Health knowledge-** Principles, methods, applications and organisation of screening for early detection, prevention, treatment and control of disease, https://www.healthknowledge.org.uk/public-health-textbook/disease-causation-diagnostic/2c-diagnosis-screening/principles-methods-applications **The National Library of Medicine-** articles about screening outcomes, such as Estimating the lifetime risk of a false positive screening test result, https://pubmed.ncbi.nlm.nih.gov/36791062

C1 Urine composition	• **Whole class teaching and learning – Normal Urine** Students to produce an infographic about the urinary tract and the composition of normal urine, including: ○ organic solutes ○ Inorganic solutes ○ colour/clarity ○ odour ○ normal values ○ pH ○ specific gravity ○ water • **Whole class and individual activity - Abnormal urine** ○ Presenting students with case studies of patients with abnormal urine results. ○ Students should attempt to diagnose the patient based on the urine test results and suggest treatment plans. (This may need to be taught in conjunction with C2 urinalysis) • **Whole class activity – Diabetes** ○ If possible, a diabetic nurse/ healthcare professional could speak with the students and answer questions about diabetes- including causes of the different types of diabetes, how they can be diagnosed and how they can be treated • **Whole class and individual activity - Other diseases** ○ Create disease comparison charts comparing different urine-related diseases, highlighting their causes, symptoms, and	**Urologyhealth.org -** how does the urinary tract work, https://www.urologyhealth.org/urology-a-z/what-is-urology/how-does-your-urinary-tract-work-video **Creative Learning on YouTube -** a video about Human Urinary System and the formation of urine. https://www.youtube.com/watch?v=1NtPjzm1-74 **biologycorner.com**- a urinalysis simulation which includes case study patients, https://www.biologycorner.com/2018/06/02/urine-luck-a-urinalysis-simulation/

	treatments. This can help students understand similarities and differences between various conditions. ○ Use or create videos that show how urine-related diseases develop and affect the body. Animated videos can particularly help in explaining processes that are hard to visualise.	
C2 Urinalysis [EL – PRS]	• **Whole class teaching and learning - Introduction** ○ Discuss learner's ideas about how urine could be tested, what it could be tested for, what results outside of the normal range could indicate (linking back to C1) • **Laboratory activity - Urinalysis [EL – PRS]** ○ Test artificial urine for urinalysis concepts and diagnosis of urinary tract infection ○ Different samples of artificial urine can be produced to mimic the look and the smell of urine for a range of tests. ○ Each sample should be slightly different so that the students can obtain test results based on colour, odour, pH, and the presence/absence of protein and glucose. ○ Artificial urine samples can be made by dissolving salt, urea, glucose, albumin, 2M hydrochloric acid and 1M ammonia into 1 dm^3 of water, with a few drops of yellow food colouring. - Tests should include: - qualitative observations for colour and smell - colorimetry for colour - universal indicator paper for pH - glucose test strips and/or Benedict's reagent for glucose - Biuret test for protein	**Nursing times-** a review of urinalysis and how to interpret results https://www.nursingtimes.net/bladder-and-bowel/urinalysis-how-to-interpret-results-07-06-2016/ **Creative-chemistry** has details about a Urine analysis activity, https://www.creative-chemistry.org.uk/documents/urinalysis.pdf **The National Library of Medicine** reports on Artificial Urine for Teaching Urinalysis Concepts and Diagnosis of Urinary Tract Infection in the Medical Microbiology Laboratory, https://pmc.ncbi.nlm.nih.gov/articles/PMC5577974/

	• **Whole class activity – Key indicators** For each key indicator in urinalysis, students should consider factors that could detrimentally impact the accuracy of the results, such as: ○ Sample Collection: ○ Contamination: Contamination with menstrual blood, vaginal discharge, or toilet paper can affect results. - Improper Collection: Not collecting a midstream sample can lead to inaccurate results. - Handling and Storage: ○ Temperature: Storing the sample at incorrect temperatures can alter the results. ○ Timeliness: Delay in analysing the sample can lead to degradation of certain components. ○ Diet: Certain foods (e.g., beets, blackberries, asparagus) can alter urine colour. ○ Hydration: Overhydration can dilute urine, while dehydration can concentrate it, both affecting test results. ○ Medications: Some medications can affect urine composition and test results. ○ Supplements: Certain vitamins and supplements can also alter urine characteristics. ○ Technical Errors: - Improper Use of Reagents: Incorrect use of dipsticks or reagents can lead to inaccurate readings.	

	- Microscope Calibration: Improperly calibrated microscopes when looking at cells in urine can affect the accuracy of microscopic examination.	

Delivering signposted transferable skills

Signposted transferable skills are not mandatory for the delivery of the unit, and it is therefore your decision to deliver these skills as a part of the qualification. Below we have provided some ideas of teaching and learning activities that you could use to deliver these skills if you chose to.

Transferable skills	Ideas for delivery
EL – SRS Secondary Research Skills	Use of journal articles and studies should be used throughout the unit e.g. The National Library of Medicine reports on Artificial Urine for Teaching Urinalysis Concepts and Diagnosis of Urinary Tract Infection in the Medical Microbiology Laboratory

Resources

This section has been created to provide a range of links and resources that are publicly available that you might find helpful in supporting your teaching and delivery of this unit in the qualification. We leave it to you, as a professional educator, to decide if any of these resources are right for you and your students, and how best to use them.

Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate. We'd also suggest that you bookmark useful websites and consider enabling students to access them through the school/college intranet.

Websites

Resources - Secondary STEM Learning resources including gene technology and modern analytical techniques.

Teachers Royal Society of Biology teacher resources, including practical support and professional development resources.

Resource Hub - Institute of Biomedical Science Institute of Biomedical Sciences Resource Hub providing resources, activities and case studies.

About Cancer | Cancer Research UK Cancer Research UK Information about research into Cancer, treatments and case studies.

About — Sickle Cell Education Series Sickle Cell Education Series a free educational platform providing teaching resources for Sickle Cell Disease

Diabetes UK - Know diabetes. Fight diabetes. | Diabetes UK Diabetes UK offering information on Type 1 and Type 2 Diabetes.

Heart health questions, information and support - BHF British Heart Foundation provides information about various heart conditions.

Information and support | Parkinson's UK Parkinsons UK providing information on symptoms, diagnosis and treatments and therapies.

Downloadable resources - Mental Health UK Mental Health UK offers downloadable resource packs.

Welcome to UK Stem Cell Foundation UK Stem Cell Foundation providing information about Stem Cell research areas.

ABPI Interactive Resources for Schools ABPI provides resources including animations, diagrams and activities for schools.

Pearson paid resources also available

- Pearson Student book
- ActiveBook (a digital version of the Student Book, via ActiveLearn Digital Service)
- Digital Teacher Pack (via ActiveLearn Digital Service)

Unit 6: Human Reproduction and Fertility

Unit overview

Unit 6: Biomedical Science	
Assessment type: Internal	
Learning Aim	**Topics**
A Understand the anatomy and physiology of the human reproductive system	A1 Structure and functions of the female and male reproductive organs A2 Female reproductive cycle A3 Puberty in males and females
B Understand the role of hormones in the regulation and control of the reproductive system	B1 Reproductive processes B2 Foetal development and birth B3 Contraceptive methods and their health implications
C Examine the causes, treatments and impact of infertility on the people's health	C1 Causes of infertility C2 Potential treatments for infertility C3 The impact of infertility on the health and wellbeing of humans
Assessment overview This unit is Internal assessed through a Pearson-Set Assignment Brief (PASB). Pearson sets the assignment for the assessment of this unit. The PSAB will take approximately 11 hours to complete. The PSAB will be marked by centres and verified by Pearson. The PSAB will be valid for the lifetime of this qualification.	

Common student misconceptions

Below are some common misconceptions related to the content of this unit by students and ideas for how you can help your students to avoid and overcome these.

What is the misconception?	How to help students overcome it
The idea that sperm actively "race" to the egg, rather than understanding the biological mechanisms of fertilisation	The idea that sperm race to the egg is a myth. The process of fertilisation is a complex synergy between the egg and sperm. Eggs release chemicals that attract sperm and can even choose which sperm to attract.
Hormones only affect reproduction	Hormones like oestrogen, have wide-ranging effects beyond reproduction, including impacts on bone density, mood, and skin health.
All contraceptive methods are 100% effective	No contraceptive method is 100% effective at preventing fertilisation. Even the most effective methods, like intrauterine devices (IUDs) and hormonal implants, have a small failure rate.
Infertility is only a female issue	Infertility is often thought to be a women's issue, but in reality, male factors contribute to about 30-40% of infertility cases. Both partners should be evaluated when facing infertility.

Learning Activities and Resources

This section offers a starting point for delivering the unit by outlining a logical sequence through the unit topics and suggesting practical activities and teacher guidance for covering the main areas of content during guided learning time. Transferable skills are integrated into various activities, with those embedded in a unit indicated by an acronym in square brackets. The acronym combines the letters from the broad skill area and the specific transferable skill, e.g., **[IS-WC]**.

Please note the activities provided below are suggestions and not mandatory. Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate.

Learning Topic	Activities and guidance for unit content delivery	Resources
A1 Structure and functions of the female and male reproductive organs [EL-SRS]	• **Whole class teaching and learning – Organs in the reproductive system** ○ Using anatomical models discuss the position in the body and the structure of the female and male reproductive organs ○ Research and label human reproductive organ system diagrams with the name, structure and function of each organ. ○ Ensure that all structures listed in the specification are included.	**BBC Bitesize -** BBC bitesize has information on the structure and function of the human reproductive system, https://www.bbc.co.uk/bitesize/guides/znxnscw/revision/1 **YouTube -** Videos could be used such as Professor Dave Explains The human reproductive system". Videos may also include information about fertilisation/ egg and sperm production as well as the organ system. https://www.youtube.com/watch?v=TucxilB76bo

A2 Female reproductive cycle	• **Individual/ Small group Activity – Conception** Students could produce a storyboard or a personification story of the journey of an egg and a sperm during conception. ○ Learner should include details about - wafting of ova through fallopian tubes, - semen delivery, - fertilisation (including role of acrosome in penetration of the zona pellucida), - implantation - reference to hormones. • **Whole class teaching and learning – Menstrual cycle** ○ Students could use Interactive tools and animations to show the follicular and uterine lining changes in relation to the hormonal changes ○ Using the information from their own research from the interactive tools and animations, students could write their own questions with the correct answer, that can then be compiled into a summary quiz based on the menstrual cycle. • **Individual activity - Menopause** Students could produce a comprehensive and informative leaflet that explains what menopause is, including its symptoms and stages, The leaflet should be visually appealing and easy to read for patients. Key Sections to Include: ○ Introduction to Menopause - Briefly define menopause.	**YouTube -** Videos could be used for information, such as Launchpad learning: Endocrine system: Hormones, https://www.youtube.com/watch?v=xry7vtBjYK4 **SchoolTube.com -** a 3D animation of the menstrual cycle, https://www.schooltube.com/the-menstrual-cycle-a-3d-animation/ **St.Luke's hospital.com -** an interactive tool about the menstrual cycle (this should only be used for educational purposes and not for fertility/ contraception advice) Menstrual cycle - interactive tool | Pregnancy Health Center | Health Information | St. Luke's Hospital **National Institute on Aging**- a video defining "what is menopause", https://www.youtube.com/watch?v=af-356SbCkY **NHS-** Students could use the NHS website for information https://www.nhs.uk/conditions/periods/fertility-in-the-menstrual-cycle/

<table>
<tr>
<td></td>
<td>

Explain when it typically occurs (usually between ages 45-55).
Mention that it is a natural part of aging for women.

Symptoms

List common symptoms such as hot flashes, night sweats, mood swings, and irregular periods.
Explain that symptoms can vary in severity and duration.

Stages of Menopause

Perimenopause: The transition period leading up to menopause, where symptoms begin to appear.
Menopause: Defined as the point when a woman has not had a menstrual period for 12 consecutive months.
Post menopause: The years after menopause when symptoms may continue to lessen.

</td>
<td>Purpose games.com- a quiz about the female menstrual cycle https://www.purposegames.com/tag/hormones
Geekymedics.com - a quiz about the female menstrual cycle https://app.geekymedics.com/learn/quiz/rach_houghton-menopause-hrt/</td>
</tr>
<tr>
<td>A3 Puberty in males and females</td>
<td>

Whole class teaching and learning - Introduction

Divide students into small groups.

Instruct students to fill in a table to summarise the changes to the human body during puberty (females, males, both).
e.g.
<table>
<tr><td>Males</td><td>Females</td><td>Males and Females</td></tr>
<tr><td>Testes produce sperm</td><td>Hips get wider</td><td>Pubic and armpit hair grow</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td>
<td>Medicalnewstoday- articles about puberty, https://www.medicalnewstoday.com/articles/156451

The National Library of Medicine- a population-based study about the timing of puberty in boys and girls from October 2018, https://pubmed.ncbi.nlm.nih.gov/30307620/</td>
</tr>
</table>

	○ Allow students to use textbooks, reference materials, and the internet to research the changes. ○ Once the tables are filled, bring the class back together and have each group share their findings. ○ Discuss any similarities and differences in the changes experienced by females and males. • **Whole class and individual activity - Hormonal control and regulation of puberty** ○ Students could be given scientific articles about hormonal control and regulation of puberty, such as MedicalNewsToday "what to know about puberty". Students are then asked to summarise the article in a 300-word count paragraph. (if the article has an abstract this should be removed before sharing with the students). ○ To summarise the article students should consider: - the article's hypothesis or research question - the methodology used in the study. - the key findings and results. - the conclusions drawn by the authors. ○ Students could use journal articles about the timing of puberty in boys and girls. ○ Allow students time to read the articles and take notes on key points, including the study's methodology, findings, and conclusions.	

	○ Divide students into small groups. ○ Each group discusses the following questions: - What was the main hypothesis or research question of the study? - What methods were used to collect and analyse data? - What were the key findings? - Are the conclusions drawn by the authors supported by the data? - What are the strengths and weaknesses of the study? - How might the study's findings impact our understanding of puberty? ○ Presentation and Debate ○ Each group presents their analysis to the class. ○ Encourage a class-wide discussion and debate on the validity of the studies and the conclusions drawn.	
B1 Reproductive processes	• **Whole class teaching and learning – Cell division** Provide each student or group with pop-it beads and magnetic centromeres (if available)- the beads represent chromosomes ○ Students could produce a stop motion animation of cell division or a series of photographs to represent the key stages of mitosis/meiosis - Prophase: Start with a cell with a set number of chromosomes (e.g., 4 chromosomes, two homologous pairs). Use different colours to represent chromosomes from each parent. - Metaphase: Align the chromosomes at the centre of the cell (equator). - Anaphase: Separate the chromatids and move them to opposite poles of the cell.	**Bio.libretexts.org**- an activity of modelling mitosis and meiosis using pop-it beads bio.libretext.org/ cell division/ modelling mitosis and meiosis **YouTube-** Videos could be used to explain gamete formation, such as Sketchy Learning, Oogenesis: Female Gamete Production Explained https://www.youtube.com/watch?v=yGeNuJLwTXA **Med.libretexts.org-** an anatomy and physiology section, including a section on

	- Telophase: Form two new nuclei around the separated chromatids. - Cytokinesis: Divide the cell into two daughter cells, each with a complete set of chromosomes. Alternatively, a card sort can be used to incorporate gamification ○ Students can be given key information about mitosis and meiosis on separate cards and then sort the cards into two piles for comparison ○ Cards should include: - virtual representations of cells undergoing meiosis and mitosis. - Number of divisions - Chromosome pairs - Presence or absence of recombination/cross-over - Number of resulting daughter cells - If the daughter cells are identical to the somatic cell - Type of nucleus- haploid or diploid • **Whole class teaching and learning activity – oogenesis** ○ Students watch video clips that outline the stages of oogenesis ○ Students should consider the stages that occur before birth and link to puberty and menopause. ○ Students could role-play as different hormones and cells involved in oogenesis. This can help them understand the interactions and functions of the various components involved in oogenesis. ○ Roles include: - Oocytes (Egg Cells)	spermatogenesis, https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Anatomy_and_Physiology_(Boundless)/26%3A_The_Reproductive_System/26.4%3A_Physiology_of_the_Male_Reproductive_System/26.4C%3A_Spermatogenesis **WHO -** factsheets about polycystic ovary syndrome (PCOS), https://www.who.int/news-room/fact-sheets/detail/polycystic-ovary-syndrome **Pharmaceutical-journal.com** - a section of case-based learning, including management of polycystic ovary syndrome, which has case studies which could be used https://pharmaceutical-journal.com/article/ld/case-based-learning-management-of-polycystic-ovary-syndrome **The American Urological Association-** a male infertility case study in the education section , https://www.auanet.org/documents/education/medical%20student%20curriculum/Male-Infertility-Case-Study.pdf

	- Granulosa Cells - Theca Cells - Follicle-Stimulating Hormone (FSH) - Luteinizing Hormone (LH) - Oestrogen - Progesterone o Provide each student with a role card or name tag that includes a brief description of their character's function. o Early Follicular Phase: FSH stimulates the growth of the primary follicles. Granulosa cells produce oestrogen, which helps in follicle development. Theca cells assist in the production of oestrogen. o Mid-Follicular Phase: Increasing levels of oestrogen lead to the maturation of the dominant follicle. Granulosa cells continue to support oocyte development. o Ovulation: A surge in LH triggers ovulation, releasing the mature oocyte. The remaining granulosa and theca cells form the corpus luteum. o Luteal Phase: The corpus luteum produces progesterone and oestrogen to prepare the uterine lining for potential pregnancy. If fertilization does not occur, the corpus luteum degenerates, leading to a drop in hormone levels and the start of a new cycle. o After the role-playing, gather the students to discuss what they experienced and learned. Example questions could include: - How did the hormones and cells interact with each other? - What are the key functions of each hormone and cell type? - How do the levels of FSH, LH, oestrogen, and progesterone change throughout the cycle?	

	• **Laboratory activity- Ovarian Tissue** ○ Students identify and examine the different stages of oocyte development using prepared microscope slides of ovarian tissue. - Primordial Follicles- Instruct students to find and observe primordial follicles. These are the earliest stage of oocyte development, characterised by a single layer of flat, squamous cells surrounding the oocyte. - Primary Follicles- Next, students will identify primary follicles, where the oocyte is surrounded by a single layer of cuboidal granulosa cells. - Secondary Follicles- Students will then locate secondary follicles, which have multiple layers of granulosa cells and a developing zona pellucida around the oocyte. - Graafian (Mature) Follicles- Finally, students will identify Graafian follicles, which are large, mature follicles with a fluid-filled antrum and a well-developed zona pellucida. ○ Students should draw and label each stage of oocyte development they observe under the microscope, taking detailed notes on the characteristics and differences between each stage. • **Whole class teaching and learning - spermatogenesis and testicular tissues** ○ Create posters, charts, or digital presentations that detail the spermatogenesis process, including diagrams, labels and descriptions. ○ Students should focus on the following key stages:	

	- Spermatogonia - Primary Spermatocytes - Secondary Spermatocytes - Spermatids - Spermatozoa (mature sperm cells) • **Whole class activity – normal and abnormal morphology** ○ Students could produce a Venn diagram to compare and contrast oogenesis with spermatogenesis ○ Present case studies of conditions or diseases related to oogenesis, such as polycystic ovary syndrome (PCOS). ○ Discuss how these conditions affect the process. ○ Discuss case studies related to male reproductive health, such as infertility or hormonal imbalances, to illustrate how these conditions affect spermatogenesis.	
B2 Foetal development and birth	• **Small group Activity -** ○ Using models or diagrams show the stages of development of a foetus ○ Focus on the following key stages: - Fertilisation - Zygote - Blastocyst - Embryo - Foetus (with a focus on key milestones at different weeks of pregnancy) ○ Case studies of ultrasounds could also be used.	**Science4inquiry.com-** Do you see what I see? series which contains "An overview on the developmental changes that occur during the three trimesters of pregnancy" https://science4inquiry.com/LessonPlans/NewLessons/SeeWhatISee.pdf **Yourhormones.info-** an overview of glands, including the placenta, https://www.yourhormones.info/glands/placenta/ **NHS website has** a section about labour and birth, including what complications can affect the placenta?,

	• **Small group activity – The placenta** ○ Students should research the placenta: - linking its function the endocrine system - considering its development and structure - what happens after birth - what complications there could be that affect the placenta. ○ Students present their research on a poster which is displayed in the classroom. ○ Students then take time to view each groups poster and provide constructive feedback on each poster. • **Whole class activity – Parturition** Arrange for a healthcare professional to visit the class or join via video call. Prepare questions related to parturition and childbirth. Allow the guest speaker to share their experiences and knowledge about parturition and have students ask questions and engage in a discussion. • **Small group activity** – Dilation of the cervix during labour Students can visualise the dilation of the cervix using food stuff (such as blueberry for 1 cm, cherry for 2 cm, lime for 4 cm, cookie for 6 cm, orange of 8cm and a bagel for 10cm). Discuss the significance of each stage of cervical dilation and how it relates to the progress of labour. Consider the importance of understanding cervical dilation for expectant mothers and healthcare professionals.	https://www.nhs.uk/pregnancy/labour-and-birth/what-happens/placenta-complications/ **NHS website** has a section about labour and birth, including the stages of labour and birth, https://www.nhs.uk/pregnancy/labour-and-birth/what-happens/the-stages-of-labour-and-birth/ **YouTube-** the Nucleus Education Media channel includes a video of labour and delivery: Patient Education Animation: Labour and Vaginal Birth, https://www.youtube.com/watch?v=ZDP_ewMDxCo
B3 Contraceptive methods and their health implications	• **Small group activity- Different types of contraception** ○ Students to create an A4 poster about one type of contraception in preparation for a marketplace activity for the exchange of information:	**Contraception choices-** a range of activities and worksheets to introduce contraception, https://www.contraceptionchoices.org/

	○ Students should select one from the following: - condoms - oral contraceptive - injection - implant - emergency contraception - male sterilisation - female sterilisation ○ Students should include the following information: - name, - how it works reference to hormones (if applicable), - likelihood of pregnancy, - possible side effects, - any other key information. ○ Use the posters as a marketplace to collate information about each contraception for their own notes. OR ○ students could then have a photocopied set of the posters in a booklet • **Whole class and individual activity** Students identify contraceptives from their description and picture using preprepared cards or using the Educaplay contraceptive matching game.	**TedEd-** a video about "how do contraceptives work?", https://www.ted.com/talks/nwhunter_how_do_contraceptives_work?subtitle=en **BBC history KS3/GCSE** has a short firm from the BBC Two series The Ascent of Woman, about the development of the contraceptive pill, https://www.bbc.co.uk/teach/class-clips-video/articles/zbjytrd **Compoundchem.com-** a summary of the chemistry of oral contraceptives, https://www.compoundchem.com/2015/02/03/oral-contraceptives/ **Educaplay.com** has a contraceptive matching game, https://www.educaplay.com/learning-resources/8027537-contraceptive_matching_game.html **NHS-** has a guide to contraception, https://www.nhs.uk/contraception/
C1 Causes of infertility	• **Whole class teaching and learning – Causes of Infertility** Students should work in small groups to produce a short video about a cause of infertility	

	○ Erectile dysfunction. ○ Low sperm production or low sperm motility. ○ Physical problems, including blockage of sperm transport, damage caused by sexually ○ transmitted infections (STIs). ○ Hormone malfunctions. ○ Anti-sperm antibodies. ○ Effects of menopause. ○ Hypo/hyperthyroidism. ○ Problems with ovulation. ○ Damage to fallopian tubes/cervix/uterus	
C2 Potential treatments for infertility	• **Whole class teaching and learning – Treatments for Infertility** ○ Students could investigate a specific case study of a couple experiencing infertility. ○ Students should research their options through informational leaflets, textbooks and web searches including - Sperm donation. - Artificial insemination (AI). - Hormone replacement therapy. - Induction of ovulation. - Antibiotics if STI related infertility ○ Provide each group or student with a detailed patient profile, including medical history and test results. Within their groups, students discuss the case and diagnose the possible causes of infertility. ○ They then decide on a suitable treatment plan based on the patient's profile.	**Patient.info and ReproductiveFacts.org,** have patient profiles and case studies related to infertility https://patient.info/womens-health/infertility-leaflet https://www.reproductivefacts.org/news-and-publications/fact-sheets-and-infographics/defining-infertility/

	○ Each group presents their diagnosis and proposed treatment plan to the class. The presenting group explains the rationale behind their choices and the expected outcomes. ○ After the presentations, hold a class discussion to compare and contrast the different treatment plans. Discuss the effectiveness, risks, and emotional impacts of each treatment. • **Whole class and individual activity - IVF** Create a timeline about the development and use of IVF ○ Divide students into small groups. Instruct each group to create a timeline that includes key milestones in the development of IVF, such as early research, significant breakthroughs, and important births (e.g., the birth of Louise Brown). ○ Students should include key figures, scientific advancements, and ethical considerations in their timelines. ○ Each group will present their timeline to the class. ○ Encourage students to explain the significance of each milestone and how it contributed to the development of IVF. ○ Allow time for questions and discussion after each presentation. ○ After all presentations, facilitate a class-wide discussion on the ethical considerations and debates surrounding IVF. ○ Ask guiding questions such as: - What are the potential benefits and risks of IVF? - How has IVF impacted society and individuals? - What ethical concerns arise from the use of IVF technology?	

C3 The impact of infertility on health and wellbeing	• **Whole class teaching and learning – Trends in infertility rates in the UK over time** Use recent articles to research the trends in infertility rates in the UK over time. ○ Ask students to research potential factors that could influence infertility rates, such as: - Environmental factors (pollution, exposure to toxins) - Lifestyle factors (diet, exercise, stress) - Medical advancements (access to fertility treatments, reproductive health care) - Socioeconomic factors (income, education, healthcare access) ○ Students should form hypotheses about how these factors might contribute to the trends in the infertility rates they observed in the data.	**Office for National Statistics website** has contraception and fertility treatment data https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/conceptionandfertilityrates/articles/howsthefertilityratechanginginenglandandwales/2024-10-28 **HFEA.gov.uk** has fertility treatment data, https://www.hfea.gov.uk/about-us/publications/research-and-data/fertility-treatment-2022-preliminary-trends-and-figures/ **BBC news-** articles about birth rates and infertility, such as "Social infertility: why birth rates hit an all-time low" from November 2024, https://www.bbc.co.uk/news/articles/cp81ynn7r4mo

Delivering signposted transferable skills

Signposted transferable skills are not mandatory for the delivery of the unit, and it is therefore your decision to deliver these skills as a part of the qualification. Below we have provided some ideas of teaching and learning activities that you could use to deliver these skills if you chose to.

Transferable skills	Ideas for delivery
EL – SRS Secondary Research Skills	When students are carrying out research for in class learning or when researching for their summative assignments students should be encouraged to uses valid and reliable sources with recommendations for key requirements for them to use to support their research e.g. peer reviewed journals. Students will develop skills to interpret secondary data and draws valid conclusions and should be encouraged to produce reference lists and cites sources appropriately to authenticate their work.

Resources

This section has been created to provide a range of links and resources that are publicly available that you might find helpful in supporting your teaching and delivery of this unit in the qualification. We leave it to you, as a professional educator, to decide if any of these resources are right for you and your students, and how best to use them.

Pearson is not responsible for the content of any external internet sites. It is essential that you preview each website before using it to ensure the URL is still accurate, relevant, and appropriate. We'd also suggest that you bookmark useful websites and consider enabling students to access them through the school/college intranet.

Websites

Teacher Resources Sexual Health Victoria – Teaching resources

Lesson: Fertility and infertility | Oak National Academy Oak Academy teaching resources around fertility and infertility

Fertility Education Initiative (FEI) » British Fertility Society British Fertility Society giving information around fertility and infertility

Fertility resources - Leeds Teaching Hospitals NHS Trust Leeds Teaching Hospitals providing case studies around fertility

| STEM STEM Learning Sexual Reproduction in Humans

HFEA: UK fertility regulator HFEA providing statistical information about fertility treatments

Infertility - NHS NHS information on fertility and infertility.

The body in pregnancy articles | Pregnancy information | NCT NCT information around pregnancy

Recommendations | Antenatal care | Guidance | NICE Information around antenatal care

Polycystic ovary syndrome WHO provides information on Polycystic Ovary Syndrome

Pearson paid resources also available

- Pearson Student book
- ActiveBook (a digital version of the Student Book, via ActiveLearn Digital Service)
- Digital Teacher Pack (via ActiveLearn Digital Service)

5. Pearson Qualification Support and Resources

This section provides information on support and resources that are available on the Pearson website for this qualification.

Exam Wizard

A free online resource containing a huge bank of past paper questions and support materials to help you create your own mock exams and tests

Pearson Set Assignment Briefs (PSABs)

These assignments are set by Pearson and marked internally by the centre. They should be used for all internal assessments on the course. There are specific PSABs for each internally assessed unit on the course.

Purpose Statement

This provides an overview of the qualification's key details. It outlines what students will study, the knowledge and skills they will develop, and any related subjects that complement the qualification. It also highlights potential progression routes for further learning and lists the Higher Education Institutes that have formally expressed their support and recognition for the qualification.

Results plus

A free online results analysis tool for teachers giving a detailed breakdown of students' performance in BTEC external assessments.

Sample Assessment Material (SAMs)

These resources illustrate the format and style of questions for the external assessment for this qualification. A mark scheme is also provided which shows how credit is awarded for these questions. The resources can be used to help prepare students for their external assessment.

Specification

This document contains an overview of the qualification, qualification purpose and structure, units including content and assessment, planning and implementing the qualification, qualification grade, glossary of terms used for internally assessed units, Transferable skills framework, digital skills framework, sustainability framework.

Subject Adviser

A dedicated subject adviser available throughout the year so please do get in touch if you would like any support or guidance with:

- Planning your courses
- Overview of BTEC quality assurance processes
- Suggested resources
- Teaching and Assessment of internal units and components
- Teaching external units and components
- The training and support materials we have available.

Training

Available training sessions can be booked here. On the left-hand side of the screen, select the qualification 'BTEC National' and subject. Where current training is available a list of titles, an overview of the training and dates will be provided giving teachers the option to select and book onto relevant sessions.

Transferable Skills Guide for Teachers

This guide provides and overview of the BTEC Transferable Skills Framework and how it has been used to integrate the delivery of these skills in the new suite of BTEC Level 3 and Level 2 qualifications starting in 2025.

Transition Guide

This guide provides an overview of what's new in the qualification, a comparison of the previous qualification to this new qualification, an overview of the assessment approach, a mapping guide to show where content is the same, updated or new.

Annexe

Curriculum Planning

The models in this section are intended to support your delivery planning and provide suggestions for the types and subjects of qualifications that might be delivered with this qualification.

Suggested combinations with other qualifications

This qualification can be combined in the following ways depending on the destination of students.

For students intending to progress to higher education to study Nursing

Option 1	Option 2	Option 3
Pearson Level 3 AAQ in Health and Social Care (Extended Certificate)	A Level Psychology	Pearson Level 3 AAQ in Medical Science (Extended Certificate)

For students intending to progress to higher education to study Physiotherapy

Option 1	Option 2	Option 3
Pearson Level 3 AAQ in Medical Science (Extended Certificate)	A Level Chemistry	A Level Physical Education

BTEC Key Terms

GLH – Guided Learning Hours, time the students have supervised teaching and learning

IV – Internal Verification, for internal quality assurance

Lead IV – the person responsible for the internal quality assurance across a qualification or programme subject area.

PSAB – Pearson Set Assignment Brief, used for summative internal assessments

SV – Standards Verification, for external quality assurance

Transferable Skills

Managing Yourself

Acronym	
MY-TPR	Taking Personal Responsibility
MY-PS&R	Personal Strengths and Resilience
MY-COP	Career Orientation Planning
MY-PGS	Personal Goal Setting

Effective Learning

Acronym	
EL-MOL	Managing Own Learning
EL-CL	Continuous Learning
EL-SRS	Secondary Research Skills
EL-PRS	Primary Research Skills

Interpersonal Skills

Acronym	
IS-WC	Written Communications
IS-V&NC	Verbal and Non-verbal Communications
IS-T	Teamwork
IS-C&SI	Cultural and Social Intelligence

Solving Problems

Acronym	
SP-CT	Critical Thinking
SP-PS	Problem Solving
SP-C&I	Creativity and Innovation

June 2025

For information about Pearson Qualifications, including Pearson Edexcel and BTEC qualifications visit qualifications.pearson.com

Pearson Education Limited. Registered in England and Wales No. 872828
Registered Office: 80 Strand, London WC2R 0RL.

VAT Reg No GB 278 537121