

TITLE: B1 Cell Biology (Part 1 – Cell Structure)

Unit Overview (Linked to the KS3 Programme of Study)

Students will develop their understanding of cells as the fundamental units of living organisms and how cell structure relates to function. This section of the course introduces the differences between prokaryotic and eukaryotic cells, the structure and function of animal, plant and bacterial cells, and the use of light and electron microscopes to study cells. Students will apply mathematical skills to calculate magnification, image size and actual size, including the use of standard form. They will also investigate cells through Required Practical 1 (Microscopy) and explore how cell specialisation and differentiation enable multicellular organisms to carry out complex functions. Finally, students will learn how cell division supports growth, repair and replacement of cells, providing the foundation for later study of stem cells, mitosis and transport in cells.

Prior Learning (KS3)

Students have learnt previously about cells as the fundamental units of living organisms. This has involved:

- Describing that all living organisms are made of cells.
- Identifying and explaining the functions of the main structures in animal and plant cells.
- Using a light microscope to observe and compare plant and animal cells.
- Explaining how specialised cells are adapted for specific functions.
- Describing how cells are organised into tissues, organs and organ systems.
- Understanding that substances move into and out of cells by diffusion.

This prior learning provides the foundation for understanding more advanced cell biology, including the structure of bacterial cells, cell specialisation, differentiation, microscopy and the relationship between cell structure and function.

Future Learning (KS5)

At GCSE and A Level you will build on your knowledge of cell structure and function by studying how cells divide, specialise and communicate. You will learn how genetic information controls cell activities, how substances move across cell membranes, and how cells work together within complex biological systems. At A Level, this understanding is extended to topics such as cell signalling, gene expression, stem cells, immunity, biotechnology and modern medical treatments, allowing you to explain biological processes at a molecular level.

Misconceptions

1. Prokaryotic and Eukaryotic Cells

- All cells contain a nucleus.
- Bacterial cells are not living cells.
- Prokaryotic cells are larger than eukaryotic cells.
- Bacteria do not contain genetic material.

2. Animal and Plant Cells

- Plant and animal cells have exactly the same structures.
- All cells contain chloroplasts.

- Chloroplasts are only responsible for giving plants their green colour.
- Mitochondria create energy rather than releasing energy through respiration.
- Ribosomes and mitochondria have the same function.

3. Microscopy

- Higher magnification always gives a clearer image.
- Magnification and resolution mean the same thing.
- Objects become physically larger when viewed under a microscope.
- Scientists can see all cell structures clearly using a light microscope.

4. Magnification and Cell Size

- Magnification and actual size are the same thing.
- Very small measurements do not need units.
- Standard form is only used in mathematics.
- Larger image size means the object itself is larger.

5. Cell Specialisation and Differentiation

- All cells in an organism perform the same function.
- Differentiation means cells become bigger.
- Specialised cells can perform every function in the body.
- Mature animal cells can easily become any type of cell.
- Cell division only occurs during growth and not during repair.

6. Structure and Function

- Cell structures exist independently and do not work together.
- Adaptations are random and unrelated to a cell's role.
- A specialised cell can survive without important organelles.
- The structure of a cell does not affect how well it performs its function.

Practical Requisitions

[8A Requisitions.docx](#)

Mastery (HPA)

Students explain and justify ideas using evidence from the Periodic Table, linking patterns in groups and periods to the properties and reactions of elements. They apply their knowledge to unfamiliar elements, make predictions using trends, and evaluate how scientists used evidence to develop and improve the Periodic Table.

B1.01 Cells – Eukaryotes and Prokaryotes		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	• Identify the main structures present in eukaryotic and prokaryotic cells	Analyse the similarities and differences between	Working Scientifically	EEF 4 (Memory): Retrieve prior learning about plant and

	- Compare how genetic material is organised in prokaryotic and eukaryotic cells - Compare the relative sizes of prokaryotic and eukaryotic cells - Perform order of magnitude calculations, including the use of standard form	prokaryotic and eukaryotic cells. Apply knowledge of cell structure to explain why bacteria are classified differently from animal and plant cells. Evaluate the usefulness of classification systems when studying living organisms.	WS 1.1 (Development of Scientific Thinking) Understand how cell classification developed through scientific evidence. WS 1.2 (Models) Use cell diagrams as models of microscopic structures. WS 3.6 (Explain using Evidence) Explain similarities and differences between cell types. WS 4.1 (Scientific Vocabulary) Use terms such as prokaryote, eukaryote, chromosome, ribosome and cytoplasm accurately. Maths Skills 1c (Comparisons) Compare cell sizes. 2h (Order of Magnitude) Compare sizes using powers of ten. 3a (Standard Form) Perform calculations involving cell size.	animal cells from KS3. EEF 3 (Modelling): Model comparisons between cell types using diagrams and labelled examples. EEF 6 (Language): Explicit teaching of specialist scientific vocabulary. EEF 7 (Feedback): Feedback used to improve explanations and comparisons.
Do Now (5 mins)	Purpose Retrieve prior knowledge about cells from KS3. Suggested Structure (teacher adapts) - What is a cell? - Name one structure found in an animal cell. - Name one structure found in a plant cell. Diamond (Challenge) - Why might different types of cells have different structures? Teacher Uses Responses To - Assess prior knowledge. - Identify misconceptions about cell structure. - Establish links with previous learning.			
Hook / Intro (5 mins)	Introduce Key Idea “Not all cells are the same.” Suggested Strategy Display: - Animal cell - Plant cell - Bacterial cell Ask: - Which cells appear most similar? - Which looks different? - Why might scientists classify them differently? Pedagogical Rationale Creates curiosity and introduces biological classification.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Cell Types Introduce: Eukaryotic Cells Examples: - Animal cells - Plant cells			

Contain:

- Nucleus
- Cytoplasm
- Cell membrane
- Ribosomes
- Mitochondria

Plant cells additionally contain:

- Cell wall
- Chloroplasts
- Vacuole

Prokaryotic Cells

Examples:

- Bacteria

Contain:

- Cytoplasm
- Cell membrane
- Ribosomes

Do **not** contain:

- Nucleus

Genetic material exists as a single circular loop of DNA.

Relative Sizes

Introduce:

- Prokaryotes are much smaller than eukaryotes.
- Typical bacterial cell $\approx 0.2\text{--}2\text{ }\mu\text{m}$
- Typical animal cell $\approx 10\text{--}30\text{ }\mu\text{m}$

Teacher Modelling (EEF 3)

Model comparison table:

Feature	Eukaryote	Prokaryote
Nucleus	✓	✗
Ribosomes	✓	✓
Cell membrane	✓	✓

Model order of magnitude comparison.

Check for Understanding (Hinge Point)

- What is a prokaryote?
- Which cells contain a nucleus?
- How is bacterial DNA organised?

	Which type of cell is usually larger? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported comparison. Pupils - Label diagrams. - Complete comparison tables. - Sort characteristics into prokaryote/eukaryote categories. Teacher Role - Model first examples. - Reinforce vocabulary. - Address misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: - Compare prokaryotic and eukaryotic cells. - Explain key structural differences. - Calculate simple order-of-magnitude comparisons. - Use scientific terminology accurately. Teacher Flexibility Teachers select format based on class need: - Comparison table - Diagram annotation - Card sort - Structured written response Success Criteria - Correct identification of cell structures. - Accurate comparison of cell types. - Correct use of scientific vocabulary. - Successful interpretation of cell size information. Adaptation Prompts If pupils struggle - Use labelled diagrams. - Provide vocabulary support. - Scaffold comparison tables. If secure - Explain why bacterial cells are classified separately.			

	• Compare relative sizes using standard form. •			
Support / Diamond (challenge)	Support • Labelled diagrams. • Vocabulary mat. • Comparison framework. Example sentence stem: “A prokaryotic cell differs from a eukaryotic cell because _____.” Diamond (Challenge) • Explain why prokaryotic cells are considered simpler than eukaryotic cells. • Compare genetic material storage in different cell types. • Evaluate why classification of cells is important in biology.			
Common misconceptions	• Bacteria are not made of cells. • All cells contain a nucleus. • Prokaryotes are larger than eukaryotes. • Ribosomes only occur in animal cells. • Plant cells are prokaryotic.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Define prokaryote. • Identify a eukaryotic cell. • Compare bacterial and animal cells. • Complete a cell classification question. Diagnostic Focus Can pupils: • Distinguish prokaryotic and eukaryotic cells? • Describe how genetic material is organised? • Use scientific vocabulary accurately? • Interpret cell size information?			
Exit ticket (5 mins)	Purpose Inform planning for B1.02 Animal and Plant Cells Example Questions • What is a prokaryotic cell? • Which structure is absent from bacterial cells? • Which type of cell is usually larger? Teacher Uses Responses To			

	Identify misconceptions before moving on to detailed cell structure.			
Adaptive teaching	• Retrieval links to KS3 cell knowledge. • Hinge questions identify misconceptions early. • Visual models reduce cognitive load. • Vocabulary explicitly taught and revisited. • Challenge develops comparison and evaluation. • Exit ticket informs next lesson planning.			
British Values	Individual Liberty - Students independently apply scientific knowledge to compare cell types and explain classification. Tolerance - Students recognise that scientific classification systems develop through evidence and improved understanding			
Teacher Notes for MTP adaptations				

B1.02 Animal and Plant Cells		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- Name and identify the main structures present in animal and plant cells - Explain how the main sub-cellular structures are related to their functions	Analyse how the structure of sub-cellular components enables them to perform specific functions. Apply knowledge of organelle function to explain how cells survive and carry out life processes. Evaluate which cell structures are most important for the survival of a cell and justify your reasoning.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand the relationship between structure and function in living systems. WS 1.2 (Models) Use cell diagrams as models to explain cell structure. WS 3.6 (Explain using Evidence) Use biological knowledge to explain how organelles support cell function. WS 4.1 (Scientific Vocabulary) Use terms such as nucleus, cytoplasm, mitochondria, ribosome and chloroplast accurately. Maths Skills 1c (Classification) Classify structures according to function. 2c (Patterns and Relationships) Compare similarities and differences between plant and animal cells.	EEF 4 (Memory): Retrieve prior knowledge from KS3 cells and previous lesson on prokaryotes and eukaryotes. EEF 3 (Modelling): Model how to link sub-cellular structure to biological function. EEF 6 (Language): Explicit teaching of specialist biological vocabulary. EEF 7 (Feedback): Feedback used to improve explanation of structure-function relationships.
Do Now (5 mins)	Purpose Retrieve prior learning about eukaryotic cells and cell structures. Suggested Structure (teacher adapts) - What is a eukaryotic cell? - Name one structure found in a bacterial cell. - Which structure contains genetic material in eukaryotic cells? Diamond (Challenge) - Why might different cell structures have different functions? Teacher Uses Responses To - Assess recall of B1.01. - Identify misconceptions about cell structure. - Prepare pupils for deeper study of organelles.			
Hook / Intro (5 mins)	Introduce Key Idea “Just as different organs in the body have different jobs, different parts of a cell also have specialised functions.” Suggested Strategy Show a diagram of a factory. Ask: - What jobs are carried out in a factory? - Could one worker carry out every task? - How might this be similar to a cell? Pedagogical Rationale Introduces the concept of specialisation and provides an accessible analogy for organelle function.			
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Animal Cells Introduce the main sub-cellular structures: Nucleus - Contains genetic material. - Controls the activities of the cell.			

	Cytoplasm • Site of many chemical reactions. Cell Membrane • Controls what enters and leaves the cell. Mitochondria • Site of aerobic respiration. • Releases energy needed by the cell. Ribosomes • Site of protein synthesis. Content: Plant Cells Introduce additional structures: Cell Wall • Strengthens and supports the cell. Chloroplasts • Site of photosynthesis. • Contain chlorophyll. Permanent Vacuole • Contains cell sap. • Helps maintain cell rigidity. Key Idea The structure of an organelle is linked to its function. Cells are able to survive because different structures carry out specialised tasks. Teacher Modelling (EEF 3) Model structure-function explanations: “The nucleus controls the cell because it contains the genetic information needed to direct cell activities.” “Mitochondria release energy through respiration, which is why cells that require lots of energy often contain many mitochondria.” Model comparison:			
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	<table><tr><th>Structure</th><th>Animal Cell</th><th>Plant Cell</th></tr><tr><td>Nucleus</td><td>✓</td><td>✓</td></tr><tr><td>Cell Wall</td><td>X</td><td>✓</td></tr><tr><td>Chloroplasts</td><td>X</td><td>✓</td></tr></table> Check for Understanding (Hinge Point) • Which organelle controls the cell? • Which organelle is the site of aerobic respiration? • Why do plant cells contain chloroplasts? • Which structures are only found in plant cells? Mini whiteboards / cold calling	Structure	Animal Cell	Plant Cell	Nucleus	✓	✓	Cell Wall	X	✓	Chloroplasts	X	✓			
Structure	Animal Cell	Plant Cell														
Nucleus	✓	✓														
Cell Wall	X	✓														
Chloroplasts	X	✓														
Guided Practice (10 mins)	Task Type Supported identification and explanation. Pupils • Label animal and plant cell diagrams. • Match organelles to functions. • Complete structure-function statements. Teacher Role • Model first examples. • Reinforce terminology. • Correct misconceptions immediately.															
Main Task (20 mins)	Core Task Pupils: • Identify and label the main sub-cellular structures. • Compare plant and animal cells. • Explain the functions of organelles. • Link organelle structure to function. Suggested Activities • Diagram annotation • Comparison table • Structure-function matching task • Extended explanation questions Teacher Flexibility Teachers select format based on class need: • Labelled diagrams • Card sort activity															

	• Structured table • Written explanations Success Criteria • Correctly identify cell structures. • Explain the functions of organelles. • Compare plant and animal cells accurately. • Use biological vocabulary appropriately. • Link structure to function. Adaptation Prompts If pupils struggle • Provide partially labelled diagrams. • Use organelle-function matching cards. • Provide sentence starters. If secure • Explain why cells need each organelle. • Compare specialised cells. • Analyse consequences of missing organelles. •			
Support / Diamond (challenge)	Support • Labelled cell diagrams. • Vocabulary mat. • Organelle-function table. Example sentence starters: “The function of the nucleus is to _____. ” “Chloroplasts are important because _____. ” Diamond (Challenge) • Explain why plant cells require chloroplasts but animal cells do not. • Analyse which organelle is most important for survival. • Evaluate how cell structures work together to enable life.			
Common misconceptions	• All cells contain chloroplasts. • The nucleus is only found in animal cells. • Mitochondria create energy rather than release energy from respiration. • Plant and animal cells are completely different. • Ribosomes and mitochondria perform the same function.			

Assessment (5 mins)	Formative and Summary Quick Check Options • Identify an organelle from a diagram. • State the function of an organelle. • Compare plant and animal cells. • Explain the role of mitochondria. Diagnostic Focus Can pupils: • Identify sub-cellular structures? • Explain organelle functions? • Compare plant and animal cells accurately? • Link structure and function?			
Exit ticket (5 mins)	Purpose Inform planning for B1.03 Microscopy RP Example Questions • Which organelle controls the cell? • Which organelle is the site of aerobic respiration? • Name one structure found only in plant cells. Teacher Uses Responses To Identify misconceptions before practical microscopy work.			
Adaptive teaching	• Retrieval strengthens understanding of eukaryotic cells. • Hinge questions identify misconceptions about organelles. • Visual models reduce cognitive load. • Subject-specific vocabulary is explicitly taught and revisited. • Challenge tasks develop analytical thinking. • Exit ticket informs planning for the required practical.			
British Values	Democracy - Students discuss and justify explanations about how sub-cellular structures are adapted to perform specific functions. Individual Liberty - Students independently apply biological knowledge to explain the role of organelles in living cells.			
Teacher Notes for MTP adaptations				

B1.03 Microscopy RP		HPA CHALLENGE	Skills	EEF Recommendations
Learning Objectives	- Use a light microscope to observe plant and animal cells - Produce clear, labelled biological drawings from microscope observations - Explain how to use a light microscope safely and effectively as part of Required Practical 1	Evaluate the strengths and limitations of light microscopes when studying cells. Analyse the quality of microscope observations and identify factors affecting accuracy. Apply knowledge of microscopy to explain why some cell structures are difficult to observe.	Working Scientifically WS 2.1 (Scientific Attitudes) Make careful observations and record evidence accurately. WS 2.2 (Experimental Skills and Strategies) Select and use appropriate equipment safely and correctly. WS 2.3 (Risk) Recognise hazards and follow safe laboratory procedures. WS 3.1 (Recording Data) Produce accurate scientific drawings and labels. WS 3.6 (Explain using Evidence) Explain observations using biological knowledge. WS 4.1 (Scientific Vocabulary) Use terms such as microscope, eyepiece, objective lens, specimen and resolution accurately. Maths Skills 1c (Measurement) Use	EEF 5 (Practical Work): Practical work used to develop understanding of cell structure through first-hand observation. EEF 3 (Modelling): Model microscope setup and scientific drawing techniques step by step. EEF 6 (Language): Explicit teaching of microscopy vocabulary. EEF 7 (Feedback): Feedback used to improve observational accuracy and scientific drawing skills.
Do Now (5 mins)	Purpose Retrieve knowledge of plant and animal cells before practical microscopy work. Suggested Structure (teacher adapts) - Name one structure found in all eukaryotic cells. - Which organelle controls the cell? - Name one structure found only in plant cells. Diamond (Challenge) - Why do scientists need microscopes to study cells? Teacher Uses Responses To - Assess recall of cell structure. - Identify misconceptions before practical work. - Prepare pupils for making observations.			
Hook / Intro (5 mins)	Introduce Key Idea “Most cells are too small to be seen with the naked eye, so scientists use microscopes to reveal a hidden world.” Suggested Strategy Display: - A photograph of an onion epidermis. - A microscope image of onion cells. Ask: - Which image gives more information? - Why can we not see cells without equipment? - How might scientists record what they observe? Pedagogical Rationale Creates a purpose for microscopy and introduces observation as a scientific skill.			
Direct Teaching:	Content: The Light Microscope			

Cell Structure (10 – 15 mins)	Introduce key parts: • Eyepiece lens • Objective lens • Stage • Stage clips • Light source • Focus wheel Functions <table><tr><th>Part</th><th>Function</th></tr><tr><td>Eyepiece lens</td><td>Magnifies the image</td></tr><tr><td>Objective lens</td><td>Provides different magnifications</td></tr><tr><td>Stage</td><td>Holds the slide</td></tr><tr><td>Light source</td><td>Illuminates the specimen</td></tr><tr><td>Focus wheel</td><td>Produces a clear image</td></tr></table> Using a Microscope Model the procedure: 1. Place slide on stage. 2. Start on low magnification. 3. Use coarse focus carefully. 4. Adjust using fine focus. 5. Increase magnification if needed. Biological Drawings Explain rules: • Use pencil only. • Draw clear single lines. • No shading. • Include labels. • Draw only what is observed. Teacher Modelling (EEF 3) Demonstrate: • Setting up a microscope. • Focusing on a prepared slide. • Producing a biological drawing from an image. Model labelling: “Labels should be straight and touch the structure being identified.” Check for Understanding (Hinge Point) • Which part do you look through?	Part	Function	Eyepiece lens	Magnifies the image	Objective lens	Provides different magnifications	Stage	Holds the slide	Light source	Illuminates the specimen	Focus wheel	Produces a clear image		scales and measurements appropriately. 4a (Interpretation) Interpret microscope images and compare observations.
Part	Function														
Eyepiece lens	Magnifies the image														
Objective lens	Provides different magnifications														
Stage	Holds the slide														
Light source	Illuminates the specimen														
Focus wheel	Produces a clear image														

	• Why should low magnification be used first? • Why is shading not used in scientific drawings? • What is the purpose of the focus wheel? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported practical preparation. Pupils • Label a microscope diagram. • Match microscope parts to functions. • Identify errors in biological drawings. Teacher Role • Model first examples. • Reinforce correct practical technique. • Correct misconceptions before practical work begins.			
Main Task (20 mins)	Core Task Required Practical 1 Pupils: • Use a light microscope to observe cells. • Focus on prepared slides or fresh specimens. • Produce labelled biological drawings. • Record observations accurately. Possible Specimens • Onion epidermis • Plant tissue • Prepared animal cell slides Teacher Flexibility Teachers select approach based on equipment and class need: • Prepared slides • Fresh onion epidermis • Demonstration followed by pupil practice • Rotational practical stations Success Criteria • Use the microscope safely. • Focus a specimen successfully. • Produce an accurate biological drawing.			

	- Label visible structures correctly. - Follow practical procedures accurately. Adaptation Prompts If pupils struggle - Provide labelled microscope diagrams. - Use prepared slides. - Provide drawing scaffolds. If secure - Compare plant and animal cell observations. - Critique the quality of microscope images. - Evaluate the limitations of light microscopy.			
Support / Diamond (challenge)	Support - Microscope setup checklist. - Scientific drawing guidance sheet. - Labelled microscope diagram. Example sentence starters: “The structure I observed was _____.” “I identified this structure because _____.” Diamond (Challenge) - Explain why some organelles cannot be seen clearly using a light microscope. - Evaluate the strengths and limitations of light microscopes. - Compare observations with textbook cell diagrams.			
Common misconceptions	- Higher magnification always produces a clearer image. - Microscopes make cells physically larger. - Scientific drawings should be artistic. - Labels can point anywhere on a diagram. - All cell structures can be seen clearly with a light microscope.			
Assessment (5 mins)	Formative and Summary Quick Check Options - Label microscope parts. - Identify good scientific drawing practice. - Explain why microscopes are needed.			

	Diagnostic Focus Can pupils: • Use the microscope correctly? • Produce scientific drawings? • Explain microscope functions? • Make accurate observations?			
Exit ticket (5 mins)	Purpose Inform planning for B1.04 Microscopy Calculations Example Questions • Why is a microscope needed to study cells? • Which microscope part is used for magnification? • State one rule for biological drawings. Teacher uses responses to identify misconceptions before introducing magnification calculations.			
Adaptive teaching	• Retrieval strengthens understanding of cell structure. • Hinge questions identify misconceptions before the practical. • Teacher modelling supports procedural knowledge. • Practical scaffolds support confidence and accuracy. • Challenge activities extend evaluation of microscopy. • Exit ticket informs planning for microscopy calculations.			
British Values	Rule of Law - Students follow agreed laboratory procedures and safety expectations when using microscopes. Mutual Respect - Students use shared equipment responsibly and respect the observations and evidence collected by others.			
Teacher Notes for MTP adaptations				

B1.04 Microscopy Calculations		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	• Understand how microscopy techniques have developed over time • Explain how electron microscopy has increased	Analyse the advantages and limitations of light and electron microscopes.	Working Scientifically	EEF 4 (Memory): Retrieve prior learning about cell

	understanding of sub-cellular structures - Carry out calculations involving magnification, image size and actual size using the formula: $\text{Magnification} = \text{Image Size} \div \text{Actual Size}$ - Express answers in standard form where appropriate	Apply magnification calculations to unfamiliar biological examples. Evaluate how developments in microscopy have improved scientific understanding of cells.	WS 1.1 (Development of Scientific Thinking) Understand how improvements in technology lead to advances in scientific knowledge. WS 1.2 (Models) Use microscope images as models of biological structures. WS 3.5 (Interpret Data) Interpret magnification information and scale. WS 3.6 (Explain using Evidence) Explain how evidence from microscopy supports biological understanding. WS 4.1 (Scientific Vocabulary) Use terms such as magnification, resolution, electron microscope, image size and actual size accurately. Maths Skills 1a (Use of Numbers) Use standard units and conversions.	structures and microscopy from B1.02 and B1.03. EEF 3 (Modelling): Model magnification calculations step-by-step using worked examples. EEF 6 (Language): Explicit teaching of mathematical and microscopy vocabulary. EEF 7 (Feedback): Use feedback to improve mathematical accuracy and scientific explanations.
Do Now (5 mins)	Purpose Retrieve prior learning about microscopy and cell structure whilst preparing pupils for quantitative work. Suggested Structure (teacher adapts) - What is the purpose of a microscope? - Name one advantage of using a microscope. - What is one organelle that can be seen using a light microscope? Diamond (Challenge) - Why might scientists need more powerful microscopes than those used in school laboratories? Teacher Uses Responses To - Assess understanding of B1.03. - Identify misconceptions about magnification. - Prepare pupils for microscope comparisons.			
Hook / Intro (5 mins)	Introduce Key Idea "The more powerful our microscopes become, the more we learn about life." Suggested Strategy Display: - A simple light microscope image of a cell. - An electron microscope image showing detailed sub-cellular structures. Ask: - Which image provides more detail? - Why might scientists need greater detail? - How has technology changed what we know about cells? Pedagogical Rationale Introduces the importance of technological developments in science and provides a reason for learning magnification calculations.			

Direct Teaching: Cell Structure (10 – 15 mins)	Content: Developments in Microscopy Light Microscopes • Produce useful images of cells. • Allow observation of many cell structures. • Limited by their resolution. Electron Microscopes • Much higher magnification. • Much higher resolution. • Reveal structures not visible with a light microscope. Key Idea Magnification makes an image appear larger. Resolution refers to the amount of detail that can be seen. A higher magnification does not automatically mean a clearer image. Microscopy Calculations Introduce: Magnification Formula Image Size = Actual (real)Size x Magnification ALWAYS substitute before rearranging Worked Example 1 Image size = 50 mm Actual size = 0.05 mm Image Size = Actual Size x Magnification $50 = 0.05 \times M$ $M = 50 / 0.05$ Answer: ×1000 Worked Example 2 Magnification = ×2000 Actual size = 0.01 mm		2h (Order of Magnitude) Compare microscopic scales. 3a (Standard Form) Express very small values appropriately. 3c (Formulae) Rearrange and use the magnification equation.	
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	Image Size = Actual Size x Magnification Image Size = 2000×0.01 Image Size = 20 mm Standard Form Recap: $0.000002 \text{ m} = 2 \times 10^{-6} \text{ m}$ Explain why standard form is useful when working with very small biological structures. Teacher Modelling (EEF 3) Model: 1. Identifying known values. 2. Selecting the correct formula. 3. Substituting accurately. 4. Checking units. 5. Converting to standard form where required. Model common mistakes: • Incorrect unit conversion. • Calculator errors. • Confusing image size and actual size. Check for Understanding (Hinge Point) • What is magnification? • What is resolution? • Which microscope has the greatest resolution? • How is magnification calculated? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported calculations and interpretation. Pupils • Complete partially scaffolded calculations. • Compare light and electron microscopes. • Interpret magnification statements. Teacher Role • Model first calculation. • Check calculator use. • Reinforce unit accuracy.			
Main Task (20)	Core Task			

mins)	Pupils: • Complete magnification calculations. • Rearrange the formula to determine image size or actual size. • Compare microscope types. • Explain how microscopy has improved scientific understanding. Suggested Activities • Magnification practice questions • Comparison table • Standard form questions • Application questions using microscope images Teacher Flexibility Teachers select format based on class need: • Scaffolded worksheet • GCSE-style calculation practice • Comparison task • Mixed retrieval and application task Success Criteria • Correctly use the magnification equation. • Rearrange the equation when necessary. • Use standard form appropriately. • Explain the benefits of electron microscopy. • Use scientific and mathematical vocabulary accurately. Adaptation Prompts If pupils struggle • Provide formula triangles. • Supply step-by-step calculation guides. • Use worked examples. If secure • Apply formulae to unfamiliar contexts. • Convert values into standard form independently. • Evaluate microscope technologies.			
Support / Diamond (challenge)	Support • Formula sheet. • Unit conversion guide. • Calculation scaffold.			

	Example sentence starters: "Magnification is calculated by..." "Electron microscopes are useful because..." Diamond (Challenge) • Explain why resolution is often more important than magnification. • Analyse microscope images and estimate actual sizes. • Evaluate how electron microscopes have transformed biology.			
Common misconceptions	• Magnification and resolution are the same thing. • Larger magnification always produces a clearer image. • Electron microscopes simply "zoom in" further. • Units can be ignored in calculations. • Standard form is only used in physics and mathematics.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Calculate magnification. • Define resolution. • Compare light and electron microscopes. • Convert a value into standard form. Diagnostic Focus Can pupils: • Use the magnification formula correctly? • Distinguish magnification from resolution? • Compare microscope types? • Use standard form appropriately?			
Exit ticket (5 mins)	Purpose Inform planning for B1.05 Cell Specialisation and Differentiation. Example Questions • What is magnification? • Which microscope provides greater resolution? • Complete a magnification calculation.			

	Teacher uses responses to identify misconceptions before moving on to specialised cells.			
Adaptive teaching	• Retrieval links microscopy with prior cell knowledge. • Hinge questions identify misconceptions about magnification. • Worked examples reduce cognitive load during calculations. • Formula scaffolds support less confident mathematicians. • Challenge promotes evaluation and application. • Exit ticket informs planning for specialised cells and differentiation.			
British Values	Individual Liberty - Students independently apply mathematical and scientific knowledge to solve problems involving magnification. Democracy - Students compare methods and justify solutions when discussing calculation approaches and microscope evidence.			
Teacher Notes for MTP adaptations				

8A.05 Elements of Group 1		HPA Challenge	Skills	EEF Recommendations
Learning Objectives	- State examples of specialised animal and plant cells - Explain how the structure of different types of cells relates to their function in a tissue, organ system or whole organism - Describe when differentiation occurs in most animal cells and in many plant cells - Explain the importance of cell differentiation - Explain the role of cell division in growth, repair and replacement of cells	Analyse how specialised cells are adapted for their functions. Apply knowledge of differentiation to explain how multicellular organisms develop and function.	Working Scientifically WS 1.1 (Development of Scientific Thinking) Understand how specialised structures enable biological function. WS 1.2 (Models) Use diagrams and models to explain cell adaptation. WS 3.6 (Explain using Evidence) Explain structure-function relationships using biological knowledge. WS 3.7 (Evaluation) Evaluate the importance of specialisation and differentiation. WS 4.1 (Scientific Vocabulary) Use terms such as specialised, differentiation, adaptation, tissue and multicellular accurately. Maths Skills 1c (Classification) Group cells according to structure and function. 2c (Patterns and Relationships) Identify	EEF 4 (Memory): Retrieve prior learning about organelles and cell structure. EEF 3 (Modelling): Model how specific adaptations enable specialised cells to perform their roles. EEF 6 (Language): Explicit teaching of specialist biological vocabulary. EEF 7 (Feedback): Feedback used to improve explanations linking structure and function.
Do Now (5 mins)	Purpose Retrieve prior knowledge from B1.02 and B1.04 about cell structures and organelles. Suggested Structure (teacher adapts) - Which organelle is the site of aerobic respiration? - Which organelle contains genetic material? - Name one structure found only in plant cells. Diamond (Challenge) - Why might different types of cells need different structures? Teacher Uses Responses To - Assess understanding of organelle functions. - Identify misconceptions about cell structure. - Prepare pupils for specialisation and differentiation.	Evaluate the importance of cell differentiation for survival, growth and repair.		
Hook / Intro (5 mins)	Introduce Key Idea “If every cell contains the same genetic information, why do nerve cells, muscle cells and root hair cells look so different?” Suggested Strategy Display images of: - Sperm cell - Nerve cell - Muscle cell - Root hair cell Ask: - Which cell looks most different? - Why might these cells have different shapes?			

	Could one type of cell perform every job in the body? Pedagogical Rationale Creates a need for explaining specialisation and links directly to structure-function relationships.		relationships between cell structure and cell function.	
Direct Teaching: Cell Structure (10 – 15 mins)	Content: Cell Specialisation Introduce: Specialised Cell - A cell adapted to perform a particular function. Animal Cell Examples Sperm Cell Adaptations: - Tail for movement. - Many mitochondria for energy. - Streamlined shape. Function: - Reach and fertilise an egg cell. Nerve Cell Adaptations: - Long structure. - Branch connections. Function: - Carry electrical impulses quickly around the body. Muscle Cell Adaptations: - Many mitochondria. - Specialised fibres. Function: - Contract to produce movement. Plant Cell Examples Root Hair Cell Adaptations: - Large surface area. - Thin walls.			

	Function: - Absorb water and mineral ions efficiently. Palisade Cell Adaptations: - Large numbers of chloroplasts. Function: - Carry out photosynthesis. Content: Differentiation Introduce: Differentiation - The process by which a cell becomes specialised. Key GCSE Biology Point Animals - Most cells differentiate early in development. - Mature animal cells usually cannot become different cell types. Plants - Many cells retain the ability to differentiate throughout life. - Growth continues in specific regions called meristems. Content: Cell Division Introduce: Cell division is important for: - Growth - Repair - Replacement of worn-out cells Key Idea Specialisation allows multicellular organisms to function efficiently because different cells perform different jobs. Teacher Modelling (EEF 3) Model structure-function explanations: Root Hair Cell “The large surface area increases the rate of water absorption, making the cell highly effective at its role.”			
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	Sperm Cell “The tail allows movement, increasing the chance of reaching the egg cell.” Model linking: Adaptation → Function → Survival Check for Understanding (Hinge Point) • What is a specialised cell? • What is differentiation? • Why does a sperm cell have a tail? • Why do root hair cells have a large surface area? • Why is cell division important? Mini whiteboards / cold calling			
Guided Practice (10 mins)	Task Type Supported comparison and explanation. Pupils • Match specialised cells to their functions. • Match adaptations to purposes. • Complete scaffolded structure-function explanations. Teacher Role • Model first examples. • Reinforce adaptation vocabulary. • Correct misconceptions immediately.			
Main Task (20 mins)	Core Task Pupils: • Describe examples of specialised animal and plant cells. • Explain how adaptations enable cells to perform specific functions. • Explain differentiation. • Explain the importance of cell division. Suggested Activities • Adaptation card sort • Structure-function table • Cell comparison task • Extended explanation question			

	Teacher Flexibility Teachers select format based on class need: • Structured worksheet • Diagram annotation • Comparison table • GCSE-style application questions Success Criteria • Identify specialised cells. • Describe adaptations accurately. • Link structure and function. • Explain differentiation. • Explain the importance of cell division. • Use biological vocabulary correctly. Adaptation Prompts If pupils struggle • Provide adaptation-function matching cards. • Use labelled diagrams. • Provide sentence starters. If secure • Analyse unfamiliar specialised cells. • Explain why multicellular organisms require different cell types. • Compare specialisation in plants and animals.			
Support / Diamond (challenge)	Support • Specialised cell fact sheets. • Vocabulary mat. • Structure-function scaffold. Example sentence starters: “This cell is specialised because _____.” “Its adaptation helps it to _____.” Diamond (Challenge) • Explain why multicellular organisms depend on specialised cells. • Analyse how cell division and differentiation work together. • Evaluate which specialised cell adaptation is most important for survival.			

Common misconceptions	• All cells have exactly the same function. • Differentiation means cells become larger. • Root hair cells absorb food rather than water and minerals. • Mature animal cells can easily become any cell type. • Cell division only occurs in growing children.			
Assessment (5 mins)	Formative and Summary Quick Check Options • Define differentiation. • Identify a specialised cell. • Explain one adaptation. • State one purpose of cell division. Diagnostic Focus Can pupils: • Explain structure-function relationships? • Describe differentiation? • Explain why specialisation is important? • Use scientific vocabulary accurately?			
Exit ticket (5 mins)	Purpose Review and consolidate learning from the Cell Structure section of B1 Cell Biology. Example Questions • What is differentiation? • Name a specialised cell and one adaptation. • Why is cell division important? Teacher Uses Responses To Identify misconceptions before moving into the next section of Cell Biology.			
Adaptive teaching	• Purpose • Review and consolidate learning from the Cell Structure section of B1 Cell Biology. • Example Questions • What is differentiation? • Name a specialised cell and one adaptation. • Why is cell division important? • Teacher Uses Responses To • Identify misconceptions before moving into the next section of Cell Biology.			
British Values	Individual Liberty - Students independently apply biological knowledge to explain how specialised cells perform specific roles.			

	Tolerance - Students recognise that multicellular organisms require many different cell types working together to survive and function.
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Teacher Notes for MTP adaptations
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