Name: _____

Cell Structure

This booklet should be handed in to your Y12 Biology teacher by the end of the first week in September.

Please email any questions to Miss Whelan - o.whelan@brookfield.derbyshire.sch.uk

Prokaryotic and Eukaryotic cells

Part of our definition/description of what it means to be a living thing on Earth includes the assertion that living things are made of cells and cell products. In other words, we consider the cell to be a pretty fundamental structural aspect of life.

Cells in our world come in two basic types, **prokaryotic** and **eukaryotic**.
"Karyose" comes from a Greek word which means "kernel," as in a kernel of grain. In biology, we use this word root to refer to the nucleus of a cell. "Pro" means "before," and "eu" means "true," or "good." So "Prokaryotic" means "before a nucleus," and "eukaryotic" means "possessing a true nucleus." This is a big hint about one of the differences between these two cell types. Prokaryotic cells have no nuclei, while eukaryotic cells do have true nuclei. This is far from the only difference between these two cell types, however

In this independent study task, you should learn and be able to recall the difference between prokaryotes and eukaryotes as well as the structure and function of the key organelles that make up each type of cell.

Extract from Specification

Content
The structure of eukaryotic cells, restricted to the structure and function of: • cell-surface membrane • nucleus (containing chromosomes, consisting of protein-bound, linear DNA, and one or more nucleoli) • mitochondria • chloroplasts (in plants and algae) • Golgi apparatus and Golgi vesicles • lysosomes (a type of Golgi vesicle that releases lysozymes) • ribosomes • rough endoplasmic reticulum and smooth endoplasmic reticulum • cell wall (in plants, algae and fungi) • cell vacuole (in plants). In complex multicellular organisms, eukaryotic cells become specialised for specific functions. Specialised cells are organised into tissues, tissues into organs and organs into systems. **Students should be able to** apply their knowledge of these features in explaining adaptations of eukaryotic cells.

Content
Prokaryotic cells are much smaller than eukaryotic cells. They also differ from eukaryotic cells in having: • cytoplasm that lacks membrane-bound organelles • smaller ribosomes • no nucleus; instead they have a single circular DNA molecule that is free in the cytoplasm and is not associated with proteins • a cell wall that contains murein, a glycoprotein. In addition, many prokaryotic cells have: • one or more plasmids • a capsule surrounding the cell • one or more flagella. Details of these structural differences are **not** required. Viruses are acellular and non-living. The structure of virus particles to include genetic material, capsid and attachment protein.

Prokaryotic and Eukaryotic cells

Task 1 Find/draw a labelled diagram of a prokaryotic and a eukaryotic cell

Organelles of a cell

The way a cell is constructed is referred to as a **cells ultrastructure**. There are many parts to both prokaryotic and eukaryotic cells
For your exams, you will be expected to recognise different parts of a cell, specifically that of an epithelial cell from the small intestine as well as describe the organelles structure and function

Task 2 Research the structure and function of the different organelles found within prokaryotes and eukaryotes

Make sure you state whether or not the organelle is found within a prokaryotic and/or a eukaryotic cell by ticking the specific box

Plasma Membrane	Prokaryotic ☐ Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure		
Function		

Nucleus	Prokaryotic ☐ Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure		
Function		

Cell Wall	Prokaryotic ☐	Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure			
Function			

Mitochondria	Prokaryotic ☐	Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure			
Function			

Ribosomes	Prokaryotic ☐	Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure			
Function			

Rough Endoplasmic	Prokaryotic ☐	Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure			
Function			

Smooth Endoplasmic	Prokaryotic ☐	Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure			
Function			

Golgi Apparatus	Prokaryotic ☐	Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure			
Function			

Vacuole	Prokaryotic ☐	Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure			
Function			

Chloroplasts	Prokaryotic ☐	Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure			
Function			

Lysosomes	Prokaryotic ☐	Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure			
Function			

Flagella	Prokaryotic ☐ Eukaryotic ☐	Labelled diagram/image (where applicable)
General description of structure		
Function		

Use the space below to include any other organelles that may be of interest

Prokaryotic and Eukaryotic cells

Task 3 Complete the following summary table to illustrate the main characteristics between prokaryotic and eukaryotic cells

Characteristic	Prokaryotes	Eukaryotes
Example	Bacteria	Human
Approximate cell size (µm)		
Unicellular or multicellular?		
Membrane bound? organelles?		
Type of Genetic Material		
Flagella present?		
Cell wall present? Composition?		
Ribosomes present?		
Cytoplasm present?		
Arrangement of genetic material		
Type of cellular division		
Any other key pieces of information		

Virus

Task 4 Viruses are acellular and non living consisting of genetic material, capsid and various attachment proteins
Complete the following tasks based on the life cycle and structure of a virus

1. Find/draw a diagram of a generic virus

2. Describe the purpose of the following parts of a virus

   a. Genetic material _____
   _____
   _____

   b. Capsid _____
   _____
   _____

   c. Attachment proteins _____
   _____
   _____

3. Using the information you have researched on viruses, explain how viruses invade your body cells and make you ill.
   You may wish to draw/find a diagram of the life cycle of a virus to help you

Diagram/image (if necessary)

Cell differentiation and specialisation

Most cells in the body have a very similar ultrastructure, but some have differentiated, changing their ultrastructure in order to become more adapted to a particular function in the body. These cells are referred to as specialised cells

Task 5 Research 4 different specialised found within animals and/or plants and apply your knowledge of cell ultrastructure to explain how these cells are adapted for a particular function. Include a labelled diagram of each cell type

Cell Name_____	Cell Name_____
Cell Name_____	Cell Name_____

Exam Questions

Task 6 Complete the following exam questions.

1 (a) Describe how phospholipids are arranged in a plasma membrane.

[2 marks]

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1 (b) Cells that secrete enzymes contain a lot of rough endoplasmic reticulum (RER) and a large Golgi apparatus.

1 (b) (i) Describe how the RER is involved in the production of enzymes.

[2 marks]

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1 (b) (ii) Describe how the Golgi apparatus is involved in the secretion of enzymes.

[1 mark]

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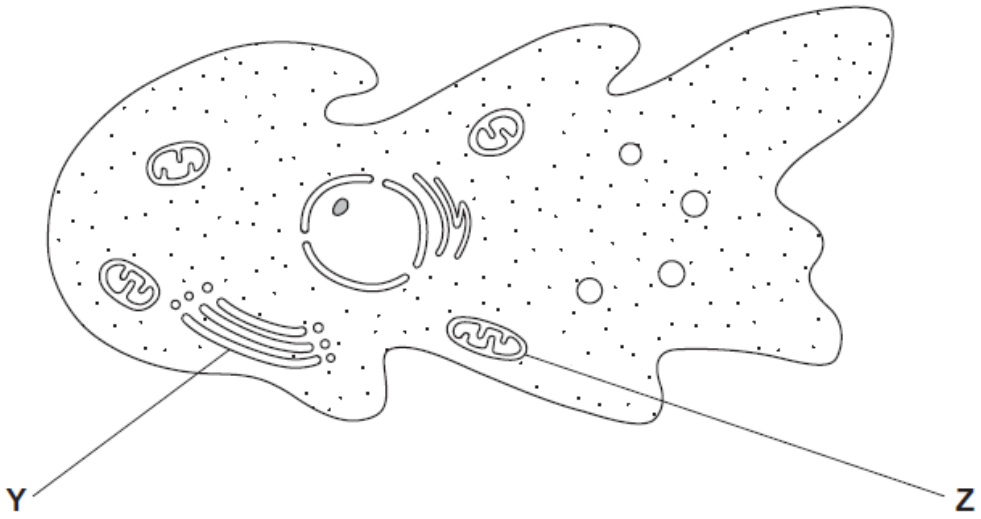
2 An amoeba is a single-celled, eukaryotic organism. Scientists used a transmission electron microscope to study an amoeba. The diagram shows its structure.



2 (a) (i) Name organelle **Y**.

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(1 mark)

2 (a) (ii) Name **two** other structures in the diagram which show that the amoeba is a eukaryotic cell.

1 .....

2 .....

(2 marks)

2 (b) What is the function of organelle **Z**?

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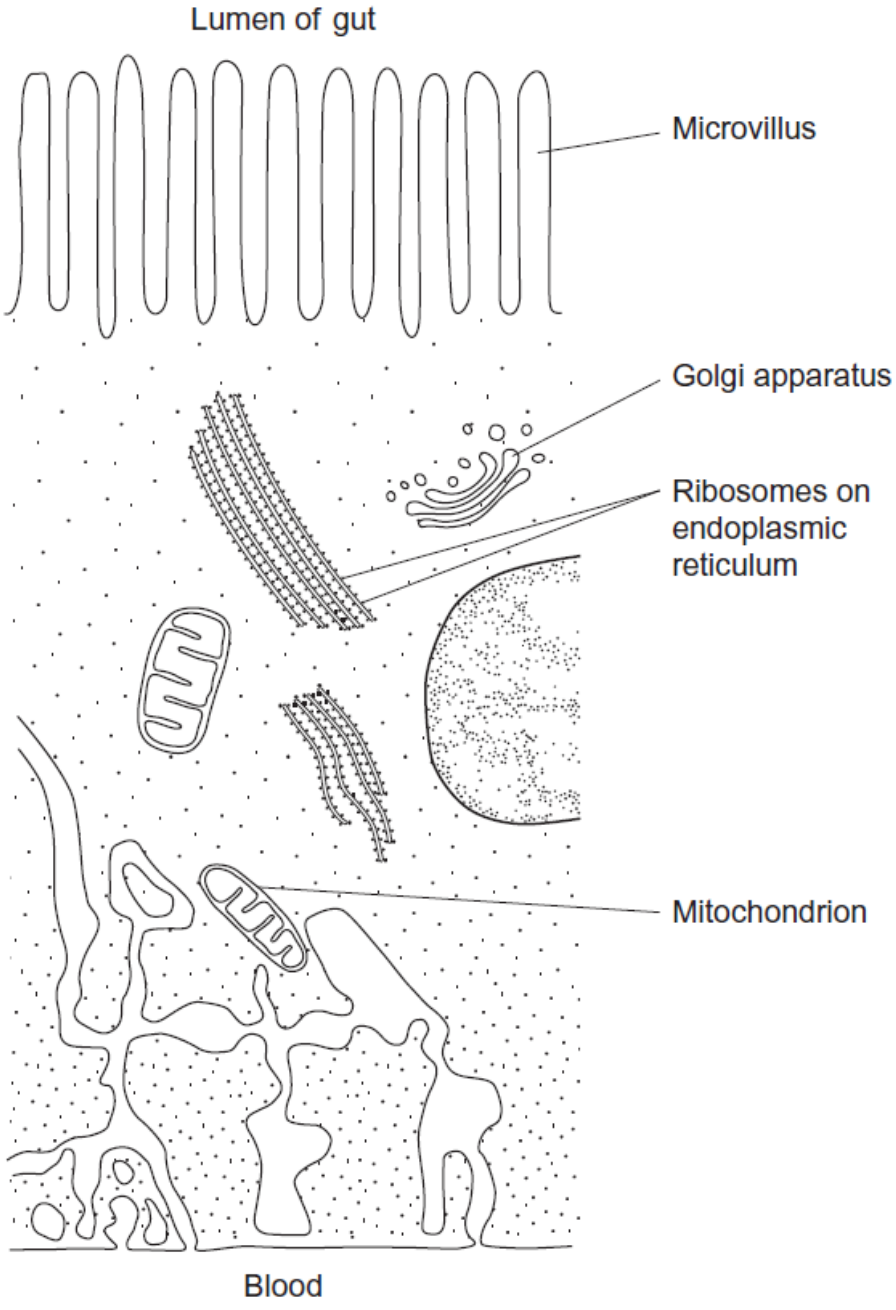
(1 mark)

3 (a) The table shows some features of cells. Complete the table by putting a tick in the box if the feature is present in the cell.

Feature	Cell		
	Cholera bacterium	Epithelial cell from intestine	Epithelial cell from alveolus of lung
Cell-surface membrane			
Flagellum			
Nucleus			

(3 marks)

3 (b) The diagram shows part of an epithelial cell from an insect's gut.



This cell is adapted for the three functions listed below. Use the diagram to explain how this cell is adapted for each of these functions.

Use a **different** feature in the diagram for each of your answers.

3 (b) (i) the active transport of substances from the cell into the blood

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(2 marks)

3 (b) (ii) the synthesis of enzymes

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(2 marks)

3 (b) (iii) rapid diffusion of substances from the lumen of the gut into the cytoplasm

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(1 mark)

4 The epithelial cells that line the small intestine are adapted for the absorption of glucose. Explain how.

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(6 marks)

(Extra space) .....

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END OF QUESTIONS

Other tasks to complete:

- Download the AQA A-Level Biology Specification so you have a copy for reference.
- Use the mark scheme at the back of the booklet to check your answers. Make any corrections using a different coloured pen.
- Make sure you have a folder that can be used to store revision materials/independent study ready for September

Question	Marking Guidance	Mark	Comments
1(a)	1. Bilayer; 2. Hydrophobic / fatty acid / lipid (tails) to inside; 3. Polar / phosphate group / hydrophilic (head) to outside;	2 max	1. Accept double layer 1. Accept drawing which shows bilayer 2. & 3. need labels 2. & 3. accept water loving or hating
1(b)(i)	1. (Rough endoplasmic reticulum has) ribosomes; 2. To make protein (which an enzyme is);	2	1. accept "contains / stores" 2. Accept amino acids joined together / (poly)peptide 2. Reject makes amino acids 2. Ignore glycoprotein
1(b)(ii)	(Golgi apparatus) modifies (protein) **OR** packages / put into (Golgi) vesicles **OR** transport to cell surface / vacuole;	1	Accept protein has sugar added Reject protein synthesis Accept lysosome formation

Question	Marking Guidelines	Mark	Comments
2(a)(i)	Golgi (apparatus/body);	1	
2(a)(ii)	1. Nucleus; 2. Mitochondrion; 3. Endoplasmic reticulum/ER; 4. Lysosome;	2 max	1. Accept: nucleolus/nuclear envelope/nuclear membranes 2. Accept cristae/mitochondrial membranes 3. Ignore reference to rough/ smooth 4. Reject lysozyme
2(b)	(Aerobic) respiration/ATP production/provide energy;	1	Accept Krebs cycle/ electron transport. Ignore 'produces energy' Reject anaerobic respiration Ignore what energy is used for

Question	Marking Guidelines	Mark	Comments
3(a)	✓ ✓ ✓ ✓ ✓ ✓	3	Mark across, one mark for each correct row. If crosses are used and no ticks, accept cross as equivalent to tick. If crosses are used as well as ticks, mark tick only.
3(b)(i)	1. Mitochondria respire; 2. Release energy/ produce ATP; 3. Transport against gradient; ***OR*** 4. Infolding of membrane; 5. Increases area; 6. More proteins for active transport;	2 max	2. Do not credit make energy 3. Do not credit active transport as this is given in question. 3. Do not accept diffusion against. 4. Reject microvilli but if mentioned can still accept points 5 and 6.
3(b)(ii)	1. Ribosomes make proteins/ enzymes; 2. Enzymes are proteins; ***OR*** 3. Mitochrondria respire; 4. Release energy/produce ATP; 5. (Energy/ATP) for protein / enzyme synthesis;	2	Ignore references to Golgi or rough ER.
3(b)(iii)	Microvilli increase area / have large area;	1	Ignore references to other properties of microvilli.

4)	1. Microvilli; 2. Large/increased surface area; 3. Many mitochondria; 4. (Mitochondria/respiration) produce ATP / release or provide energy (for active transport); 5. Carrier proteins for active transport; 6. Channel / carrier proteins for facilitated diffusion; 7. Co-transport of sodium (ions) and glucose or symport / carrier protein for sodium (ions) and glucose; 8. Membrane-bound enzymes digest disaccharides / produce glucose	6 max	1. Reject villi on epithelial cells 1. Accept brush border 2. Accept large SA:vol ratio 3. Need idea of "lots" 4. Reject: energy produced 5. Accept Na^+K^+ pump 7. Neutral: Channel proteins 8. Accept named example