Mark scheme - Cell Structure

Question			Answer/Indicative content	Marks	Guidance
1			C	1	
			Total	**1**	
2			D	1	
			Total	**1**	
3			D	1	**Examiner's Comments** This question was also well answered, with most candidates correctly giving D as the answer.
			Total	**1**	
4			B ✓	**1**	**Examiner's Comments** This question was straightforward recall and the majority of candidates chose the correct response.
			Total	**1**	
5		i	*B* comment about detail of organelles (1) comment about shapes of cells (1)	2	**No Mark for identification of B** e.g. light microscope would not allow nuclear pores / ribosomes / endoplasmic reticulum / plasmodesmata to be seen. e.g. sieve tube elements are angular / hexagonal.
		ii	the ability to see more detail / separate two objects (1)	1	
		iii	Nile blue (1) to increase contrast / to make nuclei visible / to show no nuclei in sieve tubes (1)	2	
			Total	**5**	
6		i	X (cellulose) cell wall ✓ Y cell surface membrane / plasma membrane ✓	max 3	*If additional incorrect answer given, then 0 marks* Y **ACCEPT** plasmalemma

			Z vacuole membrane / tonoplast ✓		Z **IGNORE** vacuole **Examiner's Comments** Almost all candidates correctly identified X as the cell wall. Few however went on to gain both of the other marks. The vast majority of candidates knew Y was the 'cell membrane' but failed to use the correct A Level terminology of cell surface membrane or plasma membrane. Z was typically identified as the vacuole rather than the vacuole membrane, although label line U was to the vacuole. Some candidates thought the label line pointed to the nuclear membrane, despite the nucleus being clearly labelled.
		ii	sucrose solution ✓	1	*If additional incorrect answer given, then 0 marks* **ACCEPT** sugar solution / external solution / solution placed in **DO NOT CREDIT** 'solution' unqualified **Examiner's Comments** It seems that the majority of candidates did not appreciate that the cell wall is fully permeable and so sucrose solution would therefore enter the space at W. Typical wrong responses were water/air/nothing.
			Total	**4**	
7			☑ ; ☐ ☑ ; ☐ ☐ ☑ ;	3	If four ticks given reduce mark by 1 If five ticks given reduce mark by 2 If six ticks given reduce mark by 3 For each mark reduction annotate with 'CON' **Examiner's Comments** Candidates were asked to select the statements that could be used as evidence for the endosymbiotic theory. Many able candidates correctly selected the features which highlighted the similarities between the organelles and free-living bacteria. These included the

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>similarities in overall size, type of ribosomes and the circular organisation of DNA. However, it was quite common for candidates to select the exact opposite of the 3 correct answers. This was either a misinterpretation of the question or, more likely, that weaker candidates simply ticked the boxes opposite the statements they knew to be correct statements.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>3</td><td></td></tr>
<tr><td>8</td><td></td><td></td><td>
<table>
<tr><th>Statement about onion root cells</th><th>True</th><th>False</th></tr>
<tr><td>contain chloroplasts</td><td></td><td>✓</td></tr>
<tr><td>contain mitochondria</td><td>✓</td><td></td></tr>
<tr><td>contain 70S ribosomes in cytoplasm</td><td></td><td>✓</td></tr>
<tr><td>have pili</td><td></td><td>✓</td></tr>
<tr><td>have cellulose cell walls</td><td>✓</td><td></td></tr>
</table>
3 correct = ✓
all correct = ✓✓
</td><td>2</td><td>ALLOW use of crosses in place of ticks

<u>Examiner’s Comments</u>

Most candidates scored 1 mark for this question, with the most common errors being to believe that the onion cells have 70s ribosomes and pili.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
<tr><td>9</td><td></td><td>i</td><td>erythrocyte ✓</td><td>1(AO1.1)</td><td>ALLOW red blood cell

<u>Examiner’s Comments</u>

OCR support

Different images from the Dennis Kunkel library of photomicrographs can be shown to give candidates practice in spotting the distinctive biconcave disk shape of erythrocytes and seeing the variation in the much smaller number of leucocytes.

https:/www.ocr.org.uk/qualifications/as-a-level-gce-biology-a-h020-h420-from-</td></tr>
</table>

					2015/delivery-guide/module-ba02-module-2-foundations-in-biology/delivery-guide-badg001-cell-structure-211#230468
		ii	immunity / immune system / immune response ✓	1(AO1.1)	**Mark the first answer.** If an additional answer is given that is incorrect, then = **0 marks** **ALLOW** immune protection **OR** defence against / protection from / destroy / fight, pathogens / bacteria / protoctists / parasites / foreign antigens / non-self antigens / infection / infectious disease / malignant cells / cancer cells **IGNORE** details e.g. engulf pathogens / make antibodies / specific / non-specific / phagocytosis **Examiner's Comments** Correct answers included immunity, immune response and immune defence. Other answers such as phagocytosis or making antibodies did not achieve any marks, because they were specific for each cell.
			Total	**2**	
10		i	A = (permanent / temporary) vacuole ✓ B = nucleolus ✓	2 (AO1.1)	**ALLOW** vacule **DO NOT ALLOW** nucleus **Examiner's Comments** Most candidates correctly identified A as the vacuole, but only a minority of candidates identified B as the nucleolus, with many identifying it as the nucleus. Other answers seen included xylem and phloem, and air space for vacuole.
		ii	(x)14000 / 1.4 x 10^4 ✓✓	2 (AO2.8)	If the answer is incorrect, award one mark for a correct calculation not rounded to 2 s.f. (e.g. 0.02 / 0.0000014 = 14285.71429 20000 / 1.4 = 14285.71429) **ALLOW** 0.019/0.0000014 = 13571.428

					or 0.021/0.0000014 = 15000 for 1 mark **Examiner's Comments** On the whole this question was well answered, with the majority of candidates correctly calculating the magnification. However, some candidates lost a mark for failing to round the answer to 2 significant figures. **OCR support** There are available resources on the 'Maths for Biology' website which can be used to support candidates with the correct use of significant figures: https:/www.ocr.org.uk/subjects/biology/maths-for-biology/handling-data/
		iii	no, shading / cross hatches / AW ✓ add, a scale / magnification ✓ add a title ✓	2 max (AO3.4)	**Mark first two improvements described** e.g. only use outlines **IGNORE** references to labels or annotations and the use of a pencil (because this is mentioned in the question stem) **IGNORE** drawing should take up half a page / no overlapping lines / use continuous lines **Examiner's Comments** Many candidates correctly recognised that the drawing could be improved by removing shading or by adding a scale bar. However, many referred to adding labels or annotations or the use of a sharp pencil which gained no credit, as this was mentioned in the question stem.

					OCR support The Biological Drawing handbook can be used as a guidance in this case: https:/www.ocr.org.uk/Images/251799-biology-drawing-skills-handbook.pdf
		iv	place stain at edge of sample (not the centre) ✓ lower cover slip at an angle / use mounted needle ✓ use blotting paper to, remove excess stain / pull stain through ✓ use more than one stain (to improve contrast) ✓	2 max (AO3.3)	**Mark as prose** **IGNORE** use forceps / lay sample flat **ALLOW** place stain at side of sample **ALLOW** stated angles given e.g. 45° **ALLOW** 'tissue/paper towel' instead of 'blotting paper' **ALLOW** ensure stain covers whole sample **Examiner's Comments** Candidates who had a practical knowledge of slide preparation scored well, mentioning lowering the cover slip at an angle or using blotting paper to remove excess stain, as ways to improve the method. However, many candidates wrote about aseptic technique, adding water, wearing gloves, or pressing down on the cover slip to remove air bubbles, which gained no credit. **OCR support** Practical work should be an integral part of the study of Biology. The practicals provided by OCR to support the practical endorsement include Practical Activity Group (PAG) 1 in which there is practical activity on preparing microscope slides which can be applied into different contexts. PAG activities are available on OCR interchange: https:/interchange.ocr.org.uk/Downloads/PAG1.zip

			Total	**8**	
11			1 compartmentalisation / maintain different conditions from cell cytoplasm ✓ 2 separating proteins (synthesised) from cell cytoplasm ✓ 3 hold, ribosomes / enzymes, in place ✓ 4 AVP ✓–	2 max (AO2.1)	**1 ALLOW** keeps specific conditions needed in RER **ALLOW** controls what enters RER **ALLOW** for attachment of ribosomes e.g. packaging proteins into transport vesicles / labelling proteins (on vesicle membranes)
			Total	**2**	
12		i	*label* ribosome ✓ *explanation* cannot see with, this / light, microscope / need EM to see ✓ (LM) <u>resolution</u>, not high enough / too low ✓ (LM) <u>magnification</u>, not high enough / too low ✓ it is a nucleus ✓ **OR** *label* (large permanent) vacuole ✓ *explanation* it is an air bubble ✓ it spans more than one cell ✓ a vacuole is inside one cell ✓	3 max (AO2.3 (AO3.4)	1 mark for identifying incorrect label. 2 max for **matching** explanation. **IGNORE** structure shown too large **ALLOW** not visible / cannot be, viewed / detected for 'see' **ALLOW** resolution not, sharp / clear / strong / detailed, enough
		ii	*any three from:* label lines should not cross ✓ no arrowheads ✓ no, shading / colouring in ✓ give, magnification / scale ✓ give title ✓ draw <u>cell walls</u> as two lines ✓ draw organelles in proportion ✓	3 max (AO3.4)	**ALLOW** must be parallel **ALLOW** give diagram a name **ALLOW** ref. nuclei /structures labelled as ribosomes, too big

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td><u>Examiner’s Comments</u>

In this question candidates needed to relate structure to function (both aspects) in four types of cells. Partial answers achieved a lower level and mark, as did those that tried to address all of the required areas but made errors. The commonest errors were confusing erythrocytes and neutrophils, cilia and microvilli, and ciliated cells with goblet cells.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
<tr><td>13</td><td></td><td>i</td><td>to provide, lots of / much, energy / ATP ✓</td><td>1
(AO2.1)</td><td>DO NOT ALLOW make / produce energy.
ALLOW cell, needs / uses, lots of, energy / ATP</td></tr>
<tr><td></td><td></td><td>ii</td><td>Golgi apparatus ✓
to, modify / process / package, protein ✓
ref. vesicles / secretion (of mucus) / exocytosis ✓</td><td>2 max
(AO2.1)</td><td>ALLOW smooth endoplasmic reticulum / SER
ALLOW lipid / triglyceride, synthesis (for smooth ER)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>3</td><td></td></tr>
<tr><td>14</td><td></td><td></td><td><table><tr><th>Animal</th><th>Plant</th><th>Yeast</th><th>Bacter</th></tr><tr><td></td><td></td><td>budding</td><td></td></tr><tr><td>yes</td><td>yes</td><td>yes</td><td>no</td></tr><tr><td></td><td>cellulose</td><td></td><td>peptidog</td></tr><tr><td>yes</td><td>yes</td><td>yes</td><td>yes</td></tr></table></td><td>4</td><td>Mark the first answer in each box. If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then = 0 marks

Award 1 mark for each correct row

ACCEPT tick / present & cross / not present / absent / none

IGNORE ref to nucleoid

CREDIT murein as alternative to peptidoglycan
ACCEPT peptidoglycin
DO NOT ACCEPT peptoglycan

ACCEPT ‘on RER’ or ‘in cytoplasm’ for yes
ACCEPT ref to size of ribosomes (large / 80S / 22nm in Eukaryotes, small / 70S / 18nm in bacteria)

Examiner's Comments</td></tr>
</table>

					Overall, this question was one of the most straightforward in the paper, expecting candidates to simply recall their knowledge. Errors were made either because students had not revised the content sufficiently well, or through phrasing their responses incorrectly. This was generally well answered by candidates, especially rows 1 and 2 where the majority of candidates identified budding as the means of cell division and that all except the bacterium possess a nucleus. However, a significant number of candidates suggested cytokinesis, binary fission or mitosis as the means of cell division. Rows 3 and 4 were less well answered. The material in the cell wall of plant cells (cellulose) was well known, but only the best candidates knew peptidoglycan and how to spell this term correctly. Some guessed at cellulose, polysaccharide and chitin or left the space blank. The most common mistake in row 4 was to suggest that either yeast or bacterium had no ribosomes.
			Total	**4**	
15			B ✓	1 AO2.3	
			Total	**1**	
16		i	length / size , similar to that of a bacterium ✓ contain (circular) DNA ✓ contain (70S / small / 20nm) ribosomes ✓ (may) have plasmids ✓ have double membrane ✓	max 2 (AO3.2) (AO2.1)	**If more than two responses given:** mark **first** response on each prompt line. If responses on first prompt line and nothing on second line then mark first **two** on first prompt line
		ii	*cells with mitochondria / early eukaryotes* **1** would be able to respire aerobically ✓ **2** (this) produces more ATP ✓ **3** ATP needed for , active transport / cell division / protein synthesis / DNA replication ✓ **4** more ATP allows faster metabolic , processes / reactions ✓	3 (AO2.1)	**Assume for cells with mitochondria** **Only need to mention ATP once** **ALLOW ORA** for cells without mitochondria for **MPs 1, 2, 4** **ALLOW** releases more energy **DO NOT ALLOW** 'produces' energy **IGNORE** growth **ALLOW** more ATP so can meet higher metabolic demand

			Total	**5**	
17			**A** ✓	1	**Examiner's Comments** This question tests knowledge of differences between prokaryote and eukaryote cell structure. The correct response is A. However, many candidates believe that prokaryotes do not have ribosomes. They do not appear to distinguish between ribosomes and membrane bound organelles.
			Total	**1**	
18	a	i	**C** / ribosomes	1	
		ii	*Any two from:* A rough endoplasmic reticulum D Golgi apparatus E secretory vesicle F mitochondrion (1)(1)	2	
	b		C/A then D then E (1)(1)(1)	3	letters must be in correct order, if not all correct: allow one mark if C/A as first letter given allow one mark for E as last letter given allow one mark for D in the middle **IGNORE B** as this is plasma membrane rather than an organelle
			Total	**6**	
19			C	1(AO1.2)	
			Total	**1**	
20			**C** ✓	1	**Examiner's Comments** This question tested knowledge about the function of different organelles. Many candidates were successful but some had forgotten that vesicles are used to transport the enzymes to the cell surface membrane and for exocytosis.
			Total	**1**	
21				**3 max**	***NOTE** answers must be the in context of **protein** transport. Penalise once if a*

			1 transport vesicle from RER ✓ **2** modification / processing / folding ✓ **3** in / at, Golgi (body / apparatus) ✓ **4** (packaged into) secretory vesicle ✓ **5** vesicles move along the cytoskeleton ✓ **6** (vesicle) fuses with, cell surface / plasma, membrane ✓ **7** (secretion occurs by) exocytosis ✓		*different material (e.g. gene) is transported* to max 2 **2** **ACCEPT** example of modification e.g. converted into a glycoprotein **ACCEPT** in context of RER or Golgi **3** **IGNORE** SER / smooth endoplasmic reticulum **5** **ACCEPT** use of motor proteins / chaperones / microtubules **6** **ACCEPT** merges with **DO NOT ACCEPT** binds / attaches / dissolves **7** **DO NOT ACCEPT** exocytosis in context of excretion (rather than secretion) **DO NOT ACCEPT** vesicle being released by exocytosis **Examiner's Comments** Some candidates wrongly answered in terms of the transport of the gene, RNA or even the ribosome itself, rather than the protein. Others limited their answers to accounts of transcription and translation without moving on to secretion. However, many candidates had learned the topic well and gained full marks in a single sentence. Generally candidates knew that processing and packaging happens at the Golgi apparatus, but could be less clear on other details. Few candidates included the distinction between transport vesicles and secretory vesicles, or used the precise terms. Several candidates failed to

					specify that the vesicle fused with the cell surface membrane, rather than just the cell membrane, and described the vesicle being released rather than the protein. Some candidates were familiar with the function of the cytoskeleton and used terms like chaperones and motor proteins.
			Total	**3**	
22			(m)RNA transported out of nucleus (1) (m)RNA transported to / associates with ribosome (1) translation / protein synthesis, occurs at ribosome (1) (t)RNA brings specific amino acids **or** (t)RNA described (1) peptide bonds form between adjacent amino acids **or** peptide bonds described (1) polypeptide / protein processed through Golgi apparatus (1)	4	
			Total	**4**	
23			B	1	
			Total	**1**	
24		i	3 bases / triplet, code for 1 (specific) amino acid ✓ sequence of, bases / triplets, determines the sequence of, amino acids / primary structure ✓ (code) non-overlapping ✓ AVP ✓	2 max	e.g. more than one codon codes for an amino acid / degenerate code is, universal / similar in eukaryotes and prokaryotes
		ii	mechanical strength (to cells) ✓ cell, support / stability / maintains shape ✓ movement of (named), molecules / vesicles / organelles within cell **OR** holding organelles in position ✓ formation / movement, of, cilia / flagella ✓	3 max	**IGNORE** strength unqualified **ALLOW** maintain internal organisation

			cell movement / endocytosis / exocytosis / phagocytosis / cytokinesis / described ✓		
		iii	movement of mRNA from nucleus to ribosome ✓ movement of polypeptides through the rER ✓ movement of vesicles from rER to Golgi ✓ movement of vesicles between cisternae of Golgi (cis to trans face) ✓ movement of secretory vesicles from Golgi to cell surface membrane✓	2 max	Note: this requires more detail than part ii
			Total	**7**	
25			attach to cytoskeleton (1) moved by, protein motors / dynein (1)	2	**ACCEPT** by change in length of microtubules
			Total	**2**	
26		i	cell division / cytokinesis ✓ *idea of* cell movement ✓	1 max (AO2.1)	**ALLOW** binary fission / for replication **DO NOT ALLOW** mitosis e.g. 'allows flexibility' / 'allows it to bend'
		ii	*idea of* maintaining cell, shape / structure ✓	1 (AO2.1)	**ALLOW** to change cell shape / provide support
		iii	binds to, actin / cytoskeleton ✓ *idea that* actin might not function correctly ✓	1 max (AO3.2)	e.g. stops muscle contraction / causes paralysis
			Total	**3**	
27	a		(using) microtubules / tubulin / motor proteins ✓	1	**ALLOW** kinesins / dyneins / 'moto' proteins **IGNORE** spindle fibres, centrioles **<u>Examiner's Comments</u>** Just under half of candidates associated movement of organelles in a cell with microtubules or motor proteins.
	b		**1** <u>goblet cells</u>, secrete / release / make / produce / form, <u>mucus</u> ✓ **2** <u>mucus</u> traps, pathogens / microorganisms /	4 max	**IGNORE** excrete **ALLOW** named example of a lung

			bacteria ✓ **3** ref. phagocytes / neutrophils / macrophages / lysozyme ✓ **4** cilia / ciliated cells / ciliated epithelium, sweep / brush / waft / move / AW, mucus ✓ 5 cytoskeleton / microtubules / tubulin, move(s) / make(s) up, the cilia ✓		pathogen **IGNORE** cilia trap, pathogens / microorganisms **ALLOW** 'cillia' / other spelling that looks and sounds same **DO NOT ALLOW** cilia cells **Examiner's Comments** Most candidates scored one or more marks. High ability responses showed correct and precise use of biological terms such as goblet cells, mucus, cilia and pathogens. Lower ability responses did not distinguish between the roles of two sorts of epithelial cells, goblet cells and ciliated cells. The commonest error was to say that cilia trap pathogens.
			Total	**5**	