

# Cell structure 1

Level: Edexcel A Level 9BN0

Subject: Biology

Exam Board: Suitable for all boards

Topic: Cell structure 1

Type: Mark Scheme

To be used by all students preparing for Edexcel Biology A Level 9BN0 foundation or higher tier but also suitable for students of other boards.



## Mark schemes

<b>1</b>	(a)	Differentiation / specialisation	1	
	(b)	(i)	(cellulose) <u>Cell</u> wall;	1
		(ii)	Two marks for correct answer 2350–2500;; <i>Accept measured and real lengths in different units for one mark.</i>  One mark for a measured length divided by real length;	2
	(iii)	<u>Chloroplasts</u> absorb <u>light</u> ; <i>Q Do not accept chlorophyll as alternative to chloroplasts</i>  Or  Large vacuole pushes <u>chloroplasts</u> to edge (of cell);  Or  Thin / permeable (cell) wall to absorb carbon dioxide;	1 max	
			<b>[5]</b>	
<b>2</b>	(a)	(i)	Crista / <u>inner</u> membrane;	1
		(ii)	Matrix;	1
	(b)	B;	1	
	(c)	(i)	Reduce / prevent <u>enzyme</u> activity;	1
		(ii)	Prevents osmosis / no (net) movement of water;  So organelle / named organelle does not burst / shrivel; <i>Q Allow reference to cell rather than organelle for first mark point only.</i> <i>Regard damage as neutral</i>	2
(d)	(Mitochondria) use aerobic respiration;  Mitochondria produce ATP / release energy required for <u>muscles</u> (to contract); <i>Q Do not accept reference to making / producing energy.</i>	2		
		<b>[8]</b>		



**3** (a)  $\times 20\,000$   
*Accept range from 18 000 to 22 000* 1

(b)

✓	
✓	
	✓

*1 mark for each correct column* 2

- (c) 1. DNA contains thymine **and** RNA contains uracil; 2  
2. DNA contains deoxyribose **and** RNA contains ribose. 2

[5]

**4** (a) 1. Starch formed from  $\alpha$ -glucose but cellulose formed from  $\beta$ -glucose; 2  
2. Position of hydrogen and hydroxyl groups on carbon atom 1 inverted. 2

- (b) 1. Insoluble;  
2. Don't affect water potential;  
**OR**  
3. Helical;  
*Accept form spirals*

4. Compact;  
**OR**  
5. Large molecule;  
6. Cannot leave cell. 2

- (c) 1. Long and straight chains;  
2. Become linked together by many hydrogen bonds to form fibrils;  
3. Provide strength (to cell wall). 3

[7]



- 5**
- (a)
    1. (If injected into egg), gene gets into all / most of cells of silkworm;
    2. So gets into cells that make silk.

2
  - (b)
    1. Not all eggs will successfully take up the plasmid;
    2. Silkworms that have taken up gene will glow.

2
  - (c) Promoter (region / gene).
 

1
  - (d)
    1. So that protein can be harvested;
    2. Fibres in other cells might cause harm.

2
- [7]**

- 6**
- (a)
    1. Add drop of water to (glass) slide;
    2. Obtain thin section (of plant tissue) and place on slide / float on drop of water;
    3. Stain with / add iodine in potassium iodide.
      3. *Allow any appropriate method that avoids trapping air bubbles*
    4. Lower cover slip using mounted needle.

4
  - (b)
    1. **W** – chloroplast, photosynthesis;
    2. **Z** – nucleus, contains DNA / chromosomes / holds genetic information of cell.

2
  - (c)
    1. High resolution;
    2. Can see internal structure of organelles.

2
  - (d) Length of bar in mm × 1000.
 

1
- [9]**

**7**

(a)

Feature	Bacterium	Human immunodeficiency virus (HIV) particle
RNA	✓	✓
Cell wall	✓	
Enzyme molecules	✓	✓
Capsid		✓

*1 mark for each correct vertical column*

2



- (b) 1. (Complementary) nucleotides/bases pair  
**OR**  
A to T **and** C to G;  
*Ignore '(DNA polymerase) forms base pairs/nucleotide pairs'*
2. DNA polymerase;
3. Nucleotides join together (to form new strand)/phosphodiester bonds form;  
*Ignore '(DNA polymerase) forms base pairs/nucleotide pairs'*  
*If clearly writing rote answer about DNA replication **2 max** e.g. helicase or separating strands*

3

- (c) 1. DNA double stranded/double helix **and** mRNA single-stranded;  
*Contrast requires both parts of the statement*
2. DNA (very) long **and** RNA short;  
*Accept 'RNA shorter' or 'DNA bigger/longer'*
3. Thymine/T in DNA **and** uracil/U in RNA;
4. Deoxyribose in DNA **and** ribose in RNA;  
*R Deoxyribonucleic/ ribonucleic acid*  
*Ignore ref. to histones*  
*Ignore ref. to helix and straight chain alone*
5. DNA has base pairing **and** mRNA doesn't/ DNA has hydrogen bonding and mRNA doesn't;
6. DNA has introns/non-coding sequences **and** mRNA doesn't;  
*Ignore ref to splicing*

3 max

[8]

8

- (a) 1. From ADP and phosphate;  
*Accept  $P_i/PO_4^{3-}$  / (P)*  
*Reject P/Phosphorus*  
*Reject use of water in the reaction*
2. By ATP synthase;
3. During respiration/photosynthesis;

2 max

- (b) 1. To provide energy for other reactions/named process;  
*Reject 'produce' energy*
2. To add phosphate to other substances **and** make them more reactive/change their shape;

2

- (c) (Can see) 3D image;

1

- (d) Crista/cristae;

*Ignore matrix*

1



- (e) Value between 20,750 (83mm) and 21,250 (85mm) two marks;;  
Formula given/used but calculation wrong, award 1 mark

$$\text{Magnification} = \frac{\text{image size}}{\text{Object size}}$$

(Large number divided by 4)

2

[8]

9

- (a)

White blood cell		✓	✓
Bacteria cell	✓	✓	

2

- (b) 2.80 (µm);;

Answer in range 2.76–2.83 scores 2 marks

If length incorrect but divided by 30 000, allow 1 mark

2

- (c) (i) Circular DNA / smaller/70S ribosomes / no introns / no histones/proteins associated with DNA;

Ignore reference to plasmids

1

- (ii) 1. Able to respire aerobically;
- 2. So make (more) ATP/ release (more) energy;

Reject 'producing energy' unqualified

2

[7]



10

- (a) 1. Thin slice/section;
- 2. Put on slide in water / solution / stain;
- 3. Add cover slip;

*Accept: 'between two slides'*

Max 2

- (b) 200 (µm);;

OR

- 1. Divide image length by key length eg  $64/16 = 4$ ;
- 2. Multiply by 50 eg  $4 \times 50$ ;

*Accept for 2 marks answers in the range of 185-217 (µm)*

*Max 1 mark for responses not within the range*

*Accept: measurements in the ranges 63-65mm and 15-17mm*

2

- (c) 1. Select large number of cells / select cells at random;

*Accept: > 3 for "large number"*

*Accept: many fields of view for 'large number of cells'*

*Accept: all cells in field of view*

- 2. Count number of chloroplasts;
- 3. Divide number of chloroplasts by number of cells;

*Ignore: 'calculate the mean'*

3

[7]

11

- (a)

Protein synthesis	L;
Modifies protein	H;
Aerobic respiration	N;

3

- (b) 1800–2200;

*1.8, 2.0 or 2.2 in working or answer = 1 mark.*

*Ignore units in answer.*

1 mark for an incorrect answer in which student clearly divides measured length by actual length (of scale).

*Accept I / A or I / O for 1 mark but ignore triangle.*

*Accept approx 60mm divided by 30µm for 1 mark*

2

[5]

12

- (a) 1. Large / dense / heavy cells;
- 2. Form pellet / move to bottom of tube (when centrifuged);
- 3. Liquid / supernatant can be removed.

*Must refer to whole cells.*

3



(b) Break down cells / cell parts / toxins.  
*Idea of 'break down / digestion' needed, not just damage*

1

(c) 1. To stop / reduce them being damaged / destroyed / killed;  
*Reject (to stop) bacteria being denatured.*

2. By stomach acid.  
*Must be in context of stomach.*

2

(d) 1. More cell damage when both present / A;

2. Some cell damage when either there on their own / some cell damage in B and C;  
*MP1 and MP2 – figures given from the graph are insufficient.*

3. Standard deviation does not overlap for A with B and C so difference is real;  
*MP3 and MP4 **both** aspects needed to gain mark.*

4. Standard deviations do overlap between B and C so no real difference.  
*MP3 and MP4 accept reference to significance / chance for 'real difference'*

3 max

(e) 1. Enzyme (a protein) is broken down (so no enzyme activity);  
*Accept hydrolyse / digested for 'broken down'.*

2. No toxin (as a result of protein-digesting enzyme activity);  
*Must be in the correct context.*

3. (So) toxin is protein.  
*This must be stated, not inferred from use of 'protein-digesting enzyme'.*

3

[12]

**13** (a) 1. Bilayer;  
*Accept double layer*  
*Accept drawing which shows bilayer*

2. Hydrophobic / fatty acid / lipid (tails) to inside;

3. Polar / phosphate group / hydrophilic (head) to outside;  
*2. & 3. need labels*  
*2. & 3. accept water loving or hating*

2 max





- (b) (i) 1. (Rough endoplasmic reticulum has) ribosomes;  
*accept "contains / stores"*
2. To make protein (which an enzyme is);  
*Accept amino acids joined together / (poly)peptide*  
*Reject makes amino acids*  
*Ignore glycoprotein*

2

- (ii) (Golgi apparatus) modifies (protein)

**OR**

packages / put into (Golgi) vesicles

**OR**

transport to cell surface / vacuole;

*Accept protein has sugar added*

*Reject protein synthesis*

*Accept lysosome formation*

1

[5]

14

- (a) QWC

1. (Phagocyte engulfs) to form vacuole / vesicle / phagosome;  
*Accept surrounds bacteria with membrane*
2. Lysosome empties contents into vacuole / vesicle / phagosome;  
*Accept joins / fuses*
3. (Releasing) enzymes that digest / hydrolyse bacteria;  
*Ignore breakdown / destroy / lytic enzymes*

3



(b) Two suitable structures;;

Examples,

1. Cell wall;
2. Capsule / slime layer;
3. Circular DNA;  
*Reject "circular chromosome"*
4. Naked DNA / DNA without histones;
5. Flagellum;
6. Plasmid;
7. Pilus;
8. 70s / smaller ribosomes;
9. Mesosome;

2 max

[5]

15

(a) (i) **(Whole-cell vaccine),**

*Accept converse statements for other vaccine*

*Reject references to the vaccine being alive or the disease reproducing etc*

1. Heat(ing) supposed to kill bacteria;
2. Some might be alive / active / viable;  
*Accept active pathogens present*
3. (If so) bacteria could reproduce;
4. Bacterium makes or contains toxin;
5. Toxin might not be affected / all destroyed by heat;
6. Bacteria or toxins attacking / killing person's cells;

3 max

(ii) **(Whole-cell vaccine),**

*Ignore references to more / greater antigens unqualified. It is the variety of antigens that matters*

1. (Contains) many different / greater range of antigens;
2. Each antigen causes its own immune response / production of / has a specific (type of) antibody;

2



- (b) 1. Only patients who had whooping cough have toxin / antibody / immune response;  
*Accept converse e.g. those without antibody had another disease*
2. Toxin is an antigen and is (only) produced by this bacterium;
3. Leading to presence of specific antibody / only 4% had this antibody / 13% did not have antibody;

3

- (c) 1. There may not be large rises;
2. Might be the result of wrong diagnosis / reference to difference in figures / 13% diagnosed with whooping cough didn't have it;  
*Ignore reference to new strains or antigenic variability*

2

[10]

- 16** (a) 1. **A:** phospholipid (layer);  
*1. Reject hydrophobic / hydrophilic phospholipid*
2. **B:** pore / channel / pump / carrier / transmembrane / intrinsic / transport protein;  
*2. Ignore unqualified reference to protein*

2

- (b) (i) Condensation (reaction);

1



- (ii) Organelle named; Function in protein production / secretion;

*Function must be for organelle named*

*Incorrect organelle = 0*

eg

1. Golgi (apparatus);  
*1. Accept smooth endoplasmic reticulum*
2. Package / process proteins;

**OR**

3. Rough endoplasmic reticulum / ribosomes;  
*3. Accept alternative correct functions of rough endoplasmic reticulum. ER / RER is insufficient*  
*3. Accept folding polypeptide / protein*
4. Make polypeptide / protein / forming peptide bonds;

**OR**

5. Mitochondria;
6. Release of energy / make ATP;  
*6. Reject produce / make energy*  
*6. Accept produce energy in the form of ATP*

**OR**

7. Vesicles;
8. Secretion / transport of protein;

2

[5]

17

- (a) (i) Substance that causes an immune response / production of antibodies;

*Ignore foreign / non-self*

1

- (ii)
1. Not lipid soluble;
  2. Too large (to diffuse through the membrane);
  3. Antigens do not have the complementary shape / cannot bind to receptor / channel / carrier proteins (in membranes of other epithelial cells);

2 max



- (b) 1. (Vaccine contains) antigen / attenuated / dead pathogen;  
*1. Reject if in context of injection of vaccine*
2. T-cells activate B-cells;
3. B-cells divide / form clone / undergo mitosis;
4. Plasma cells produce antibodies;
5. Memory cells produced meaning more antibodies / antibodies produced faster in secondary response / on reinfection;

5

[8]

18

- (a) (i) (Aerobic) respiration;  
*Accept ATP production / energy release*  
*Reject anaerobic respiration*  
*Reject energy production*

1

- (ii) Golgi (apparatus / body);  
*Ignore smooth ER*

1

- (b) ('It' = Optical microscope)  
*Ignore reference to magnification*
1. Has low resolution / not high enough resolution;  
*Accept converse relating to EM*
2. (Because) wavelength of light not short enough / too long;  
*Accept larger wavelength*  
*Accept statements that microscopes have a wavelength*

2

[4]

19

(a)

Statement	Starch	Cellulose	Glycogen
Found in plant cells	✓	✓	
Contains glycosidic bonds	✓	✓	✓
Contains β-glucose		✓	

One mark for each correct row

3



(b) Hydrolysis;

*Accept: if phonetically correct*

*Do not accept: 'hydration'*

1

(c) 1. Coiled / helical / spiral;

*Feature = one mark*

*Explanation = one mark*

*Note: these are independent marking points*

*These must be related for both marks but can be in reverse order*

2. (So) compact / tightly packed / can fit (lots) into a small space;

3. Insoluble;

4. (So) no osmotic effect / does not leave cell / does not affect water potential;

*Accept: prevents osmosis*

5. Large molecule / long chain;

6. (So) does not leave cell / contains large number of glucose units;

*4. and 6. Accept: can't cross membranes*

7. Branched chains;

8. (So) easy to remove glucose;

2 max

(d) Two marks for correct answer of 479 - 521;

*Accept: measured and actual lengths in different but correct units  
for 1 mark*

One mark for incorrect answers in which candidate clearly divides measured length by actual length;

*The actual range is 23 - 25mm, If they just divide this by 48 they  
gain 1 mark*

*Just writing the formula is insufficient, numbers must be used*

2

[8]

20

(a) (i) Golgi (apparatus / body);

1



- (ii)
1. Nucleus;  
*Accept: nucleolus / nuclear envelope / nuclear membranes*
  2. Mitochondrion;  
*Accept cristae / mitochondrial membranes*
  3. Endoplasmic reticulum / ER;  
*Ignore reference to rough / smooth*
  4. Lysosome;  
*Reject lysozyme*

2 max

- (b) (Aerobic) respiration / ATP production / provide energy;  
*Accept Krebs cycle / electron transport.*  
*Ignore 'produces energy'*  
*Reject anaerobic respiration*  
*Ignore what energy is used for*

1

- (c)
1. High / better resolution;
  2. Shorter wavelength;
  3. To see internal structures / organelles / named organelles;  
*Accept ultrastructure*

2 max

[6]

21

- (a)
1. Mitochondria respire to release energy / produce ATP;  
*1. Do not credit make energy*
  2. Transport against gradient;  
*2. Do not credit active transport as this is given in question.*  
*2. Do not accept diffusion against.*

**OR**

3. Infolding of membrane increases area;  
*3. Reject microvilli but if mentioned can still accept point 4.*
4. More proteins for active transport;

2 max



(b) 1. Ribosomes make proteins / enzymes;  
*Ignore references to Golgi or rough ER.*

2. Enzymes are proteins;

**OR**

3. Mitochondria respire;

4. Release energy / produce ATP;

5. (Energy / ATP) for protein / enzyme synthesis;

2

(c) Microvilli increase area / have large area;

*Ignore references to other properties of microvilli.*

1

[5]

22

(a) 1. Granum / grana / thylakoid;

*Ignore references to membranes, stacks or discs.*

2. Stroma;

*Allow phonetic spellings.*

2

(b) 1. Absorbs / traps / uses light;

*Light dependent reaction = marking point 1.*

2. For photosynthesis;

3. Produces carbohydrates / sugars / lipids / protein;

*Accept any named product of photosynthesis for marking point 3.*

*Reference to light dependent and light independent reactions  
= two marks*

2 max

(c) Correct answer in range of 2.53 - 2.66;

Any length divided by 30000 = 1 mark;

2

[6]

23

(a) (i) (Human cells) don't have a cell wall;

*Accept "they" refers to human cells.*

1

(ii) (Affects) protein synthesis;

*Allow description e.g. 'amino acids not joined together / translation.*

*Reject: affects transcription.*

1





- (b) 1. Mutation present / occurs;  
*Ignore antibiotic causes mutation.*
2. Resistance gene / allele;  
*1. or 2.*  
*Reference to immunity disqualifies first credited marking point.*
3. Resistant bacteria (survive and) reproduce;  
*Reference to mitosis negates marking point 3.*

2

[4]

24

- (a) (Plasma / cell) membrane;  
*Reject: nuclear membrane*

1

- (b) Nucleus / nuclear envelope / nuclear membrane / nucleolus;  
*Accept: membrane-bound organelles only if an example has not been given*

Mitochondrion;

(Smooth / rough) ER;

Lysosome;

Microvillus / brush border;

*Neutral: villi*

Golgi;

Linear / non-circular DNA / chromosome;

*Neutral: DNA strands*

80S / denser / heavier / larger ribosomes;

*Neutral: ribosomes*

2 max

- (c) (i) Higher resolution / higher (maximum) magnification / higher detail (of image);

**OR**

Allows internal details / structures within (cells) to be seen / cross section to be taken;

*Accept: 'better' instead of 'higher'*

*Neutral: shorter wavelength*

*Reject: longer wavelength*

*Reject: can be used on living specimens*

**Q Do not accept 'clearer' image**

1



- (ii) Thin sections do not need to be prepared / shows surface of specimen / can have 3-D images;

*Accept: can be used on thick(er) specimens*

*Reject: can be used on living specimens*

*Neutral: refs. to staining / preparation / artefacts / colour*

1

- (d) Two marks for correct answer of 0.42 – 0.46;;

One mark for incorrect answers in which candidate clearly divides measured width by magnification;

*Correct answer = 2 marks outright*

*Accept: 0.4 or 0.5 only if working is correct for 2 marks*

*Do not award a mark for 0.4 or 0.5 if there is no working out*

*Ignore rounding up*

2

- (e) As height increases, the number of deaths decrease / inversely proportional / negative correlation;

Correct reference to increase / decrease at 14-30m;

*Accept: converse statement*

*Must give a trend and not simply give individual points*

*Do not penalise for 'more likely to get cholera'*

2

[9]

25

- (a) Cell wall;

Starch (store);

Chloroplast;

*Accept: phonetic spelling*

2 max

- (b) Insoluble;

Reduces / 'stops' water entry / osmosis / does not affect water potential / is osmotically inactive;

*Accept: description for first point e.g. 'does not dissolve'.*

2

- (c) Light sensitive eyespot / eyespot detects light;

Flagellum enables movement towards light;

Chloroplast / chlorophyll absorbs light / for photosynthesis;

*Do not penalise references to 'many chloroplasts'.*

3

[7]



26

(a) Peptide;

**Q** Do not accept polypeptide  
Neutral: covalent

1

(b) (F) H J E (K);

All three boxes correct = 2 marks  
Two boxes correct = 1 mark

2

(c) (Site of aerobic) respiration;

Release ATP / energy for active transport / transport against the concentration gradient / protein synthesis / exocytosis;

**Q** Reject: anaerobic respiration

**Q** Reject: produces / makes energy

Accept: produces ATP for energy

Reject: produces ATP for respiration

Neutral: protein secretion

2

(d) (i) Breaks open cells / disrupts cell membrane / releases cell contents / releases organelles / break up cells;

Reject: breaks down cell wall

Neutral: separates the cells

Reject: breaks up cells so they can be separated

Reject: breaks up / separates organelles

1

(ii) Removes (cell) debris / complete cells / tissue;

Neutral: to isolate organelle **G** / mitochondria

Neutral: removes unwanted substances / impurities

Reject: removes organelles / cell walls

1

(iii) Reduces / prevents enzyme activity;

Reject: ref. to denaturation

1

(iv) Prevents osmosis / no (net) movement of water / water does not enter organelle / water does not leave organelle;

So organelle / named organelle is not damaged / does not burst / does not shrivel;

Neutral: ref. to water potential

**Q** Ref. to cells rather than organelles negates the second mark only

Reject: ref. to turgid / flaccid for second mark

Reject: organelle 'explodes' for second mark

2

[10]



27

Fatty acids used to make phospholipids;  
Phospholipids in membranes;  
More phospholipids more membranes made;

2 max

Fatty acids respired to release energy;  
More triglycerides more energy released;  
Energy used for cell production / production of named cell component;

*Do not allow credit for 'making' energy*

2 max

[4]

28

(a) (i) Mitochondrion;

*Neutral: cristae*

1

(ii) (Site of aerobic) respiration / ATP production / energy release;

**Q Reject: anaerobic respiration**

**Q Reject: energy produced**

Active transport / transport against the concentration gradient;

*Accept: energy produced in the form of ATP*

2

(b) 89 – 91 gains 2 marks;

*Correct answer gains 2 marks outright*

Principle of:

$\frac{\text{correct measured length}}{\text{magnification}}$  gains 1 mark;

*89-91 (mm) / 1000 or 8.9-9.1 (cm) / 1000 gains 1 mark*

2



(c) Suitable explanation given e.g.

*Accept: converse arguments*

Reduced surface area; (So) less absorption;

*Neutral: structure Z incorrectly named*

(Membrane-bound) enzymes less effective;

(So) proteins / polypeptides not digested;

*Reduced surface area for absorption gains 2 marks*

Cell membranes damaged;

(So) Fewer / less effective carrier / channel proteins;

*Accept: references to diffusion and active transport for 'absorption'*

Carrier / channel proteins damaged;

(So) less absorption;

*Reject: active transport if linked to channel proteins*



29

- (a) **B** Golgi (body / apparatus);  
**C** Mitochondria / mitochondrion; 2

- (b) 1. Chloroplasts / plastids  
2. Cell wall  
3. Cell vacuole  
4. Starch grains / amyloplasts;  
*Any 2 for 1 mark* 1 max

- (c) 1. Ice-cold – Slows / stops enzyme activity to prevent digestion of organelles / mitochondria;  
2. Buffered – Maintains pH so that enzymes / proteins are not denatured;  
*Reject reference to cells*  
3. Same water potential – Prevents osmosis so no lysis / shrinkage of organelles / mitochondria / **C**;  
*Ignore damage*  
*For each mark must link reason to relevant property* 3

- (d) 1. Break open cells / homogenise / produce homogenate;  
2. Remove unbroken cells / larger debris; 2

- (e) Nucleus / nuclei; 1

- (f) Mitochondria / organelle **C** less dense than nucleus / organelle in first pellet;  
*Accept 'lighter' for less dense* 1

[10]

30

- (a) 1. How to break open cells and remove debris;  
2. Solution is cold / isotonic / buffered;  
3. Second pellet is chloroplast. 3

- (b) 1. **A** stroma;  
2. **B** granum.  
*Accept thylakoid* 2



(c)  $\left(\frac{\textit{length of chloroplast}}{\textit{length of bar}}\right) \mu\text{m}$

1

(d) **Two** of the following for **one** mark:

Mitochondrion / ribosome / endoplasmic reticulum / lysosome / cell-surface membrane.

1 max

[7]