



EXAM PAPERS PRACTICE

## Cell structure 2

Level: OCR A Level H420

Subject: Biology

Exam Board: Suitable for all boards

Topic: Cell structure 2

Type: Mark Scheme

To be used by all students preparing for OCR A Level Biology H420 foundation or higher tier but also suitable for students of other boards.

## Mark schemes

- 1** (a) **A** – receptor /extrinsic (protein);  
*Accept glycoprotein/antigen*
- B** – transmembrane/intrinsic/channel/carrier (protein);  
*Accept hydrophobic tail*
- C** – phospholipid;  
*Ignore ref. to bilayer*
- 3**
- (b) Cell wall;  
*Accept smaller/70S ribosome(s)*
- Capsule/slime layer;  
*Accept DNA without histone*
- (Bacterial) flagellum;  
*Reject capsid*
- Circular DNA/chromosome;
- Plasmid;
- Mesosome;
- 2 max**
- 2** (a) X = mitochondria;  
Y = (rough) endoplasmic reticulum;  
*Accept ribosomes/ER/RER for Y*  
*Reject smooth endoplasmic reticulum for Y*
- 2**
- (b) (i) (Sections cut at) different angles/in different planes;  
*Ignore name given to organelle*
- 1**
- (ii) Z modifies/packages/transport/secretes mucus/ Z adds sugars to proteins;  
X provides ATP/energy (for this);  
*Accept makes in relation to Z but not X*  
*Ignore names of organelles if function correct*
- 2**
- [5]**



- 3**
- (a) (i) Ribosome(s); 1
- (ii) Plasma/cell (surface) membrane; 1  
*Accept membrane unless disqualify with, e.g. nuclear membrane*
- (b) **Two** suitable comparisons, accepting bacterial cell has; 2 max
- Examples,  
Bacterial cell has capsule/slime layer;  
Cell wall;  
(Bacterial) flagellum;  
Mesosome;  
Different size ribosomes;  
Circular DNA;  
Human cell has nucleus;  
Membrane-bound organelles;  
Two named examples of membrane-bound organelles;  
*Reject ref to thin and flat*
- (c) Carry genetic information/genes; 1  
*Reject/ignore to carry DNA to carry genetic code*  
*Accept genetic material with coded information – information for protein synthesis*  
*Ignore genetic material on its own*
- 4**
- (a) (i) no cell wall / only has (plasma) membrane; 1
- (ii) has capsule / slime layer; 1
- (b) correct approach which makes use of scalebar; *ignore* reference to units. 1
- (c) cellulose / starch / amylose / amylopectin; 1
- (d) (i) water potential lower / more negative in cell; 2  
(water enters by) osmosis;
- (ii) plant cell wall made of a different substance / cellulose / penicillin does not affect cellulose; 1

[5]

[7]



- 5** (a) (i) Chloroplast; 1
- (ii) Photosynthesis;  
Uses light (energy);  
To produce carbohydrates / starch / glucose / sugars / ATP / reduced NADP;  
*Note that candidates cannot be expected to have a detailed knowledge of photosynthesis.* max 2
- (b) (i) **A**; 1
- (ii) **C**; 1
- (c) (i) Slows enzymes / prevents enzymes being denatured / prevents / stops self-digestion;  
*Ignore references to bacteria. Reject enzymes not working* 1
- (ii) To remove organelle C / nuclei;  
Which are larger / more dense; 2
- [8]**
- 6** (a) presence of nuclei; 1
- (b) (i) 1 mark growth clearly calculated from difference between lengths at beginning and end of lesson
- 2 marks correct answer of 300  $\mu\text{m}$  2
- (Allow for slight measurement errors)*
- (ii) divide by time (between measurements); 1
- (c) blue-black / dark blue / purple / black;  
iodine added to slide / specimen / granules; 2
- [6]**
- 7** (a) Measure diameter of field with ruler; And proportion taken up by the cell; or Measure length with (eyepiece) graticule / eyepiece scale;  
Calibrated against stage micrometer / something of known length;  
*Reject divide apparent length by magnification* 2



- (b) Membrane / cytoplasm shrinks / pulls away from cell wall / cell plasmolysed / goes flaccid;  
Water moves down water potential gradient / to lower / more negative water potential; By osmosis; 3
- (c) (i) Reaches equilibrium / no further / maximum change in length;  
*Reject osmosis takes time* 1
- (ii) Line / curve of best fit; Extrapolate (and read off) / find where it crosses x-axis; 2
- (iii) Greater decrease / length smaller; More water removed;  
Greater difference in water potential / cell with higher / less negative water potential;  
Starch is insoluble / has no effect on osmosis

max 2

[10]

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- (a) Any two from:  
Loop of DNA; Non-cellulose cell wall;  
Plasmid; Capsule;  
Flagellum; Mesosome;  
*Accept small ribosomes* 2
- (b) (i) (Granules) turn blue-black / dark blue / black / purple with iodine; 1
- (ii) Cellulose / pectin; 1
- (c) Use principle:  
Feature of starch;  
Consequence in terms of storage;  
e.g.  
Insoluble;  
Therefore will not "wash" out of cell / affect water potential / affect osmosis;  
OR  
Molecule coiled / branched;  
Therefore large amount stored in small space / compact  
OR  
Does not affect water potential;  
So no effect on entry of water (into cell); 2

[6]



- 9** (a) removes debris / intact cells / sand;  
which would contaminate sediment A / interfere with the results; 2
- (b) (i) nuclei; 1
- (ii) ribosomes / endoplasmic reticulum / membrane / Golgi; 1
- (c) density / size / mass / weight; 1
- (d) an electron microscope has a higher resolution;  
electrons with shorter wavelength; 2
- [7]
- 10** (a) (i) Mitochondria site of respiration;  
Production of ATP / release of energy;  
For contraction;  
*Do not award credit for making or producing energy.* 3
- (ii) Enzymes are proteins;  
Proteins synthesised / made on ribosomes; 2
- (b) Lysosomes produce / contain enzymes;  
Which break down / hydrolyse proteins / substances / cells of tail; 2
- (c) 1. Chop up (accept any reference to crude breaking up);  
2. Cold;  
3. Buffer solution;  
4. Isotonic / same water potential;  
5. Filter and centrifuge filtrate;  
6. Centrifuge supernatant;  
7. At higher speed;  
8. Chloroplasts in (second) pellet; max 6
- [13]
- 11** (a) (i) Golgi; 1
- (ii) Exocytosis; 1



- (b) (i) Joining together of amino acids / synthesis / production of thyroglobulin / makes protein;  
*Do not credit synthesis of amino acids* 1
- (ii) Electron microscope has high / greater resolution;  
Because it uses electrons which have smaller wave(length); 2

[5]

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- (a) Epithelium of alveolus, capillary wall / epithelium / endothelium, plasma; 1
- (b) Cell wall;  
Capsule;  
Flagellum;  
Mesosomes;  
Plasmid;  
Genetic material / DNA / nucleoid;  
Ribosomes;

*Accept references to size only if some idea of range is given*

max 2

- (c) Large (surface) area;  
For diffusion;  
or  
Short distance to centre of cell / to all haemoglobin;  
For diffusion; 2

- (d) (i) Correct answer of approximately 7800 / 8000 = 2 marks  
Incorrect answer but clearly derived by  
dividing diameter of cell A by 7 = 1 mark 2

- (ii) Idea of cut through maximum diameter / middle; 1

[8]

13

- (a) (i) 31 / 31.2; 1
- (ii) Ratio would be less / smaller;  
Cell is thin / has large surface area / (adapted) for diffusion;  
*Accept converse. Must relate to concept of ratio.* 2

- (b) (i) 6; 1

- (ii) 11; 1



- (c) Water potential inside vesicle more negative / lower;  
Water moves into vesicle by osmosis / diffusion; 2
- (d) Mitochondria supply energy / ATP;  
For active transport / absorption against concentration  
gradient / synthesis / anabolism / exocytosis / pinocytosis;  
*Do not credit references to making,  
creating or producing energy.* 2
- (e) 1 Phospholipids forming bilayer / two layers;  
2 Details of arrangement with “heads” on the outside;  
3 Two types of protein specified;  
e.g. passing right through or confined to one layer /  
extrinsic or intrinsic /  
channel proteins and carrier proteins /  
two functional types  
4 Reference to other molecule e.g. cholesterol or glycoprotein;  
5 Substances move down concentration gradient / from high to low  
concentration;  
*Reject references to across or along a gradient*  
6 Water / ions through channel proteins / pores;  
7 Small / lipid soluble molecules / examples pass between phospholipids /  
through phospholipid layer;  
8 Carrier proteins involved with facilitated diffusion;  
*Ignore references to active transport.  
Credit information in diagrams.*

max 6

[15]

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- (a) On diagram, correctly labelled:  
Light-dependent: granum / thylakoid membranes – labelled ‘X’  
AND  
Light-independent: stroma – labelled ‘Y’;

1

- (b) Any two from:

(Water) forms  $H^+$  / hydrogen ions and electrons /  $e^-$  ;

$O_2$  / oxygen formed; [NOTO, NOTO<sup>-</sup>]

(Light) excites electrons / raises energy level of electrons / electrons to  
chlorophyll / to photosystem;

max 2





- (c) (ATP) Provides energy for GP → TP / provides P for RuP / TP → RuBP;  
(Reduced NADP) Provides H / electrons for GP → TP / reduces GP to TP;

2

[5]

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- (a) (i) A mitochondrion and B nucleus;  
(*need both for one mark*)

1

- (ii) increased surface area;  
for respiration / enzymes;

2

- (b) *any suitable feature*  
e.g. plasmid / capsule / 70S ribosomes / smaller  
ribosomes / complex cell wall / mesosome / no nucleus;

1

- (c) use of differential centrifugation / or description;  
first / low-spin pellet discarded / spin at low speed to remove cell  
wall material / cell debris;  
supernatant re-spun at higher speed / until pellet with chloroplasts is found;  
method of identifying chloroplasts e.g. microscopy;

3 max

[7]

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- (a) 16 gains 2 marks;  
(*accept 15.5 . 16.5*)  
(*principal of calculation i.e.*  
measured distance (31-33mm / 3.1-3.3cm) gains 1 mark)  
*Mag*

2



- (b) relevant adaptation;  
and explanation for second mark; e.g.

*idea of many chloroplasts / lots of chlorophyll;*  
to trap or absorb light (energy);

elongated cells;  
*idea of maximum light absorption / light penetration;*

chloroplasts move;  
to trap or absorb light (energy);

range of pigments;  
can absorb a range of wavelengths / colours / for max light absorption;

large S.A. or cell wall feature e.g. thin / permeable;  
for (rapid) CO<sub>2</sub> absorption;

2

[4]

17

- (a) matrix;

1

- (b) pyruvate;  
ADP;  
P / inorganic phosphate;  
reduced NAD;  
oxygen;

2 max

- (c) larger surface area for electron carrier system / oxidative phosphorylation; provide ATP / energy for contraction;

2

[5]

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- (a) (i) **D** plasmid / ribosome(s) / cytoplasm / storage granules;  
*(accept any sensible structure)*

**E** (slime / mucous) capsule

OR

slime / mucous layer;

2

- (ii) protection / maintain shape / prevent lysis / strength / support;

1



- (b) two of the following:  
nucleus;

OR

nuclear envelope / mitochondria / chloroplasts / sER / rER /  
golgi apparatus / 80s ribosomes

linear DNA / chromosomes / lysosomes / vacuole / vesicles /  
cellulose cell wall;

2 max

- (c) (i) starch digested / broken down;  
by amylase / carbohydrase;

2

- (ii) any sensible suggestion e.g. no secretion of amylase /  
functional amylase /  
piece of fungus might have died;

*(accept carbohydrase / enzyme for amylase)*

*(reject "no digestion" without qualification)*

1

[8]

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- (a) (i) homogeniser / blender / pestle and mortar / description  
e.g. grind with sand;

1

- (ii) centrifuge / description e.g. spin at high speeds;

1

- (b) (i) chloroplast;

1

[3]

20

- (a) X protein synthesis / translation;  
Y movement;

2

- (b) (i) cytoplasm;  
ribosomes;  
phospholipid membranes / cell membrane / semipermeable  
membrane;

*(accept folded membrane for two marks)*

2 max



- (ii) *(it = bacterium)*  
cell wall;  
capsule;  
flagellum;  
mesosome;  
no nucleus / nuclear membrane / DNA free;  
no mitochondria;  
*(accept 'no membrane-bound organelles' if neither nucleus  
nor mitochondria mark scored)*

no microvilli;  
no Golgi;  
no ER;  
70S / smaller ribosomes;

2 max

[6]

- 21** (a) chloroplast, so cell photosynthesises and moves to optimum / best light intensity for photosynthesis;  
avoids damage due to bright light;

2

- (b) (i) 2700

1

(ii) 
$$\frac{242 \times 7500 \times 900}{60} = 27\,225\,000 / 27 \times 10^6 = 2 \text{ marks}$$

*(allow 1 mark for principle:  $\frac{\text{amino acids} \times \text{proteins}}{\text{time}}$ )*

2

- (c) (i) rate slightly slower / not affected in first 20 / 30 minutes / lower peak than control;  
then decreases / much lower (than control);

*(allow 1 mark for increase in first 20 / 30 minutes, then decreased, if not compared with control / normal)*

*(disqualify flagellum grows longer)*

2

- (ii) 1. actinomycin has no effect (on growth of flagella);  
even though mRNA production / transcription prevented;  
*(accept references to 'expt 1')*  
2. (re)growth little affected by puromycin at first;  
protein synthesis inhibited, so likely to be using proteins present;

4

[11]



- 22** (a) A mitochondria;  
B ribosomes (*accept ribosomes and rER*) 2
- (b) idea of sections or cuts;  
idea of mitochondria orientated differently or in different positions / description of 3D structure of mitochondria, e.g. sausage-shaped; 2
- (c) translation / protein / polypeptide synthesis; 1
- (d) provide / produce energy or ATP (*reject create energy*);  
(*disqualify first mark if ' for respiration*)  
high respiration (rate) (*accept lots*) for active uptake / transport  
(*accept description*);  
absorption of digested food / substances / products / correctly named product  
(*only accept monosaccharides, amino acids, dipeptides*); 3
- [8]**
- 23** (a) A – granum / thylakoid;  
chlorophyll molecules to trap light / light absorbing pigments /  
light dependent reaction / part of light dependent reaction; 2
- B – stroma;  
(contains enzymes for) carbon dioxide fixation / light-independent reaction /  
part of light-independent reaction;  
(*allow ribosome role of protein in photosynthesis*) 2
- (b) (i) C – starch; 1
- (ii) from glucose in a condensation / polymerisation reaction / many  
glucose molecules joined together; 1
- [6]**
- 24** (i) named organelle e.g. nucleus / nuclear envelope; vacuole;  
chloroplast; RER; mitochondrion; no membrane bound organelles;  
(*only award if no organelles named*)  
(*reject ribosomes, cell membrane, cell wall*)
- ref to large(r) size 2 max
- (ii)  $94/95/96 \times \frac{10}{44/45/46} \frac{\text{(measured distance Y - Z)}}{\text{length of scale bar}}$   
20.4 – 21.8  
(*correct answer 2 marks*) 2



- (iii) no cell wall (permanent) / (large) vacuole / chloroplasts / smaller;  
(accept microvilli)

1 max

[5]

25

- (a) memory B / T cells do not recognise (new antigens);  
antibodies previously produced are not effective  
as shape not complementary to new antigen;

2

- (b) (i) antigen in membrane presented to lymphocytes /  
produce cytokinins;

1

- (ii) mitochondria provide (more) ATP / energy;  
(more) RER / ribosomes synthesise proteins;  
(more) Golgi body secretes / modifies or packages proteins /  
produces glycoproteins;  
(B lymphocytes) produces antibodies;

4

[7]

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- (a) (i) microvilli; (*reject brush border*)

1

- (ii) increased surface area (for diffusion);

1

- (b) (i)  $\frac{16 \times (1000)}{0.1}$  / principle of  $\frac{\text{measuring scale bar}}{\text{dividing by 0.1}}$  ;  
(15 – 17 tolerance)

160000;

(correct answer award 2 marks)

2

- (ii) electron microscope has a greater resolving  
power / objects closer  
together can be distinguished;  
electron (beams) have a shorter wavelength;

2

- (c) short diffusion pathway / short pathway to the centre / large SA:V ratio  
for faster, more diffusion;

1

[7]



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- (a) phospholipids in a double layer / area covered is twice total surface area of red blood cells;  
evidence of calculation of number  $\times$  surface area ( $4.74 \times 10^9 \times 99.4 \mu\text{m}^2$ ) /

calculation of area of 1 cell  $\frac{0.92}{4.74 \times 10^{-9}}$ ;

$0.471 \text{ m}^2 \approx 0.5 \times 0.92 \text{ m}^2 / 194 \mu\text{m} \approx 2 \times 99.4$ ;

3

- (b) EITHER feature + explanation  
red blood cells do not contain organelles / nucleus;  
so only surface membrane / no internal membranes in macerate;  
OR  
red blood cells have simple / regular / spherical shape;  
so easy to calculate surface area;  
OR  
*any two features, e.g.*  
simple / regular shape;  
all same size;

2

[5]



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- (a) Nucleus; 1
- (b) Enables organism to remain in area (of food source) / prevent its removal;  
*Q To attach' is not sufficient unless qualified* 1
- (c) (i) Correct answer of 222(%);;  
Incorrect answer that clearly identifies difference in number of cases as 5800  
–1800 or 5.8 – 1.8;  
*Correct answer gains two marks* 2
- (ii) More water-related activities / more 'organisms' with increased temperature;  
*Q Allow any reference to growth or replication of 'organisms'. Do not penalise reference to bacteria.*  
*Q Do not allow increase in water consumption.* 1
- (d) (i) All have same shape / only binds to *Giardia* / one type of / specific antigen; 1
- (ii) Has complementary (shape) / due to (specific) tertiary structure / variable region (of antibody);  
*Q Binds / fits not sufficient unless qualified;* 1
- (iii) Enzyme / second antibody would remain / is removed by washing;  
Enzyme can react with substrate (when no antigen is present); 2

[9]

29

- (a) (Group of) similar / identical cells / cells with a common origin;  
*Q Ignore references to function* 1
- (b) (i) Add iodine / stain specific for starch to the slide / cells / tissue / add iodine / stain specific for starch and examine under microscope;  
Blue-black / blue / black / purple;  
*Reject sample* 2
- (ii) Need a single layer of cells / only a few cells thick / not too many layers / detail obscured by cells underneath;  
Light must be able to pass through; 2





(c) Both are polymers / made of monomers;

Joined by condensation / molecules can be broken down by hydrolysis;

Both have 1-4 links;

Contain C(arbon), H(ydrogen) and O(xygen) / both made up of glucose;

Both insoluble;

Both contain glycosidic bonds;

*Accept other valid answers.*

*Ignore ref to unbranched.*

2 max

[7]

30

Advantages:

1 Small objects can be seen;

2 TEM has high resolution as wavelength of electrons shorter;

*Accept better*

Limitations:

3 Cannot look at living cells as cells must be in a vacuum / must cut section / thin specimen;

4 Preparation may create artefact

5 Does not produce colour image;

[5]