



EXAM PAPERS PRACTICE

## Studying cells 2

Level: OCR A Level H420

Subject: Biology

Exam Board: Suitable for all boards

Topic: Studying cells 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) Correct answer: 1.25;  
*Ignore working*

**OR** (if wrong answer)

$$\frac{\text{measurement in } \mu\text{m}}{40000} / \frac{\text{measurement in mm}}{40} = 1 \text{ mark}$$

*125 but wrong order of magnitude = 1 mark*

2

(ii) **C** has myosin / thick (and actin / thin) filaments;

**OR**

**A** has only actin / thin (/ no myosin / no thick) filaments;

1 max

(b) When contracted:

Thick & thin filaments/myosin & actin overlap more;

Interaction between myosin heads & actin / cross-links form;

Movement of myosin head;

Thin filaments / actin moved along thick filaments / myosin;

Movement of thin filaments / actin pulls Z-lines closer together;

Displacement of tropomyosin to allow interaction;

Role of  $\text{Ca}^{2+}$ ;

Role of ATP;

*Allow ref. to 'sliding filament mechanism' /  
described if no other marks awarded*

4 max



EXAM PAPERS PRACTICE

- (c) (i) 8 has DMD but 3 and 4 do not / 12 has DMD but 6 and 7 do not / neither parent has the condition but their child has;  
*Allow parents 3 and 4 give 8, parents 6 and 7 give 12* 1
- (ii) 4 **AND** 7; 1
- (iii) Parental genotypes: 6 =  $X^D Y$  AND 7 =  $X^D X^d$   
**AND**  
Gametes correct for candidate's P genotypes – e.g.  
 $X^D$  and  $Y$  +  $X^D$  and  $X^d$ ;  
Offspring genotypes correctly derived from gametes e.g.  
 $X^D X^D$  +  $X^D X^d$  +  $X^D Y$  +  $X^d Y$ ;  
Male offspring with MD correctly identified:  $X^d Y$ ;  
Probability = 0.25 / correct for candidates offsprings genotypes;  
*Accept 1/4 / 1 in 4 / 1:3 / 25%*  
*NOT 3:1 / 1:4* 4
- (d) (i) No gene fragment **G**; 1
- (ii) Only one copy of gene fragment **F**;  
Male has only one X-chromosome / is XY  
(c.f. female has two / is XX); 2
- (iii) 10 has only one copy of gene fragment **G**;  
10 has only one normal X-chromosome / has one abnormal /  
has only one normal allele / has one  $X^d$  / is  $X^D X^d$  / is heterozygous;  
11 has two normal X-chromosomes / has 2 normal alleles /  
is  $X^D X^D$  / has not got  $X^d$  / has 2 copies of (F and) G; 3
- (e) (i) To prevent rejection / prevent antibody production vs. injected cells /  
injected cells have (foreign) antigen (on surface); 1
- (ii) Shows effect of cells / not just effect of injection / not just effect of  
salt solution; 1



- (iii) Only one person tested so far – need more to see if similar results / need more to see if reliable;

Need to assess if new (dystrophin positive) muscle fibres are functional / if muscle becomes functional;

Can't tell how widespread effect is in the muscle / sample taken near injection site;

Need to test for harmful side effects;

Need to test if successful for other mutations of dystrophin gene;

Need to assess permanence / longevity of result/insufficient time allowed in investigation;

(In this patient) only small response / %;

Further sensible suggestion;

4 max

[25]



- 2** (a) Differentiation / specialisation 1
- (b) (i) (cellulose) Cell wall; 1
- (ii) Two marks for correct answer 2350–2500;;  
*Accept measured and real lengths in different units for one mark.*  
One mark for a measured length divided by real length; 2
- (iii) Chloroplasts absorb light;  
*Q Do not accept chlorophyll as alternative to chloroplasts*
- Or
- Large vacuole pushes chloroplasts to edge (of cell);
- Or
- Thin / permeable (cell) wall to absorb carbon dioxide; 1 max
- [5]
- 3** (a) Single layer of cells / few layers of cells;  
So that light that can pass through / cells absorb light; 2
- (b) Method of determining area of field of view / area seen using microscope;  
Count number of stomata in field of view;  
Repeats and calculation of mean; 3
- (c) Water vapour accumulates / increased humidity / reduced air movement (around stomata);  
Water potential / diffusion gradient reduced; 2
- [7]
- 4** (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]

5

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]

6

- (a) To ensure the colour is the same at the start;

1

- (b) Yes – curve on graph with bromelain present remains approximately constant / rises very slightly;

Would decrease if killing of cells occurred / would increase if cells still dividing;

2

- (c) Use of mouse cells (rather than human);  
(Carried out) *in vitro* / not in living organisms;  
Only tested on one type of cancer;  
Not possible to predict effect on humans (as no data collected);

3 max



(d) The faster the rate of division the faster the cancer would grow;  
By measuring rate of cell division you could see how effective the treatment was;

2

(c) Not ethical to replace conventional treatment;  
As life of patient is at risk (if bromelain not effective);

2

[10]

7

(a) (i) break open cells / release cell contents;

1

(ii) keep pH the same / controls pH;  
prevent change to / denaturing of proteins / enzymes;

2

(b) (i)

2

(ii) site of respiration which releases energy / ATP;  
required for movement against concentration gradient;  
*ignore first point for thermodynamically incorrect statements  
such as "making energy".*

2

[7]

8

(a) Several / more than one polypeptide chain in molecule;

*Evidence must only relate to 4<sup>o</sup> structure*

1

(b) Chemical bonds formed between sulphur-containing groups /  
R-groups / form stronger disulphide bonds;  
Bind chain(s) to each other;

2

(c) Different number / sequences of amino acids;  
Bonds in different places which gives different shape;

2

(d) Outer layer of skin cells are dead / do not respire  
Do not contain mitochondria / do not produce ATP / release energy;  
Cells do not have required proteins / carriers;

3

(e) 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;
- 4 must cut section / thin specimen;
- 5 Preparation may create artefact
- 6 Does not produce colour image;

6  
[14]

9

(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]





- 10** (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]**
- 11** (a) 1. e.m. gives high resolution due to short wavelength of electrons;  
2. antibodies attach specifically to target proteins;  
3. gold particles are electron dense;  
4. electrons must pass through a vacuum so material must be dead / fixed for e.m.;  
5. cross-bridge cycling requires living cells / metabolism / named aspect-e.g. ATP  
synthesis; 5
- (b) 1.  $\text{Ca}^{2+}$  removes blocking molecules / uncovers binding site on actin;  
2. correct references to  $\text{Ca}^{2+}$  binding to troponin / moving tropomyosin;  
3. allows myosin heads to attach to actin filaments;  
4. allows sliding of the actin and myosin filaments;  
5. binding of ATP causes myosin (head) to detach (from actin);  
6. (hydrolysis of) ATP releases energy;  
7. which changes the configuration / cocking of the myosin head;
- 5 max**
- [10]**
- 12** (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]

13

(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]

14

- (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]



15

- (a) two environmental or developmental variables and explanation;

examples,

all plants of the same age, so same time for cell divisions / differentiation;  
all plants given the same watering, so same amount of water for cell expansion;

*(reject reference to photosynthesis)*

all plants given same light, so same rate of photosynthetic;  
same temperature, so enzymes / named metabolic process at optimum temperature;

same named ion / minerals in soil(e.g. nitrate),  
so same available for a named function,  
(e.g. amino acid / protein synthesis);

2 max

- (b) count cells using microscope;  
count number of cells in cell division / where chromosomes visible;  
and then the total number of cells in field of view;

2 max

- (c) only cells at tip have ability to divide / cells further back don't divide;  
cells further back differentiating / named example of  
*(accept reference to loss of totipotent cells)*  
differentiated tissue / too old / reduction in plant hormone;  
cell wall too thick / vacuole too large to allow division;

2 max

- (d) new cells added at tip;  
cells increase in volume / larger;  
increase in length (of cells);  
as vacuoles get larger;  
due to uptake of water (by osmosis);

3 max

[9]

16

- (i) cold - no / reduced enzyme action / e.g. stops autolysis;  
*(reject "cell activity reduced")*

isotonic - stops osmotic effects / description of effect on cells or organelles;

buffer - prevents damage to enzymes / proteins;

3

- (ii) break open the cells / release the cell contents;

1

- (iii) supernatant / liquid above the pellet;  
spun at a high(er) speed;

*(mark as independent points)*

2

[6]



- 17** (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]**
- 18** (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]**
- 19** (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/secret/ 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]

20

- (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:

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

*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*

2

[7]