EXAM PAPERS PRACTICE

Studying cells 2

Level: CIE A Level 9700
Subject: Biology
Exam Board: Suitable for all boards
Topic: Studying cells 2
Type: Mark Scheme

To be used by all students preparing for CIE Biology A Level 9700 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)

$$\frac{\text{measurement in µm}}{40000} \;/\; \frac{\text{measurement in mm}}{40} = 1 \text{ mark}$$

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 Ca^{2+};

Role of ATP;

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

4 max

(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 = $\mathbf{X^DY}$ AND 7 = $\mathbf{X^DX^d}$

AND

Gametes correct for candidate's P genotypes – e.g.

$\mathbf{X^D}$ and **Y** + $\mathbf{X^D}$ and $\mathbf{X^d}$;

Offspring genotypes <u>correctly derived</u> from gametes e.g.

$\mathbf{X^DX^D}$ + $\mathbf{X^DX^d}$ + $\mathbf{X^DY}$ + $\mathbf{X^dY}$;

Male offspring with MD correctly identified: $\mathbf{X^dY}$;

Probability = 0.25 / correct for candidates offsprings genotypes;

Accept ¼ / 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^DX^d / is heterozygous;

11 has two normal X-chromosomes / has 2 normal alleles / is X^DX^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 <u>cells</u> / 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

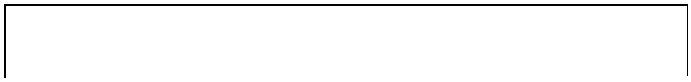
(a) (i) break open cells / release cell contents;

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 4º 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. Ca^{2+} removes blocking molecules / uncovers binding site on actin;
2. correct references to 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 vacuole s 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/transports/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]

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:

$\frac{\text{correct measured length}}{\text{magnification}}$ 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]