EXAM PAPERS PRACTICE

Cell structure 2

Level: AQA AS 7401
Subject: Biology
Exam Board: Suitable for all boards
Topic: Cell structure 2
Type: Mark Scheme

To be used by all students preparing for AQA AS Biology 7401 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

[5]

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/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]

3

(a) (i) Ribosome(s);

1

(ii) Plasma/cell (surface) membrane;

Accept membrane unless disqualify with, e.g. nuclear membrane

1

(b) **Two** suitable comparisons, accepting bacterial cell has;

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

2 max

(c) Carry genetic information/genes;

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

1

[5]

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) <u>water potential</u> lower / more negative in cell;
(water enters by) <u>osmosis</u>;

2

(ii) plant cell wall made of a different substance / cellulose / penicillin does not affect cellulose;

1

[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 µm

2

(Allow for slight measurement errors)

(ii) <u>divide</u> 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 <u>with</u> 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]

8

(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]

12 (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]

14 (a) <u>On diagram, correctly labelled:</u>

Light-dependent: granum / thylakoid membranes – labelled 'X'
AND
Light-independent: stroma – labelled 'Y';

1

(b) <u>Any two from:</u>

(Water) forms H^+ / hydrogen ions <u>and</u> electrons / e^- ;

O_2 / oxygen formed; [*NOT* 'O', *NOT* 'O $^-$']

(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]

15

(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]

16

(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_2 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]

18 (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 / vescicles / 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]

19 (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 × 10^6 *= 2 marks*

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

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) $94 / 95 / 96 \times \frac{10}{44 / 45 / 46} \frac{(\text{measured distance } \mathbf{Y} - \mathbf{Z})}{\text{lenght of scale bar}}$

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]

26

(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]

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

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

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

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]

28 (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]