EXAM PAPERS PRACTICE

Cell structure 1

Level: CIE A Level 9700
Subject: Biology
Exam Board: Suitable for all boards
Topic: Cell structure 1
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) 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]

2

(a) (i) Crista / inner membrane;

1

(ii) Matrix;

1

(b) B;

1

(c) (i) Reduce / prevent enzyme activity;

1

(ii) Prevents osmosis / no (net) movement of water;

So organelle / named organelle does not burst / shrivel;

Q *Allow reference to cell rather than organelle for first mark point only.*

Regard damage as neutral

2

(d) (Mitochondria) use aerobic respiration;

Mitochondria produce ATP / release energy required for muscles (to contract);

Q *Do not accept reference to making / producing energy.*

2

[8]

3 (a) × 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. DNA contains deoxyribose **and** RNA contains ribose.

2

[5]

4 (a) 1. Starch formed from α-glucose but cellulose formed from β-glucose;
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 short**er**' or 'DNA bigg**er**/long**er**'*

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 Pi/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

Magnification = image size / 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 × 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 <u>protein</u>;

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 <u>both</u> 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 <u>water potential</u>;

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. Mitochrondria 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 <u>enzyme</u> 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

2

[7]

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 <u>osmosis</u> 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 <u>and</u> 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) $\left(\frac{length\ of\ chloroplast}{length\ of\ bar}\right)$ µm

1

(d) **Two** of the following for **one** mark:
Mitochondrion / ribosome / endoplasmic reticulum / lysosome / cell-surface membrane.

1 max

[7]