

BIOLOGY

2017 — 2023

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BIOLOGY 9700

TOPICAL PAST PAPER WORKSHEETS

2017 - 2023 | Questions + Mark scheme

AVAILABLE PAPERS

P1

1676 Questions

P2

409 Questions

P4

403 Questions

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TOPICS	P1	P2	P4
CELL STRUCTURE	214	40	2
BIOLOGICAL MOLECULES	255	50	2
ENZYMES	119	31	13
CELL MEMBRANES AND TRANSPORT	127	33	2
THE MITOTIC CELL CYCLE	127	33	9
NUCLEIC ACIDS AND PROTEIN SYNTHESIS	134	42	8
TRANSPORT IN PLANTS	178	37	4
TRANSPORT IN MAMMALS	149	35	3
GAS EXCHANGE AND SMOKING	145	29	4
INFECTIOUS DISEASE	114	36	0
IMMUNITY	114	43	1
ENERGY AND RESPIRATION			44
PHOTOSYNTHESIS			37
HOMEOSTASIS			41
CONTROL AND CO-ORDINATION			47
INHERITED CHANGE			56
SELECTION AND EVOLUTION			44
BIODIVERSITY, CLASSIFICATION AND CONSERVATION			47
GENETIC TECHNOLOGY			39

1 - (9700/42_Winter_2020_Q1) - Cell Structure, Photosynthesis

Fig. 1.1 shows a transmission electron micrograph of a chloroplast.

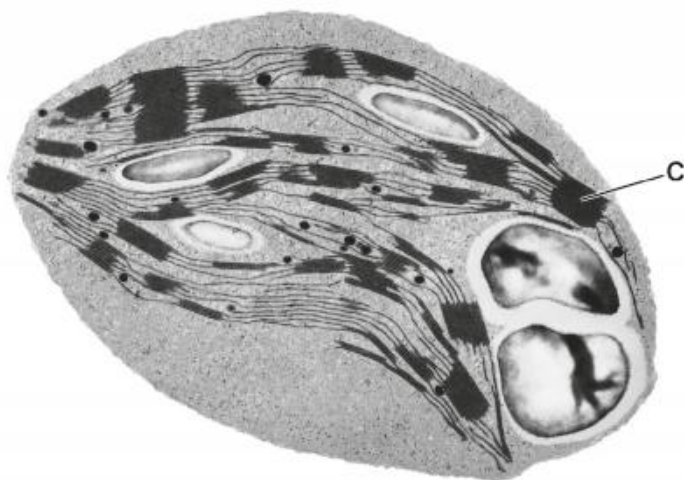


Fig. 1.1

(a) On Fig. 1.1, use label lines and letters to label:

A – the storage site of the carbohydrate product of photosynthesis

B – the site of the light independent stage.

[2]

(b) (i) Name the structure labelled **C** in Fig. 1.1.

C [1]

(ii) Explain how the structure of **C** is linked to its function.

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..... [4]

(c) (i) The anatomy of **C4** plants is adapted to allow the rate of photosynthesis to remain high at high temperatures.

C3 plants do not have these adaptations and an additional reaction occurs at high temperatures that reduces the rate of photosynthesis.

Explain why the reaction that takes place at high temperatures in **C3** plants reduces the rate of photosynthesis.

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..... [2]



2 - (9700/42_Summer_2021_Q9) - *Cell Structure, Transport In Plants*

- (a) Describe how the structure of a mitochondrion is related to its function. [9]
- (b) Explain how rice is adapted to grow with its roots submerged in water. [6]

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1 - (9700/41_Summer_2020_Q4) - *Biological Molecules, Enzymes*

Mitochondrial complex I is a large enzyme complex that forms part of the electron transport chain. The enzyme is composed of many different polypeptides.

The genes coding for these polypeptides are located either in mitochondrial DNA (mtDNA) or in nuclear DNA. Mutations in these genes can lead to the production of an enzyme that does not function efficiently. This results in a disease known as mitochondrial complex I deficiency. If severe, this can lead to death in early childhood.

(a) Explain why people with mitochondrial complex I deficiency may have muscle weakness and difficulty with nervous coordination of movement.

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..... [2]

(b) When mitochondrial complex I deficiency is caused by mutation in mtDNA:

- a cell in an ovary produces gametes with different proportions of normal mitochondria and mitochondria that contain the mtDNA mutation (mutant mitochondria)
- a person has disease symptoms when the proportion of mutant mitochondria in their cells exceeds a certain threshold
- the severity of disease symptoms, and the age at which they appear, can vary greatly in the children of one woman.

In a family with a history of mitochondrial complex I deficiency that is caused by a mutation in a **nuclear** gene, the probability of a child inheriting the mutation can be predicted.

Suggest why, in families where mitochondrial complex I deficiency is caused by mtDNA mutation, it is **not** possible to predict the probability of a child inheriting the mutation.

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..... [3]

- (c) Genetic screening can be carried out on people with symptoms of mitochondrial complex I deficiency.

Previously 7 mtDNA genes and 37 nuclear genes were sequenced. Some of the people tested did not have mutations in any of these genes. As a result, another gene was sequenced in these people and was found to be mutated.

This led to the suggestion that genetic screening should sequence a larger proportion of the genome for people suspected of having this disease.

Discuss the **ethical** reasons for and against sequencing a larger proportion of the genome for people suspected of having mitochondrial complex I deficiency.

..... [3]

- (d) One mutation linked to mitochondrial complex I deficiency is a base substitution. It causes the amino acid glycine to be replaced by the amino acid valine in a region of α helix in a protein that is important for the formation of mitochondrial complex I.

Glycine is a small amino acid with an R group of one hydrogen atom whereas valine has a larger and branched R group.

Predict how the change in amino acids would affect the structure of the protein.

..... [2]

2 - (9700/43_Summer_2020_Q4) - Biological Molecules, Enzymes

Lung epithelial cells have a thin layer of watery mucus on their surface.

The normal allele of the *CFTR* gene codes for a transport protein that transports chloride ions out of epithelial cells.

Fig. 4.1 is a diagram of part of the cell surface membrane and the mucus layer of an epithelial cell with normal CFTR proteins.

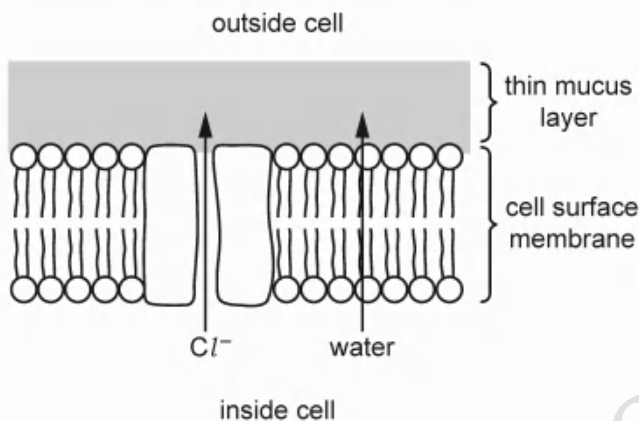


Fig. 4.1

Cystic fibrosis (CF) is a genetic disorder caused by having two recessive alleles of *CFTR*. In severe cases of CF, the transport proteins are not added to the cell surface membrane. This causes the mucus layer to be thick and sticky.

(a) Explain why the absence of CFTR proteins will cause the mucus layer to be thick and sticky.

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..... [2]

(b) The probability of a baby having CF when both parents are heterozygous carriers for CF is 25%.

It is possible to carry out prenatal screening to check for CF by using one of these tests:

- amniocentesis, using cells from the amniotic fluid
- chorionic villus sampling, using cells from the placenta.

Both tests slightly increase the probability of the pregnancy failing (miscarriage).

Outline the advantages of carrying out prenatal screening for CF.

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..... [3]



ANSWERS

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1 - (9700/42_Winter_2020_Q1) - Cell Structure, Photosynthesis

(a)	A – label line pointing to starch grain ; B – label line pointing to stroma ;	2
(b)(i)	granum / grana ; A stack of thylakoids I thylakoid	1
(b)(ii)	any four from: 1 (stack of) <u>thylakoids</u> ; 2 (membranes / thylakoids / C) form large / increase, surface area ; 3 for, (named) pigments / photosystems / light-harvesting clusters ; 4 for absorption of light <u>energy</u> ; 5 so, large number of / many, enzymes / ETC / ATP synthase / stalked particles ; 6 for, light dependent stage / photophosphorylation ;	4
(c)(i)	1 oxygen, combines / reacts, with, rubisco / RuBP ; 2 less / no, carbon dioxide, combines / reacts, with, rubisco / RuBP ; A less or no carbon fixation 3 <i>ref. to photorespiration ;</i> <i>ignore refs to denaturation</i>	2
(c)(ii)	any three from: 1 photosynthesis (by C3 plants) is occurring ; 2 decrease in (atmospheric) carbon dioxide or increase in (atmospheric) oxygen or increase in / high, oxygen to carbon dioxide ratio ; 3 rubisco favours reaction with oxygen / AW ; 4 C4 plants have a selective advantage / description ; 5 oxygen acts as a selection pressure ; 6 AVP ; e.g. <i>ref. to mutation in C3 plants</i>	3

2 - (9700/42_Summer_2021_Q9) - Cell Structure, Transport In Plants

(a)	<p>any nine from:</p> <p>1 (function is) to make ATP ;</p> <p>2 <i>ref. to</i> double membrane / outer and inner membrane / envelope ;</p> <p><i>inner membrane</i></p> <p>3 folded / cristae, to increase / for large, surface area ;</p> <p>4 has, ATP synthase / stalked particles ;</p> <p>5 has, ETC / carrier (proteins) / cytochromes ;</p> <p>6 (site of) oxidative phosphorylation / chemiosmosis ;</p> <p>7 impermeable to protons ;</p> <p><i>intermembrane space</i></p> <p>8 has low pH / high concentration of protons ;</p> <p>9 protons pumped into intermembrane space ;</p> <p>10 proton gradient between intermembrane space and matrix or protons diffuse from intermembrane space to matrix ;</p> <p><i>matrix</i></p> <p>11 contains (co)enzymes for, link reaction / the Krebs cycle ;</p> <p><i>outer membrane</i></p> <p>12 permeable to, pyruvate / reduced NAD / oxygen ;</p> <p>13 AVP ; e.g. ribosomes / DNA, involved in protein synthesis</p>	9
(b)	<p>any six from:</p> <p>1 <u>aerenchyma</u> ;</p> <p>2 in stem and roots ;</p> <p>3 help <u>oxygen</u> to, move / diffuse, to, roots / submerged parts ;</p> <p>4 shallow roots ;</p> <p>5 air (film) trapped on underwater leaves / described ;</p> <p>6 greater internode growth or leaves or flowers grow above water level ;</p> <p>7 (growth regulated by) gibberellin / ethene ;</p> <p>8 anaerobic respiration, in roots / underwater / when submerged ; A alcoholic fermentation</p> <p>9 tolerant to high <u>ethanol</u> (concentration) ;</p> <p>10 <i>ref. to</i> ethanol / alcohol, dehydrogenase ;</p>	6