Sacred Heart Canossian College
2022-2023 Mock Examination
S6 Biology
Marking Scheme

Paper 1

Section A: Multiple-choice Questions (36 marks)

1	A
2	D
3	D
4	B
5	C
6	A
7	B
8	B
9	C
10	B

11	D
12	D
13	C
14	B
15	A
16	A
17	A
18	C
19	C
20	A

21	A
22	B
23	C
24	C
25	B
26	C
27	A
28	D
29	A
30	D

31	C
32	A
33	C
34	B
35	C
36	B

Section B: Conventional Questions (84 marks)

1. (a)

Part	Air	Liquid	
A	✓		(1)
B		✓	(1)
C		✓	(1)

(b) If part D is blocked, air cannot flow between the throat and the middle ear. (1)
The air pressure on the two sides of the eardrum becomes unequal. (1)
This causes the eardrum to bulge. A bulged eardrum cannot vibrate freely and so hearing becomes more difficult. (1)

Total: 6 marks

2. Refraction of light by the cornea is reduced as it is less convex. (1)
As a result, the images of distant objects can be focused onto the retina / yellow spot. (1)

Total: 2 marks

3. The dissolved oxygen content of waterlogged soil is low. (1)
The plant roots do not have enough oxygen for respiration. (1)
Thus, root cells cannot absorb minerals from the soil through active transport. (1)

Total: 3 marks

4. (a) * Mitotic cell division (1)
The amount of DNA in the daughter cell is the same as the parent cell at the end of the division. (1)
(b) B (1)
It works by inhibiting DNA replication. (1)

Total: 4 marks

5. (a) *Vertebrates (1)
Because they all have backbones. (1)

(b) Any ***one*** sets of the following:
- The S-shaped vertebral column (1)
absorbs shock during movement. (1)
- The pelvic girdle is larger (1)
to support the weight of the upper part of the body. (1)
- The leg bones are thicker/larger (1)
to raise the body above the ground. (1)

(c) It allows for distant vision / frees both hands for work. (1)

Total: 5 marks

6. (a) * translation (1)

(b) The mRNA coding for the viral spike protein binds to a ribosome. (1)
Specific amino acids are carried to the ribosome by tRNA molecules. (1)
The anticodons on the tRNA molecules bind to the complementary codons on the mRNA. (1)
Adjacent amino acids are joined by a peptide bond, forming the polypeptide which then folds into the spike protein. (1)

(c) The antigen on the spike protein will bind to the receptor of the B-lymphocyte. (1)
The activated lymphocyte proliferates and differentiates into memory cells to remember the type of antigen. (1)
When the same type of antigen enters the body again, the secondary immune response will be triggered. (1)

(d) Y represents antibodies which bind to the spike protein on the virus. (1)
As a result, Y binds several virus particles together as a big mass / clump (1)
to facilitate the phagocytosis by phagocytes. (1)

Total: 11 marks

7. (a) *Oxidative phosphorylation (1)

(b) A defective electron transport chain causes oxidative phosphorylation to stop. (1)
NADH / FADH cannot be oxidised back to NAD / FAD. (1)
Pyruvate will be reduced to lactic acid (to regenerate NAD / FAD). (1)
When lactic acid is produced at a faster rate than it can be removed, it accumulates in the body and reaches a high level in the blood. (1)

(c) (i) Individual 3 has Disease X, so he should have at least one allele for Disease X from either one of his parents in order to have the disease. (1)
Since both parents are normal and they should have at least one allele for normal, one of the parents must be heterozygous. (1)
Under heterozygous condition, the dominant phenotype will be shown (1)
Therefore, normal is the dominant phenotype and Disease X is inherited in an autosomal recessive pattern. (1)

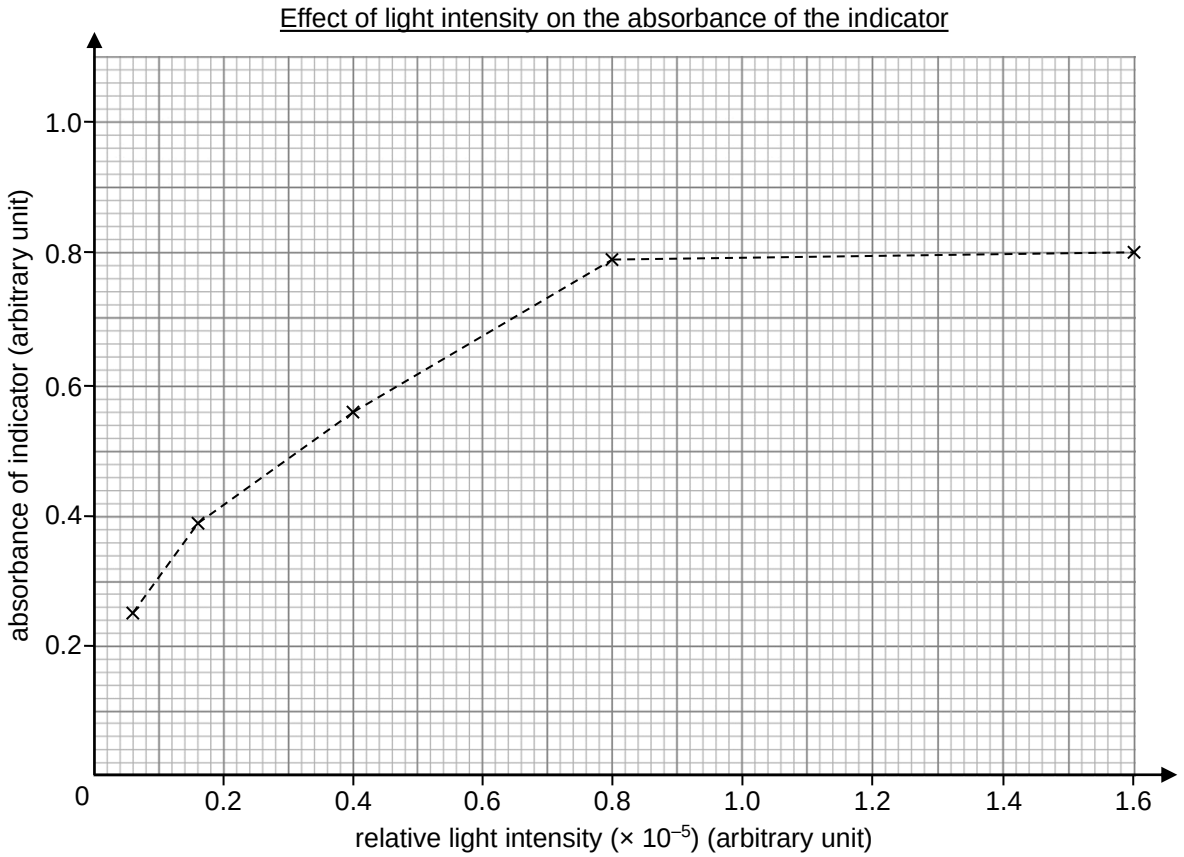
(ii)

	Mitochondrial inheritance		
Mutated gene(s) inherited from?	☐ Father	☑ Mother	(1)
Male and female offspring have the same chance of being affected?	☑ Yes	☐ No	(1)
Disease can be inherited from unaffected parents?	☐ Yes	☑ No	(1)

Total: 12 marks

8. (a) Stronger light, provided by closer to the table lamp, was absorbed by the chlorophyll in the green algae of bottle 1 to promote higher rate of photochemical reactions, (1)
leading to formation of more NADPH and ATP. (1)
As NADPH provided reducing power and ATP provided energy needed for higher rate of carbon fixation, (1)
so the increase in carbon dioxide fixation resulted in greater uptake of carbon dioxide present in the bottle. (1)
Therefore, bottle 1 measured to have a higher absorbance than that of bottle 5. (1)

(b) Correct title (1)
Correct choice of axes (1)
Correct labelling of axes with units (1)
Correct plotting and joining of points (1)
(Deduct 1 mark if the line passes through the origin in the graph)



(c) From 0.06 $\times 10^{-5}$ to 0.8 $\times 10^{-5}$ units of light intensity, the rate of photosynthesis of green algae increases significantly with increasing light intensity. (1)
The increase stops when the light intensity is higher than 0.8 $\times 10^{-5}$ units. (1)

(d) Source of error: The heat emitted by the table lamp might increase the temperature of the indicator in the glass bottles, affecting / reducing the rate of photosynthesis of the algae. (1)
Improvement: Place a water tank / heat shield between the table lamp and the glass bottles. (1)

Total: 13 marks

9. (a) In both cells Y and Z, the percentage of the inner mitochondrial membrane is much higher than that of the outer mitochondrial membrane, (1)
because the inner mitochondrial membrane is highly folded while the outer membrane is not. (1)

(b) (i) *Amylase / proteases / lipases (1)

(ii) Cell Y (1)
The percentage of rough endoplasmic reticulum (RER) membrane in cell Y is highest, meaning the cell contains a largest number of RER. (1)
RER is the site of protein synthesis. (1)
Pancreatic cells secrete pancreatic juice which contains various digestive enzymes and enzymes are protein molecules. (1)

(c) Mature red blood cell (1)
It does not have a nucleus (1)
and membrane-bounded organelles (e.g. mitochondria and RER). (1)

(d) The percentage of cell membrane in the epithelial cell of the small intestine would be higher than that of cell Z (1)
as part of its cell membrane is folded into microvilli (1)
to increase the surface area of absorption. (1)

Total: 13 marks

10. (a) Interneurones / Motor neurones (1)

(b) (i) Any ***two*** of the following: (1,1)
- To maintain a concentration gradient of dopamine for diffusion across the synaptic cleft
- To free the receptor sites to bind with more dopamine molecules / to prevent continuous stimulation of receptor
- To recycle the neurotransmitter

(ii) Since the drugs have a similar molecular structure as that of dopamine, they can bind to the receptor sites of the postsynaptic neurone / stimulate the postsynaptic neurone (1)
and elicit a nerve impulse to mimic the effect of dopamine. (1)

Total: 5 marks

11. *7 marks for content and 3 marks for logical presentation and clarity of expression.*

<u>Flow of carbon in the ecosphere (2 marks max.)</u>

Carbon in the algae, in the form of organic matter, is transferred to shrimps by feeding. (1)
As the organisms in the ecosphere carry out respiration, the carbon is released back to the seawater in the form of carbon dioxide. (1)
The waste material of shrimps and dead bodies of organisms are decomposed by bacteria in the ecosphere. The organic matter in these materials is eventually converted to carbon dioxide through decomposition and respiration and released back to the seawater. (1)

<u>Flow of energy in the ecosphere</u>

In the presence of light, algae carry out photosynthesis, converting light energy into chemical energy. (1)
The chemical energy is transferred to the shrimps when the shrimps feed on the algae. (1)

Differences in the two transfer mechanisms (3 marks max.)

Cycling of carbon / energy	Carbon can be cycled in the ecosphere. It can be utilised by organisms and returned to the air in the ecosphere to form a cycle. (1)	Energy cannot be cycled in the ecosphere and a constant energy source from the sun is required. (1)
Loss of carbon / energy	Carbon dioxide in the seawater is returned to the algae when the algae carry out photosynthesis. There is no loss of carbon in the ecosphere like the energy does. (1)	A large portion of energy is lost to the surroundings as energy is transferred along the food chain through heat energy in respiration / uneaten parts / excretory products or egesta. (1)

Total: 7 + 3 marks