2022-2023
MOCK EXAM
S6 Bio
Paper 1

SACRED HEART CANOSSIAN COLLEGE

2022-2023 MOCK EXAMINATION

Secondary 6

BIOLOGY

Paper 1

SECTION B: Question-Answer Book B

This paper must be answered in English

INSTRUCTIONS FOR SECTION B

(1) Refer to the general instructions on the cover of the question paper of Section A.

(2) When told to check this question paper, you should make sure that all the questions are there. Look for the words 'END OF PAPER' after the last question.

(3) Answer ALL questions.

(4) Write your answers in the spaces provided in this Question-Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

(5) Supplementary answer sheets will be supplied on request. Write your name, class and class number on each sheet. Hand in the supplementary answer sheets with this Question-Answer Book B for Section B.

(6) Present your answers in paragraphs wherever appropriate.

(7) The diagrams in this section are NOT necessary drawn to scale.

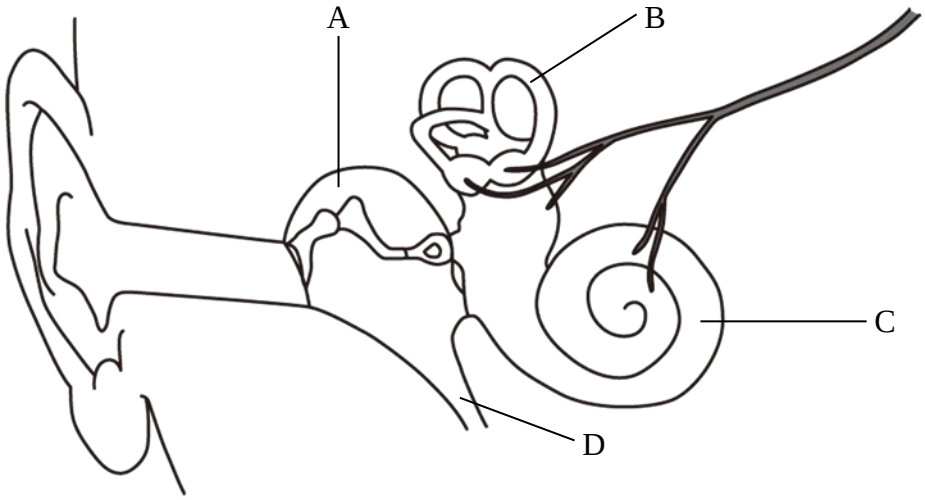
Name: _____

Class: _____ No.: _____

Question No.	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

Section B: Conventional Questions (84 marks)

1. The diagram below shows the human ear and its associated structures.

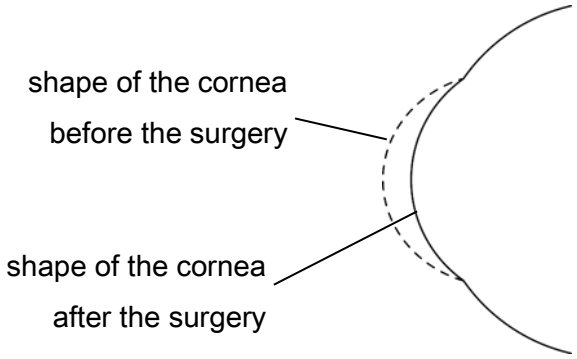


(a) In the table below, put a tick '✓' in the appropriate box to show whether each of parts A, B and C contains air or liquid. (3 marks)

Part	Air	Liquid
A		
B		
C		

(b) Explain why it is more difficult to hear when part D becomes blocked as a result of suffering from a common cold. (3 marks)

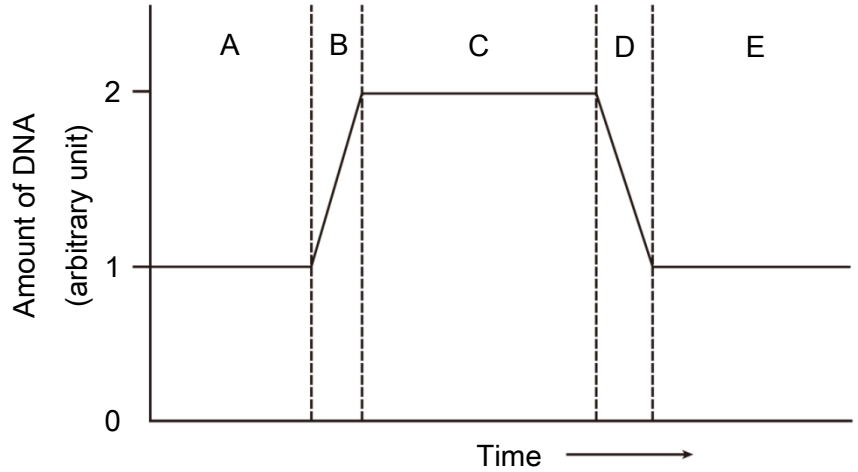
2. The man had short sight. One way of correcting short sight is to use laser surgery to alter slightly the shape of the cornea. The diagram below shows the effect of laser surgery on the shape of the cornea.



Explain how laser surgery can correct short sight with reference to the alteration of the corneal shape. (2 marks)

3. Based on the principle of absorption of minerals in roots, explain why plants may grow poorly in soil flooded with water. (3 marks)

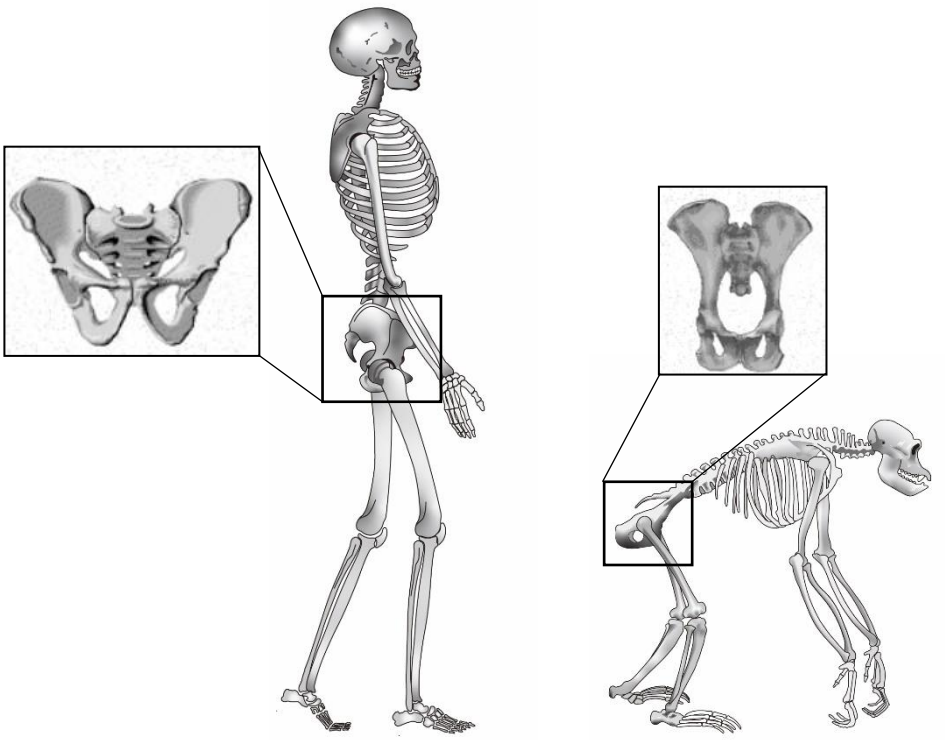
4. The graph below shows the change in the amount of DNA in a cell undergoing a complete cycle of a certain type of cell division.



(a) Which type of cell division is the cell undergoing? Explain your answer. (2 marks)

(b) Cisplatin is a chemical which binds to DNA and it stops free DNA nucleotides joining together. In which period, A to E, would you expect cisplatin to have the greatest effect? Explain your answer. (2 marks)

5. The diagrams below show the skeleton of a human and that of a chimpanzee.



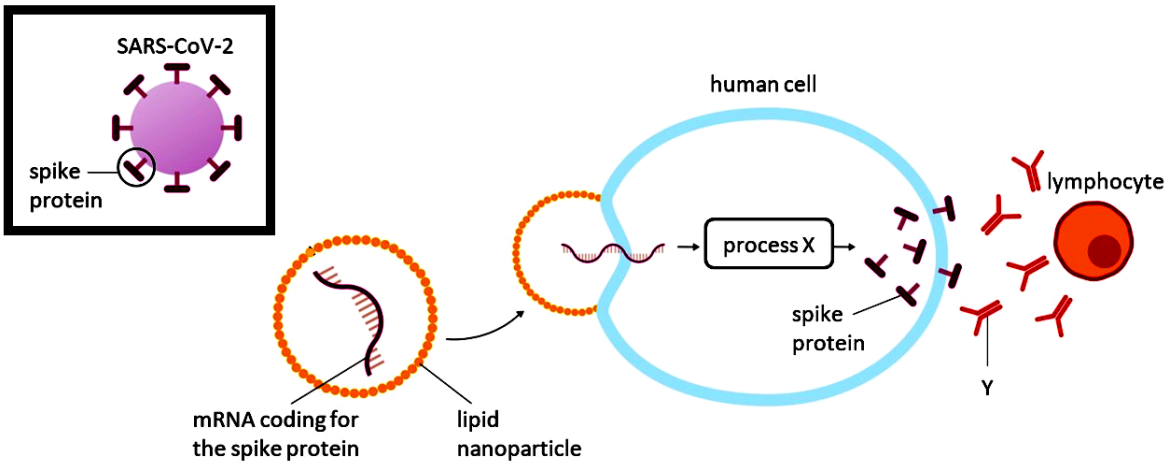
human chimpanzee

(a) Humans and chimpanzees belong to the same group as fish. Name this group. Explain your answer. (2 marks)

(b) With reference to the above diagrams, describe and explain ***one*** adaptation of the human skeleton that allows humans to walk upright. (2 marks)

(c) Suggest ***one*** advantage of the upright posture to humans. (1 mark)

6. BNT162b2 is an mRNA vaccine against SARS-CoV-2, the virus that causes COVID-19. It is designed to instruct body cells to produce the viral spike protein (with antigen) that helps stimulate an immune response. The diagram below shows how the vaccine works (the diagram inside the small box shows the virus SARS-CoV-2).



(a) Name process X. (1 mark)

(b) Describe the events in process X which lead to the production of the viral spike protein in the human cell. (4 marks)

(c) With reference to the answer of (b), explain how the vaccine can enable us to have extra immunity and protect us against COVID-19. (3 marks)

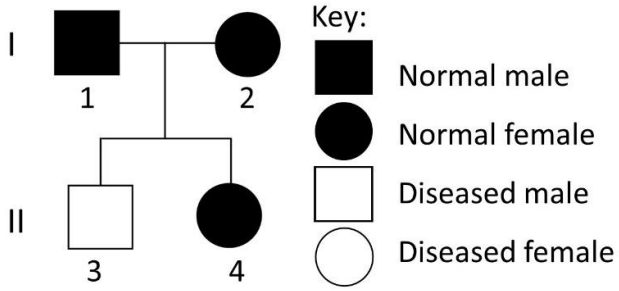
6. (d) Y is a protein molecule produced by a type of lymphocyte. With reference to the binding site of molecule Y, describe the function of Y in phagocytosis against the virus. (3 marks)

7. Disease X is a type of mitochondrial diseases, which is a group of genetic diseases that are caused by mutations in genes involved in normal functioning of mitochondria.

(a) Name the process of respiration that takes place in the inner membrane of the mitochondria. (1 mark)

(b) In some patients with Disease X, certain proteins involved in the electron transport chain are not functioning. With reference to the process stated in (a) and its significance, explain why patients with Disease X usually have high levels of lactic acid in their blood even when they are at rest. (4 marks)

(c) (i) Disease X is most commonly inherited in an autosomal pattern. Based on the pedigree below, deduce whether the disease is inherited in an autosomal dominant or recessive pattern. (4 marks)

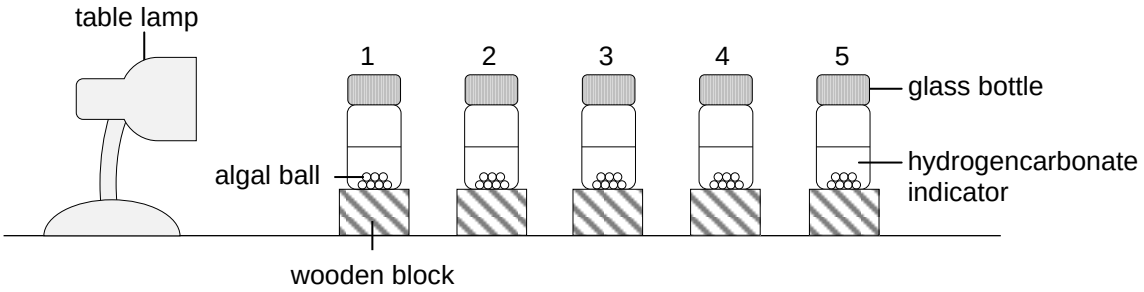


7. (c) (ii) Disease X can also be inherited in a mitochondrial pattern. Mitochondrial DNA is a circular chromosome found inside the mitochondria. It can only be inherited from mother because all the mitochondria in a zygote come from the ovum. Complete the table below by putting a '✓' in the appropriate box to answer the question stated. You may put more than one '✓' for each item.

(3 marks)

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

8. A student carried out an experiment to study the effect of light intensity on the rate of photosynthesis of green algae. He first put the green algae in gelatin balls. 20 algal balls were then put into each of the 5 tiny glass bottles in a dark room. 10 cm^3 of red hydrogencarbonate indicator solution was added into each glass bottle. The glass bottles were placed at different distances (D) from a table lamp, as shown in the diagram below.



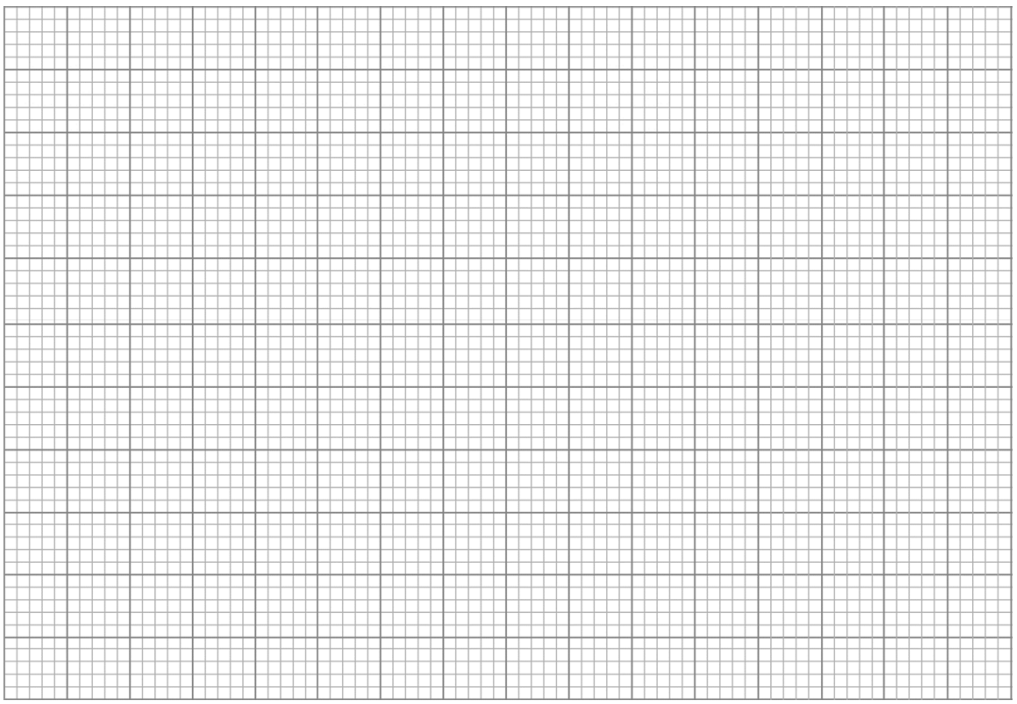
After 60 minutes, the student measured the absorbance (or the colour) of the hydrogencarbonate indicator using a colorimeter. The table below shows the experimental results.

Glass bottle	1	2	3	4	5
Relative light intensity ($1/D^2$) / $\times 10^{-5}$ arbitrary unit	1.60	0.80	0.40	0.16	0.06
Absorbance* of indicator / arbitrary unit	0.80	0.79	0.56	0.39	0.25

* Absorbance refers to the quantity of light absorbed by a sample and can be used to indicate the rate of photosynthesis in this experiment. Higher the absorbance means darker the colour of the hydrogencarbonate indicator.

(a) Greater colour change can be seen in glass bottle 1. With reference to the biochemical pathway of photosynthesis, state and explain the absorbance difference of the indicator in glass bottles 1 and 5. (5 marks)

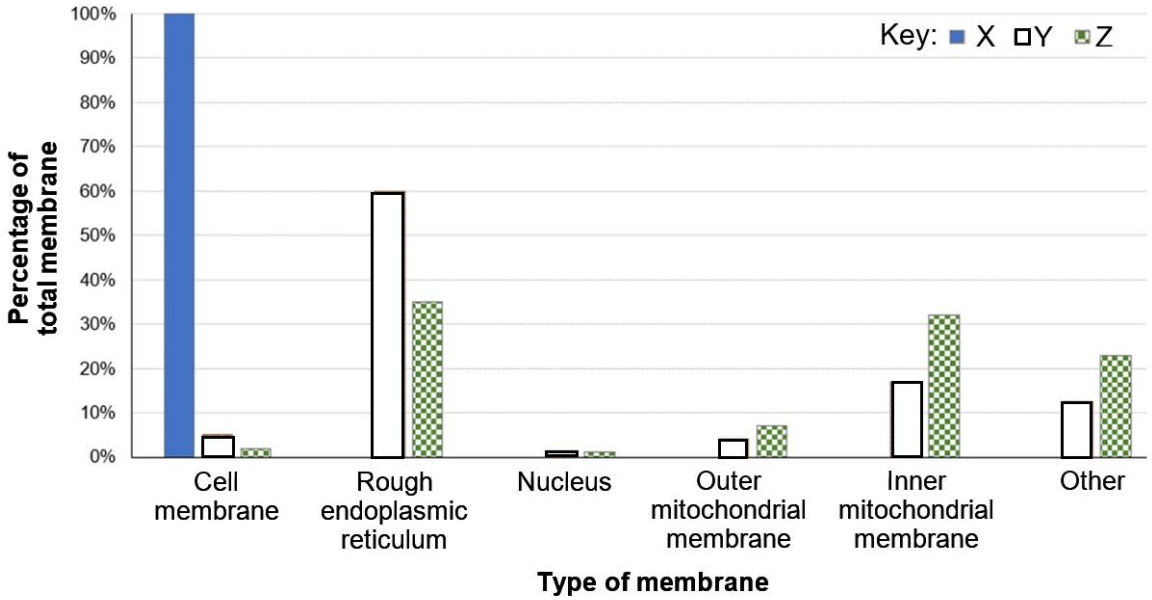
8. (b) Using the graph paper below, plot a graph to show the effect of an increasing light intensity on the absorbance of the indicator. (4 marks)



(c) What conclusion(s) can be drawn from the graph about the effect of light intensity on the rate of photosynthesis of green algae? (2 marks)

(d) Give ***one*** critical source of error in this experiment and suggest ***one*** way of improvement to reduce it. (2 marks)

9. In an investigation, scientists determined the relative abundance of different types of membranes found in three types of human cells, X, Y and Z. The bar chart below shows the results.



(a) Using your knowledge of the structure of organelles, explain the difference between the percentage of the inner mitochondrial membrane and that of the outer mitochondrial membrane in both cells Y and Z. (2 marks)

(b) It is known that one of the three types of cells used in the investigation is responsible for the production of pancreatic juice.

(i) Name a digestive enzyme that is present in the pancreatic juice. (1 mark)

(ii) With reference to the bar chart, suggest and explain the type of cells responsible for the production of pancreatic juice. (4 marks)

Answers written in the margins will not be marked.

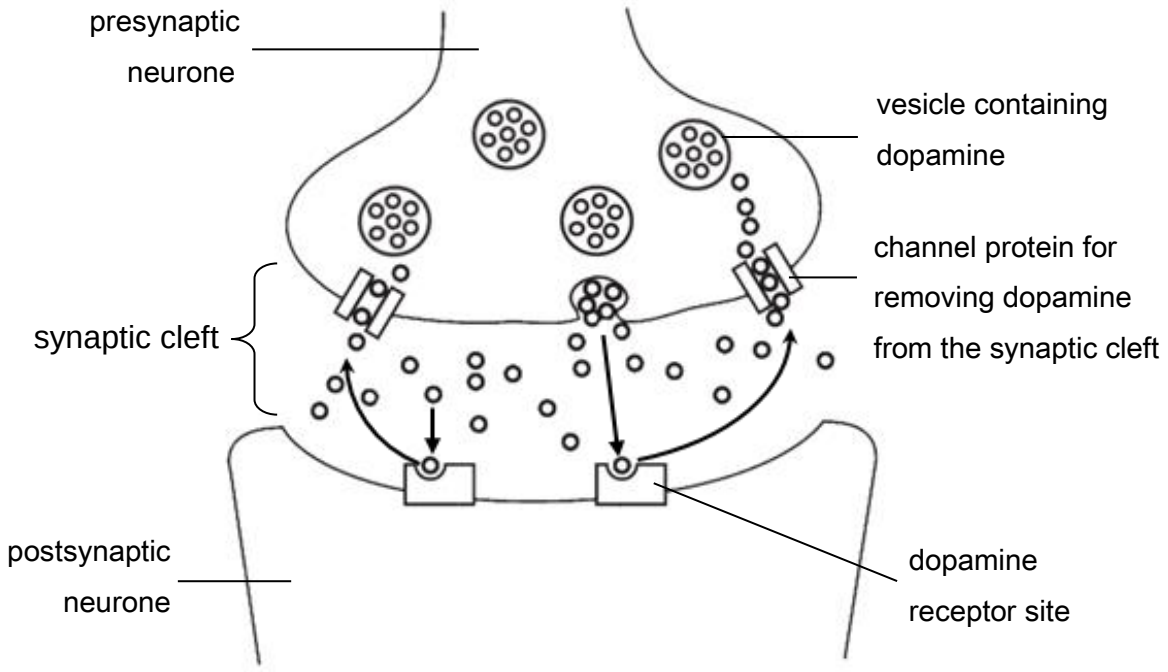
9. (c) Deduce with ***two*** reasons what cell X is. (3 marks)

(d) With reference to the function of the organ, explain why the relative abundance of cell membrane of an epithelial cell in the small intestine is different from that of cell Z. (3 marks)

10. Parkinson's disease is a disease of the central nervous system. It is caused by the loss of neurones in one part of the brain. These neurones are responsible for producing the chemical dopamine. Dopamine serves as a neurotransmitter in parts of the brain and nervous system that control movements.

(a) What type(s) of neurones is / are most likely affected by Parkinson's disease? (1 mark)

(b) The diagram below shows the events at a synapse which uses dopamine as the neurotransmitter.



(i) Explain why dopamine molecules have to be removed from receptor sites and the synaptic cleft so that the synapse can keep on functioning. (2 marks)

(ii) Some drugs for treating Parkinson's disease have a similar molecular structure as that of dopamine. Suggest how these drugs work. (2 marks)

You are required to present your answer in essay form to the following question. Criteria for marking will include relevant content, logical presentation and clarity of expression.

11. Ecosphere is a self-sustaining ecosystem sealed in a transparent glass sphere. It contains bacteria, algae, shrimps and seawater. Describe the flow of carbon and energy starting from producers of the ecosphere. Contrast the two transfer mechanisms in this ecosphere. (10 marks)

END OF PAPER

Answers written in the margins will not be marked.