Sacred Heart Canossian College
Mock Examination (2020-2021)

S6 Biology Paper 1

Section B: Question-Answer Set B

Instructions for Section B:

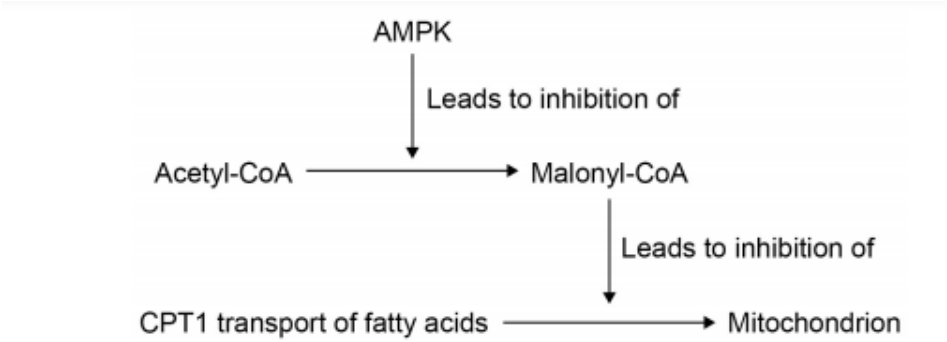
1. *Refer to the general instructions on the cover of the question paper of Section A.*
2. *When told to check this question paper, you should make sure that all the questions are there. Look for the words 'END OF PAPER' after the last question.*
3. *Answer ALL questions.*
4. *Write your answers in the spaces provided in this Question-Answer Set. 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 the Question-Answer Set B for Section B.*
6. *Present you answers in paragraphs wherever appropriate.*
7. *The diagrams in this section are NOT necessary drawn to scale.*

Section B: Conventional Questions (84 marks)

1. For each of the diseases listed in column 1, select from column 2 one sentence that matches it. Put the appropriate letter in the space provided. (3 marks)

Column 1		Column 2
Malaria	_____	A. It is caused by viruses.
COVID-19	_____	B. It is caused by protists.
Tuberculosis	_____	C. It is caused by bacteria.
		D. It is caused by fungi.

2. When we exercise, an enzyme called AMP-activated protein kinase (AMPK) will be activated. AMPK is an enzyme that regulates a number of cellular processes. The following diagram shows one effect of activation of AMPK during exercise.



*CPT 1 are channel proteins that transport fatty acids into the mitochondria as a respiratory substrate.

With reference to the above information, deduce the benefit of activation of AMPK during exercise. (3 marks)

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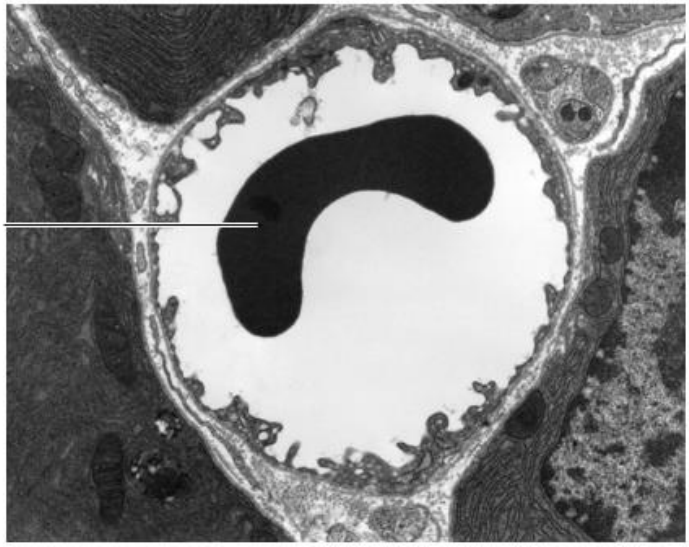
3. The photomicrograph below shows the section of a blood vessel, P, in pancreatic tissues.



(x8000)

(a) Name the type of blood vessel that P belongs to. (1 mark)

_____

(b) With reference to one observable feature shown in the photomicrograph, explain how cell Q is adapted to its function. (2 marks)

_____

_____

(c) By means of a flowchart, shows the route through which cell Q is transported from the pancreas to the lung. Indicate only the major blood vessels and organs involved. (2 marks)

Pancreas → _____

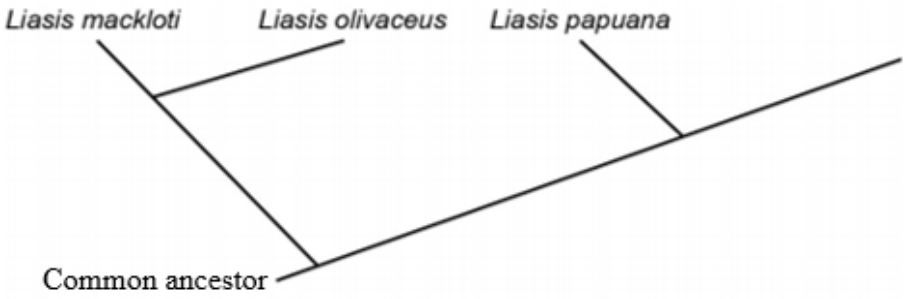
_____

4. The diagrams below show the hypothetical evolutionary relationships among three species of snakes using two different methods of classification.

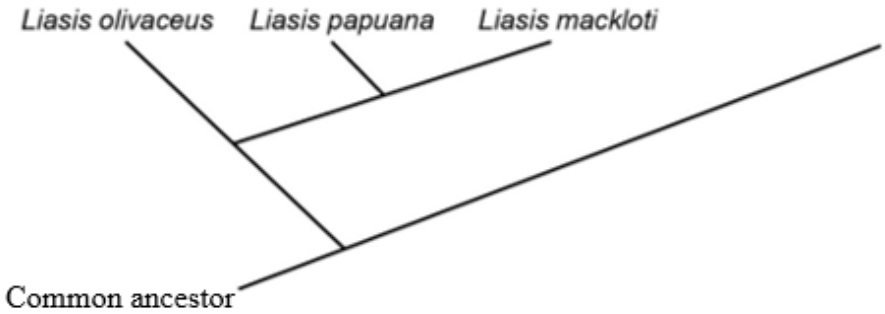
   Classification **X** is based on the frequency of observable characteristics.
   Classification **Y** is based on the comparisons of genetic diversity.

   All three species of snakes belong to the Python family.

Classification **X**



Classification **Y**



(a) Based on the above diagrams, what do classification methods X and Y suggest about the evolutionary relationships among the three species of snakes? (2 marks)

Classification X: _____

_____

_____

Classification Y: _____

_____

_____

(b) State one comparison of genetic diversity that the scientists may use in order to generate Classification Y. (1 mark)

_____

_____

Answers written in the margins will not be marked.

4. (c) Based on the results from the comparison of genetic diversity, there is a debate about the name of one of these species of snakes. Some scientists name it *Liasis papuana* and other scientists name it *Apodora papuana*.

(i) State the name of the taxon about which the scientists disagree. (1 mark)

_____

(ii) Which nature of science is exemplified by the debate? (1 mark)

_____

_____

(d) Complete the following table to show the missing names of the taxa when classifying these snakes. (2 marks)

Taxon (in hierarchical order)	**Name**
	Eukarya
Kingdom	Animalia
	Chordata
	Reptilia
	Squamata
Family	Python

5. A student isolated chloroplasts from spinach leaves into a solution to form a chloroplast suspension. She used the chloroplast suspension and DCPIP solution to investigate the light-dependent reaction of photosynthesis. DCPIP solution is blue when oxidised and colourless when reduced. The student set up three test tubes as follows:

Tube	Content		Condition
1	1 cm^3 solution without chloroplast	9 cm^3 DCPIP solution	In light
2	1 cm^3 chloroplast suspension	9 cm^3 DCPIP solution	In darkness
3	1 cm^3 chloroplast suspension	9 cm^3 DCPIP solution	In light

The student recorded the colour of the DCPIP in each of the tubes at the start and after the tubes had been left at 20 ^{o}C for 30 minutes. Her results are shown in the table below:

Tube	Colour of DCPIP in tube	
	At start	After 30 minutes
1	blue	blue
2	blue	blue
3	blue	colourless

(a) The solution used for producing the chloroplast suspension must be an isotonic solution. Explain why. (2 marks)

(b) Explain the purpose of setting up test tube 1. (2 marks)

Answers written in the margins will not be marked.

5. (c) Describe and explain the colour change of the DCPIP solution in test tube 3 with reference to the aim of the investigation. (3 marks)

6. A student carried out an investigation to study the effect of bile salts on the digestion of lipids. She prepared two tubes, X and Y, each containing 2 cm^3 of sodium hydrogencarbonate solution, 5 cm^3 of full cream milk and a few drops of phenolphthalein, which is a pH indicator. 2 cm^3 of bile salt solution was added to tube X but not to tube Y. At the beginning of the investigation, 1 cm^3 of lipase solution was added to each tube. Table 1 below shows the colours of phenolphthalein at different pH, and table 2 shows the results of the investigation.

Table 1 - The colours of phenolphthalein at different pH

pH range	Colour of phenolphthalein
0 – 8.3	colourless
8.3 – 10.0	very pale pink
>10.0	pink

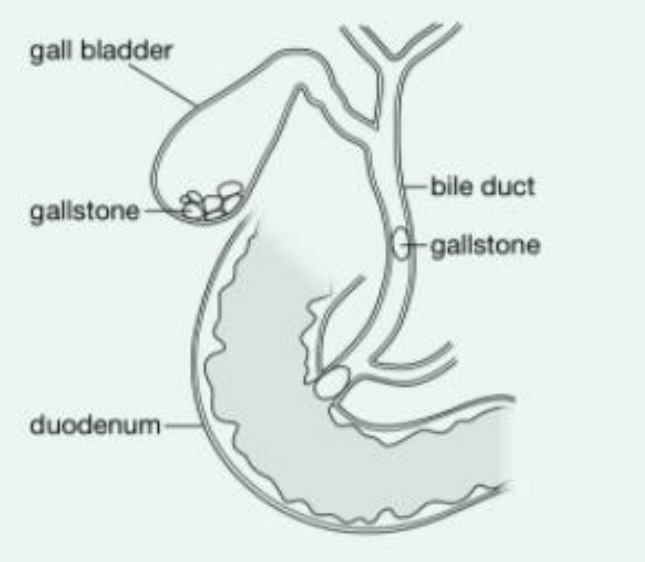
Table 2 – The results of the investigation

Time (min)	Colour change of the reaction mixture	
	Tube X (with bile salt)	Tube Y (without bile salt)
0	pink	pink
5	colourless	pink
10	colourless	pink
15	colourless	colourless

(a) Based on the function of bile salts, describe and explain the results shown in table 2. (4 marks)

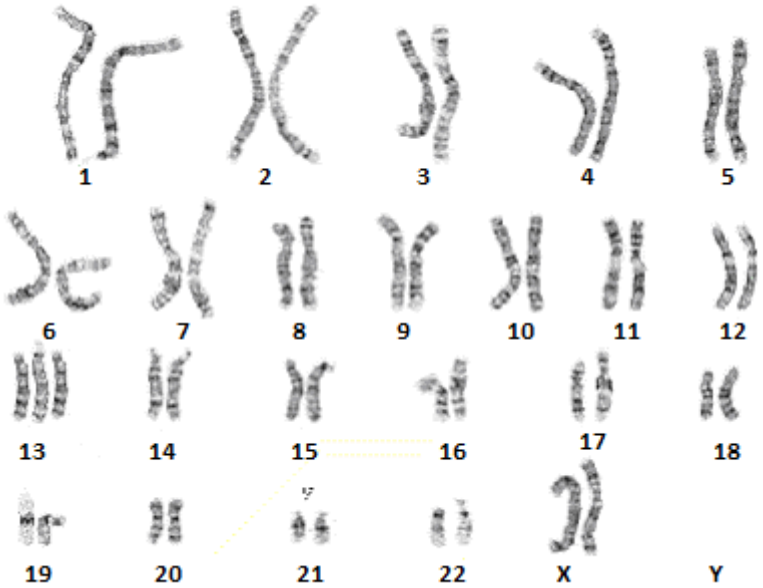
6. (b) Sodium hydrogencarbonate is another component of bile. With reference to the effect of pH on enzyme activity, state the significance of sodium hydrogencarbonate in the digestion in the small intestine. (3 marks)

(c) Gallstones are hardened deposits of bile. The diagram below shows a part of the digestive system of a patient who was diagnosed with gallstones. Suggest why the patient discharges faeces of very pale brown colour. (2 marks)



7. Patau syndrome is a genetic disease caused by chromosomal abnormality. It affects all the somatic cells in the body.

   The karyotype below shows the chromosomes from a body cell of a female who has Patau syndrome.



(a) Identify the abnormality in the karyotype of this female. (1 mark)

_____

(b) Describe how the chromosomal abnormality mentioned in (a) was resulted in this female. (4 marks)

_____

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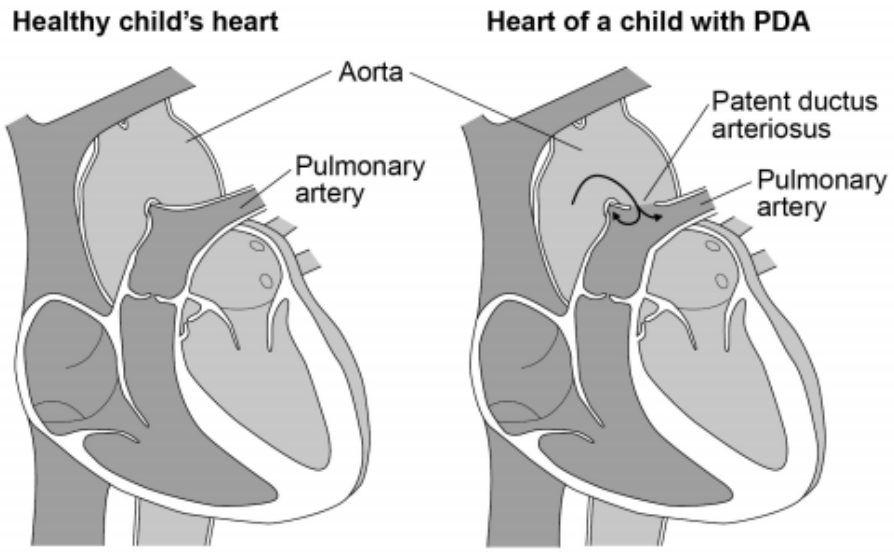
Answers written in the margins will not be marked.

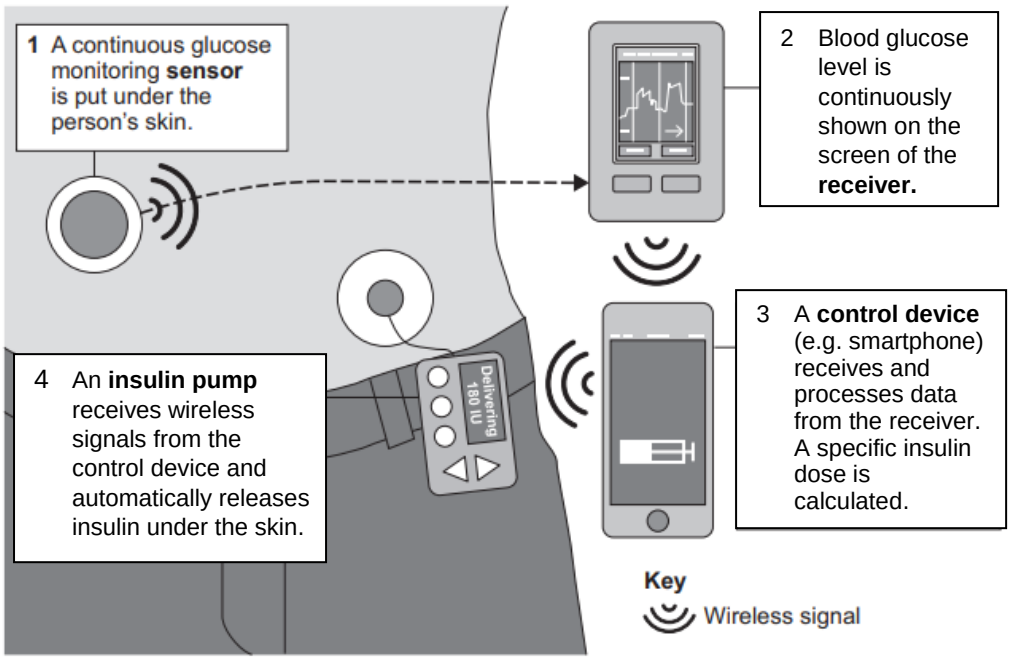
7. (c) Most children born with Patau syndrome die in the first year, often due to structural defects which lead to problems with blood circulation.

One of these defects is patent ductus arteriosus (PDA). This can result in some of the blood flowing between the aorta and the pulmonary artery. Below are diagrams showing the heart of a healthy child and that of a child with PDA respectively. (The arrows in the diagram show the movement of blood.)



With reference to the above diagrams, suggest and explain why most children with PDA cannot survive the first year of their lives. (4 marks)

8. People with type 1 diabetes cannot regulate their blood glucose level. They need to inject insulin regularly in order to control their blood glucose level. Scientists have developed an artificial pancreas to treat type 1 diabetes. The diagram below shows how the artificial pancreas works.



Susan is a patient with type 1 diabetes who has installed the artificial pancreas. She ate a meal high in sugar and her blood glucose rose to a high level.

(a) Based on the information provided in the above diagram, contrast how the artificial pancreas and the normal pancreas work with reference to the mechanism of blood glucose regulation. (4 marks)

Answers written in the margins will not be marked.

8. (b) The traditional way of monitoring and treatment for type 1 diabetes is to take a small sample of blood and put it on a test strip to find out how much insulin should be injected. Suggest a possible advantage, other than not having to do blood tests, of the artificial pancreas. (1 mark)

(c) Another treatment to type 1 diabetes is to receive a pancreas transplant. However, there is a risk of organ rejection. Describe the sequence of events that lead to rejection of a donated organ. (3 marks)

9. In order to obtain fruits of larger size, an outer ring of bark including the phloem tissues from the branches of a nectarine tree was removed (ringing). Diagrams 1 and 2 below show the positions where ringing occurred and the actual appearance of one of the branches after ringing respectively.

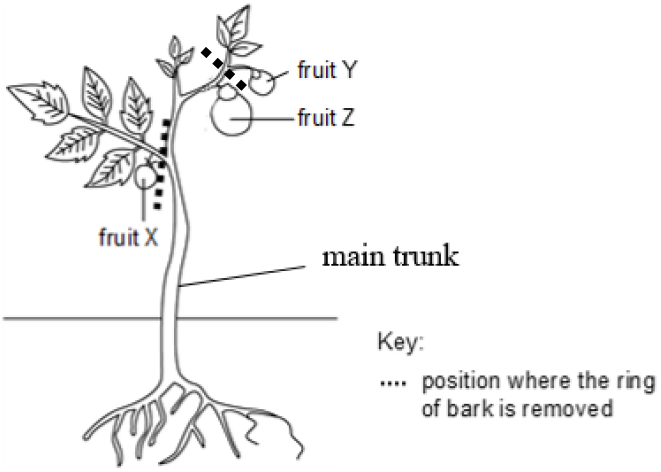


Diagram 1

Appearance of a branch after ringing

Diagram 2

(a) Explain why fruit X will become larger in size after the removal of a ring of bark. (5 marks)

(b) Given that fruits X and Y have the same size before ringing, which of them can grow and reach the size of fruit Z first? Explain your answer. (2 marks)

9. (c) Ringing branches is a common gardening practice for farmers who wish to get larger fruit size during harvest. However, they should never remove the bark from the main trunk of the tree. Explain the reason behind. (3 marks)

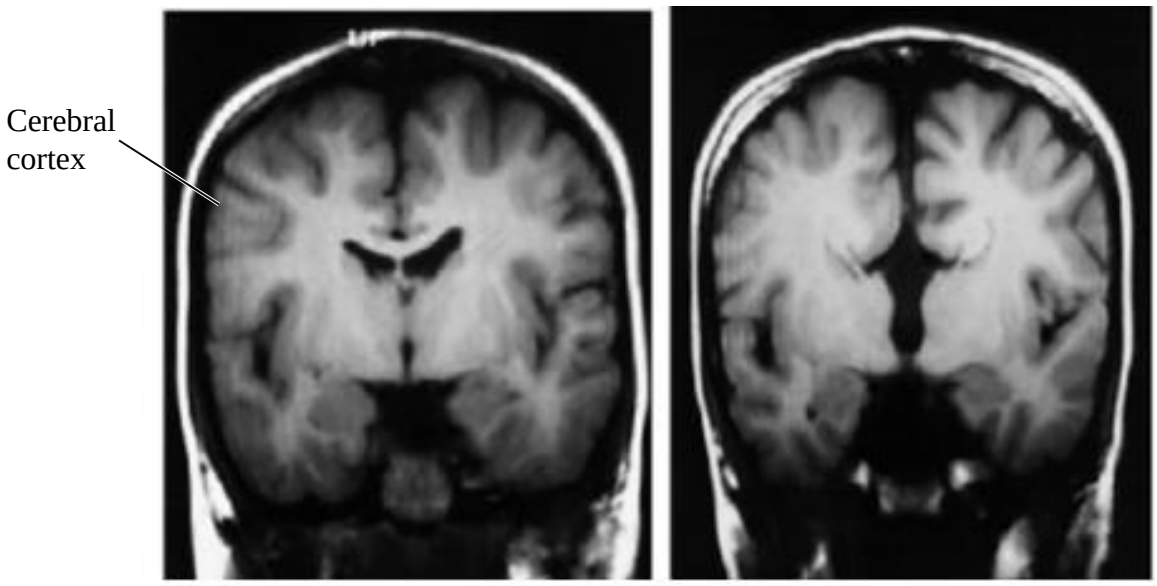
(d) The following diagram shows the fruit picked from the nectarine tree.

With reference to one observable feature from the diagram, explain briefly the method of fruit and seed dispersal by the nectarine tree. (3 marks)

10. Patients with epilepsy, a type of neurological disorder, may suffer from uncontrollable seizure (sudden, uncontrolled electrical disturbance in the brain). During these seizures, they are at risk of severe injury due to falls. The spread of these seizures can be stopped by cutting a thick band of nerve fibres which allows nervous transmission between the left and right cerebral hemispheres. This is known as the "split-brain surgery".

The diagrams below show the X-ray photographs of a normal brain and a brain after the surgery.

X-ray photograph A **X-ray photograph B**



(a) Which X-ray photograph, A or B, shows the brain after the surgery? (1 mark)

_____

(b) The surface of the cerebral cortex is highly folded. What is the significance of this feature? (1 mark)

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(c) With reference to the above X-ray photographs, explain two ways how the brain is protected when a person falls down. (2 marks)

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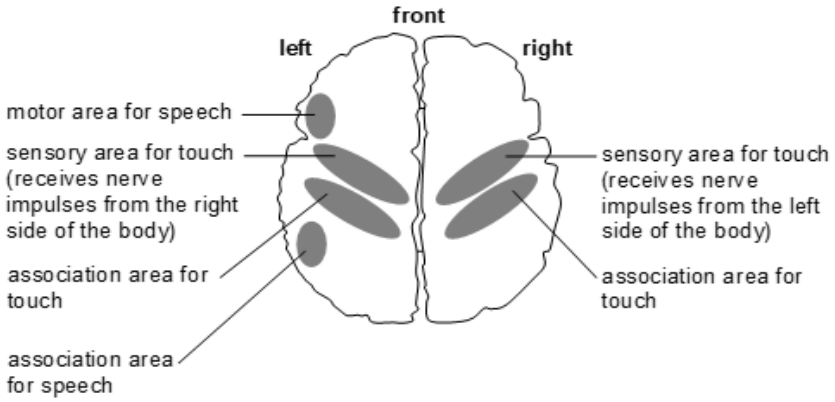
Answers written in the margins will not be marked.

10. (d) The following describes two experiments conducted by Dr. Roger Sperry on patients who received the split-brain surgery. He found that these patients' behaviours were very unusual after the surgery.

Task 1:   An object was projected on a screen in front of the split-brain patient. He was asked to cover one eye to see the object and then identify verbally what he saw.   **Result**:   When he was looking at the object with his right eye (with left eye closed), he could name the object.   When he was looking at the object with his left eye (with right eye closed), he answered "I see nothing."
Task 2:   The split-brain patient was asked to touch an object using his left hand with both of his eyes closed and then identify verbally what he was touching.   **Result**:   He could recognise the object but could not say what it was.

(i) Construct a flowchart to show the nervous pathway which resulted in the perception of vision of the split-brain patient in task 1. (1 mark)

(ii) The diagram below shows some functional areas in the cerebral cortex of a person.



With reference to the above diagram, explain the result of task 2. (4 marks)

Answers written in the margins will not be marked.

10. (d) (ii) (continued from page 17)

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. DNA fingerprinting is a technique with wide applications in different fields. Describe how a DNA fingerprint is produced from a collected sample of DNA using gel electrophoresis. Explain how DNA fingerprinting can help a man to determine whether he is the biological father of a child. (11 marks)

END OF PAPER

Answers written in the margins will not be marked.