2022-DSE

BIO Mock Exam

Paper 1B

B

Bishop Hall Jubilee School

2022 MOCK EXAM

BIOLOGY PAPER 1

Question-Answer Book B

This paper must be answered in English

Name	
Class	
Class number	

Paper 1A	Sub-Total : 36	Sub-Total:
Paper 1B	Sub-Total : 84	Sub-Total:
BIO Total	Full mark **120**	Grand Total:

Date: 24-2-2022
Time: 8:20-10:50 am
Duration: 150 mins
Total page no.: 19 (including cover page)
This paper must be answered in English

INSTRUCTIONS FOR SECTION B

1. After the announcement of the start of the examination, you should first write your name, class and class number in the space provided in Page 1.
2. Refer to the general instruction on the cover of the Question Paper for Section A.
3. Answer **ALL** question in this paper.
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. Graph paper, rough work sheets and supplementary answer sheets will be supplied on request. Write down your name, class and class number if necessary.
6. Present your answers in paragraphs wherever appropriate.
7. The diagrams in this section are NOT necessarily drawn to scale

Section B

Answer **ALL** questions. Put your answers in the spaces provided.

1. For each food substance listed in column 1, select from column 2 ***one*** phrase that correctly describes its function. Put the appropriate letter in the space provided. (3 marks)

Column 1		*Column 2*	
Vitamin C	_____	A	A component of the pigment in red blood cells
		B	A component of bone; important for keeping bones strong
Vitamin D	_____	C	Easily destroyed when exposed to oxygen
		D	Needed to prevent night blindness
Iron	_____	E	Needed to prevent rickets

2. When travelling upward on a high speed elevator, passengers are likely to feel pain in their ears.

(a) With reference to the diagram, explain why passengers are likely to feel pain in their ears when travelling on a high speed elevator. (2 marks)

_____

_____

_____

(b) With reference to the diagram, explain why this kind of ear pain can be relieved simply by swallowing. (2 marks)

_____

_____

_____

_____

Answers written in the margin will not be marked.

3. Some trees develop two types of green leaves: sun leaves and shade leaves. Sun leaves are found at the top of the tree canopy, while shade leaves are usually found at the bottom or in the interior of the tree canopy. Two types of leaves are shown below.

Sun leaf **shade leaf**

(a) By comparing the leaves shown in the above diagram with different aspects, state and explain ***one*** adaptive feature for each type of the leaf in relation to their location in the tree canopy respectively. (4 marks)

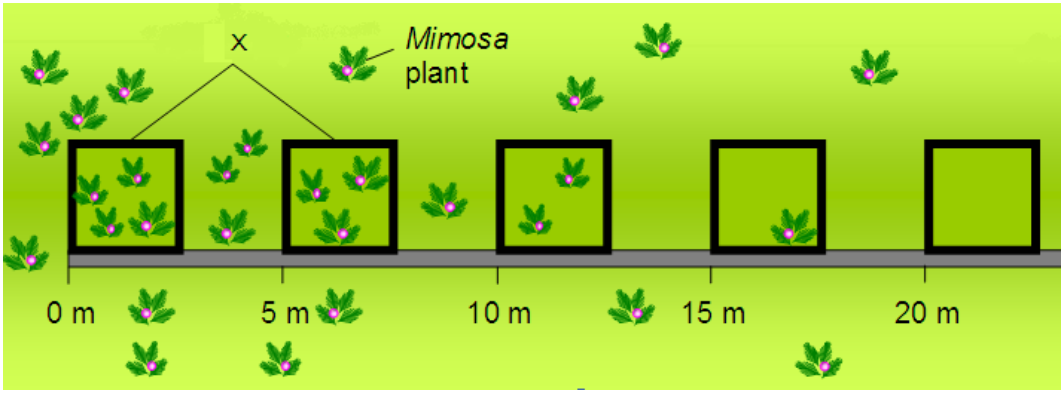
Sun leaf:

Shade leaf:

(b) Shade leaves usually have a lower compensation point than that of sun leaves. Explain the significance of this. (3 marks)

Answers written in the margin will not be marked.

4. A student studied the distribution of a species of *Mimosa* on a piece of grassland. The diagram below shows the sampling method he used.



(a) Name X. (1 mark)

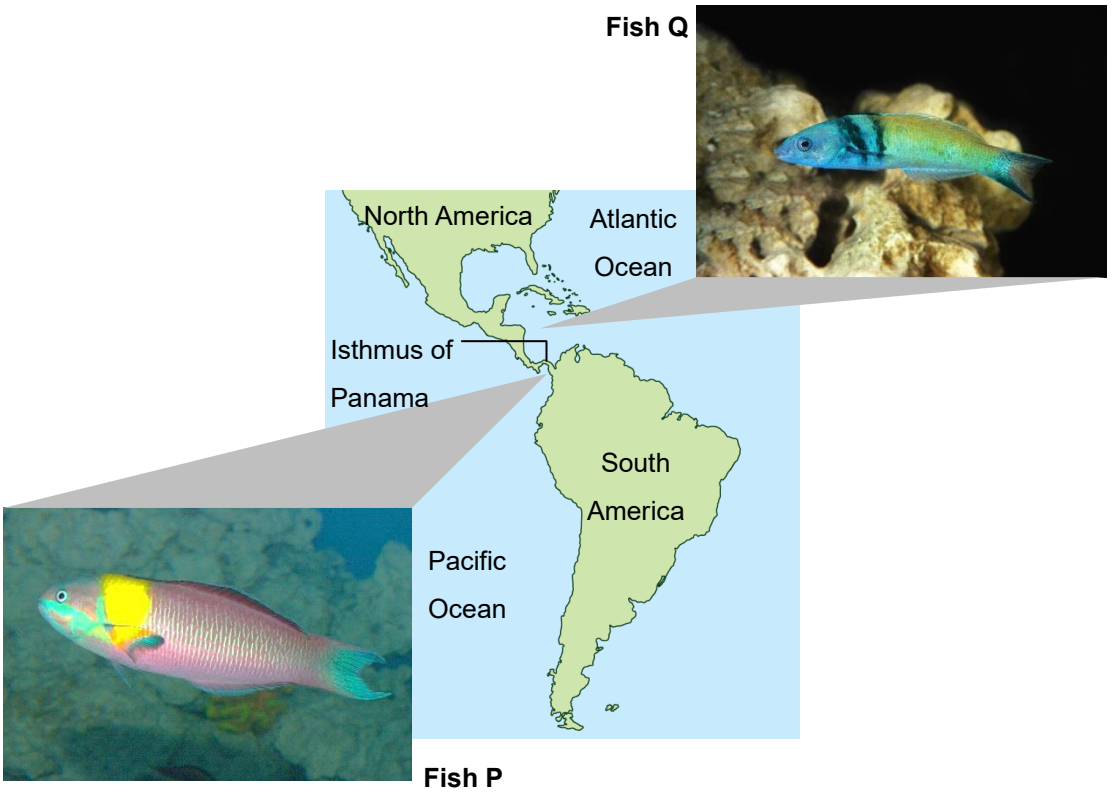
(b) Name the sampling method shown in the diagram above. (1 mark)

(c) State ***one*** limitation of the stated sampling method. (1 mark)

(d) *Mimosa* is a leguminous plant. Describe the importance of *Mimosa* in an ecosystem. (3 marks)

Answers written in the margin will not be marked.

5. The diagram below shows the locations where two fish species (P and Q) are found in Central America at present.



Scientists believe that the two fish species evolved from a common ancestor after the formation of the Isthmus of Panama, a narrow strip of land that connects North America and South America, around 2.8 million years ago.

(a) Suggest how the two fish species might have evolved from the common ancestor. (4 marks)

(b) The photographs below show two other fish species (R and S) which are also found in Central America.

Fish R

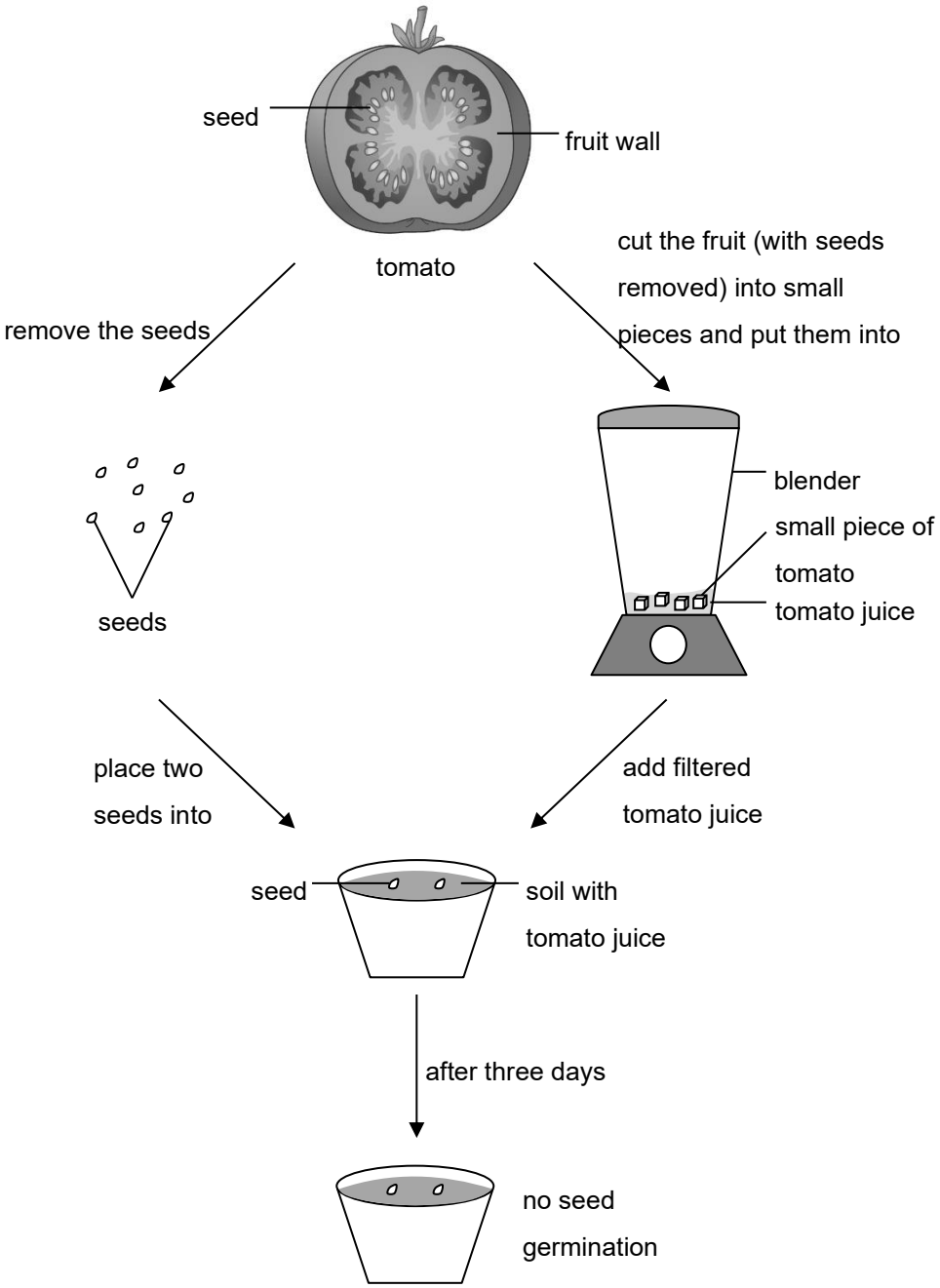
Fish S

Based on the features shown in the photographs, complete the following dichotomous key so that it can be used to identify fish P, Q, R and S. (3 marks)

1	**a**	Without a vertical black stripe through the eye ……...	
1	**b**	With a vertical black stripe through the eye ……	
2	**a**		……... Fish P
2	**b**		……... Fish Q
3	**a**	Body with horizontal stripes ……..……..	
3	**b**	Body with vertical stripes ……..……..	

Answers written in the margin will not be marked.

6. A student wanted to grow tomato plants at home. He wondered if using tomato juice can promote the growth of tomato plants from seeds. The diagram below shows how he used tomato juice to grow tomatoes. To his surprise, no seed germinated after three days.



Answers written in the margin will not be marked.

He hypothesized that the fruit wall of tomato contains certain substances that inhibit seed germination. He then carried out an experiment at the school to test his hypothesis. The main steps involved are shown below.

Step 1	Seeds were collected from four tomatoes.
Step 2	The seeds were washed thoroughly with distilled water and then blotted dry.
Step 3	The tomatoes were cut into small pieces, put into a mortar and ground using a pestle. Extract of tomato fruit wall was obtained after filtering the ground materials using a filter paper.
Step 4	10 tomato seeds were selected randomly and placed on cotton wool soaked with extract of tomato fruit wall.
Step 5	The seeds were provided with the conditions necessary for germination.
Step 6	The percentage of seeds germinated after three days was calculated.

(a) Explain why it is important to wash the seeds thoroughly (step 2) before placing them on cotton wool. (1 mark)

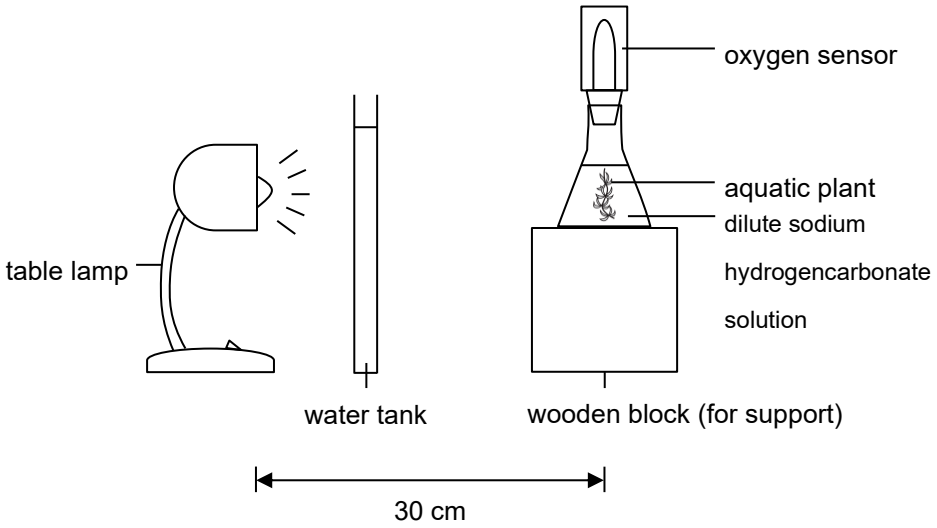
(b) Describe ***one*** condition that should be provided to the seeds in step 5 and its significance to seed germination. (1 mark)

(c) The student forgot to include a control. If you were him, how would you set up a suitable control for this experiment? Explain your answer. (3 marks)

(d) Suggest ***one*** possible advantage of delaying seed germination by the fruit wall to tomato plants. (1 mark)

Answers written in the margin will not be marked.

7. Jason carried out an investigation to study the effect of carbon dioxide concentration on the rate of photosynthesis of an aquatic plant. The set-up he used is shown in the diagram below.



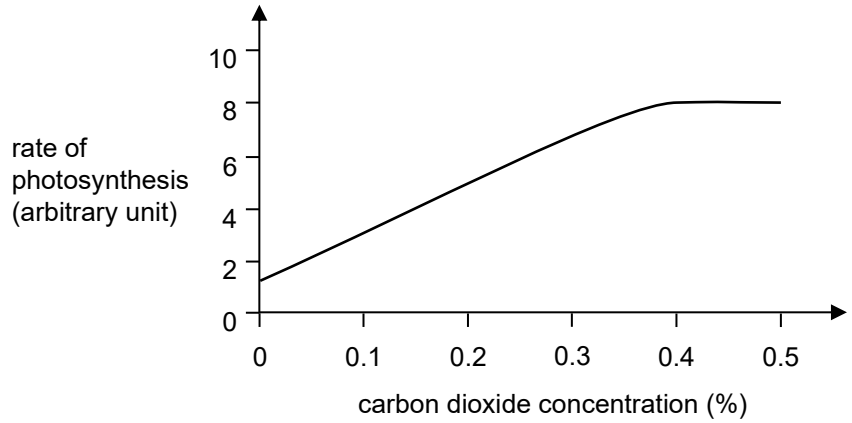
(a) Explain why placing a water tank between the table lamp and the conical flask is important for making the investigation a fair test. (2 marks)

(b) Describe how the independent variable of this investigation was manipulated. (1 mark)

(c) Each time Jason had manipulated the independent variable, he waited for five minutes before starting to record the readings of the oxygen sensor. Explain why. (1 mark)

Answers written in the margin will not be marked.

(d) The graph below shows the results obtained by Jason.



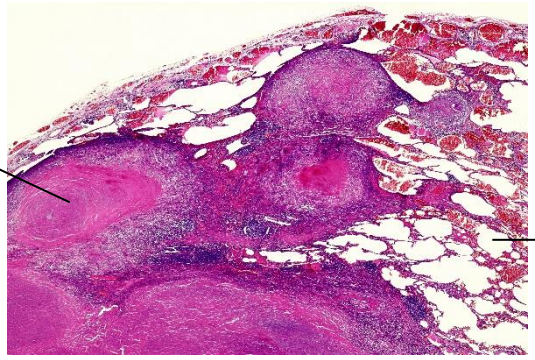
Based on your knowledge on the reactions of photosynthesis, describe and explain the change in the rate of photosynthesis when carbon dioxide concentration increased from 0% to 0.5%. (4 marks)

Answers written in the margin will not be marked.

8. Tuberculosis (TB) is an infectious disease caused by the bacterium *Mycobacterium tuberculosis*.

(a) The bacterium *M. tuberculosis* can cause TB only if it reaches the air sacs of the lungs. Describe how the defence mechanism of our body prevents this from occurring. (2 marks)

The photomicrograph below shows a section of the lung of a person suffering from TB.



(b) With reference to the photomicrograph, explain why TB patients usually experience shortness of breath. (2 marks)

(c) Another common symptom of TB is coughing up blood. Explain why TB patients usually have blood in their sputum. (1 mark)

Answers written in the margin will not be marked.

(d) Treating TB is becoming more and more challenging as *M. tuberculosis* has developed resistance to an increasing number of antibiotics. For patients with active TB, multiple antibiotics are often prescribed for at least six months.

(i) Explain why multiple antibiotics are used in the treatment. (1 mark)

(ii) What reminders should be given to patients who are undergoing the antibiotic treatment of TB so that the antibiotics currently in use can remain effective in treating TB for a longer time? Give ***two*** examples. (2 marks)

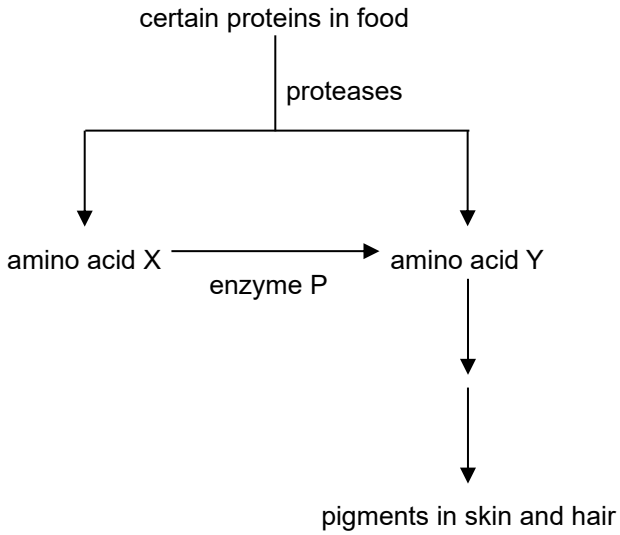
(e) Suggest ***one*** measure that individual citizens and the government can take to help prevent the spread of TB respectively.

(i) Individual citizens (1 mark)

(ii) Government (1 mark)

Answers written in the margin will not be marked.

9. The diagram below shows part of the metabolic pathways involving two amino acids, X and Y, in the human body. Amino acid Y is important for the synthesis of pigments in the skin and hair.



People suffering from a certain genetic disease cannot produce functional enzyme P. It is known that the inheritance of this disease is controlled by a pair of alleles. The disease can be diagnosed by measuring the levels of amino acids X and Y in blood. The table below shows the normal range of the ratio between the two amino acids and the typical range in patients with this genetic disease.

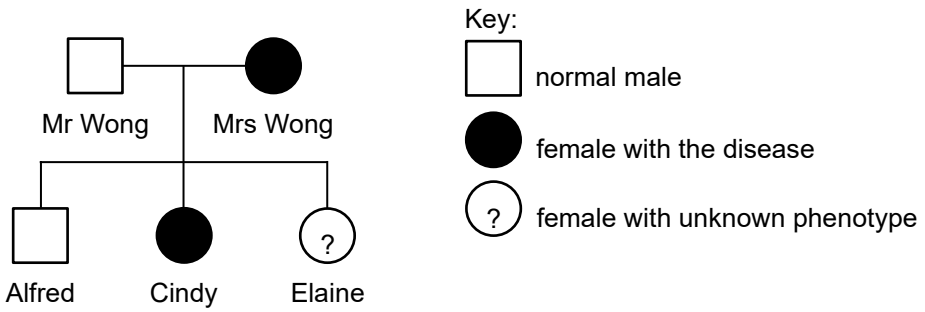
	Normal range	**Typical range in patients with the genetic disease**
Ratio of amino acid X to amino acid Y in blood	0.5–2.0	>2.6

(a) Explain the difference in the ratio of amino acid X to amino acid Y in blood between patients with the genetic disease and healthy people. (4 marks)

Answers written in the margin will not be marked.

(b) Explain why most patients with the genetic disease have lighter skin tone and hair colour than healthy people. (2 marks)

(c) The pedigree below shows the inheritance of the genetic disease in a family. It is known that the disease is caused by a recessive allele.



(i) Deduce the genotype of Mr Wong. Explain your deduction. (4 marks)
(Marks will ***not*** be awarded for genetic diagrams.)

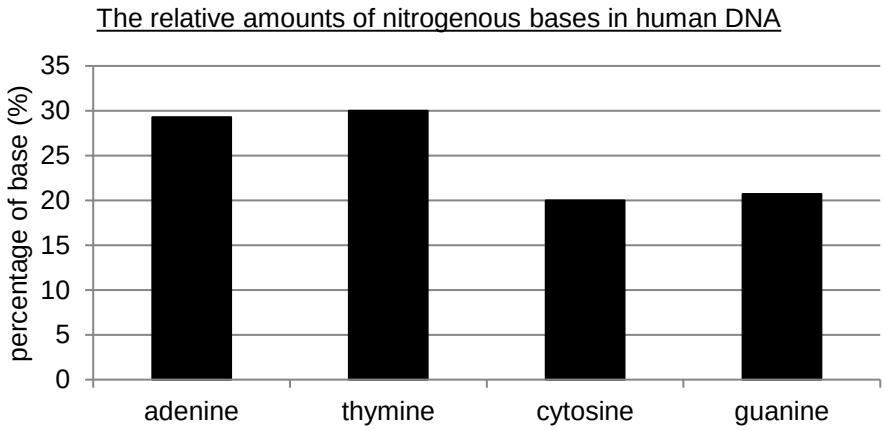
(ii) Mrs Wong has just given birth to Elaine. The couple thinks that the probability of Elaine being normal is 50% as one out of two of their children is normal. Do you agree with them? Explain your answer. (2 marks)

Answers written in the margin will not be marked.

10. The table below lists some major breakthroughs in the discovery of DNA structure and function.

Time	Scientist	Major breakthrough
1912–13	William Henry Bragg and William Lawrence Bragg	They determined the structure of crystals using X-ray, paving way for the development of X-ray crystallography.
1929	Phoebus Levene	He identified the components of DNA molecule: deoxyribose, phosphate group and the four nitrogenous bases.
1949	Erwin Chargaff	He analyzed the relative amount of nitrogenous bases in different organisms.
1953	Rosalind Franklin and Maurice Wilkins	They revealed the helical structure of DNA using X-ray crystallography.
	James Watson and Francis Crick	They worked out the three-dimensional model of DNA structure.
1958	Matthew Meselson and Franklin Stahl	They provided evidence for the semi-conservative model of DNA replication.

The graph below shows the results of Chargaff's analysis on human DNA.



(a) With reference to the results of Chargaff's analysis, what can you conclude about the ratio of the four nitrogenous bases in human DNA? (1 mark)

(b) Explain how Chargaff's discovery lay the groundwork for Watson and Crick to work out the model of DNA structure. (2 marks)

Answers written in the margin will not be marked.

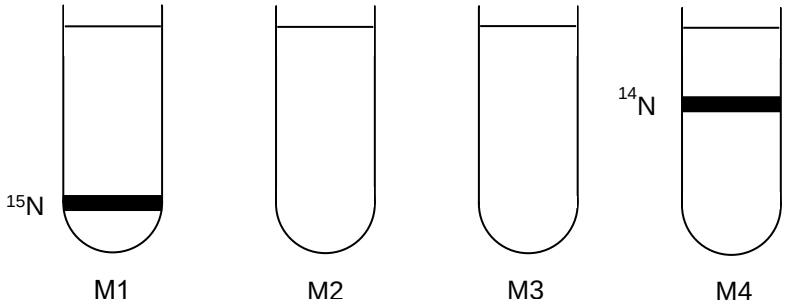
(c) In 1958, Matthew Meselson and Franklin Stahl carried out an experiment to investigate the mechanism of DNA replication. They cultured bacteria in a medium (M1) containing only ^{15}N, a heavy isotope of nitrogen. The bacteria use the nitrogen to form nucleotides.

After many generations, a small portion of the bacteria was transferred into a medium (M2) containing only ^{14}N, the 'normal' isotope of nitrogen which is lighter.

A small portion of bacteria in M2 was then removed to another medium (M3) containing only ^{14}N.

They also cultured bacteria in ^{14}N medium (M4) for a long time for comparison. The diagram below shows the positions of DNA samples extracted from M1 and M4 bacterial cultures, separated by a density gradient.

(i) Complete the diagram by drawing the position(s) of the bacterial DNA samples extracted from M2 and M3 bacterial cultures. (2 marks)



(ii) Explain the position(s) of bacterial DNA sample from M3 bacterial culture as shown in your answer to **c**. (3 marks)

(d) The table below shows two aspects of nature of science. Elaborate on how it is demonstrated by the discovery of DNA structure. (2 marks)

Nature of Science	Elaboration
Scientists build on the work of other scientists.	
Science is affected by the technology and the types of equipment available at the time.	

Answers written in the margin will not be marked.

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

11. A transport system is important to both plants and humans.

Contrast the structure and components of the transport systems of flowering plants and humans, also, compare the mechanisms for producing the driving force respectively. (11 marks)

Answers written in the margin will not be marked.

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END OF SECTION B

END OF PAPER I