2021-DSE
BIO
PAPER 1B

B

Queen's College

Mock Examination 2020 – 2021

Biology Paper 1

SECTION B: Question-Answer Book B

This paper must be answered in English.

Maximum mark: 84

INSTRUCTIONS FOR SECTION B

(1) After the announcement of the start of the examination, you should first write your Block, Class, Class number in the spaces provided on the right.

(2) Refer to the general instructions on the cover of the Question Paper for Section A.

(3) Answer **ALL** questions.

(4) Write your answers to Section B 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 block, class, class number and question number on each sheet and hand in together with this Question-Answer Book.

(6) Present your answers in paragraphs wherever appropriate.

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

(8) No extra time will be given to candidates for filling in any information after the 'Time is up' announcement.

Block	
Class	
Class number	

	Teacher's use only
Section A	/36
Question no.	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Section B	/84
Total	

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SECTION B

Answer **ALL** questions. Write your answer in the spaces provided.

1. (a) Complete the table below which shows some information about pathogens that cause diseases. (4 marks)

Name of pathogen	**Type of pathogen**	**Disease caused**	**How pathogen enters body**
Mycobacterium	Bacteria	Tuberculosis	
		AIDS	By having unprotected sex with an infected partner
Salmonella		Food poisoning	
Plasmodium		Malaria	

(b) Explain why a person is more likely to develop *Salmonella* food poisoning from food that has been left in a warm room for a few hours, than from food that has been refrigerated. (2 marks)

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2. Tom has blood donation every once every three months. The photograph below shows the process of blood donation.

(a) (i) From which type of blood vessels should the blood be withdrawn during blood donation? (1 mark)

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(ii) Give ***one*** advantage of withdrawing blood from the blood vessel you answered in (a)(i). (1 mark)

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(b) The nurse asks Tom to squeeze the rubber ball occasionally as shown in the photograph during blood donation. Explain why he needs to do. (2 marks)

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Answers written in the margins will not be marked.

3. The photograph below shows a male blue-footed booby, *Sula nebouxii*, a marine bird nesting on the Galápagos Islands:

(a) From the photograph, explain ***one*** external feature of this male blue-footed booby which helps it find its mate reproducing offspring. (2 marks)

(b) The major food source of blue-footed booby is oily fish. Explain briefly why prolonged consumption of bird feed will lead to the disappearance of the feature you answered in (a). (2 marks)

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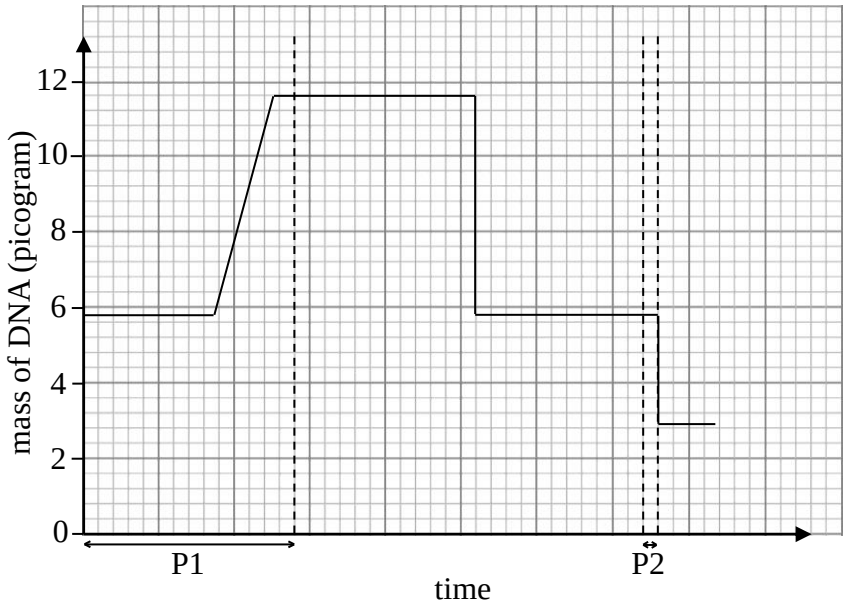
4. The photograph below shows a Rainbow Trout, the wild type has a diploid number of chromosomes (2n):

The graph below shows the changes in the mass of DNA in one of their cells undergoing meiotic cell division:



(a) Give ***one*** piece of evidence from the graph to show that the cell is undergoing meiotic cell division. (1 mark)

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(b) Why does the mass of DNA

(i) increases towards the end of P1? (1 mark)

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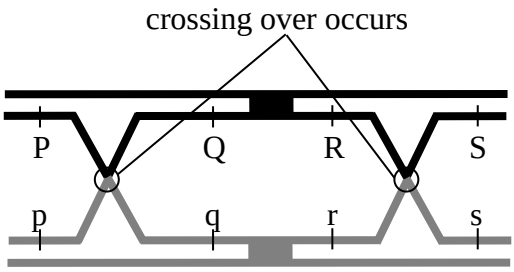
(ii) decreases at the end of P2? (1 mark)

The diagram below shows a pair of homologous chromosomes taken from the cell of a Rainbow Trout. The letters show the positions of the alleles of four genes on the chromosomes. Crossing over occurs as indicated:



(c) (i) At this time, what is the mass of DNA present in the cell? (1 mark)

(ii) List all the new combinations of alleles resulted from the crossing over. (2 marks)

(d) Unlike the wild type Rainbow Trout, some Rainbow Trout used in fish farming are triploid (3n). Explain why Rainbow Trout which are triploid are infertile. (3 marks)

Answers written in the margins will not be marked.

5. The table below shows the major events in the history of the treatment for diabetes mellitus:

Year	Events
1869	Paul Langerhans found clusters of cells with an unknown function within the pancreatic tissues when observing a pancreas under a light microscope. These cell clusters were later named islets of Langerhans, which were found to be responsible for blood glucose regulation.
1889	Oskar Minkowski and Joseph von Mering conducted experiments to show that if the pancreas is removed surgically from a dog, it will develop diabetes.
1921	Banting and Best first removed the pancreas from a dog (dog A) to make it diabetic. They then tied off the pancreatic duct of another dog (dog B). The pancreas of dog B soon partially degenerated, but the dog did not develop diabetes. They removed the pancreas and prepared an extract. The extract was injected into dog A, which then became healthy for some time.
1922	Banting and Best tested the pancreas extract on themselves. They felt dizzy and weak after the injection.

(a) In Banting and Best's experiment, tying off the pancreatic duct led to the partial degeneration of the pancreas of dog B. Explain how this would happen. (3 marks)

(b) Suggest why Banting and Best felt dizzy after they had the injection of the pancreas extract. (4 marks)

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(c) The history of the treatment for diabetes mellitus demonstrates ***two*** aspects on the nature of science. Complete the following table to show your understanding about the nature of science based on this history. (2 marks)

Nature of science	Elaboration
Science is affected by the technology and the types of equipment available at the time.	
	Banting and Best knew that the removal of pancreas from a dog can make it diabetic.

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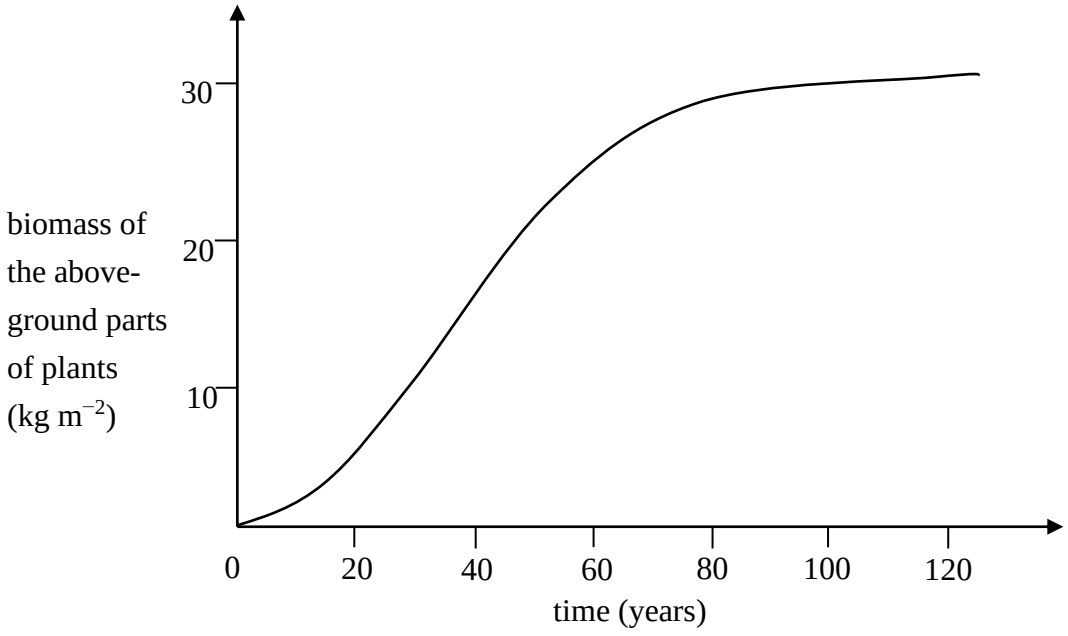
6. The photograph below shows the glacier retreat in a European mountain. An ecological succession occurs in this region and the vegetation changes with time:

The graph below shows how the biomass of plants in an area formed by glacial retreat in Europe changed with time in the succession to woodland:



(a) Identify the type of ecological succession that occurred. Give a reason to your answer.

(2 marks)

(b) In the first 20 years, herbaceous plants and some shrubs made up the vegetation of the area.

(i) Briefly describe how the data present in the graph above can be determined in the first 20 years. (2 marks)

(ii) Using your knowledge on ecological succession, explain the difference in the rate of increase in plant biomass during the first 20 years and after 100 years. (3 marks)

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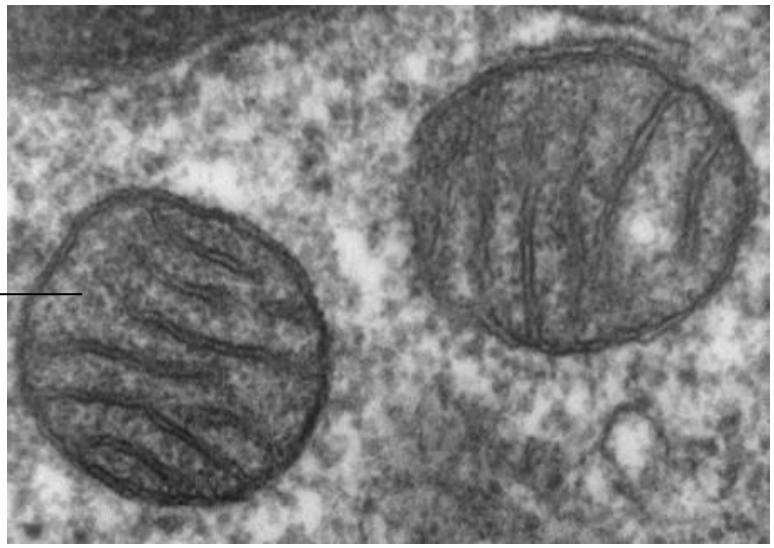
7. The electron micrograph below shows two mitochondria in a mammalian cell:



(a) Name part X in the mitochondria. (1 mark)

(b) An experiment was carried out to study the ATP production in mitochondria. Phosphate, ADP and pyruvate were added to the mitochondria isolated from mammalian cells. Then the mixture was bubbled with oxygen and maintained at 37 ^{o}C for 30 minutes.

(i) Explain why pyruvate but not glucose was used as the respiratory substrate in the experiment. (2 marks)

(ii) Explain why there would be a significant reduction in the amount of ATP produced if oxygen were not bubbled through the mixture. (3 marks)

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(c) In certain diseases, some mitochondria in cells cannot function normally. People with these diseases are unable to exercise for a long period of time. Account for this phenomenon.

(2 marks)

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8. (a) DRD4 is a dopamine receptor in humans. The DRD4 receptor gene has a large number of alleles, of which a single individual can only have two.

(i) Explain why one individual can only have two of the different alleles of the DRD4 gene. (1 mark)

(ii) Name a technique that would reveal differences in the lengths of the different forms of the DRD4 receptor gene. (1 mark)

(b) Three alleles of DRD4 have the following alterations:

- a single base-pair substitution
- a 21 base-pair deletion
- a 13 base-pair deletion

Suggest which of the three mutations will have the most serious consequences for the structure of the protein receptor. Give a reason for your choice. (3 marks)

Answers written in the margins will not be marked.

(c) One allele of DRD4 has been found more frequently amongst individuals whose personality is described as 'novelty-seeking' and whose behaviour tends to be exploratory and impulsive.

Suggest how this particular allele of the DRD4 receptor could have become common in the human population. (4 marks)

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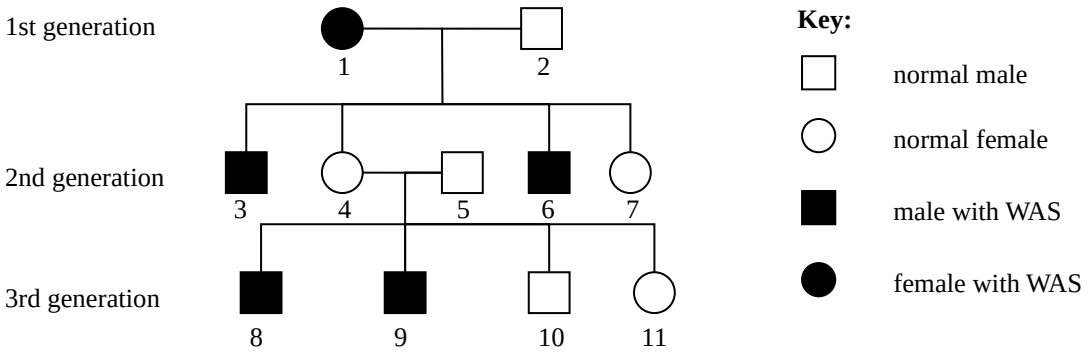
9. Wiskott–Aldrich syndrome (WAS) is a rare sex-linked inheritable disease characterised by low blood platelet count and immune deficiency. The pedigree below shows the inheritance of the disease in a family of three subsequent generations:



(a) Without using genetic diagrams, explain why the Wiskott–Aldrich syndrome (WAS) must be carried by a recessive allele on the X chromosome. (4 marks)

Answers written in the margins will not be marked.

(b) If individual 11 marries a normal male, what is the probability of their child inherited with WAS? Draw genetic diagram(s) to explain your answer. (4 marks)

(c) Individual 3 would like to marry his cousin. However, their marriage is opposed by his parents, who claims that it is at high risk for their offspring to suffer from WAS despite the ethical concerns. Give an account to justify this claim. (1 mark)

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10. Respiratory quotient is the ratio of the volume of carbon dioxide given out to the volume of oxygen taken in by an organism in a period of time. It can be used to deduce the kind of respiration carried out, and the kind of substrates used by the organism for respiration.

(a) Some seeds were soaked in water and then transferred to soil for growth. The respiratory quotient of the seeds was found to be higher in the water than in the soil. Suggest an explanation for this phenomenon. (3 marks)

(b) (i) You are provided with the following materials and apparatus:

boiling tube, one-hole stopper, graduated glass tube, ink, potassium hydroxide solution, wire gauze, soaked germinating seeds (surface sterilized)

How would you use the materials and apparatus to assemble a set-up for measuring the volume of oxygen taken in by the soaked germinating seeds? Draw the set-up in the space below. (3 marks)

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(ii) Describe how you would use the above set-up to measure the volume of oxygen taken in by the soaked germinating seeds in three hours. (2 marks)

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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. The lung is the organ of gas exchange in humans. However, in the foetus, the placenta serves as the organ of gas exchange. Briefly describe how gases are exchanged in the placenta. Describe and explain the ways in which both placenta and the lung are adapted to the exchange of gases. (11 marks)

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