CNEC CHRISTIAN COLLEGE

MOCK EXAMINATION (2021-2022)

FORM SIX

BIOLOGY PAPER 2

Time allowed: 1 hour

This paper must be answered in English

INSTRUCTIONS

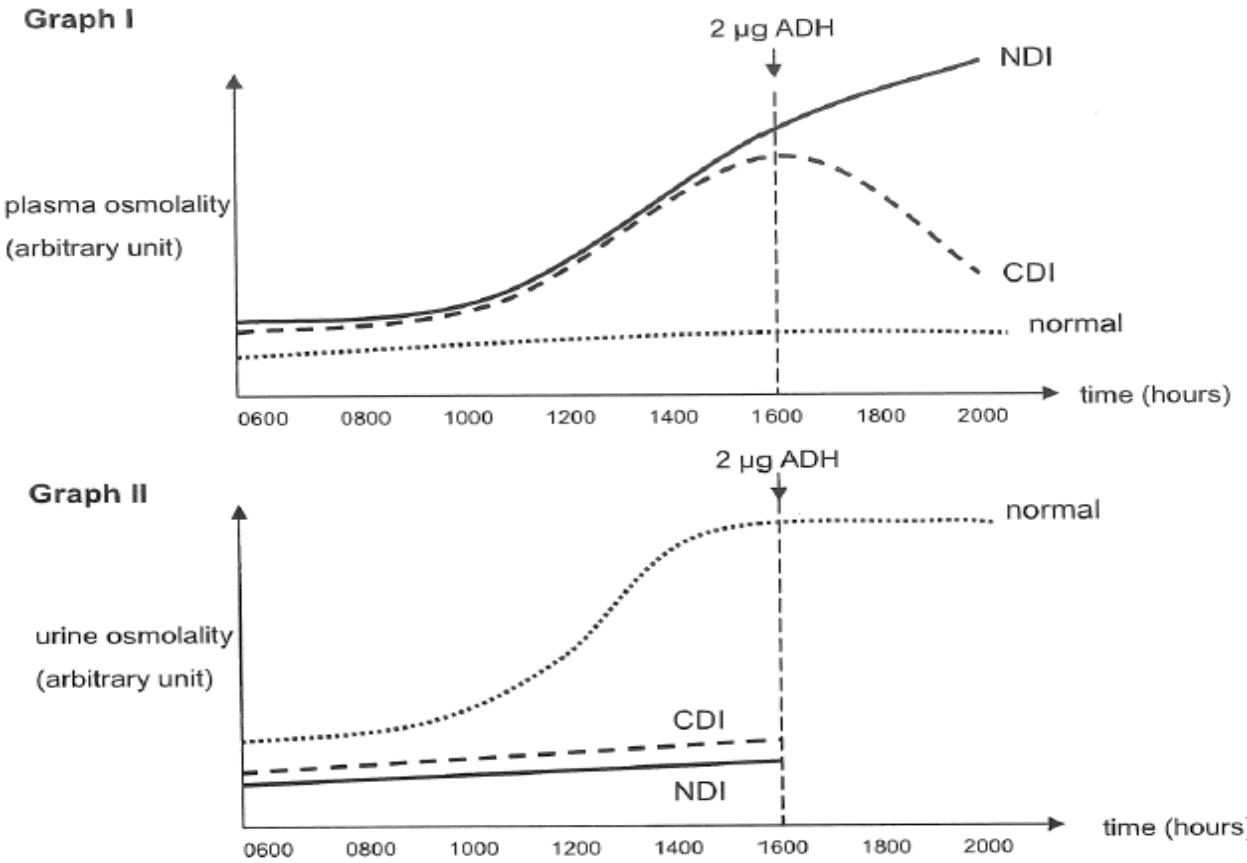
1. Write your Student Name, Class and Class Number in the spaces provided on this cover.
2. Attempt **ALL** questions.
3. Write your answers in the Answer book provided. Start each question (not part of a question) on a new page.
4. Present your answers in paragraphs wherever appropriate.
5. Illustrate your answers with diagrams wherever appropriate.
6. The diagrams in this section are NOT necessarily drawn to scale.

Student Name		Class		Class Number	

SECTION A Human Physiology

Answer **ALL** parts of the question.

1.(a) Diabetes insipidus (DI) is a condition characterized by excessive thirst and excretion of large amounts of severely diluted urine. Central diabetes insipidus (CDI) is a type of DI caused by a lack of ADH from pituitary gland. Another type of DI is called nephrogenic diabetes insipidus (NDI), in which the patients' kidneys fail to respond to ADH. Three groups of people (normal, CDI and NDI patients) participated in a water fast test, with 2μg ADH injecting at 1600. Their plasma osmolality (solute concentration) and urine osmolality were recorded:



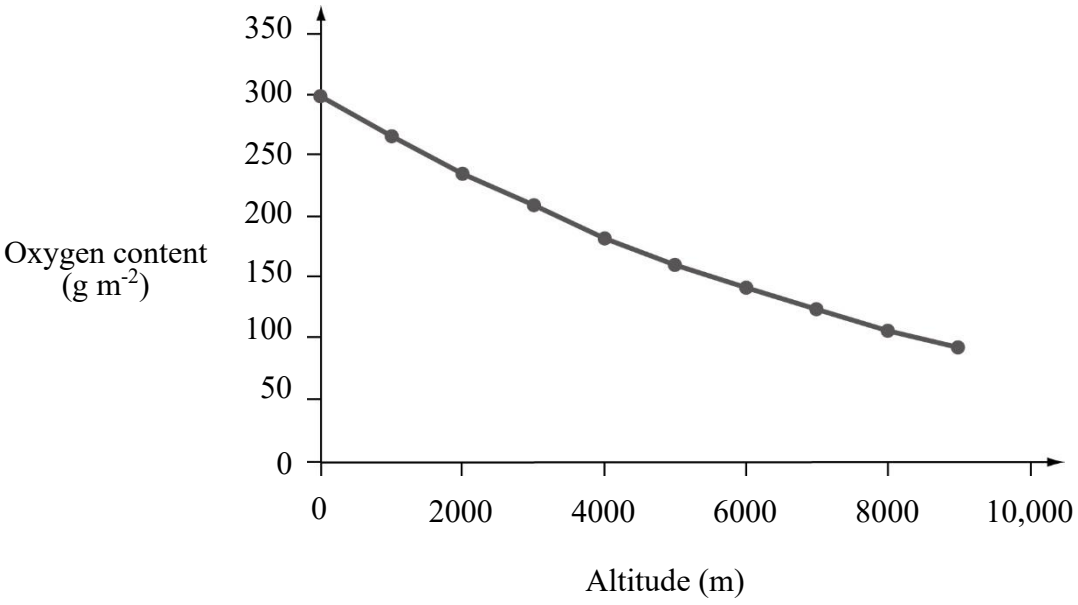
(i) (1) In view of the change in plasma osmolality, describe the change in urine osmolality of CDI and NDI patients after the injection of ADH. (2 marks)

(2) Explain the changes that you have predicted in (1). (4 marks)

(ii) Desmopressin is a synthetic peptide that can cure CDI. Desmopressin mimics the action of a hormone, which can reduce urine production. It can be treated in the form of oral tablet. State TWO features of desmopressin which enable it to enter the body and exert its effect after taking the drug orally. (2 marks)

(iii) Suggest TWO possible treatments for NDI patients. (2 marks)

1.(b) The graph below shows the oxygen content of atmospheric air at various altitudes.



(i) Briefly describe how the oxygen content of atmospheric air changes with altitude. (1 mark)

(ii) It is known that the ventilation rate of a normal person also varies with altitude.

(1) What would be the effect of an increasing altitude on the rate of ventilation? What is the significance of such change in ventilation rate? (3 marks)

(2) The chemoreceptors in carotid bodies monitor the oxygen concentration in the arterial blood. Describe how the carotid bodies set off a series of neurological events that lead to a change in ventilation rate at high altitude. (4 marks)

(3) Apart from ventilation rate, suggest another change in breathing pattern that occurs at high altitude. (1 mark)

(iii) It is known that oxygen is essential for aerobic respiration. What is the role of oxygen in aerobic respiration? (1 mark)

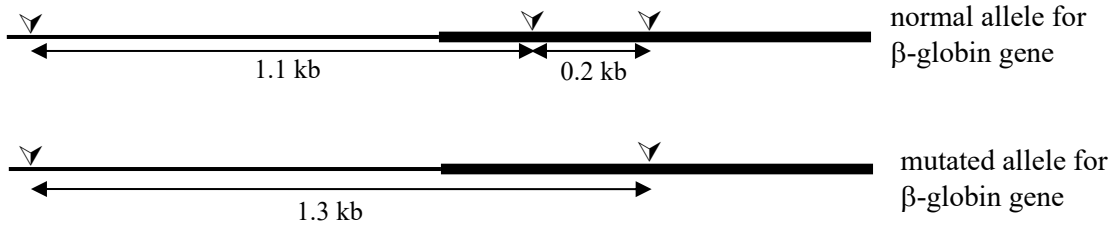
SECTION B Biotechnology

2.(a) Couples are advised to undergo genetic testing before they attempt a pregnancy to check whether they carry recessive gene mutations. This helps to predict the risk of having a child with a genetic disease.

Sickle cell anaemia is a genetic disease caused by a mutation in the gene coding for one of the polypeptides in haemoglobin, called β-globin. The mutated allele for β-globin gene is recessive. Genetic testing for sickle cell anaemia consists of several steps.

(i) Firstly, the β-globin gene in the DNA sample of the test receiver is amplified by the polymerase chain reaction (PCR). Describe how the β-globin gene can be amplified by PCR. (3 marks)

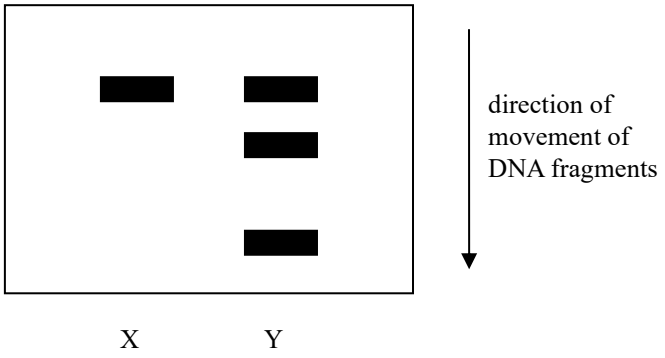
(ii) The PCR products are then treated with restriction enzyme M. The mutation of the β-globin gene removes a restriction site of M:



Key: ⩛ recognition site of restriction enzyme M

Gel electrophoresis is then carried out to separate the DNA fragments treated with restriction enzyme M.

Two women, X and Y, received the above genetic testing. The results are shown below.



(1) Deduce the genotype of X. (3 marks)

(2) Based on the result of Y, her husband is also offered a genetic testing for sickle cell anaemia. Why? (4 marks)

2.(b) Sheep can be genetically modified to produce pharmaceutical products for human use. One example of these products is human blood clotting factors. The production process starts from modifying the gene which codes for a human blood clotting factor, so that the human gene can be expressed in the mammary tissue of sheep. The modified gene is inserted into a fertilized ovum of sheep by microinjection and the fertilized ovum is allowed to develop into an embryo *in vitro*. The embryo obtained is then implanted into the uterus of a surrogate sheep. A period later the surrogate sheep may give birth to a genetically modified sheep.

(i) Explain why the above process used to produce the genetically modified sheep is considered as a sexual process. (2 marks)

(ii) Describe the steps that scientists can prepare the gene coding for a human blood clotting factor for the microinjection. (2 marks)

(iii) What are the pros and cons for inserting the gene by microinjection instead of vector? (2 marks)

(iv) In the past, human blood clotting factors were obtained from human blood. Give TWO advantages of producing human blood clotting factors from genetically modified sheep instead of the method used in the past. (2 marks)

(v) The production of genetically modified organisms is controversial concerning the environmental issues. Suggest TWO reasons why some environmentalists object the production of genetically modified organisms. (2 marks)

END OF PAPER