St. Stephen's Girls' College

Form 6 **Final Examination 2015-2016**

64 students **BIOLOGY PAPER 2** SYF. KFL

Time allowed: One hour

Form 6 ___ Class No.: ____ Name: _____

INSTRUCTIONS

1. There are TWO sections A and D in this paper. Answer ALL questions in the TWO sections.

2. Write your answers in the answer book provided. Start each question (not part of a question) on a new page.

3. Present your answers in paragraphs wherever appropriate.

4. Illustrate your answers with diagrams wherever appropriate.

5. The diagrams in this section are NOT necessarily drawn to scale.

6. Supplementary answer sheets will be provided on request. Write your class, class number and name on each sheet.

SECTION A Human Physiology: Regulation and Control

Answer **ALL** parts of this question.

1(a) Peter and Paul are healthy 20-year-old young men. They have similar height and body weight. Diagram A and B below represents one complete cardiac cycle of the two men at rest.

Diagram A

Peter

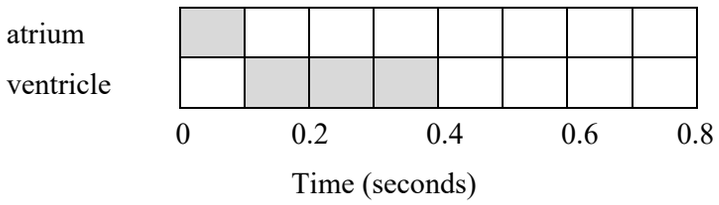
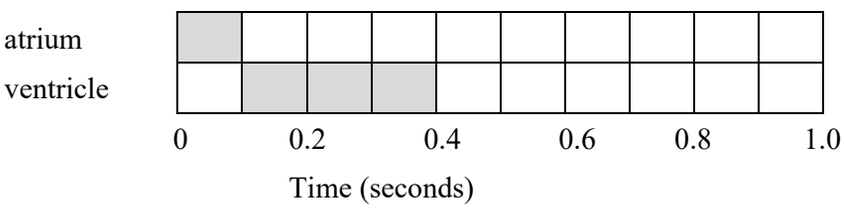


Diagram B

Paul



Key: systole diastole

(i) What is the rate of the heartbeat of Peter and Paul respectively? (1 mark)

(ii) If the volume of blood leaving the heart in one minute is 6000 mL for both of them, what is the stroke volume for Peter and Paul respectively? (2 marks)

(iii) Deduce which man is a trained runner. Explain your answer. (3 marks)

(iv) Describe how the medulla oblongata brings about an increase in cardiac output during exercise. (4 marks)

(v) During exercise, a person's rate and depth of breathing increase. Explain the importance of these changes. (2 marks)

1(b) The following table shows the water balance of an average person living in a temperate region :

Daily water gain (cm^3)		Daily water loss (cm^3)	
Drink	1 300	Urine	1500
Food	850	Expired air	400
Formation in the body by oxidation	350	Faeces	100
		Skin	500
Total amount	**2 500**		**2 500**

(i) Suggest and explain how the following figures in the column of "Daily Water Loss" in the table would change in a hot, dry climate:

(1) urine (3 marks)

(2) expired air (2 marks)

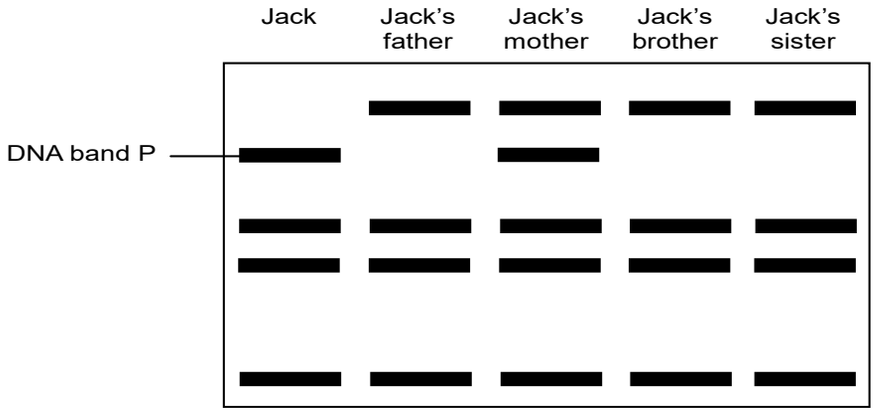
(ii) Name the hormone that brings about the change in the volume of urine form and briefly explain how it works. (3 marks)

SECTION D Biotechnology

Answer **ALL** parts of the question.

2(a) Patients with Duchenne muscular dystrophy (DMD) cannot produce the muscle protein dystrophin and thus their muscle fibres would gradually degenerate. The disease is caused by a recessive allele of the dystrophin gene located on the X chromosome.

(i). Jack is suffering from DMD. His blood sample and blood samples from the other normal members in the same family were used to produce DNA fingerprints. During the process, radioactive DNA probes and restriction enzymes which cut within the region of the dystrophin gene were used. The diagram below shows the DNA fingerprints obtained.



(1) What is the use of DNA probes? (1 mark)

(2) Explain how is the structure of DNA probes related to its use? (1 mark)

(3) Why is the probe radioactive? (1 mark)

(4) DNA band P is present in both Jack's and his mother's DNA fingerprints. Why does his mother not suffer from DMD? (2 marks)

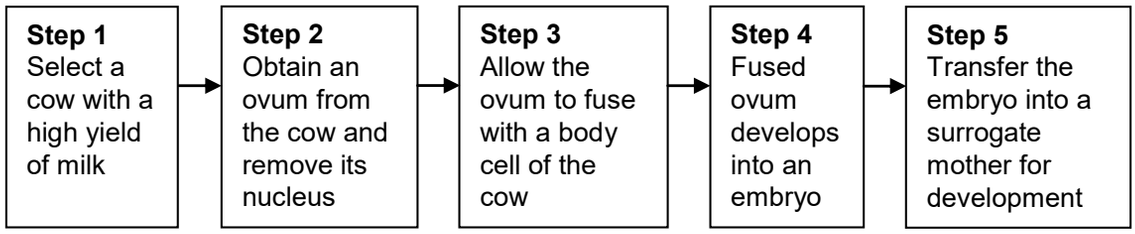
(ii) There have been investigations which explored the possibility of treating DMD using gene therapy. In one investigation, viruses containing recombinant DNA were injected into the muscle cells of mice with DMD. Some mice could produce dystrophin after receiving the gene therapy and recovered.

(1) Briefly describe how the recombinant DNA used in the gene therapy of DMD can be produced. Include the types of enzymes that are involved. (3 marks)

(2) Why were viruses used in the gene therapy? (1 mark)

(3) Why could the mice recovered still give birth to offspring with DMD? (2 marks)

2(b) The flow chart below shows a possible method to produce a calf with a high yield of milk.



(i) Explain why the calf produced using this method has a high yield of milk. (1 mark)

(ii) A body cell can be used instead of an ovum in step 2. Suggest an advantage of using an ovum. (1 mark)

(iii) Suggest how several identical calves can be produced from the embryo formed in step 4. (1 mark)

(iv) Explain why it is difficult to produce a calf with a high yield of milk by allowing an ovum of a cow with a high yield of milk to fuse with a sperm of a bull. (3 marks)

(v) How does a cloned cow differ from a genetically modified animal? (2 marks)

(vi) Some people disagree with the production of calves using this method. State ***two*** concerns these people have. (2 marks)

END OF PAPER