CANDIDATE NAME _____ **INDEX NUMBER** _____

CG _____

SERANGOON JUNIOR COLLEGE
JC2 Preliminary Examination 2016

H1 BIOLOGY
8755

Paper 2

2 Hours

Additional materials:
Writing papers

Date / Day: 13th September 2016/Tuesday

INSTRUCTIONS TO CANDIDATES
Write your name, CG and index number in the spaces at the top of this page and on all separate writing papers used.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.

Section A
Answer **all** questions.
Write your answers in spaces provided on the question paper.

Section B
Answer **only one** question out of two.
Write your answers on the separate answer paper provided.

INFORMATION FOR CANDIDATES
The intended number of marks is given in brackets [ ] at the end of each question or part question.

FOR EXAMINER'S USE	
Section A	
1	**/8**
2	**/5**
3	**/7**
4	**/7**
5	**/13**
Total	**/40**
Section B	
6 OR 7	**/20**
TOTAL	**/60**

This question paper consists of 13 printed pages

SECTION A

Answer **all** questions.

Question 1

Figure 1.1 below depicts the molecular structure of a basic unit of collagen.

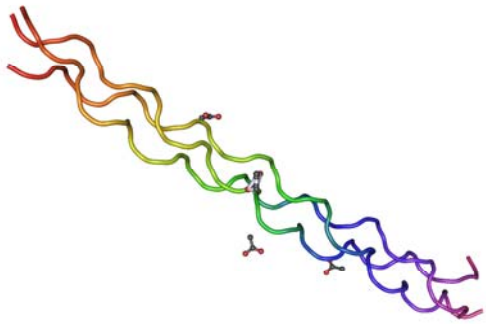

Figure 1.1

(a) State the name given to such a basic unit of collagen. [1]

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(b) Describe how the monomers of this basic unit are joined together to achieve the final molecular configuration as shown in **Figure 1.1**. [3]

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Collagen is normally found in animal connective tissue where its role is as a structural molecule. **Figure 1.2** shows an electron micrograph of collagen.

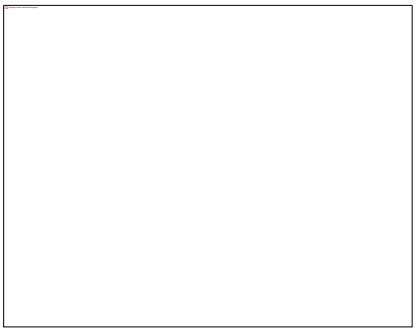

Figure 1.2

(c) Suggest why there is a banded appearance of collagen as shown in **Figure 1.2**. [1]

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Another common structural molecule found in nature is cellulose. Cellulose is the main structural molecule in plants.

(d) Compare the structures of cellulose and collagen. [3]

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[Total: 8 marks]

Question 2

The following **Figure 2.1** shows an electron micrograph of several cells.

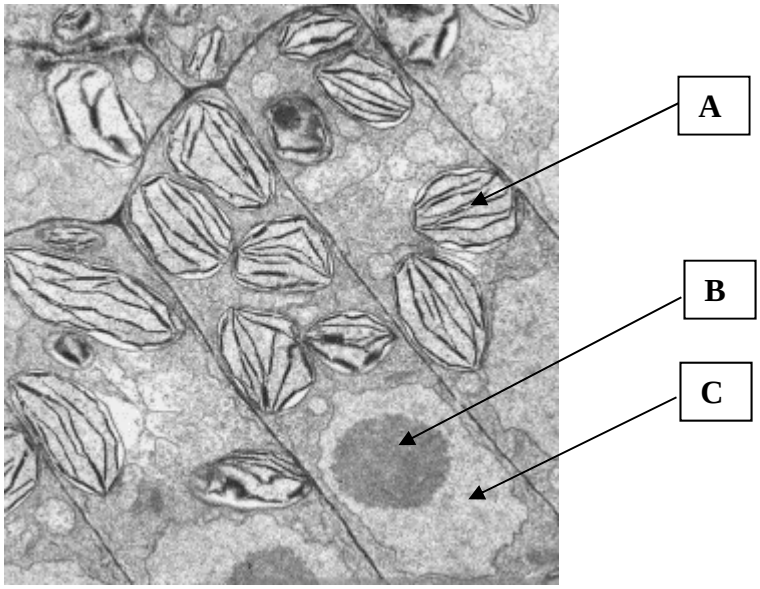

Figure 2.1

(a) Label the organelles **A and C**. [2]

A - ……..

C - ……..

(b) Discuss the role of organelle **B**. [3]

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[Total: 5 marks]

Question 3

Two recessive traits in mice are crinkly tail and soft coat. A mouse with a crinkly tail and soft coat was crossed to a true-breeding normal mouse. All the F_1 offspring were normal. The F_1 mice were then crossed to mice with crinkly tails and soft coats. The following results were obtained:

104	crinkly tail/ soft coat
102	crinkly tail/ normal coat
97	normal tail/ normal coat
99	normal tail/ soft coat

(a) Using suitable symbols, draw a genetic diagram in the space below, to show the crosses described. [4]

(b) Give a full explanation of these results. [3]

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[Total: 7 marks]

Question 4

Figure 4.1 shows a series of fossils. This series depicts how land-based amphibians could have evolved from fishes. Tiktaalik hails from the Late Devonian period, about 360 million years ago, and is both chronologically and morphologically intermediate between two other major fossils in this series, the more fish-like *Panderichthys* and the more tetrapod-like *Acanthostega*.

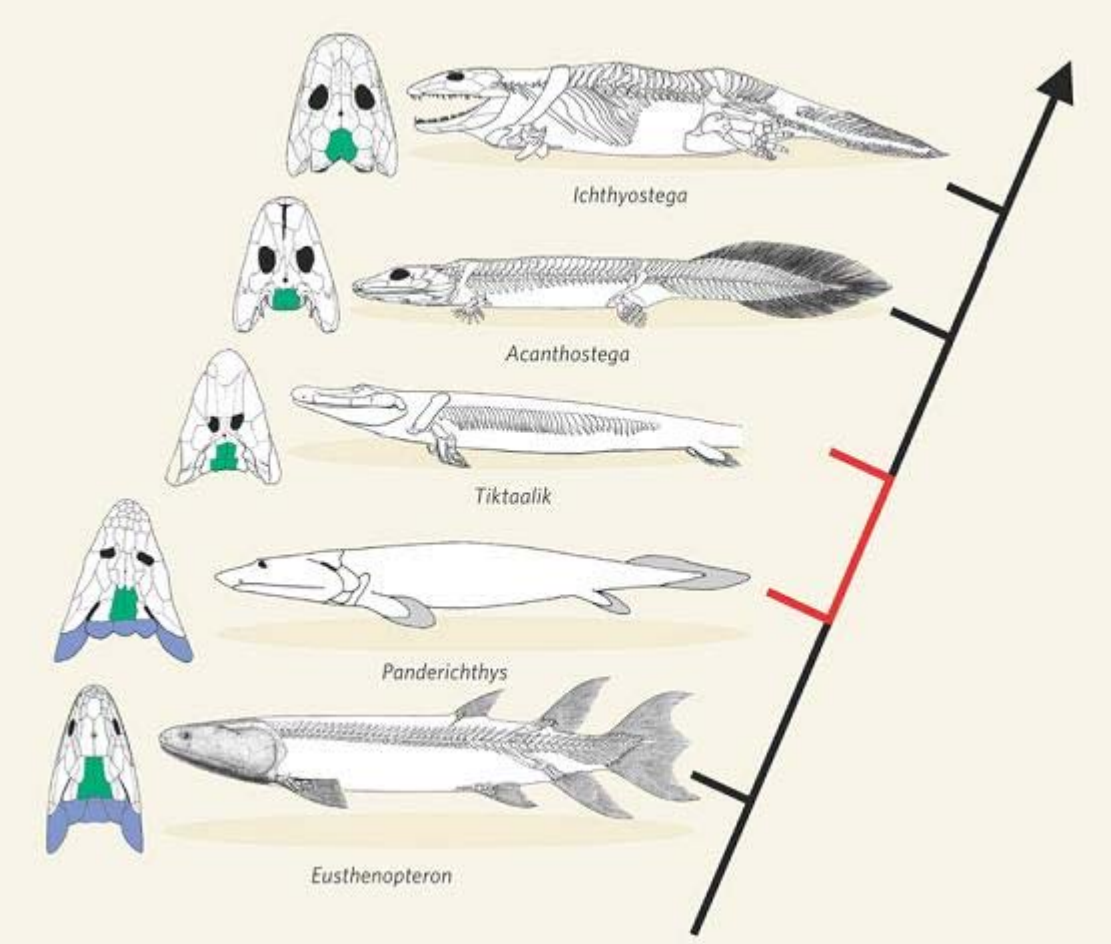

Figure 4.1

(a) Suggest how such fossil records can actually support Darwin's theory of evolution. [2]

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In most respects *Tiktaalik's* body is fish-like: it has fins and gill arches, just like a fish. However, its skull and especially its limbs mark it as a tetrapod ancestor. Species such as *Panderichthys* had true fins, similar to those of modern ray-finned fishes, consisting of an array of long, thin, spindly bones unsuitable for bearing weight. On the other side of the gap is *Acanthostega*, with true limbs – each containing a radius and an ulna, just like our arms, and outfitted with eight true toes.

(b) State the name given to similar structures such as the limbs of *Acanthostega* and *Tiktaalik*. [1]

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(c) It was believed that the environment *Tiktaalik* evolved in was filled with swampy, silty lagoons. These dirty, unclear water masses also tended to have algae covering its surface. Using this information, describe how the amphibian-like *Acanthostega* could have evolved from the species *Tiktaalik*. [4]

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Stimulus information adapted from: http://www.patheos.com/blogs/daylightatheism/2006/04/hello-beautiful/ & https://sciencenotes.wordpress.com/tag/

[Total: 7 marks]

Question 5

The location of the gene locus responsible for disease X was not discovered until 1985. Samples of DNA were obtained from a family known to have the condition. The gene locus was amplified by polymerase chain reaction and mixed with *Pst*I and *Eco*RI in two separate restriction digests. The results of gel electrophoresis followed by southern blot of both restriction digests are shown in **Figure. 5.1**.

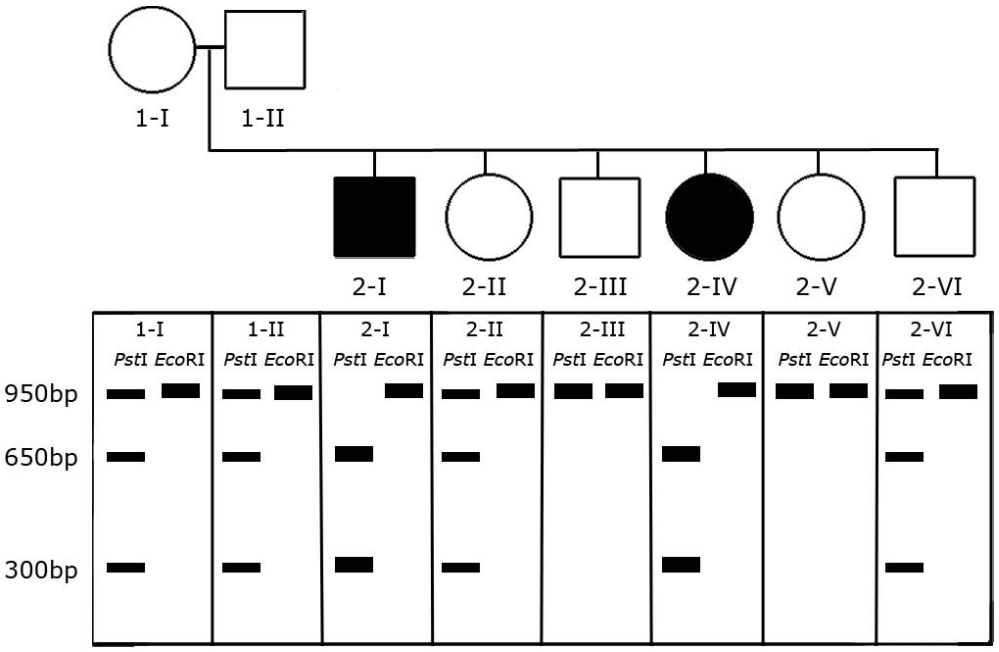

Figure. 5.1

(a) Using the information in **Figure. 5.1**,state and explain which restriction enzyme digest should be used to detect disease X. [3]

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This gene locus was amplified by polymerase chain reaction prior to gel electrophoresis and southern blot. The DNA sequence of the gene locus is shown in **Figure. 5.2**.

5' - GGATCCATCCCGATCGAAAGCTAGCTAGGATCC - 3'
3' - CCTAGGTAGGGCTAGCTTTCGATCGATCCTAGG - 5'

Figure. 5.2

(b) Design two 7-base long primers for the sequence to be amplified. [2]

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(c) Contrast between the process of PCR and DNA replication that occurs naturally in cells. [3]

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The effect of plant diseases on agriculture have recently been in the spotlight. One such disease is the ringspot virus that plagues the papaya agricultural industry. Scientists have developed effective circumventive methods to tackle the problem of the ringspot virus through genetically modifying papaya. To do this, viral genes encoding capsid proteins were transferred to the papaya genome. These viral capsid proteins elicit something similar to an "immune response" from the papaya plant. Thus, the genetically modified papaya plants were resistant to infection by the papaya ringspot virus.

Figure 5.3 below depicts the comparative infection of transgenic and non-transgenic papaya in the 1995 field trail in Kapoho, Hawaii.

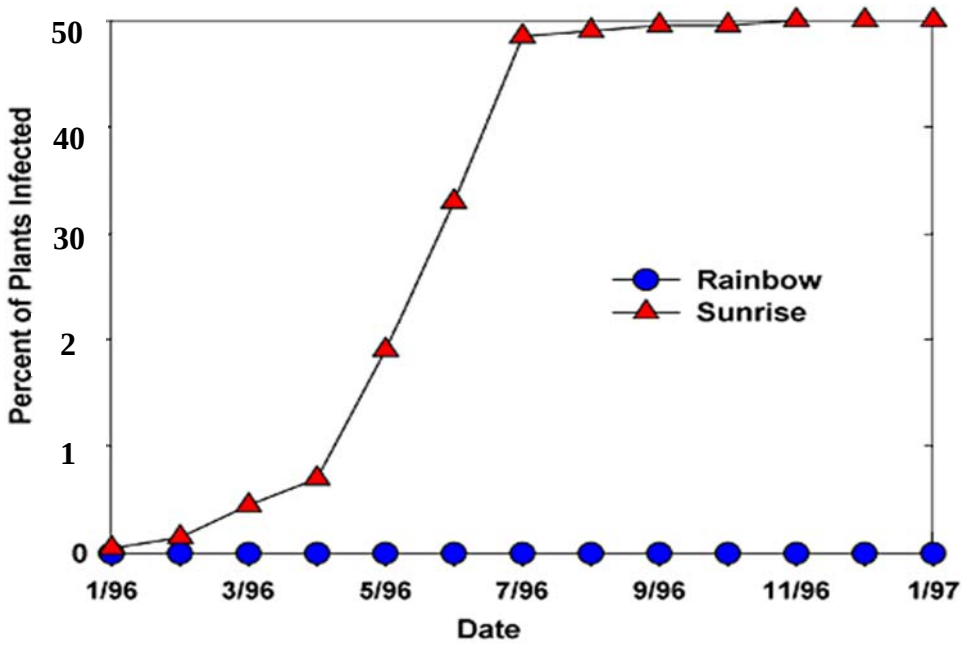

Figure 5.3

(d) With reference to **Figure 5.3**,

(i) Determine the identities of the transgenic and non-transgenic papaya species. [1]

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(ii) Evaluate and justify thoroughly the efficacy of the genetic intervention. [2]

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It was observed that three years later, the percentage of infected transgenic papaya species increased.

(e) Suggest and explain a possible reason for this phenomenon. [2]

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[Total: 13 marks]

Section B

Answer **one** question

Write your answers on the separate answer paper provided.
Your answers should be illustrated by large, clearly labeled diagrams, where appropriate.
Your answers must be in continuous prose where appropriate.
Your answers must be set out in sections (a), (b), etc as indicated in the question.

Question 6

(a) Outline the main features of the genetic code.[6]

(b) Discuss the roles of mRNA and tRNA in protein synthesis. [8]

(c) Explain the eukaryotic processing of pre-mRNA. [6]

Question 7

(a) Discuss the light dependent reactions of photosynthesis. [14]

(b) Outline the ethical and social implications of genetically modified organisms.[6]