

CANDIDATE NAME \_\_\_\_\_

INDEX NUMBER \_\_\_\_\_

CG \_\_\_\_\_



SERANGOON JUNIOR COLLEGE  
JC2 Preliminary Examination 2015

H1 BIOLOGY  
8875

<b>Paper 2</b>
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2 Hours

Additional materials:  
Writing papers

Date / Day: 21 AUG 2015 / Friday

**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	/7
2	/7
3	/8
4	/9
5	/9
Total	/40
Section B	
6 OR 7	/20
TOTAL	/60

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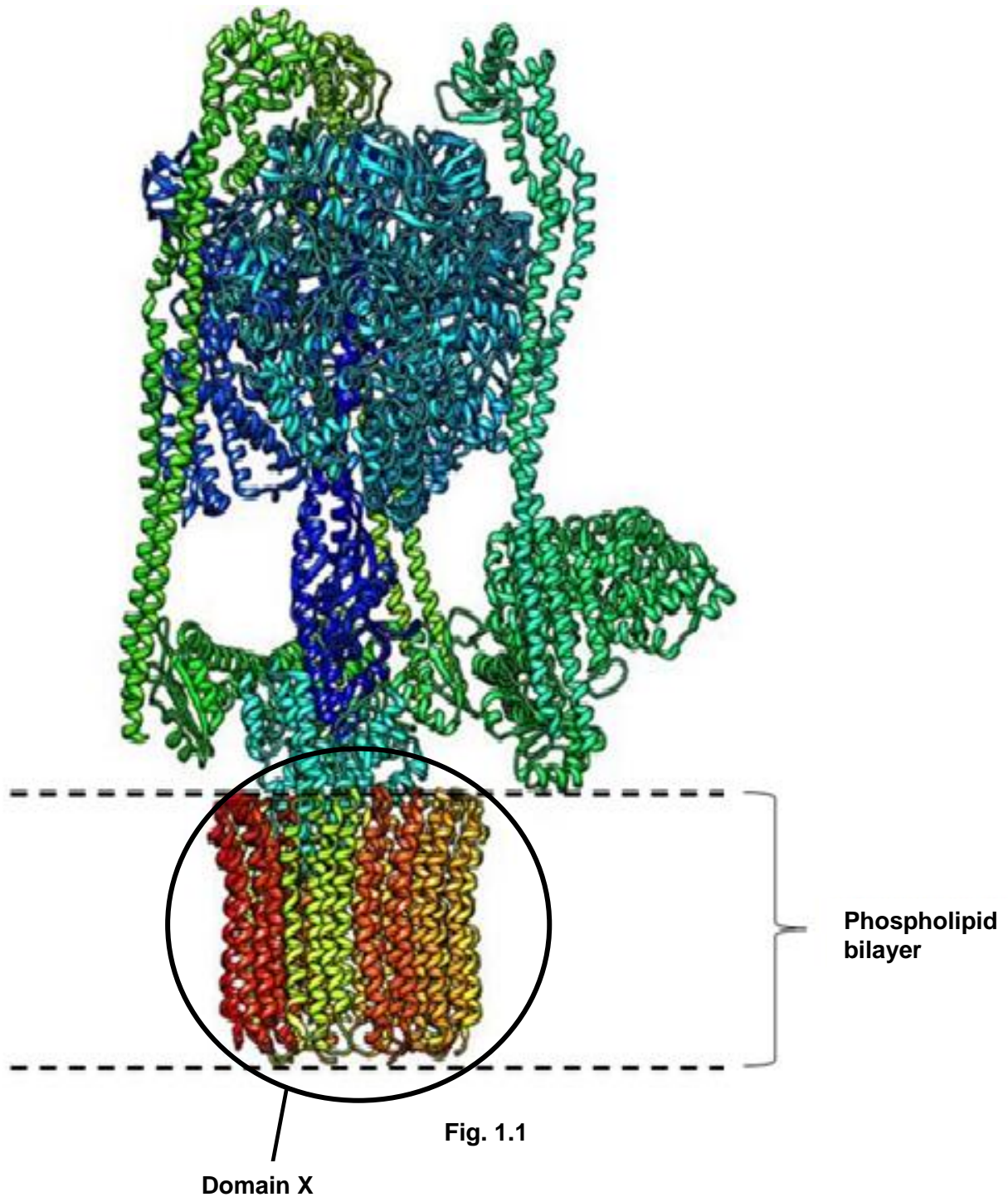
This question paper consists of 13 printed pages and 3 blank pages

## SECTION A

Answer **all** questions.

### Question 1

Transport proteins are embedded within the membranes of various organelles. **Fig. 1.1** shows the structure of one such transport protein. The protein is known to contain multiple polypeptide chains.



(a) With reference to **Fig. 1.1**, describe how the structure of Domain X is maintained. [2]

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A researcher intends to study the transport of substances carried out by the transport protein. The researcher begins by creating artificial vesicles containing only the transport protein embedded within the membrane. The artificial vesicles were then placed in 5 different solutions, each containing a different substance with a concentration of 10 arbitrary units.

The concentrations of the substances in the artificial vesicles were measured before the experiment and after 15 minutes of the experiment. The results obtained by the researcher are shown in **Table 1.2**.

<b>Solution</b>	<b>Concentration of substances in the artificial vesicles before experiment</b>	<b>Concentration of substances in the artificial vesicles after 15 minutes of the experiment</b>
1	0 AU of Na <sup>+</sup> ions	0 AUs of Na <sup>+</sup> ions
2	0 AUs of Cl <sup>-</sup> ions	0 AUs of Cl <sup>-</sup> ions
3	1 AUs of H <sup>+</sup> ions	20 AUs of H <sup>+</sup> ions
4	0 AU of protein insulin	0 AU of protein insulin
5	0 AU of amino acid glutamate	0 AUs of acidic amino acid glutamate

**Table 1.2**

(b) With reference to **Table 1.2**, explain the role of the transport protein in transporting substances across membranes. [2]

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Another Protein A is a receptor protein. However, unlike the transport protein shown in **Fig. 1.1**, it is made up of only a single polypeptide and is embedded within the cell surface membrane.

- (c) Outline the route taken by Protein A after it is synthesized by the ribosome on the rough endoplasmic reticulum. [3]

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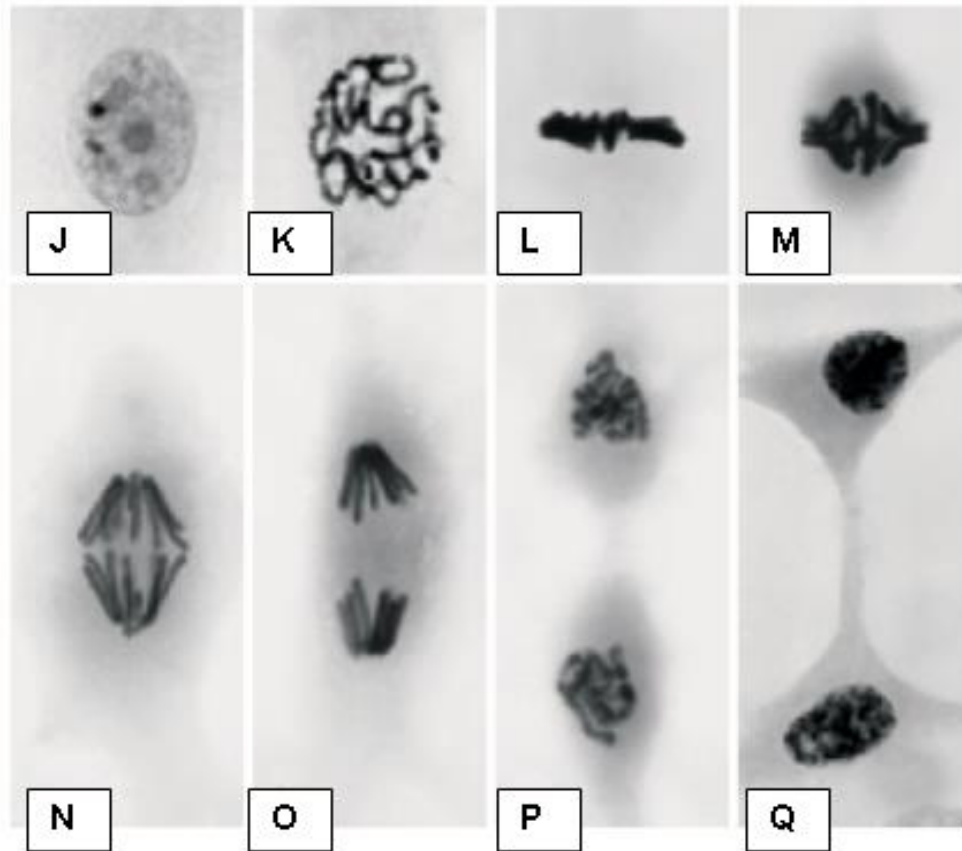
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## Question 2

**Fig. 2.1** shows cultured fibroblasts of the Indian barking deer, *Muntiacus muntjac*, undergoing different stages of the mitotic cell cycle, **J** to **Q**.



**Fig. 2.1**

**(a)** With reference to **Fig. 2.1**, identify stages **K** and **Q**. [1]

**K:** ..... **Q:** .....

**(b)** Describe the events that occur in stage **P**. [2]

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(c) Outline the role of centromeres.

[1]

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(d) Fig. 2.2 shows changes in DNA content at different stages of the animal life cycle.

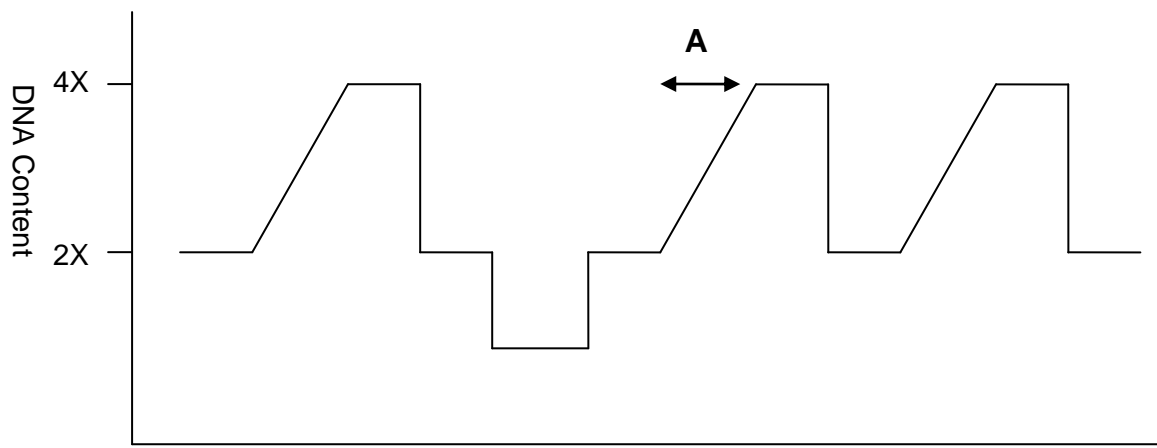


Fig. 2.2

With reference to Fig. 2.2,

(i) identify and describe Stage A.

[2]

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(ii) state the significance of Stage A.

[1]

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[Total: 7]

### Question 3

- (a) Describe how transcription differs from translation in protein synthesis. [2]

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- (b) Fig. 3.1 represents a polyribosome with several translation sites.

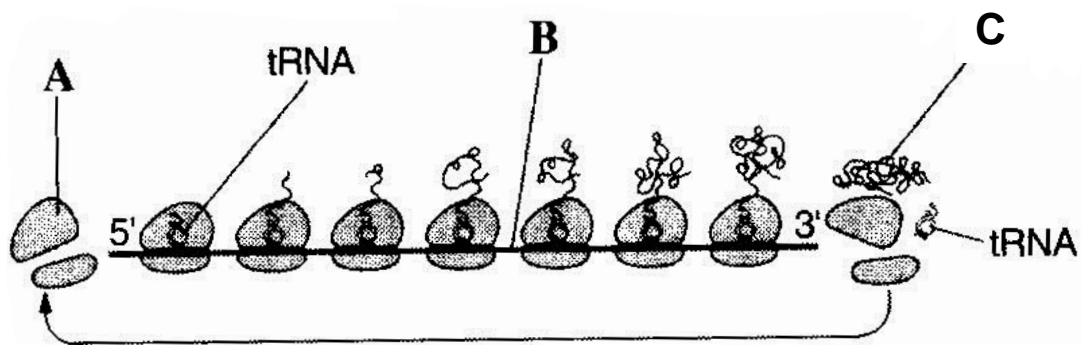


Fig. 3.1

- (i) Name the structures labelled A to C. [3]

A : .....

B : .....

C : .....

- (ii) State **two** molecules, in addition to the molecules shown in Fig. 3.1, which are required to complete translation. [1]

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(iii) Describe **two** structural features which adapt tRNA to its role in translation. [2]

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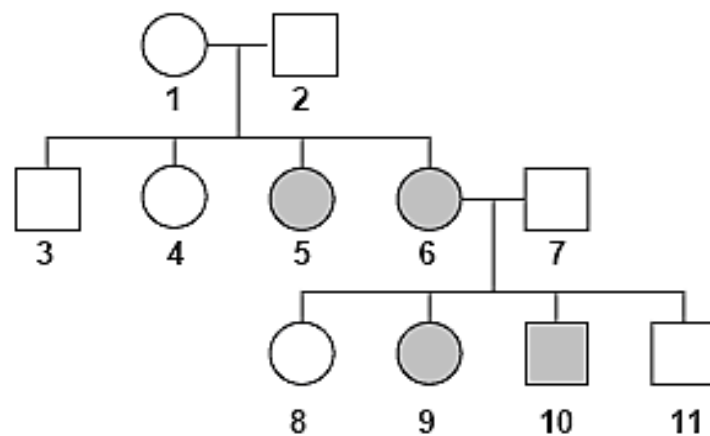
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#### Question 4

The inheritance of a genetic skin disorder in a family is shown in **Fig. 4.1**.



**Fig. 4.1**

(a) With reference to **Fig. 4.1**, state the mode of inheritance of this disease. [1]

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The blood groups of several individuals are listed below:

- Individual **1** – blood group O
- Individual **5** – blood group B
- Individual **6** - blood group A
- Individual **7** - blood group AB

- (b)** Using a genetic diagram, illustrate the probability that individuals **6** and **7** will have a child with blood group A, who suffers from the skin disorder. [3]

Two populations of a species X living in the wild were studied. One population was found to occupy the lowlands while the other population was found to occupy the highlands. While the organisms in the two populations were very similar, some phenotypic differences were observed to be present.

- (c)** Explain the presence of phenotypic differences between the organisms in the two populations. [3]

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A related species Y was discovered. To determine if species X and Y are related, an investigator studied DNA sequences which codes for an important protein that performs the same function in both X and Y.

Sequence D (from species X) and Sequence E (from species Y) were identical except at two points.

- (d)** Explain how Sequences D and E provide evidence to support the theory of evolution. [2]

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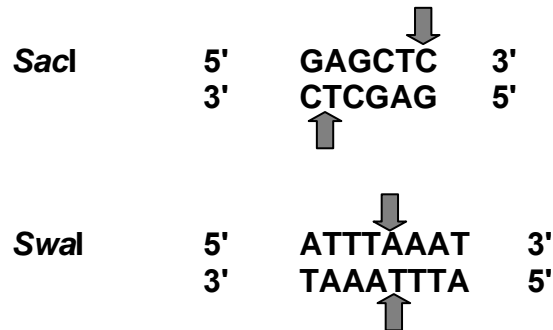
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### Question 5

**Fig. 5.1** shows the restriction sites of two different restriction enzymes. The cleavage sites are shown by means of arrows.



**Fig. 5.1**

- (a) With reference to **Fig. 5.1**, explain which restriction enzyme is more suitable for use in genetic engineering. [3]

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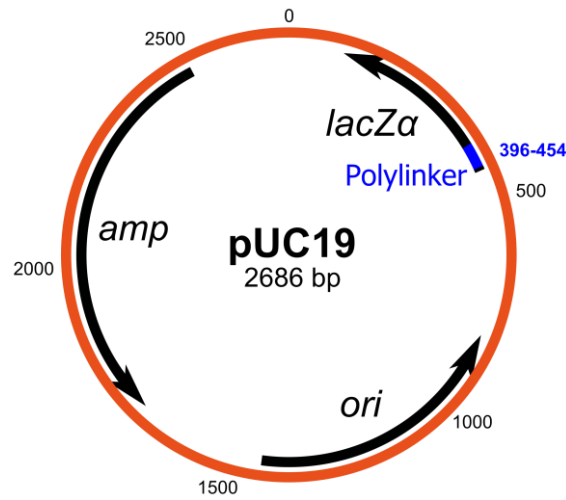
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**Fig. 5.2** shows pUC19, which is a plasmid that is commonly used in genetic engineering.



**Fig. 5.2**

- (b) With reference to **Fig. 5.2**, explain the main features of pUC19 that allows them to be used as DNA cloning vector. [2]

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An anti-thrombin gene was inserted into pUC19. The recombinant plasmid was introduced into *E. coli*.

- (c) Explain how the cells which contain the recombinant plasmids are identified. [3]

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- (d) After the cell containing recombinant plasmid was identified, there was no functional anti-thrombin produced . Suggest how this might have happened. [1]

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[Total: 9]

## 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) Compare glycogen and collagen [5]
- (b) Explain the advantages and limitations of the polymerase chain reaction. [6]
- (c) Using named examples, explain the significance of genetic engineering in solving the demand for food in the world and discuss the ethical implications of genetically modified organisms. [9]

### Question 7

- (a) Outline the main features of oxidative phosphorylation and contrast this with photophosphorylation. [9]
- (b) Compare the Krebs cycle and the Calvin cycle. [5]
- (c) Explain how gel electrophoresis is used to analyse DNA. [6]

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