

INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
in preparation for General Certificate of Education Advanced Level
Higher 1

CANDIDATE
NAME

CLASS

INDEX NUMBER

BIOLOGY

8875/02

Paper 2

29 August 2017

2 hours

Additional Materials: Answer Paper
Cover Page

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.

Section A

Answer **all** questions.

Section B

Answer **one** question.

The use of an approved scientific calculator is expected, where appropriate. You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.

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

For Examiner's Use	
Section A	
1	14
2	14
3	12
Section B	
4 OR 5	20
Total	60

This document consists of **11** printed pages and **1** blank page.



Section AAnswer **all** questions.

- 1 (a) Describe the importance of ATP in cells, giving **two** examples of processes in which it is used.

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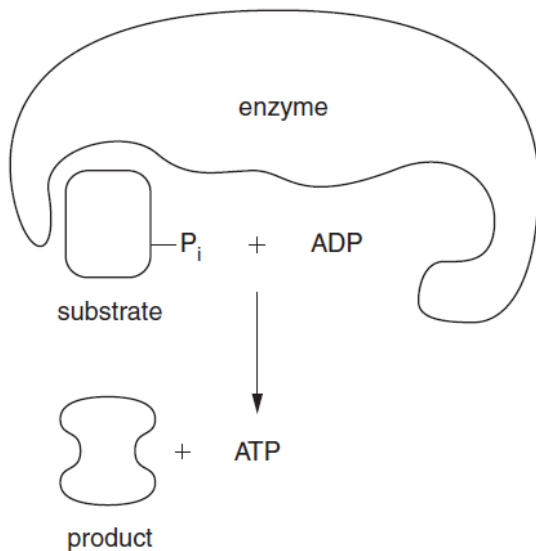
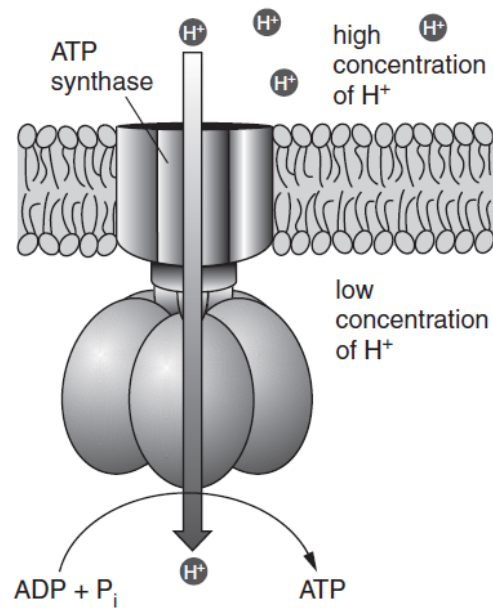
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..... [3]

Cells generate ATP by adding a phosphate group (P_i) to ADP. During the complete oxidation of glucose, cells have two ways of doing this:

- Substrate level phosphorylation
- Oxidative phosphorylation

Fig 1.1 and 1.2 are diagrams that show the main details of these two processes (not drawn to the same scale).

**Fig. 1.1****Fig. 1.2**

- (b) State precisely where these two processes occur in a cell.

substrate level phosphorylation;

oxidative phosphorylation.

..... [2]

- (c) Compare the relative amounts of ATP produced by the two processes when a molecule of glucose is completely oxidised.

.....

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..... [2]

- (d) Only substrate level phosphorylation is possible in the absence of oxygen.
Explain why oxidative phosphorylation is not possible in the absence of oxygen.

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..... [3]

- (e) Fig. 1.3 shows how glucose is transported into a cell via a transport protein held within the cell surface membrane.

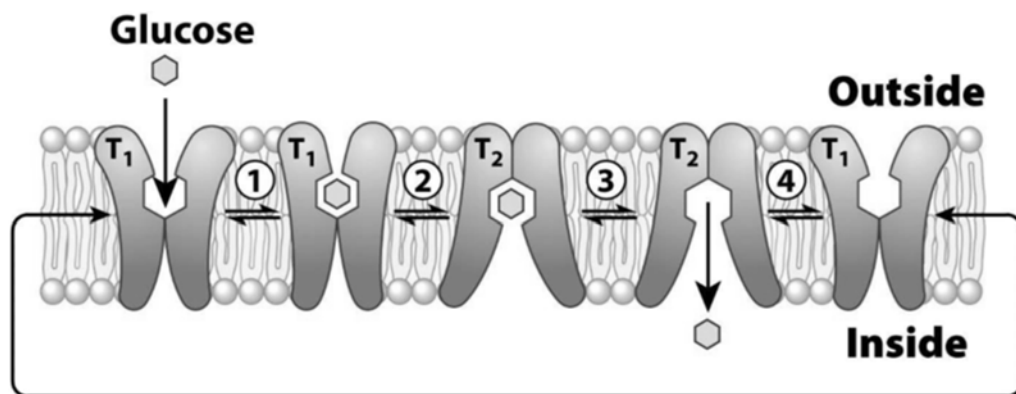


Fig. 1.3

- (i) Describe the structure of the cell surface membrane shown in Fig. 1.3.

.....

.....

.....

..... [2]

- (ii) With reference to Fig. 1.3, describe how glucose is transported into the cell.

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..... [2]

[Total: 14]

- 2 Fig. 2.1 shows a diagram of DNA replication.

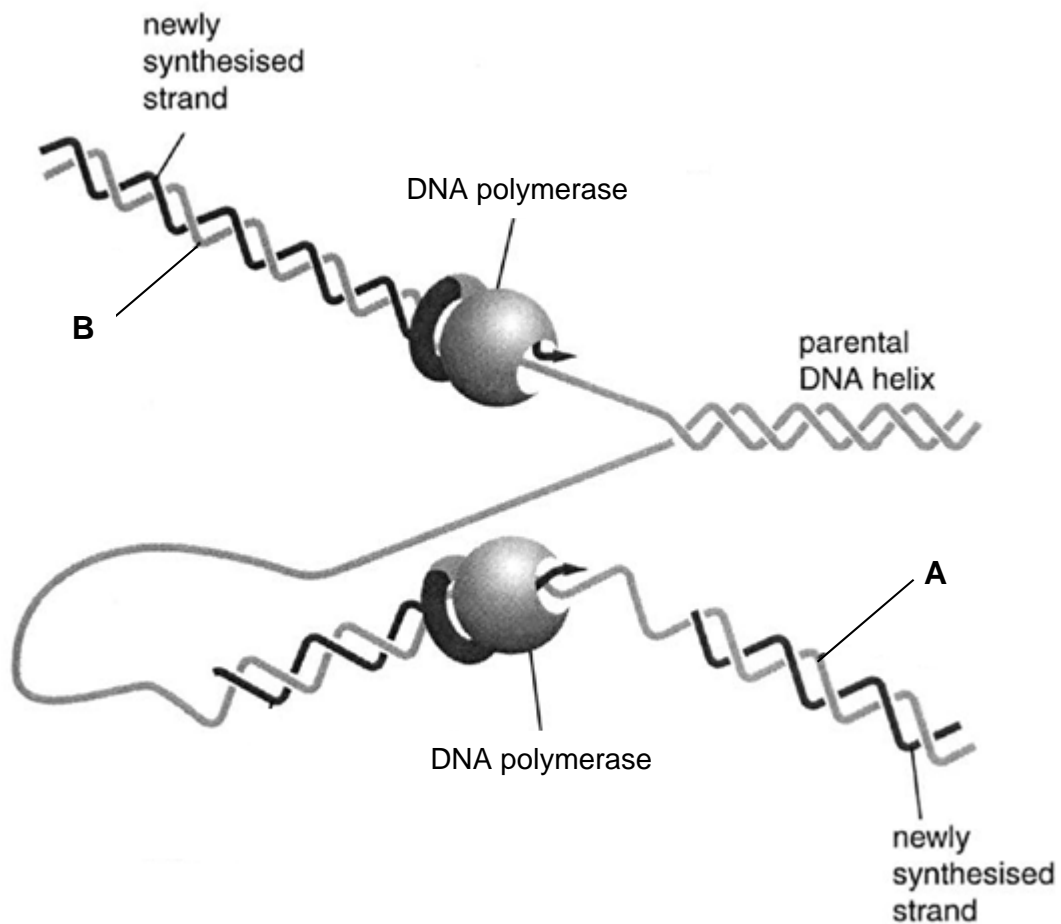


Fig. 2.1

- (a) (i) On Fig. 2.1, indicate 3' and 5' ends on both the parental template strands of the DNA molecule. [1]
- (ii) Circle which strand, A or B, is the lagging strand template used in the synthesis of new DNA daughter strand resulting in Okazaki fragments. [1]

- (b) Explain why the newly synthesised strand is formed continuously from the leading strand template while Okazaki fragments are formed using the lagging strand template.

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.....

..... [2]

- (c) Describe how gene mutations may occur during replication of DNA.

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.....

..... [2]

Cell cycle checkpoints are used by a cell to monitor and regulate the progress of the cell cycle. Checkpoints prevent cell cycle progression at specific points, allowing verification of necessary phase processes and repair of DNA damage. The cell cannot proceed to the next phase until checkpoint requirements have been met.

Checkpoints typically consist of a network of regulatory proteins that monitor and dictate the progression of the cell through the different stages of the cell cycle. However, these checkpoints may be dysregulated which can result in uncontrolled cell division and eventually cancer.

Fig. 2.2 shows a typical cell cycle with the various checkpoints.

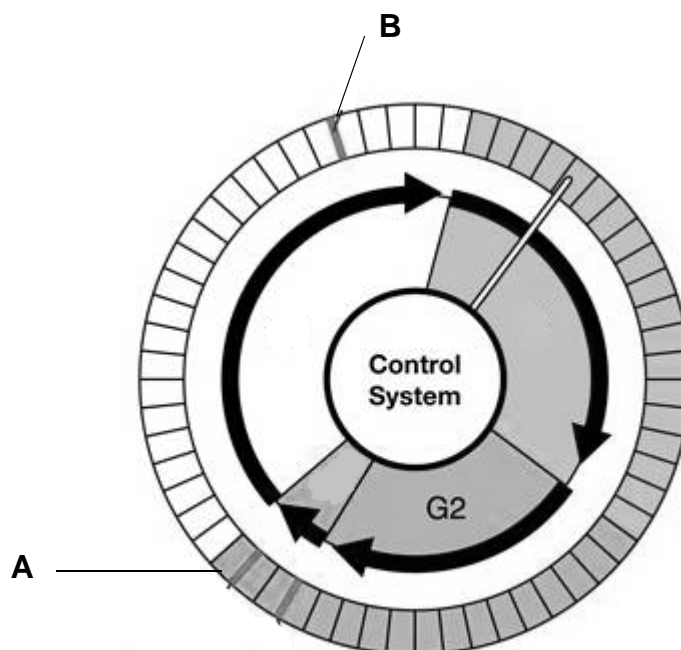


Fig. 2.2

(d) With reference to Fig. 2.2,

(i) name checkpoints **A** and **B**;

A

.....

B

.....

[1]

(ii) Describe the role of checkpoints **A** and **B**.

A

.....

B

.....

[1]

(iii) Explain what occurs in the G2 phase of cell cycle.

.....

.....

.....

.....

[2]

(e) Describe how dysregulation of the checkpoints in cell cycle may lead to cancer.

.....

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.....

[2]

(f) Some types of cancer can be treated by chemotherapy, which involves the injection of chemicals into the bloodstream.

Vincristine is a drug used for chemotherapy. This drug works partly by binding to the tubulin protein, stopping the cell from proceeding in the M phase of the cell cycle.

Explain how the use of vincristine will stop the proliferation of cancer cells.

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[2]

[Total: 14]

- 3 The fruitfly, *Drosophila*, has many different species. Three of these species, *Drosophila pseudoobscura*, *D. persimilis* and *D. miranda*, are thought to be closely related.

Samples of these three species were collected from the western United States of America.

Fig. 3.1 shows where these species naturally occur.

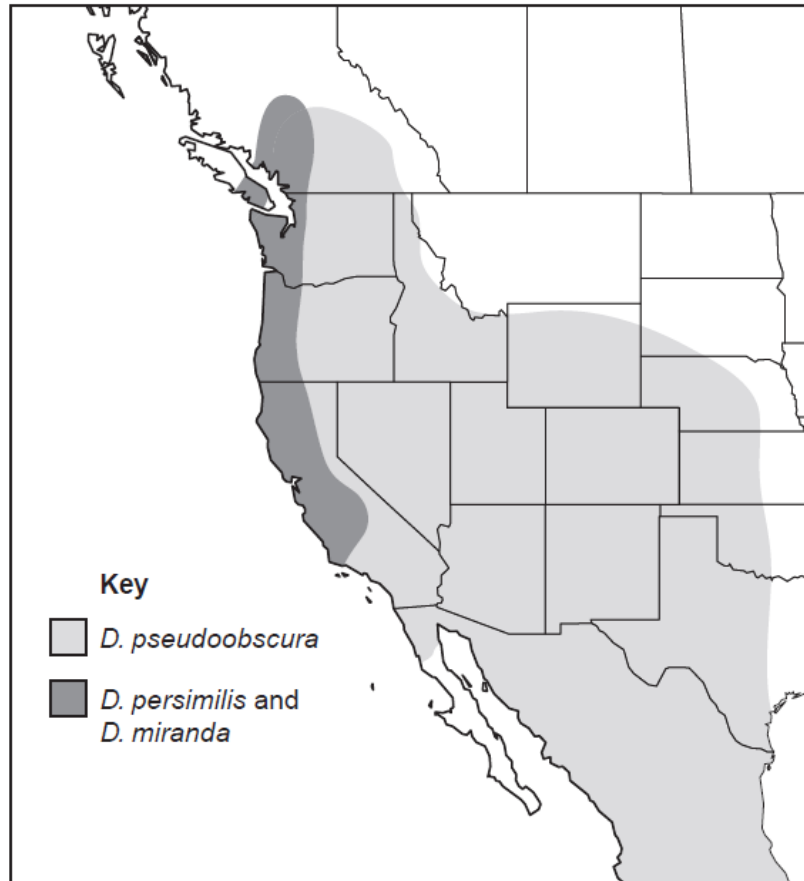


Fig. 3.1

- (a) State what must exist in a population for natural selection to occur.

[1]

The base sequences of four regions of DNA of each species were sequenced. The divergence of these base sequences in *D. pseudoobscura* and *D. persimilis* from the sequences in *D. miranda* was calculated. The results are shown in Table 3.

Table 3

DNA region	<i>Drosophila</i> species	percentage divergence of base sequence from that of <i>D. Miranda</i> /%
1	<i>pseudoobscura</i>	2.5
	<i>persimilis</i>	2.4
2	<i>pseudoobscura</i>	8.1
	<i>persimilis</i>	7.3
3	<i>pseudoobscura</i>	2.1
	<i>persimilis</i>	1.7
4	<i>pseudoobscura</i>	1.9
	<i>persimilis</i>	1.7

- (b) With reference to Table 3, describe the evidence that *D.miranda* may be more closely related to *D.persimilis* than to *D.pseudoobscura*.

----- [2]

- (c) Suggest why there is more divergence in some regions of DNA than in others.

----- [1]

- (d) Explain how *D.persimilis* and *D.pseudoobscura* could have speciated from *D.miranda*.

[4]

Beside molecular homology, scientists can also use anatomical homology to study the evolutionary relationship among vertebrate species.

Fig. 3.2 shows the relationship between six vertebrate species by comparing the bone arrangement in the forelimbs.

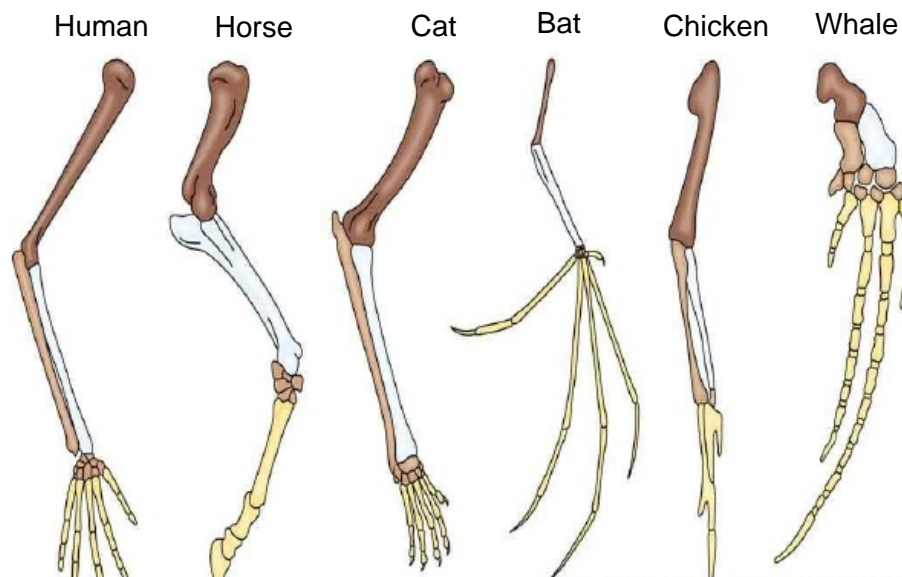


Fig. 3.2

- (e) Explain what is meant by 'homology'.

----- [1]

- (f) Explain how the anatomical homology shown in Fig. 3.2 supports Darwin's theory of evolution.

----- [3]

[Total: 12]

Section B**Answer EITHER 4 OR 5.**

Write your answers on the separate answer paper provided.

Your answers should be illustrated by large, clearly labelled diagrams, where appropriate.

Your answers must be in continuous prose, where appropriate.

Your answers must be set out in section **(a)**, **(b)** etc., as indicated in the question.

Either

- 4 (a)** Describe the polymerase chain reaction and explain the advantages and limitations of the procedures. [12]

- (b)** Explain how gel electrophoresis is used to analyse DNA. [8]

[Total: 20]

Or

- 5 (a)** Describe the unique features of zygotic stem cells, embryonic stem cells and blood stem cells and explain the normal functions of stem cells in a living organism. [10]

- (b)** With reference to two examples, explain how genetic engineering can be used to improve quality and yield of crop plants. [10]

[Total: 20]

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