



ANDERSON JUNIOR COLLEGE
HIGHER 1

NAME

PDG

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INDEX NUMBER

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BIOLOGY

8875/02

Paper 2 Core Paper

12 September 2017

Tuesday

2 hours

Additional Materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

Write your name and PD group on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graph or rough working.
Do not use paper clips, highlighters, glue or correction fluid.

Section A

Answer **all** questions.

Section B

Answer **either** Question 4 or Question 5.

All working for numerical answers must be shown.

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

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

Calculators may be used

For Examiner's Use	
PAPER 1	
1-30	
	30 marks
PAPER 2	
Section A	40 marks
1	
2	
3	
Section B	20 marks
4 or 5	
PAPER 2	60 marks
<u>TOTAL</u>	
	<u>90 marks</u>

Section A

Answer **all** the questions in this section.

- 1 Fig 1.1 shows an outline of the first three stages of aerobic respiration.

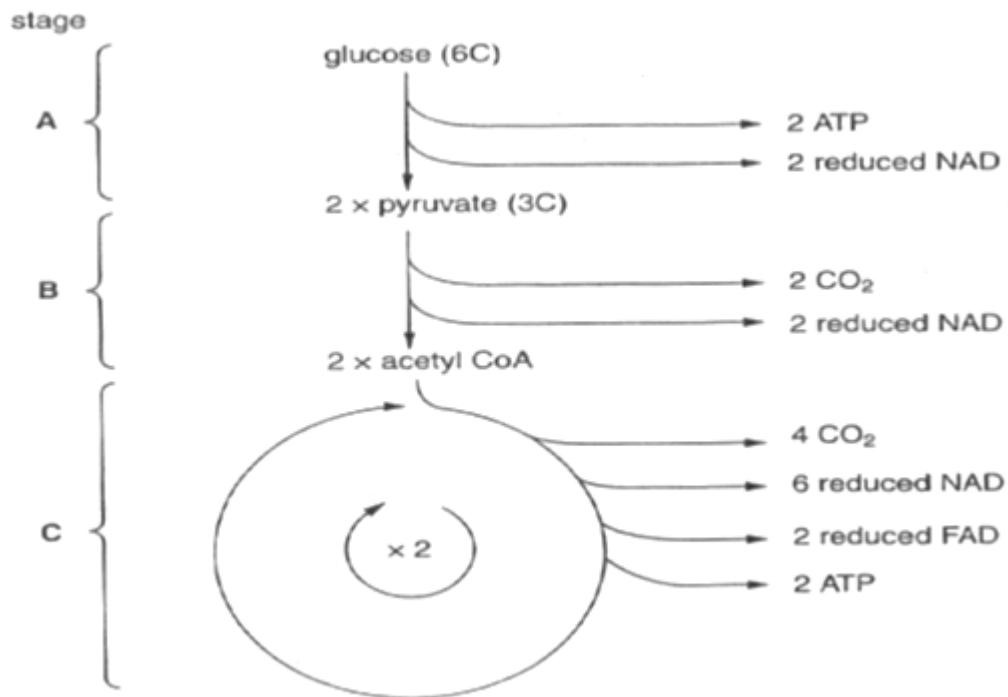


Fig. 1.1

- (a) For each glucose molecule, state the total number of molecules of ATP formed as a result of stages A to B, including any ATP produced through oxidative phosphorylation of the products. Assume that 1 reduced NAD synthesizes 2.5 ATP and 1 reduced FAD synthesizes 1.5 ATP. **Show your working.**

A:

B:

C:

- (b) Many enzymes are involved in Krebs cycle. An experiment was carried out to investigate the effect of temperature on respiration. Isolated liver mitochondria were placed in five reaction tubes, with contents and temperature of reaction tube as shown in Table 1 below. The corresponding rates of oxygen uptake were measured. Results are shown in Table 1.

Table 1

Tubes	Temperature/ °C	Volume of solution added/ cm ³		Rate of oxygen uptake / a.u
		Buffered isolated liver mitochondria	2% pyruvate solution	
1	35	Boiled and cooled	0.01	1.1
2	25	2.00	0.01	7.2
3	35	2.00	0.01	15.1
4	45	2.00	0.01	13.2
5	55	2.00	0.01	1.1

- (i) Enzymes are essential in helping to speed up the rate of metabolic reactions such as those in the Krebs cycle. Explain how enzymes help to speed up rate of reaction.

[4]

- (ii) Pyruvate has to be used as a substrate for this experiment instead of glucose. Explain why.

[2]

- (iii) With reference to Tubes 2 – 4 from Table 1, account for the effect of temperature on rate of oxygen uptake.

[4]

- (iv) With reference to Table 1, briefly explain the results to Tube 5.

[2]

[Total: 15 m]

2

Fig. 2.1 shows a part of a pancreatic cell. The pancreas is important in regulating the level of blood glucose in the body by secreting insulin at high blood glucose level.

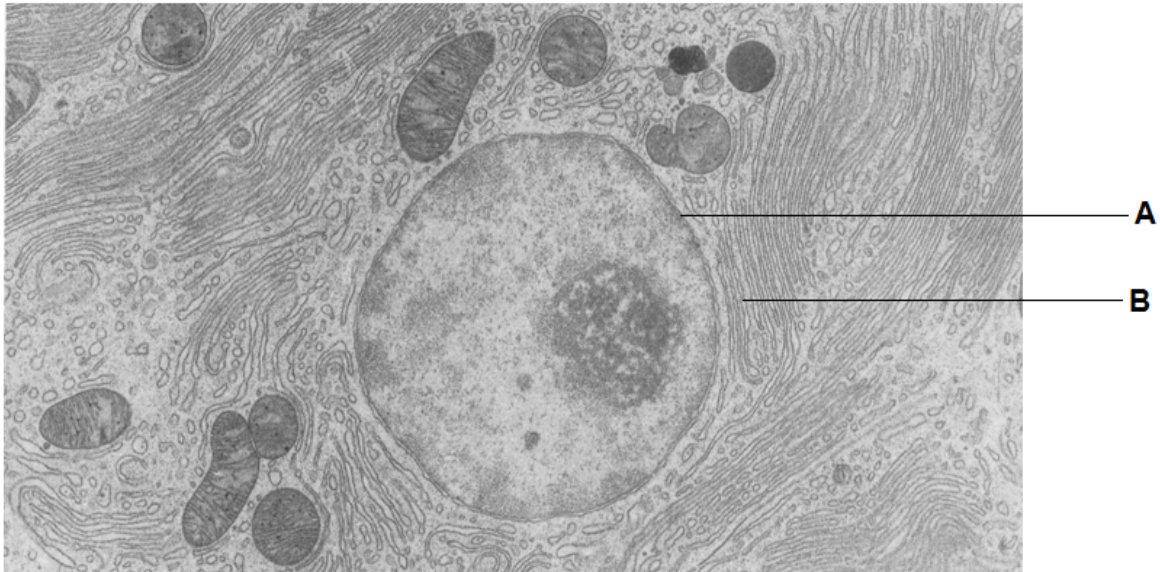


Fig 2.1

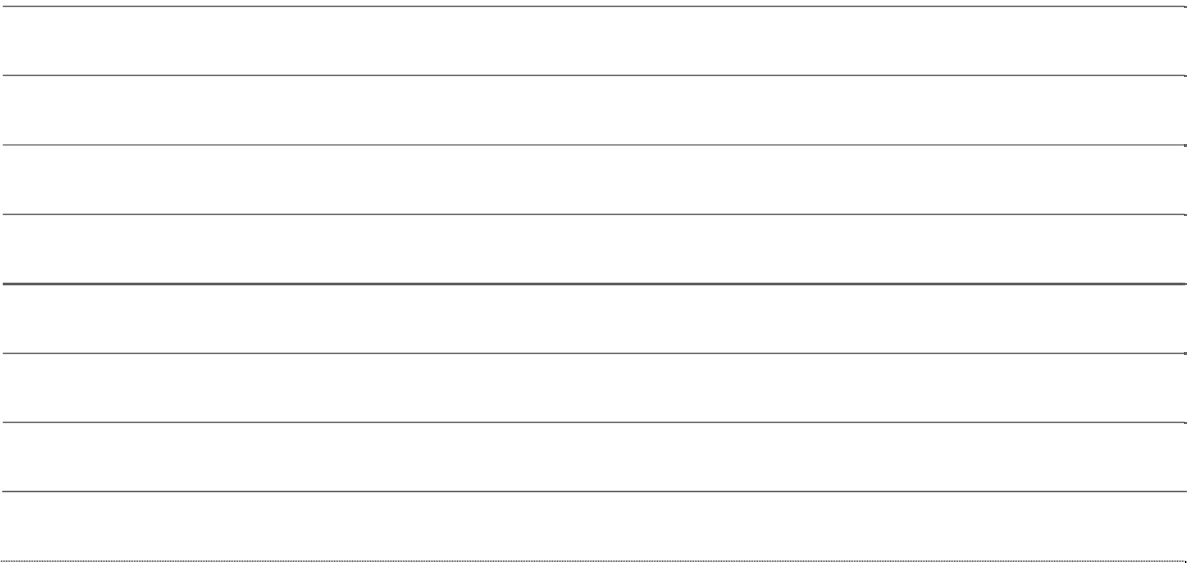
- (a) (i) State organelle A and B and describe the relationship between the two organelles in a pancreatic cell.

[3]

- (ii) State one other organelle you can observe in Fig. 2.1 and how it is important to the function of a pancreatic cell.

[1]

Starting from the position of the ribosome as shown in Fig. 2.2, outline the steps that occur to produce the complete polypeptide.



- (c) Fig. 2.3A shows a DNA base sequence. It also shows the effect of two mutations on this base sequence. Fig. 2.3B shows DNA triplets that code for different amino acids.

Original DNA base sequence	A	T	T	G	G	C	G	T	G	T	C	T
Mutation 1 DNA base sequence	A	T	T	G	G	A	G	T	G	T	C	T
Mutation 2 DNA base sequence	A	T	T	G	G	C	C	T	G	T	C	T

Fig. 2.3A

DNA triplets	Amino acid
GGT, GGC, GGA, GGG	Gly
GGT, GTA, GTG, GTC	Val
ATC, ATT, ATA	Ile
TCC, TCT, TCA, TCG	Ser
CTC, CTT, CTA, CTG	Leu

Fig. 2.3B

Some mutations affect the amino acid sequences while others do not. Using the information in Fig. 2.2A and Fig. 2.2B and a **feature of the genetic code**, explain

- (ii) why mutation 1 has no effect on the protein structure

[3]

- (ii) why mutation 2 could lead to the formation of a non-functional enzyme.

[3]

[Total: 14 m]

- 3 (a) State the structural features of DNA that make it a stable molecule.

[2]

DNA polymerase is an enzyme involved in the replication of DNA.

One of the substrates required by DNA polymerase is ATP.

ara-ATP is a chemical that affects DNA polymerase activity.

In an investigation, the effect of different concentrations of ATP on the rate of DNA synthesis was determined:

- with no ara-ATP
- with a low concentration of ara-ATP
- with a high concentration of ara-ATP.

The results of the investigation are shown in Fig. 3.1.

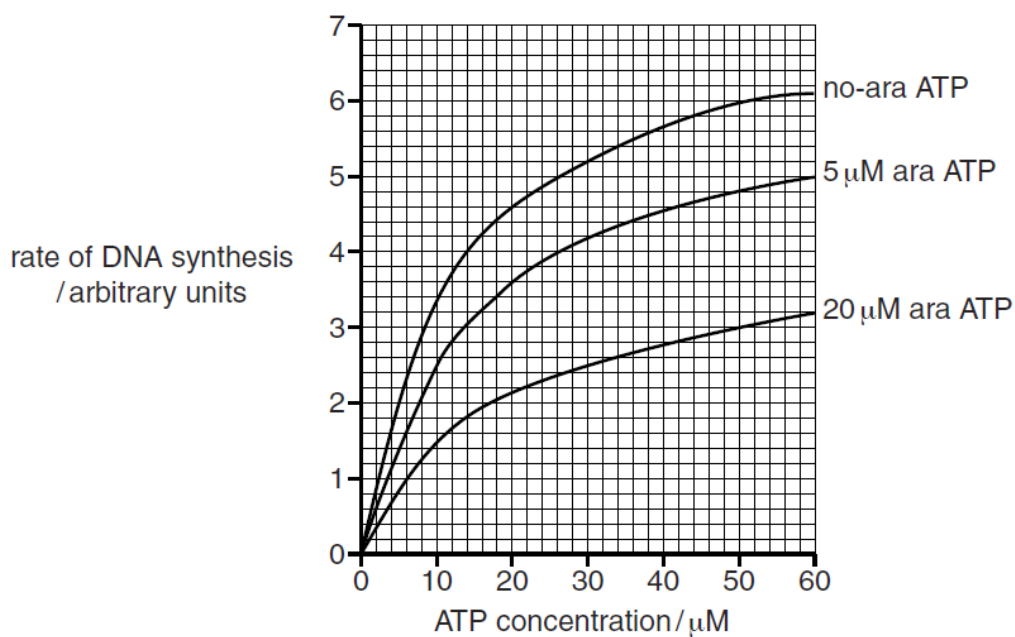


Fig. 3.1

- (b) Explain the results of the investigation shown in Fig. 3.1 in terms of mode of action of enzymes.

[4]

Colour blindness is a genetic condition characterised by the inability of the brain to perceive certain colours accurately.

- The most common form is termed red-green colour blindness (RGC).
- RGC results from a recessive allele.
- 0.6% of females worldwide have RGC.
- 8.0% of males worldwide have RGC.

The results of the investigation are shown in Fig. 3.2.

□ = male ○ = female ■ = male with RGC

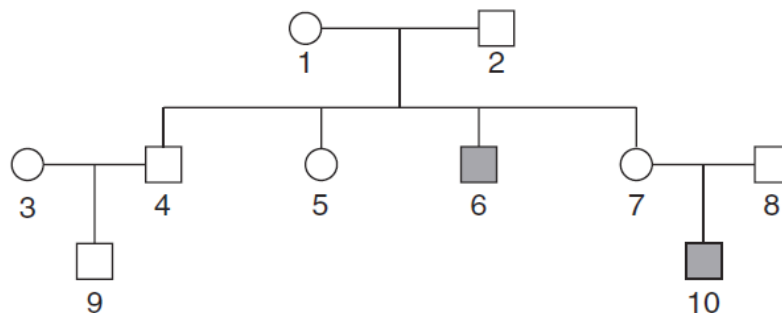


Fig. 3.2

- (c) Define the term *recessive*.

[1]

- (d) Explain why females are less likely than males to have RGC.

[2]

- (e) With reference to Fig. 3.2, and using the symbols **R** for the dominant allele and **r** for the recessive allele, state the genotypes of the individuals **1** and **6**.

1 _____

6 _____

[2]

[Total: 11 m]

Section B
Answer EITHER 4 OR 5.

Write your answers on the separate answer paper provided.

Your answer 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.

- 4 (a) Describe how gel electrophoresis separates DNA, and explain why it is useful in genetic fingerprinting analysis. [10]
- (b) Describe the features of zygotic stem cells and embryonic stem cells that distinguish them from each other. [3]
- (c) Discuss the social and ethical implications of genetically modifying plants. [7]

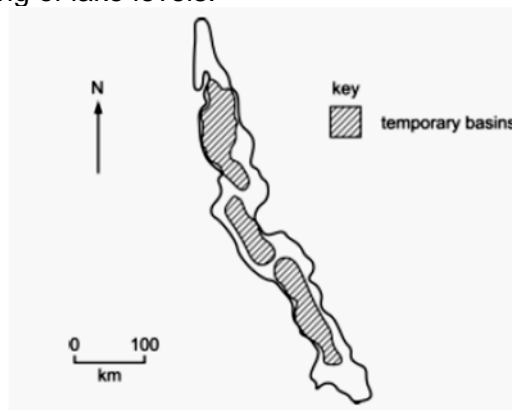
OR

- 5 (a) In Lake Tanganyika in Africa, there are six species of fish of the genus *Tropheus* and a much larger number of distinctly coloured subspecies of each of the six species. *Tropheus* species are small fish that are confined to isolated rocky habitats around the shores of Lake Tanganyika.

The six species evolved during the primary radiation phase when the lake was first filled, about 1.25 million years ago. They arose from river dwelling ancestors and then filled all available niches in the lake.

Secondary radiations into the many subspecies occurred during the last 200 000 years. Sometime during this period, the water level in the lake fell, resulting in the formation of three separate lake basins. These basins persisted for many thousands of years before the water level rose again.

Figure below shows an outline map of the lake and the location of the three temporary basins caused by lowering of lake levels.



- Using Darwin's theory of natural selection, explain how did the six species and subspecies of each species arise on Lake Tanganyika. [10]
- (b) Discuss advantages of using molecular data in determining evolutionary relationships. [3]
- (c) Describe how mitosis ensures genetic stability. [7]

[Total: 20 m]

