



Rewarding Learning

ADVANCED

General Certificate of Education

2015

Centre Number

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Candidate Number

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Biology

Assessment Unit A2 2

assessing

Biochemistry, Genetics and Evolutionary Trends



AB221

[AB221]

MONDAY 1 JUNE, AFTERNOON

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

There is an extra lined page at the end of the paper if required.

Answer **all eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.

Section A carries 72 marks. Section B carries 18 marks.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

You are reminded of the need for good English and clear presentation in your answers.

Use accurate scientific terminology in all answers.

You should spend approximately **25 minutes** on Section B.

You are expected to answer Section B in continuous prose.

Quality of written communication will be assessed in Section B, and awarded a maximum of 2 marks.

Statistics sheets are provided for use with this paper.

For Examiner's
use only

Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total
Marks

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(a) Explain precisely the term ‘transgenic organism’.

[1]

Describe the role of the following in genetic engineering:

- reverse transcriptase

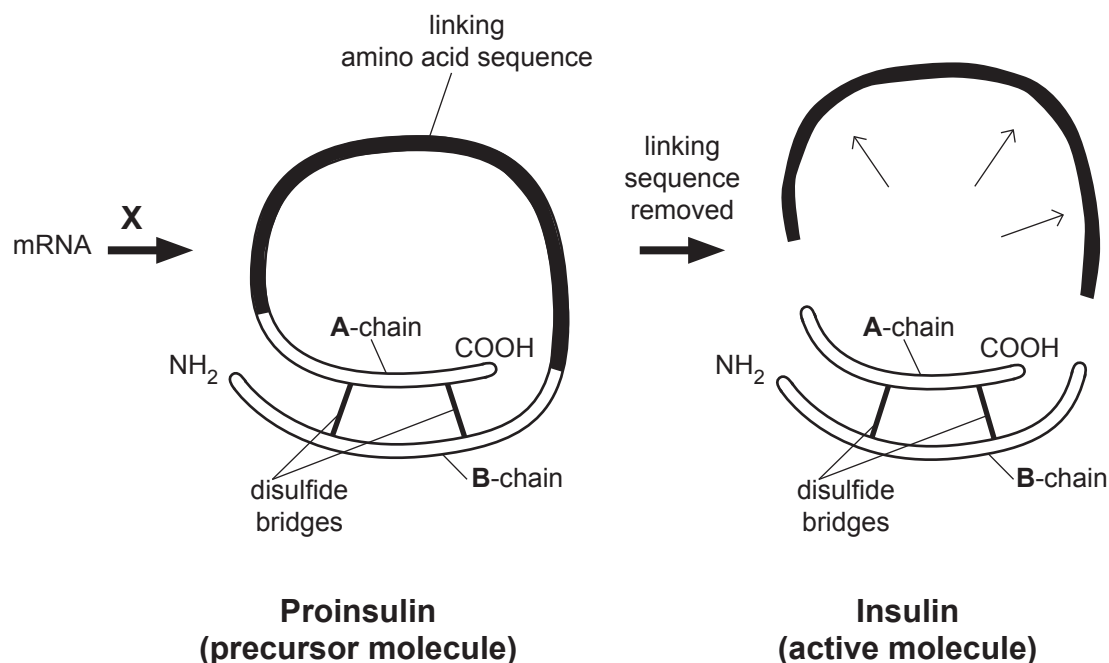
- DNA polymerase

- plasmids

[3]

Examiner Only	
Marks	Remark

This is summarised in the diagram below.



Using the information provided:

- (i) Identify process **X**.

X _____ [1]

- (ii) State the evidence which indicates that only one gene codes for insulin.

[1]

Examiner Only	
Marks	Remarks

(a) Describe **one** advantage of plants having different pigments to absorb light energy.

[1]

(b) In deciduous trees the leaves emerge in spring and are lost in autumn.

Suggest **one** advantage to trees of losing their leaves in autumn.

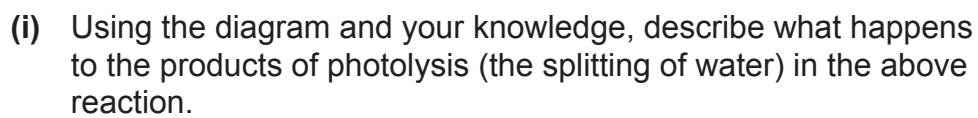
[1]

(c) Chromatography can be used to separate and identify the photosynthetic pigments present in a leaf. In an investigation, chromatography was used to compare and contrast the photosynthetic pigments present in the leaves of a particular species. This was done in May (at the start of the growing season) and in October (at the end of the growing season).

The results of the investigation are shown in the table below. Assume the technique used to extract the pigments was equally effective in both May and October.

	May (start of growing season)		October (end of growing season)	
Pigment	Colour of pigment	Intensity of colour	Colour of pigment	Intensity of colour
Carotene	yellow	4	yellow	5
Phaeophytin	yellow-grey	1	yellow-grey	2
Xanthophyll	yellow-brown	5	yellow-brown	4
Chlorophyll a	blue-green	5	blue-green	1
Chlorophyll b	green	5	green	2

Key	Intensity of pigment colour	
	Dense colouration	5
	Just visible	1



[3]

8

- (ii) Describe precisely how the products of the light-dependent reaction are used in the light-independent reaction.

[2]

Examiner Only	
Marks	Remark

- 4 Sickle cell anaemia is a condition caused by a mutation in a gene that codes for haemoglobin. In a mutated gene, the normal DNA sequence of the base triplet **CTC** is changed to **CAC**.

(a) (i) Name the type of mutation involved.

[1]

(ii) State the change in the affected mRNA codon.

_____ to _____

[1]

The table below shows the 'genetic dictionary' indicating the amino acids coded for by mRNA codons.

		second base in codon				
		U	C	A	G	
first base in codon	U	phenylalanine	serine	tyrosine	cysteine	U
		phenylalanine	serine	tyrosine	cysteine	C
		leucine	serine	stop	stop	A
		leucine	serine	stop	tryptophan	G
	C	leucine	proline	histidine	arginine	U
		leucine	proline	histidine	arginine	C
		leucine	proline	glutamine	arginine	A
		leucine	proline	glutamine	arginine	G
	A	isoleucine	threonine	asparagine	serine	U
		isoleucine	threonine	asparagine	serine	C
		isoleucine	threonine	lysine	arginine	A
		methionine and start	threonine	lysine	arginine	G
	G	valine	alanine	aspartate	glycine	U
		valine	alanine	aspartate	glycine	C
		valine	alanine	glutamate	glycine	A
		valine	alanine	glutamate	glycine	G

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(Questions continue overleaf)

It is thought that the fungus responsible, *Chalara fraxinea*, was carried to Britain from mainland Europe in infected seedlings and young trees. Once in Britain the infection spread rapidly from tree to tree by wind-borne spores, with a typical dispersal range of up to ten miles.

In early 2013, the only examples of infected ash trees in Northern Ireland were in sites which had been recently planted with commercially grown seedlings. There were no reported cases in native woodland.

- (a)** Suggest why the first cases of *Chalara fraxinea* infection in Northern Ireland were in new plantations, but not in native woodland.

[2]9615

- (i) There has been limited progress in directly linking alleles to conditions such as cancer and heart disease. Suggest **two** reasons for this limited progress.

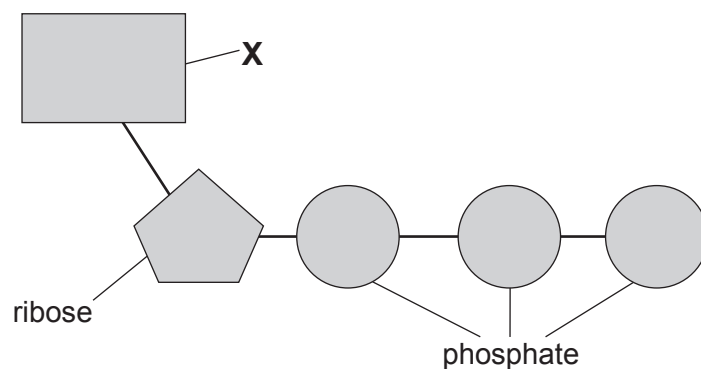
 [2]

- (ii) In terms of treatment, continued research into the link between alleles and disease is likely to be beneficial.

In this context, explain the term 'designer drug' and suggest **one** advantage of developing such drugs.

[2]

Examiner Only	
Marks	Remark



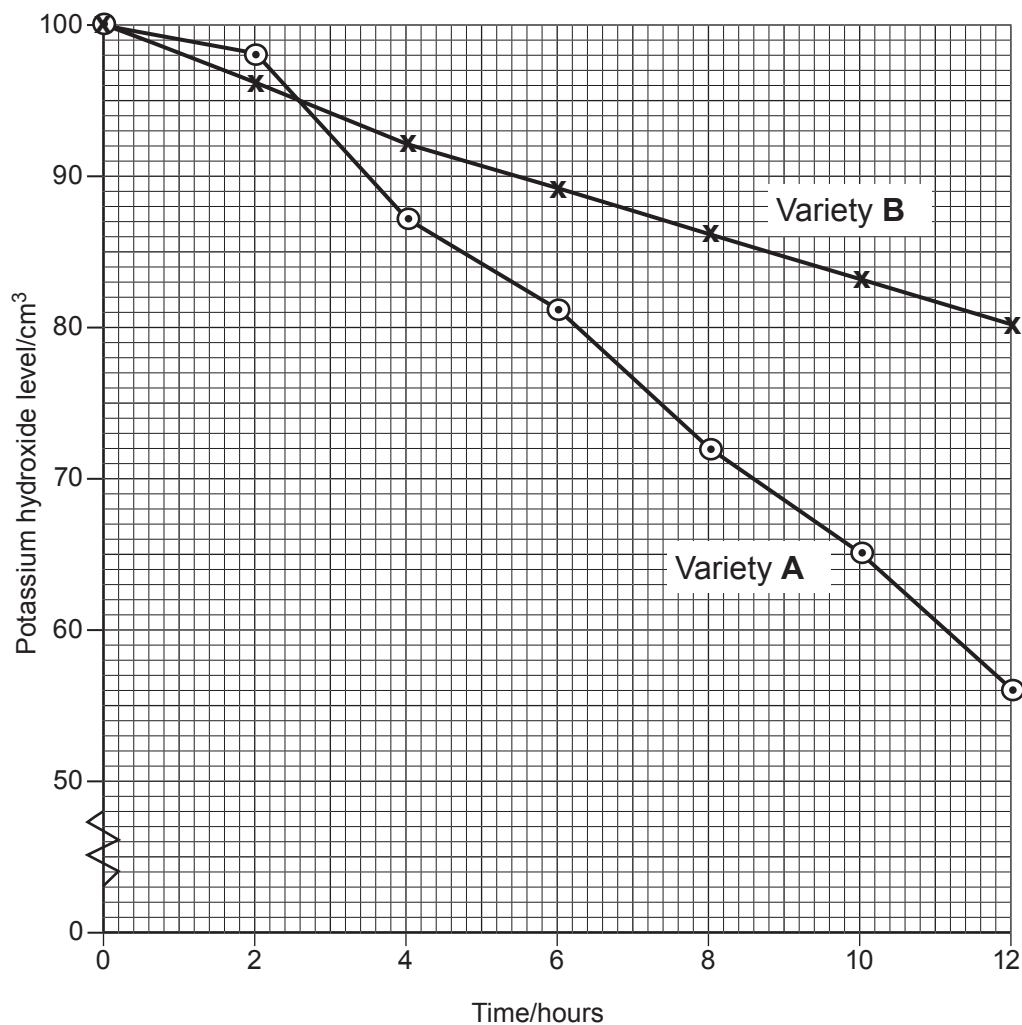
- X** _____ **[1]**

-
-
-
- [1]

1. _____
 2. _____
- [2]

Examiner Only	
Marks	Remarks

The results of the investigation are shown in the graph below.



- (ii) Suggest an explanation for the faster rate of oxygen uptake in variety **B** between 0–2 hours.

_____ [1]

- (iii) Calculate the mean rate of respiration of variety **A** between 2 and 12 hours in cm³ of oxygen used per gram of pea seed per hour. (Show your working.)

_____ cm³ oxygen g⁻¹ hr⁻¹ [3]

	Variety of pea	
	A	B
Number of cells in section (n)	100	100
Mean number of mitochondria in each cell ($\bar{x}$)	6.3	5.8
Standard deviation (error) of the mean ($\hat{\sigma}_{\bar{x}}$)	0.62	0.68

(i) State the null hypothesis for this test.

[1]

Answer_____ [2]

20

- 7 The fruit fly, *Drosophila melanogaster*, is ideally suited for genetic investigations and has been widely used for this purpose for many years.

The normal eye colour in *Drosophila* is red but a white-eyed form exists. In the genetics of eye colour, red eye (**R**) is dominant to white eye (**r**) and the inheritance of eye colour is sex linked (in a similar way to sex linked conditions in humans).

(a) State the genotypes of:

- a male with red eyes

- a female with white eyes

[2]

- (b) In a particular cross, a red-eyed female was crossed with a red-eyed male. The offspring produced are shown in the following table.

	Red eyes	White eyes
Males	48	53
Females	102	0

- (i) Using a genetic diagram, explain the outcome of this cross.

[3]

Using a genetic diagram, explain these results.
(Let **A** = normal wing and **B** = normal body colour)

[4]

1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

[illegible][illegible]

Examiner Only	
Marks	Remark

[illegible]

THIS IS THE END OF THE QUESTION PAPER

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