



Additional Assessment Materials
Summer 2021

Pearson Edexcel GCE (Biology A)

Resource Set Topic 5: On the Wild Side

Question Paper

(Public release version)

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General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

9 Tropical rainforests play a role in maintaining biodiversity and in storing carbon.

(a) In a mature tropical rainforest, there is no net increase in biomass.

(i) Which statement describes the role of photosynthesis in the carbon cycle? (1)

- A carbon dioxide is oxidised to form organic molecules
- B carbon dioxide is reduced to form organic molecules
- C organic molecules are combusted to produce carbon dioxide
- D organic molecules are decomposed to release carbon dioxide

(ii) The gross primary productivity (GPP) for one mature tropical rainforest was found to be $24\,800\text{ kJ m}^{-2}\text{ year}^{-1}$. It was estimated that 65% of GPP was used in respiration.

Calculate the energy transferred to the next trophic level. (2)

..... $\text{kJ m}^{-2}\text{ year}^{-1}$

(b) Explain how reforestation of tropical rainforests can be used to minimise climate change. (3)

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(Total for Question 9 = 6 marks)

10 Scientists have studied behavioural, anatomical and genetic variation in elephants.

The table shows some information about two populations of African elephants.

Population	Location	Feeding behaviour	Anatomical differences
Forest elephant	tropical forest of central and West Africa	feeds on leaves and fruits of high-growing plants such as shrubs and trees	<ul style="list-style-type: none">• lower jaw longer and narrower• tusks straighter and downward facing• overall a much smaller size
Savannah elephant	African savannah	feeds on grass and leaves of low-growing shrubs	<ul style="list-style-type: none">• lower jaw shorter and wider• tusks more curved and upward facing• overall a larger size

The photographs show elephants from the two populations.



Forest elephant



Savannah elephant

DNA samples were collected from these two populations of elephants.

- (a) One of the genes showing variation was the GBA gene. The table shows the frequency of the alleles of the GBA gene in the two populations.

GBA allele	Frequency of allele in the elephant population	
	Savannah elephant	Forest elephant
J	0.05	0.43
K	0.00	0.57
L	0.95	0.00

- (i) State what is meant by the term **allele**.

(1)

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- (ii) Use the Hardy-Weinberg equation to show that more than 50% of the forest elephant population are homozygous for the GBA gene.

(3)

Answer.....

(ii) Explain how two species of African elephant could evolve from a common ancestor. (3)

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(Total for Question 10 = 13 marks)

- 4 The earthworm, (*Lumbricus terrestris*), feeds on dead organic matter found in soil.



Soil pH is one of the abiotic factors that affects the population size of earthworms.

The populations of earthworms in fields with either acidic soil or alkaline soil have been investigated.

The results of this investigation are summarised in the table.

Sample	Earthworms in field with acidic soil		Earthworms in field with alkaline soil	
	Number per square metre	Mass per square metre / g m^{-2}	Number per square metre	Mass per square metre / g m^{-2}
1	80	184	723	1 164
2	59	110	1 613	1 968
3	106	253	354	439
4	31	70	728	961
5	121	238	214	233
6	75	139	874	1 739
7	97	149	668	1 096
8	138	309	121	213
9	63	95	791	1 455
10	63	84	497	736
Total	833	1 631	6 583	10 004

(c) Explain how differences between the mass of earthworms in these two soils could be shown to be statistically significant.

(3)

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(Total for Question 4 = 11 marks)

- 4 Global warming can affect abiotic factors that determine the distribution of organisms.

The presence of sodium chloride in soil is an abiotic factor that affects the germination of seeds.

The effects of sodium chloride solution and gibberellin on the germination of rice seeds have been investigated.

Gibberellin regulates developmental processes in plants.

Fifty seeds were placed in each of three Petri dishes containing different solutions.

The seeds were incubated for 96 hours and the number that germinated in each Petri dish was counted.

Treatment	Solution	Number of seeds germinating
Control	Distilled water	48
Sodium chloride	120 mmol dm ⁻³ of sodium chloride	33
Sodium chloride and gibberellin	120 mmol dm ⁻³ sodium chloride and 50 μmol dm ⁻³ gibberellin	45

- (a) (i) Give a null hypothesis for this experiment.

(1)

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- (ii) Calculate the chi-squared (χ^2) value for these results, using the formula provided.

(3)

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Answer

- (iii) In a second experiment, using the same three treatments, the chi-squared (χ^2) value was found to be 6.635.

The table gives the critical values for the chi-squared (χ^2) test at different probability levels.

Degrees of freedom	Probability level		
	0.05	0.01	0.001
1	3.841	6.635	10.83
2	5.991	9.210	13.82
3	7.815	11.34	16.27
4	9.488	13.28	18.47

Deduce the statistical significance of the results of the second experiment.

(2)

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(b) Gibberellins can activate the gene for amylase in rice seeds.

Amylase is an enzyme that hydrolyses starch in the rice seeds.

Devise an investigation to demonstrate the effect of gibberellin on amylase activity in rice seeds treated with sodium chloride.

(4)

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(Total for Question 4 = 10 marks)

10 Photosynthesis is a process that occurs in all green plants.

The electron micrograph shows part of a chloroplast in a plant cell.



(a) (i) The labelled starch grain in the chloroplast is $2.2 \mu\text{m}$ long.

Calculate the width of this chloroplast between T and U.

(2)

..... μm

