



EXAM PAPERS PRACTICE

## On the Wild Side -2

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

Time:

Total Marks Available:

Total Marks Archived:

Level: Edexcel A level Biology

Subject: Biology

Exam Board: Pearson Edexcel Level 3 GCE AS and A level Biology A (Salters-Nuffield) and also Pearsons Edexcel AS and A Level Biology B (9BI0) - Is however suitable for use by AS and A level Biology Students of other Boards

Topic: On the Wild Side -2

Type: Topic Questions

To be used by all students preparing for Edexcel AS and A level Biology A and Biology B - Students of other Boards may also find this useful



## Questions

Q1.

Ebola haemorrhagic fever is a life-threatening disease caused by the Ebola virus.

(a) Explain why antibiotics are not used to treat Ebola haemorrhagic fever.

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(b) Some of the blood plasma of individuals who have survived infection with Ebola can be collected. This can be used in the treatment of individuals currently infected with Ebola.

Explain why the blood plasma from survivors can be used to treat new cases of Ebola infection.

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(c) A study of the 2014 Ebola outbreak in Sierra Leone found that the Ebola virus was evolving rapidly.

Explain why the evolution of the virus might reduce the effectiveness of any vaccine being developed.

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**(Total for question = 9 marks)**

Q2.

The photograph shows heather, *Calluna vulgaris*, a plant that grows on moorland.



© C016/7131/Science Photo Library

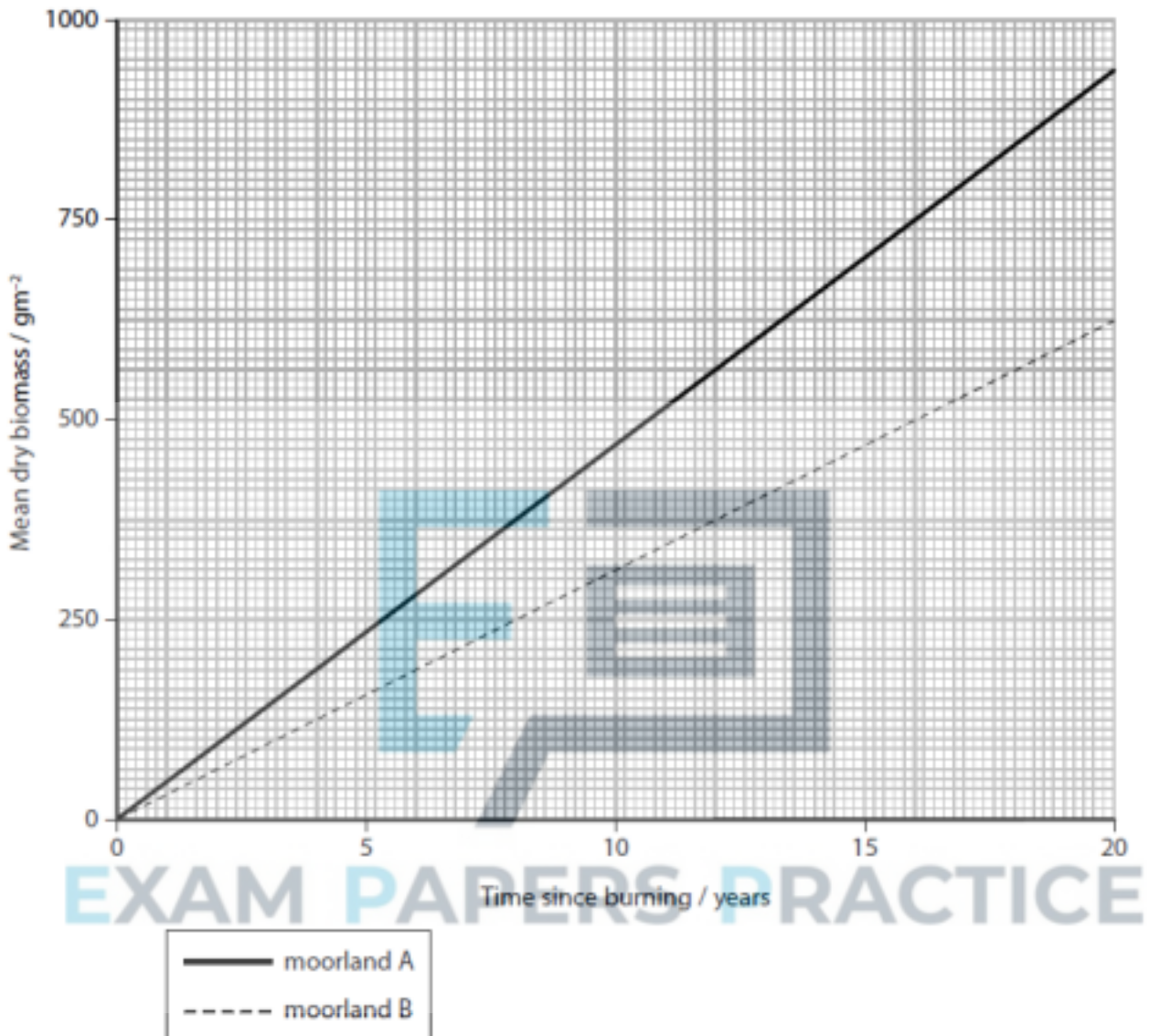
In an investigation into the net primary productivity of heather, all the vegetation on an area of two different moorlands, A and B, was removed by burning. The dry biomass, in  $\text{g m}^{-2}$ , was then measured each year for a period of 20 years.

(a) Give an equation that shows the relationship between gross primary productivity, net primary productivity and respiration.

(1)

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(b) The graph shows the change in the mean dry biomass of the heather plants during the 20 year period.



(i) Describe a method that could be used to obtain the mean dry biomass of the heather plants in year 20.

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(ii) The total solar radiation reaching moorland A was 3 144 000 kJ m<sup>-2</sup> yr<sup>-1</sup>. Each gram of dry heather contains 22.186 kJ.



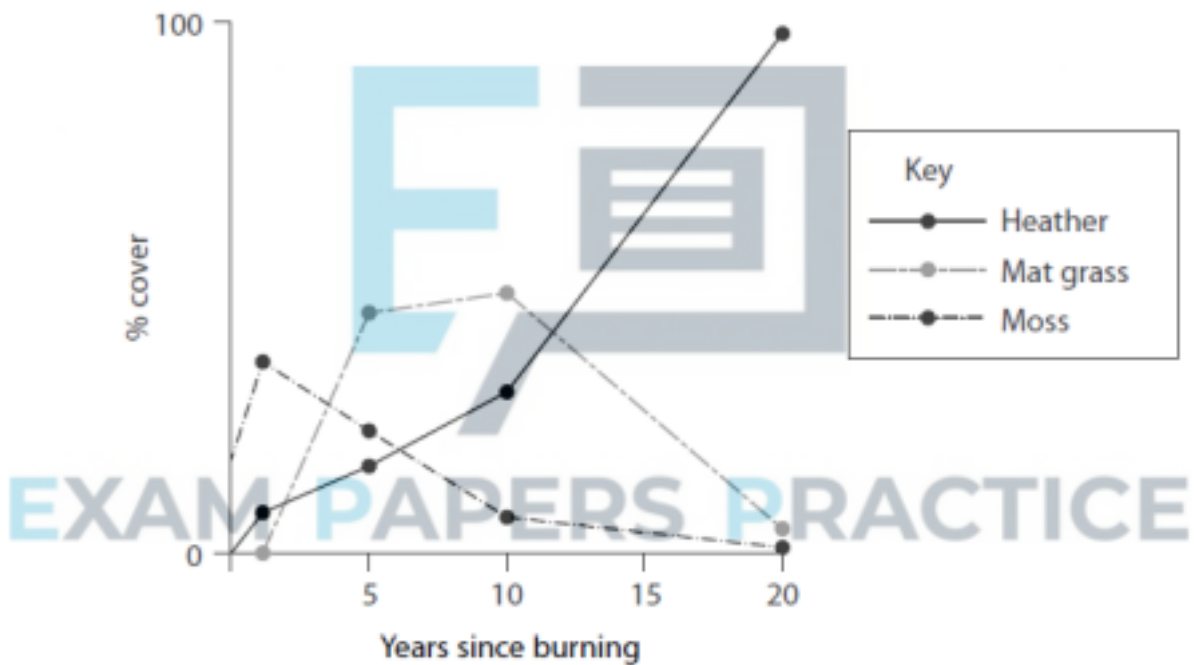
Calculate the percentage efficiency of heather plants from moorland **A** at converting solar radiation into dry biomass.

(2)

Answer .....

(iii) After the burning of the moorland, a process of succession occurred.

The following information shows some of the changes found over the 20 years.



Analyse the data to explain the changes shown.

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(Total for question = 8 marks)

Q3.

Eukaryotic cells contain membrane-bound organelles.

The photograph, obtained using an electron microscope, shows an organelle.



(Source: © Science History Images/Alamy Stock Photo)

(i) Label a part of this organelle where carbon fixation occurs.

(1)

(ii) Give the name of the component labelled X.

(1)



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(iii) Describe how the structure of a membrane in the part labelled X is related to its function.

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(iv) Describe how GP is produced by carbon fixation in this organelle.

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**(Total for question = 7 marks)**





Q4.

The scientific article you have studied is adapted from an article from *'The Scientist'*.

Use the information from the scientific article and your own knowledge to answer the following questions.

Explain how cyanobacteria evolved to 'handle high temperatures' (paragraphs 14 and 15).

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**(Total for question = 5 marks)**



Q5.

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"><li>• lower jaw longer and narrower</li><li>• tusks straighter and downward facing</li><li>• overall a much smaller size</li></ul>
Savannah elephant	African savannah	feeds on grass and leaves of low-growing shrubs	<ul style="list-style-type: none"><li>• lower jaw shorter and wider</li><li>• tusks more curved and upward facing</li><li>• overall a larger size</li></ul>

The photographs show elephants from the two populations.



Forest elephant



Savannah elephant

DNA samples were collected from these two populations of elephants.

Scientists have concluded that the forest elephant and the savannah elephant are two different species.

\* (i) Analyse the data and the information provided to comment on the validity of this conclusion.

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

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**(Total for question = 9 marks)**



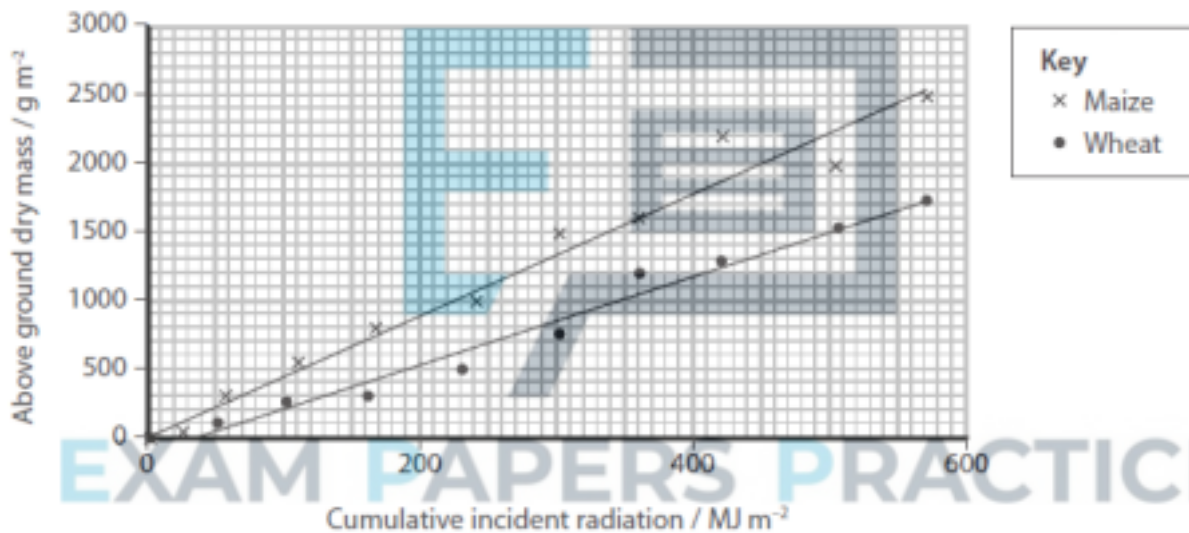
Q6.

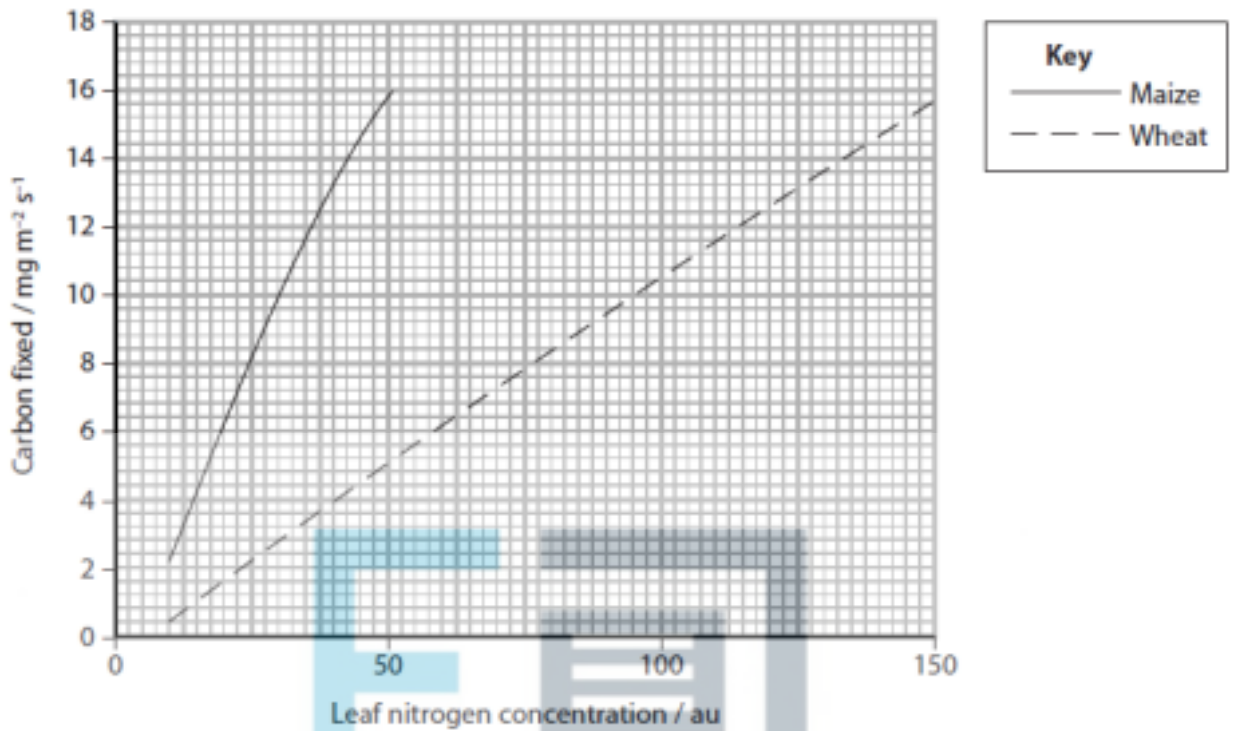
Wheat and maize are used as biofuel crops.

Scientists have investigated the effect of incident radiation and leaf nitrogen concentration on the growth of wheat and maize.

Incident radiation is a measure of the useful light energy hitting the plant. Leaf nitrogen concentration is a measure of the availability of nitrogen in the soil.

The results of these investigations are shown in the graphs.





(i) Scientists calculated the dry mass produced per MJ of incident radiation for wheat. This is shown in the table.

Plant	Above ground dry mass / $\text{g MJ}^{-1}$
Wheat	3.25

Calculate the above ground dry mass produced per MJ of incident radiation for maize.

(2)

Answer .....  $\text{g MJ}^{-1}$

(ii) Analyse the information provided about maize and wheat to determine which crop should be used for the production of biofuels.

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(iii) Sugar cane crops are also being grown for the production of biofuel.



Devise an experiment to investigate the effect of light intensity on the above ground dry mass of sugar cane crops grown in a field.

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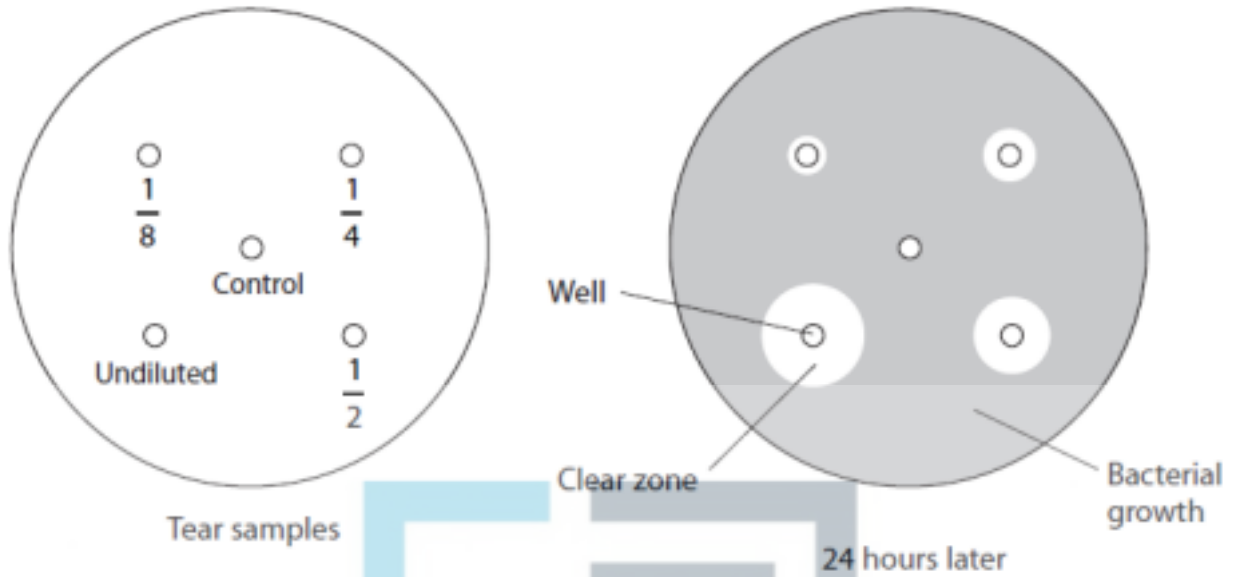
Q7.

Lysozyme is one component of the non-specific response to infection.

A student investigated the activity of lysozyme in tears.

A suspension of bacteria was mixed with molten agar and poured into a Petri dish. After the agar had solidified, wells were cut and different dilutions of tear sample were placed in the wells.

After 24 hours the Petri dish was inspected.



Explain how the student could adapt the investigation to study the effect of pH on the activity of lysozyme.

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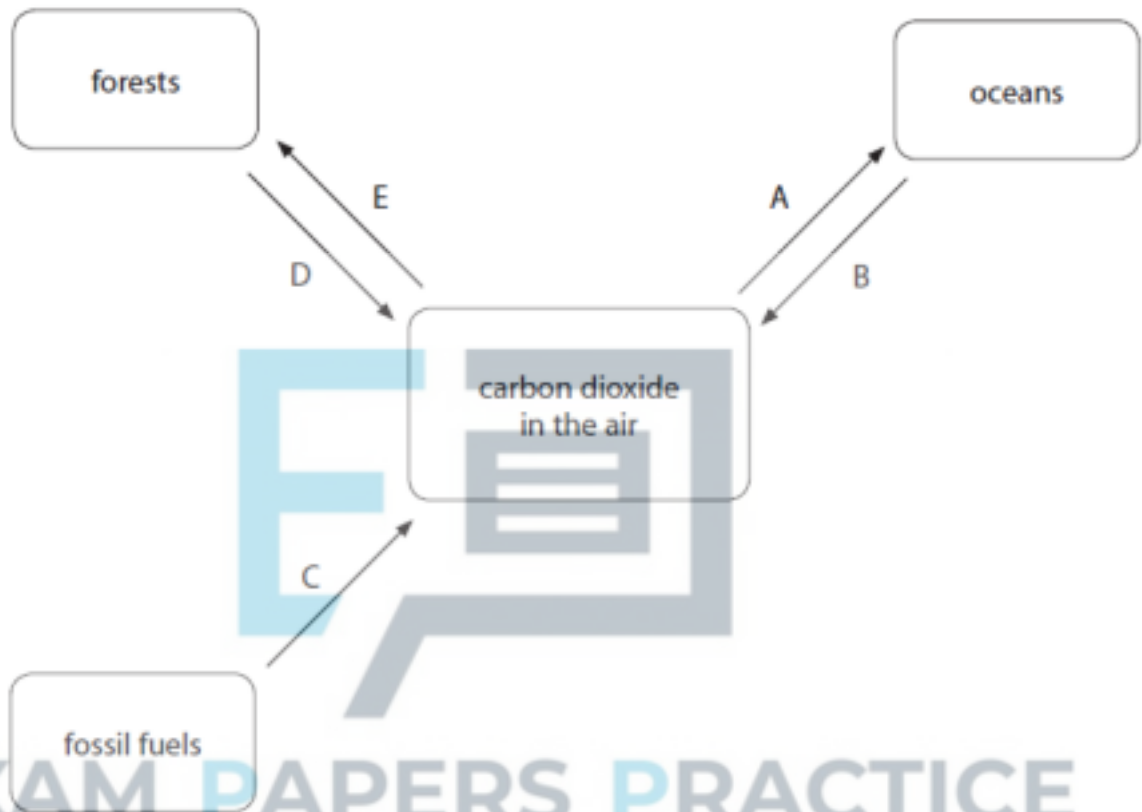
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Q8.

The diagram below shows part of the carbon cycle. The processes A, B, C, D and E, transfer carbon.



Explain how carbon dioxide is removed from the air into the oceans by process A.

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Q9.

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 <sup>-2</sup>	Number per square metre	Mass per square metre / g m <sup>-2</sup>
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

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

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(Total for question = 3 marks)

Q10.


The scientific article you have studied is adapted from several sources.

Use the information from the scientific article and your own knowledge to answer the following questions.

Probiotics include live bacteria that are ingested for health benefits.

Explain how probiotics may regulate food cravings (paragraphs 18, 19 and 20).

(3)



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**(Total for question = 3 marks)**

Q11.

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

Explain how reforestation of tropical rainforests can be used to minimise climate change.

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**(Total for question = 3 marks)**

Q12.

Trypsin is an enzyme found in many groups of living organisms.

Trypsin specifically acts on a polypeptide to form amino acids.

Trypsin molecules from vertebrates, but not other animals, have a calcium ion binding site.

Explain how this calcium ion binding site could have evolved in vertebrates.

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**(Total for question = 3 marks)**



Q13.

Explain how these two species of snake could have arisen from a common ancestor.

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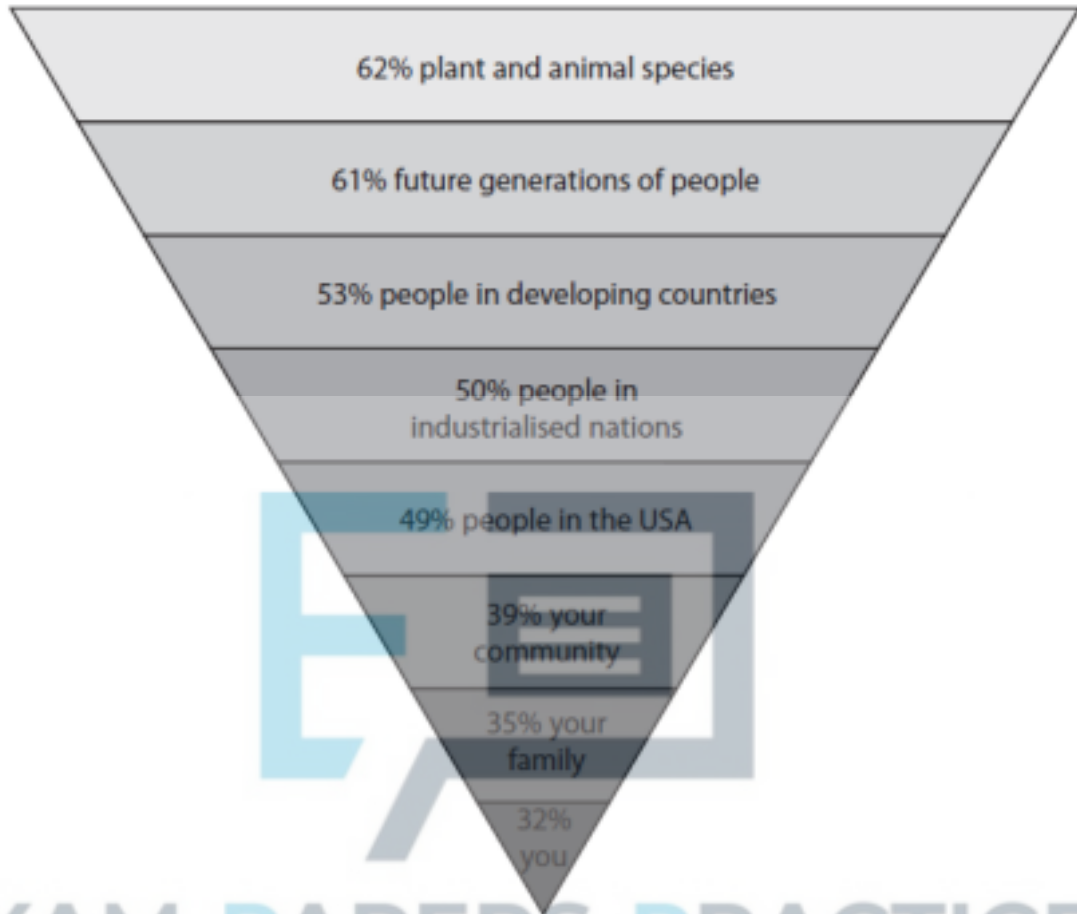
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Q14.

A survey was conducted in the USA to find out what harm people thought global warming could have.

The people were asked if they thought global warming could harm the eight groups shown in the diagram.

The diagram below shows the percentage of people who thought each group would be harmed.



Explain the meaning of the term **global warming**.

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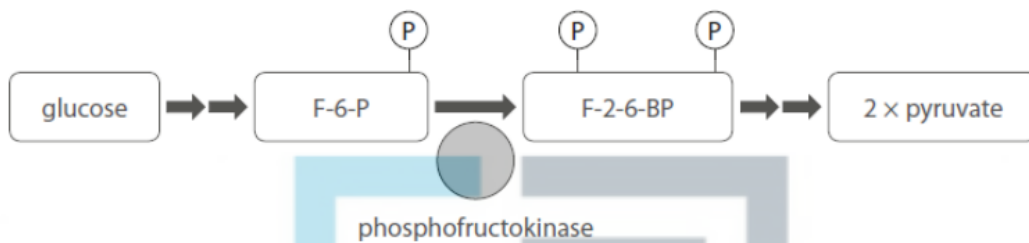




Q17.

Phosphofructokinase is an enzyme that uses ATP to convert fructose-6-phosphate (F-6-P) into fructose-2,6-bisphosphate (F-2,6-BP).

The conversion of F-6-P by this enzyme is a rate-determining step in glycolysis. This is shown in the diagram.



(i) Explain why ATP is required for this reaction.

(3)

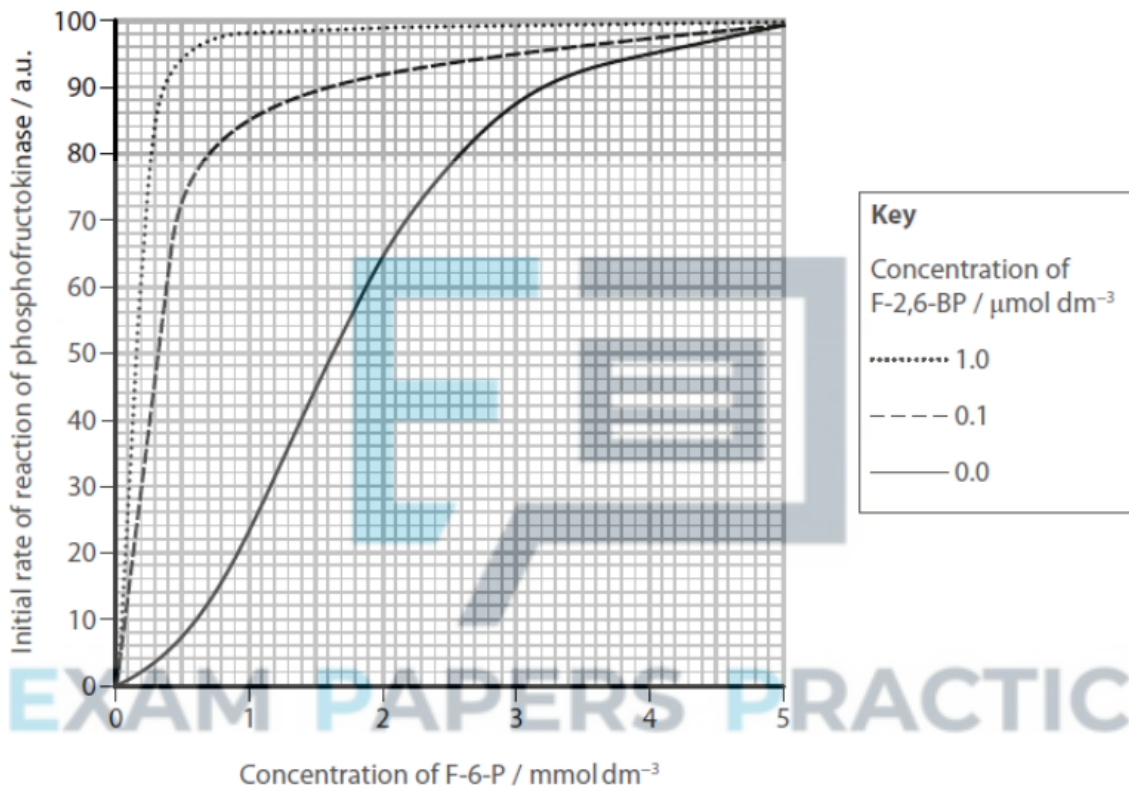
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The effect of substrate concentration on the initial rate of reaction of phosphofructokinase was investigated.



This investigation was repeated with the addition of two concentrations of F-2,6-BP.

The graph shows the results of this investigation.



Comment on the effects of F-6-P and F-2,6-BP concentrations on the rate of glycolysis.

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**(Total for question = 6 marks)**

Q18.

Explain why the value for GPP is lower than the light energy available to the ecosystem.

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Q19.

A new species of mosquito has evolved in the tunnels of the London Underground. These mosquitoes are believed to be the descendants of bird-biting mosquitoes which colonised the tunnels 100 hundred years ago. The mosquitoes now feed on rats, mice and human beings instead of birds.



(a) Place a cross in the box next to the best definition of a species.

(1)

- A** individuals can interbreed to produce fertile offspring
- B** individuals can interbreed to produce hybrid offspring
- C** individuals can interbreed to produce sterile offspring
- D** individuals can interbreed to produce offspring

(b) Explain how this species of mosquito may have evolved.

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Q20.

DCMU is a herbicide that can disrupt one of the carrier proteins in the electron transport chain of chloroplasts.

A student carried out an investigation to study the effect of DCMU concentration on the Hill reaction. The student ground up some spinach leaves in an isolation mixture containing sucrose solution at a concentration of  $0.4 \text{ mol dm}^{-3}$ . The mixture was filtered and then spun in a centrifuge. The chloroplasts were extracted.

These chloroplasts were divided equally into eight different tubes containing a solution of distilled water, DCPIP and a buffer.

A small volume of DCMU was added to each tube and the time taken for the blue DCPIP to decolourise was recorded.

(a) (i) Explain why the isolation mixture contained sucrose at a concentration of  $0.4 \text{ mol dm}^{-3}$  rather than at a concentration of  $0.8 \text{ mol dm}^{-3}$ .

(2)

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(ii) The isolation mixture had a temperature of  $4^\circ \text{C}$  and pH of 7.

Explain why this temperature and pH are appropriate.

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(b) The time taken for the DCPIP to decolourise was converted to a rate of colour change. The results

Concentration of DCMU / $\mu\text{mol dm}^{-3}$	Rate of colour change / $\times 10^{-4} \text{s}^{-1}$
0	23.5
1	12.5
2	6.3
3	4.2
4	3.2
5	2.6
6	2.2
7	2.3

are shown in the table.

(i) Analyse the data to deduce a null hypothesis for this investigation.

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(ii) The student started to analyse the data using a statistical test, called the Spearman's rank correlation coefficient ( $r_s$ ), to see if there was a correlation.

Complete the table by filling in the empty boxes.

Concentration of DCMU / $\text{mol dm}^{-3}$	Concentration ranked ( $R_1$ )	Rate of colour change / $10^{-4} \text{s}^{-1}$	Rate ranked ( $R_2$ )	Difference in ranks $d$ ( $R_1 - R_2$ )	Difference squared $d^2$
0	1	23.5	8		
1	2	12.5	7	5	25
2	3	6.3	6	3	9
3	4	4.2	5	1	1
4	5	3.2	4	1	1
5	6	2.6	3	3	9
6	7	2.2	1	6	36
7	8	2.3	2	6	36

(1)

(iii) Calculate  $r_s$  by using the equation.

$$r_s = 1 - \frac{6 \sum d^2}{n(n^2 - 1)}$$

Where  $\sum(d^2)$  is the sum of all the values for  $d^2$  and  $n$  is the number of pairs of data.

(3)

$r_s =$  .....

(iv) The table shows some of the critical values for the Spearman's rank correlation coefficient.





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Number of pairs of data ( <i>n</i> )	<i>p</i> value			
	0.10	0.05	0.02	0.01
6	0.829	0.866	0.943	1.000
8	0.643	0.786	0.833	0.881
10	0.564	0.648	0.746	0.794
12	0.506	0.591	0.712	0.777
14	0.456	0.544	0.645	0.715
16	0.425	0.506	0.601	0.665
18	0.399	0.475	0.564	0.625

Explain the outcome of the statistical test.

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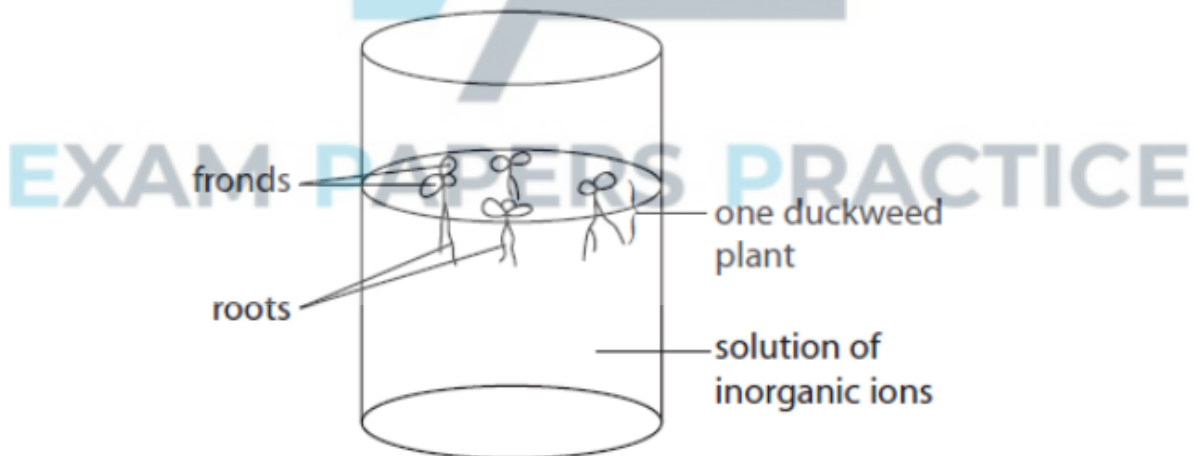


Q21.

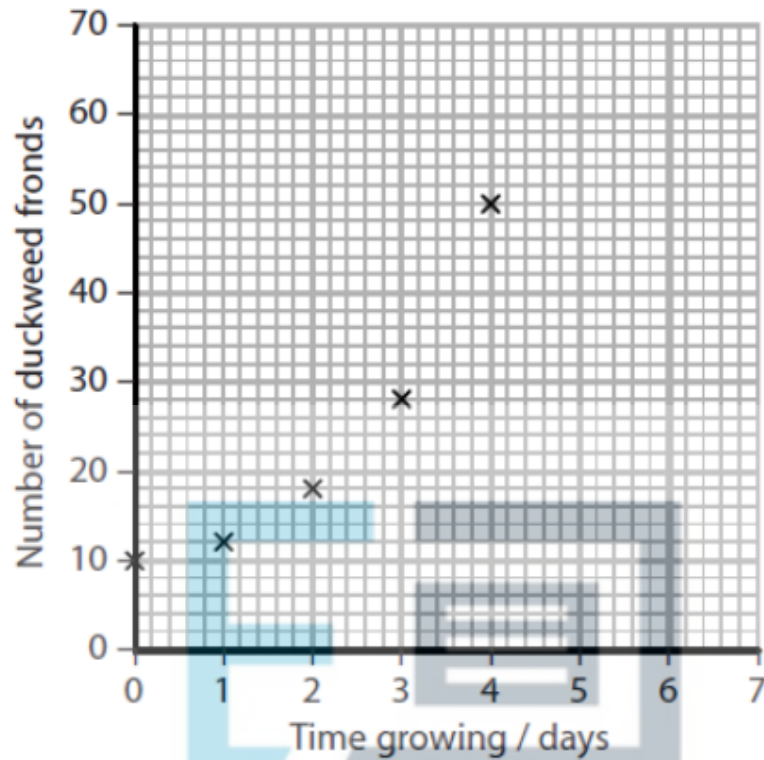
Duckweed is a small plant that floats on the surface of water. It could be a source of animal feed as it grows very quickly. Duckweed absorbs dissolved inorganic ions and this decreases water pollution.

Duckweed grows by producing more fronds, which then separate into new plants.

The diagram below shows some duckweed growing in a beaker containing a solution of inorganic ions.



The graph below shows the growth of duckweed over a four-day period.



(i) Explain what the solution should contain for the optimum growth of duckweed.

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(ii) Explain how the information in this graph could be used to estimate the increase in growth after a further six days.



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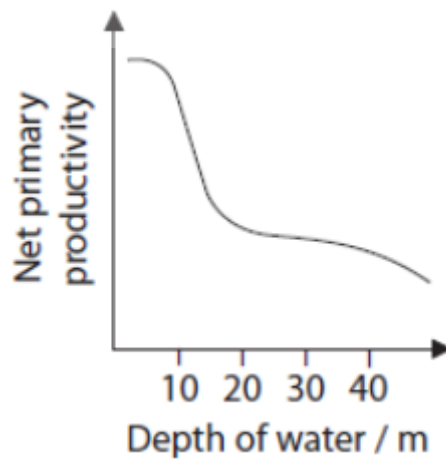
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Q22.

The graph below shows how the depth of water in a freshwater lake affects the net primary productivity (NPP).



Suggest an explanation for the effect of depth of water on the NPP in this freshwater lake.



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Q23.

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The pigment content of mountain plants can be affected by various environmental factors. These factors include altitude (height up a mountain), exposure to ultraviolet radiation (UV-B) and temperature.

These pigments include chlorophyll, found in chloroplasts, and flavonoids that are found in sap vacuoles.

Flavonoids can protect plants from ultraviolet radiation (UV-B) that can damage DNA. The altitude at which a plant grows on a mountain affects its flavonoid content.

Devise a procedure to show that an increase in altitude increases the flavonoid content of one species of plant found growing on a mountain.

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Q24.

The photograph shows a glacier at the top of a mountain.  
Glaciers in many areas of the world are retreating (reducing in size).  
The line on the photograph shows the position of the front edge of the glacier in 1985.

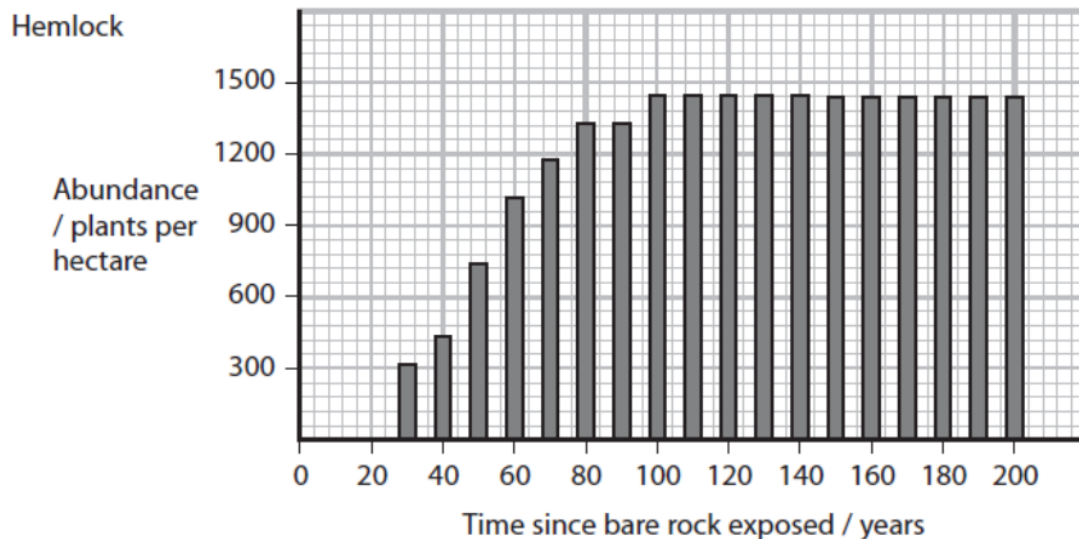
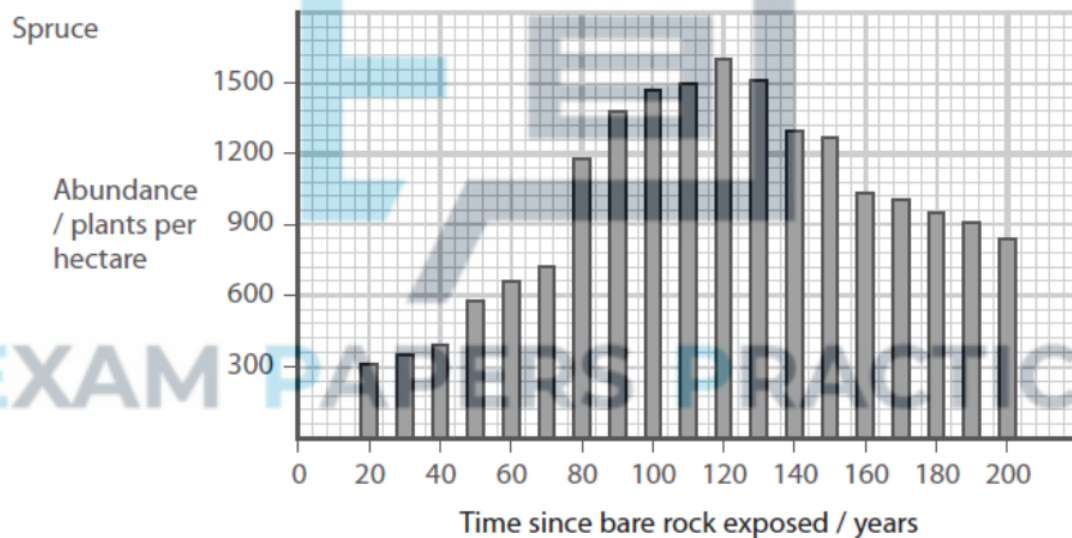
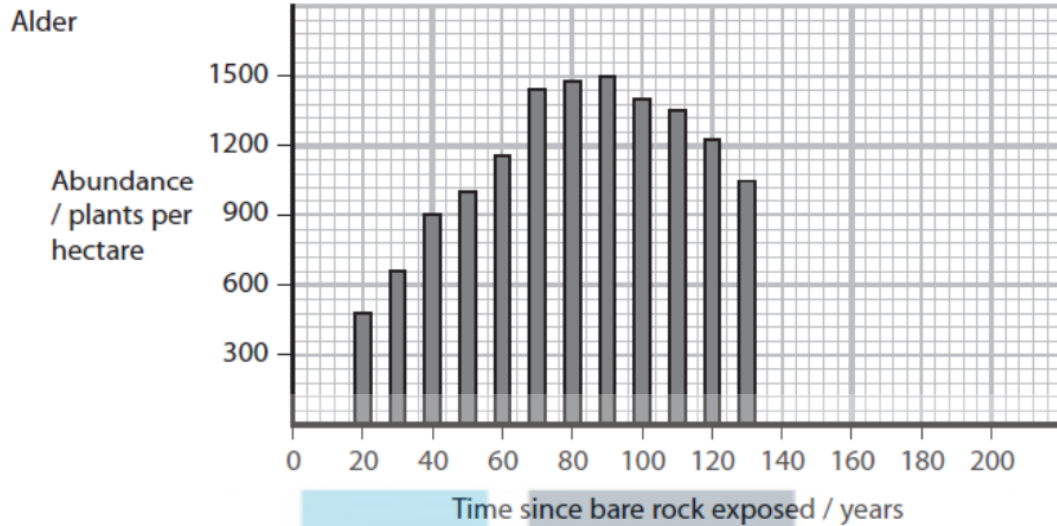


Bare rock is exposed as the glacier retreats. Two hundred years ago, bare rock was exposed after a glacier retreated. A study has been made of the long-term changes in vegetation on that area of rock after the retreat of the glacier.

The graphs show the abundance of three species of tree since the bare rock was exposed as the glacier retreated. The abundance of each species was measured every ten years for 200 years.



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Comment on the changes in the abundance of these three species over 200 years.

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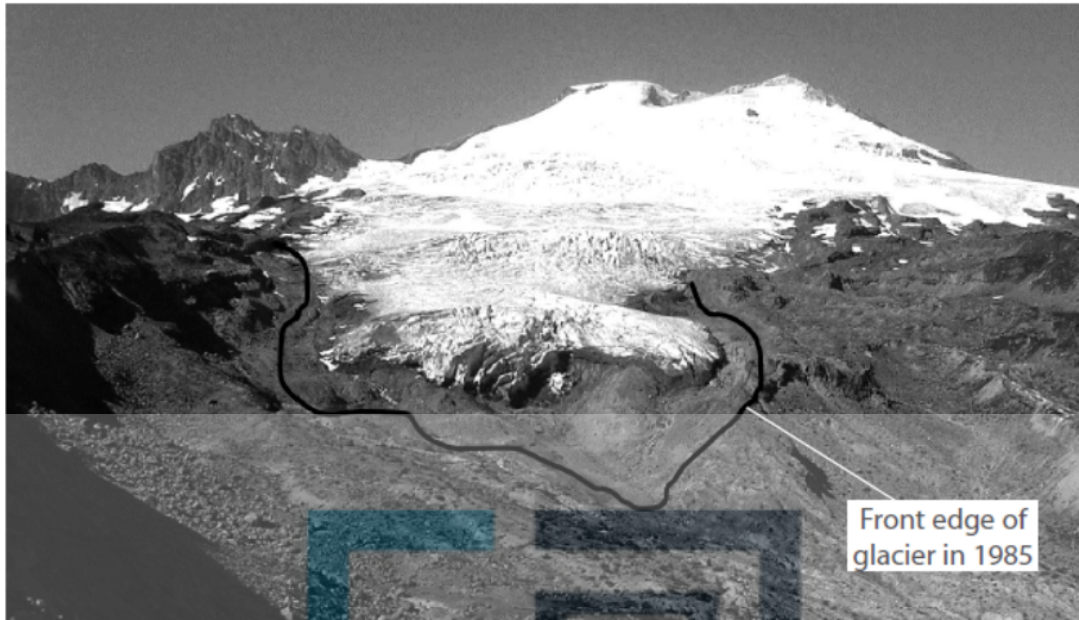


Q25.

The photograph shows a glacier at the top of a mountain.

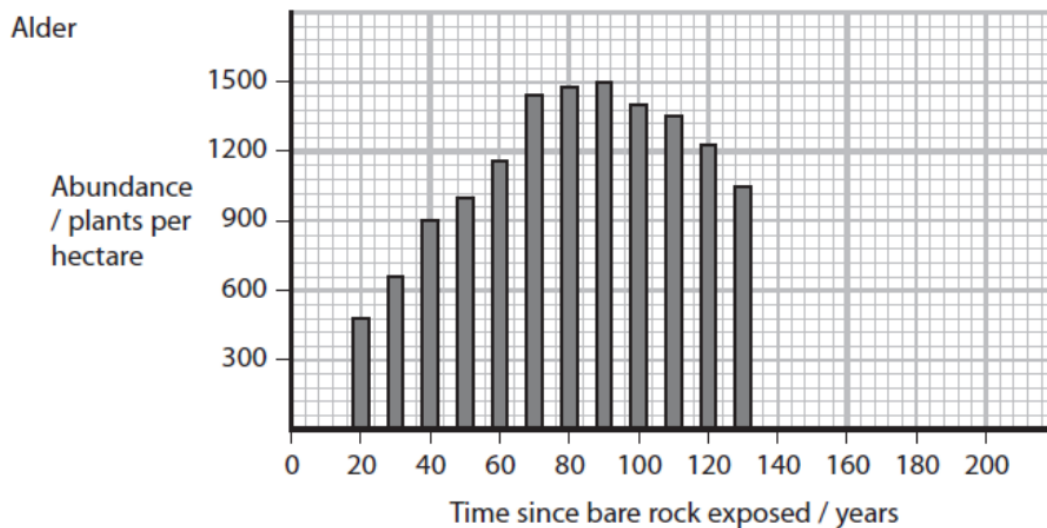
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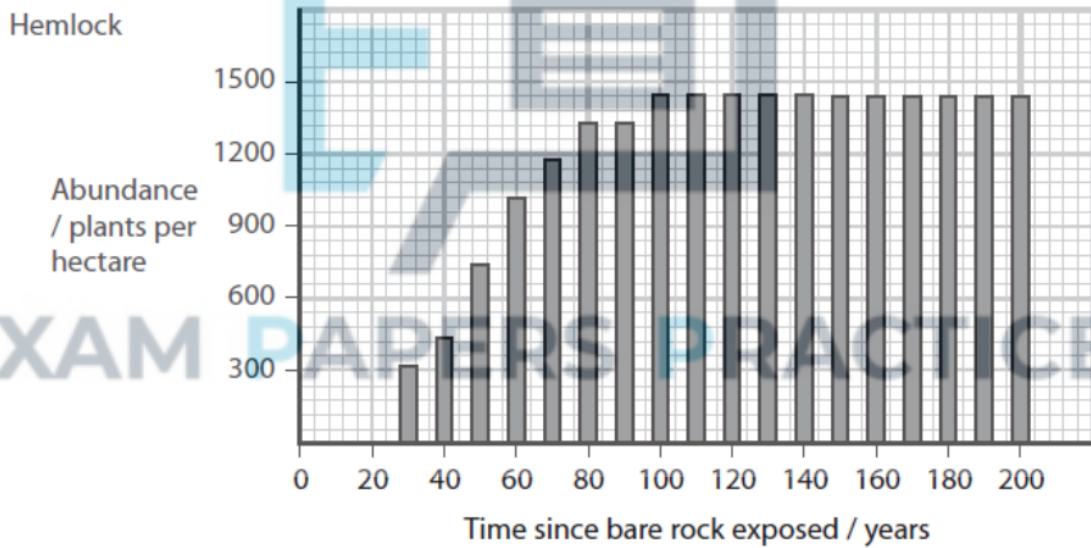
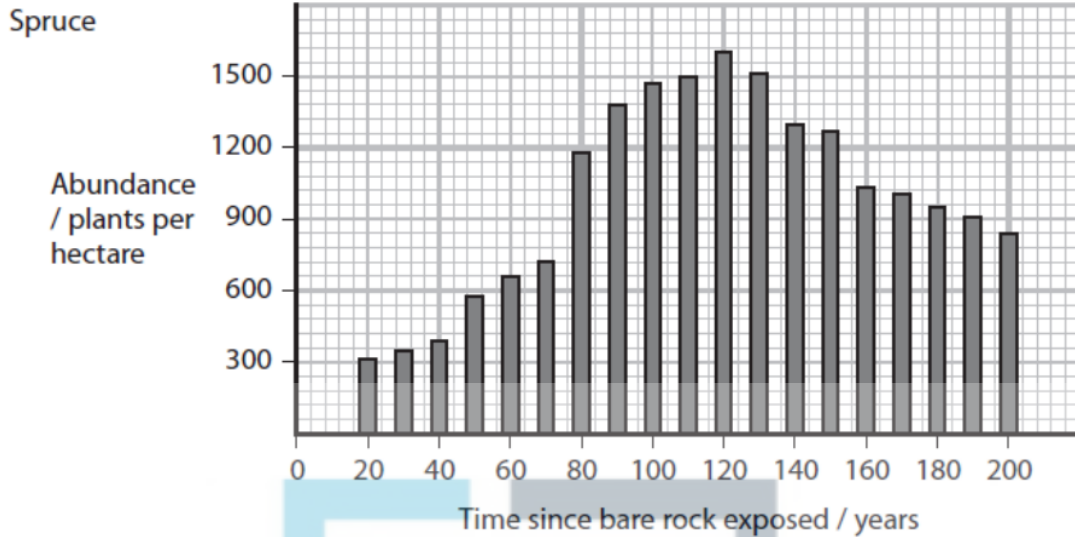
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The graphs show the abundance of three species of tree since the bare rock was exposed as the glacier retreated. The abundance of each species was measured every ten years for 200 years.





Explain what happened to the bare rock to allow the growth of these trees.

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**(Total for question = 3 marks)**



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