

On the Wild Side -4

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 -4

Type: Topic Question

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.

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 why the 'anaerobic oxidation of methane' could be a 'key climate regulator' (paragraph 2).

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(Total for question = 3 marks)

Q2.

The genomes of some species of cichlid fish have been sequenced and analysed. The data collected included:

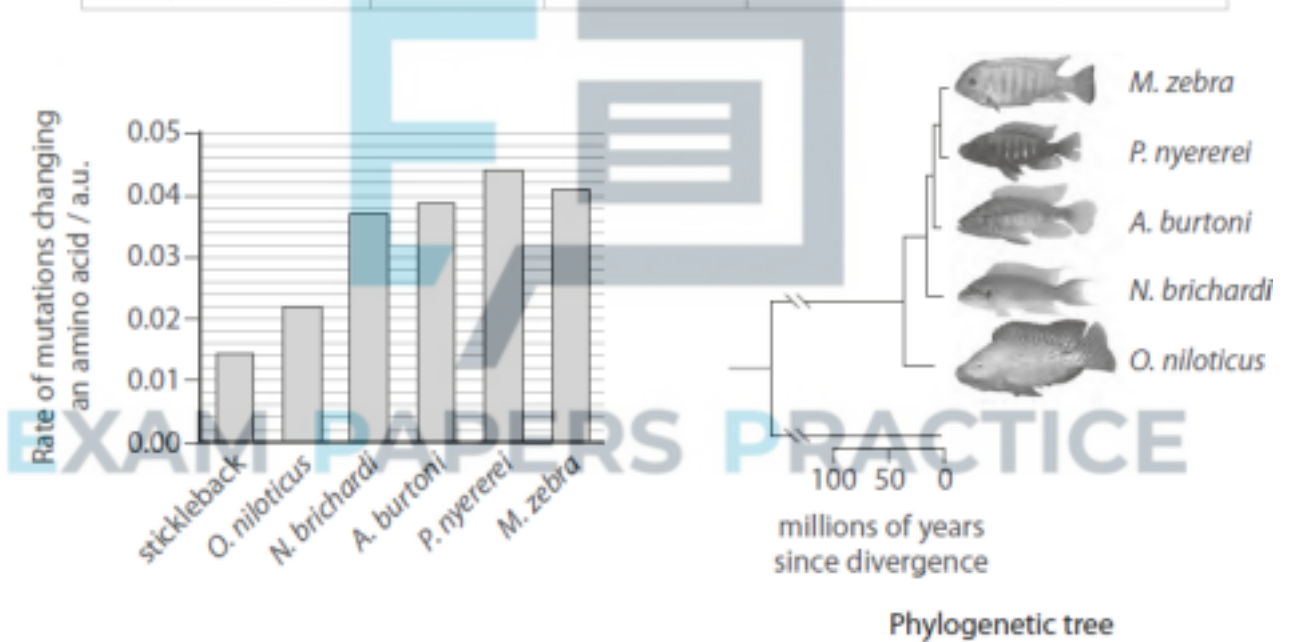
- the rate at which genes have been duplicated to produce additional copies of genes on a chromosome
- the frequency of mutations in transcription factor binding sites
- the rate of mutations that result in a change of an amino acid in a protein.

This information was used to produce a phylogenetic tree.



A comparison was made with a stickleback, which is a slowly evolving fish.

Speed of evolution	Fish	Rate of gene duplication / a.u.	Number of mutations in transcription factor binding sites (compared to <i>O. niloticus</i>)
Rapidly evolving cichlid fish	<i>O. niloticus</i>	45	0
	<i>N. brichardi</i>	45	214
	<i>A. burtoni</i>	55	140
	<i>P. nyererei</i>	45	129
	<i>M. zebra</i>	60	142
Slowly evolving fish	stickleback	10	0



Analyse all the data provided to discuss how several species of cichlid fish have evolved over a short period of time.

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(Total for question = 9 marks)

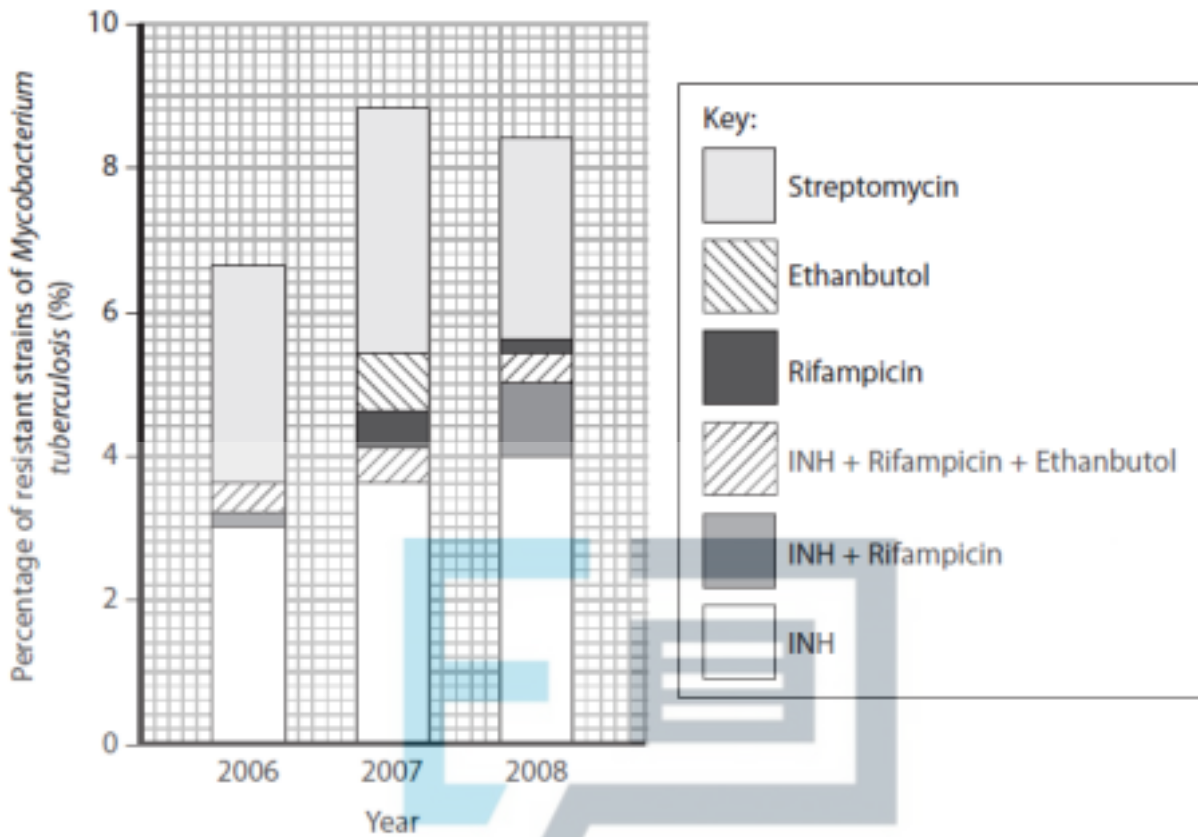
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Q3.

Treating *Mycobacterium tuberculosis* infections can be a problem, as the bacteria are resistant to many antibiotics.

There are many strains of *Mycobacterium tuberculosis*. Different strains are resistant to different antibiotics or combinations of antibiotics.

The chart below shows the percentage of resistant strains of *Mycobacterium tuberculosis* to six different antibiotics, or combinations of antibiotics, in 2006, 2007 and 2008.



(i) Using the information in the graph, compare the types of antibiotics and combinations of antibiotics that the *Mycobacterium tuberculosis* are resistant to in 2006 with 2007.

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(ii) The percentage of strains of *Mycobacterium tuberculosis* resistant to the antibiotic INH has increased during these three years.

Suggest how natural selection could have resulted in this increase.

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(iii) Suggest how hospitals could prevent an increase in the percentage of strains of *Mycobacterium tuberculosis* resistant to antibiotics.

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Q4.

Crustose coralline algae are a group of photosynthetic red algae that play an important role in the formation of coral reefs.

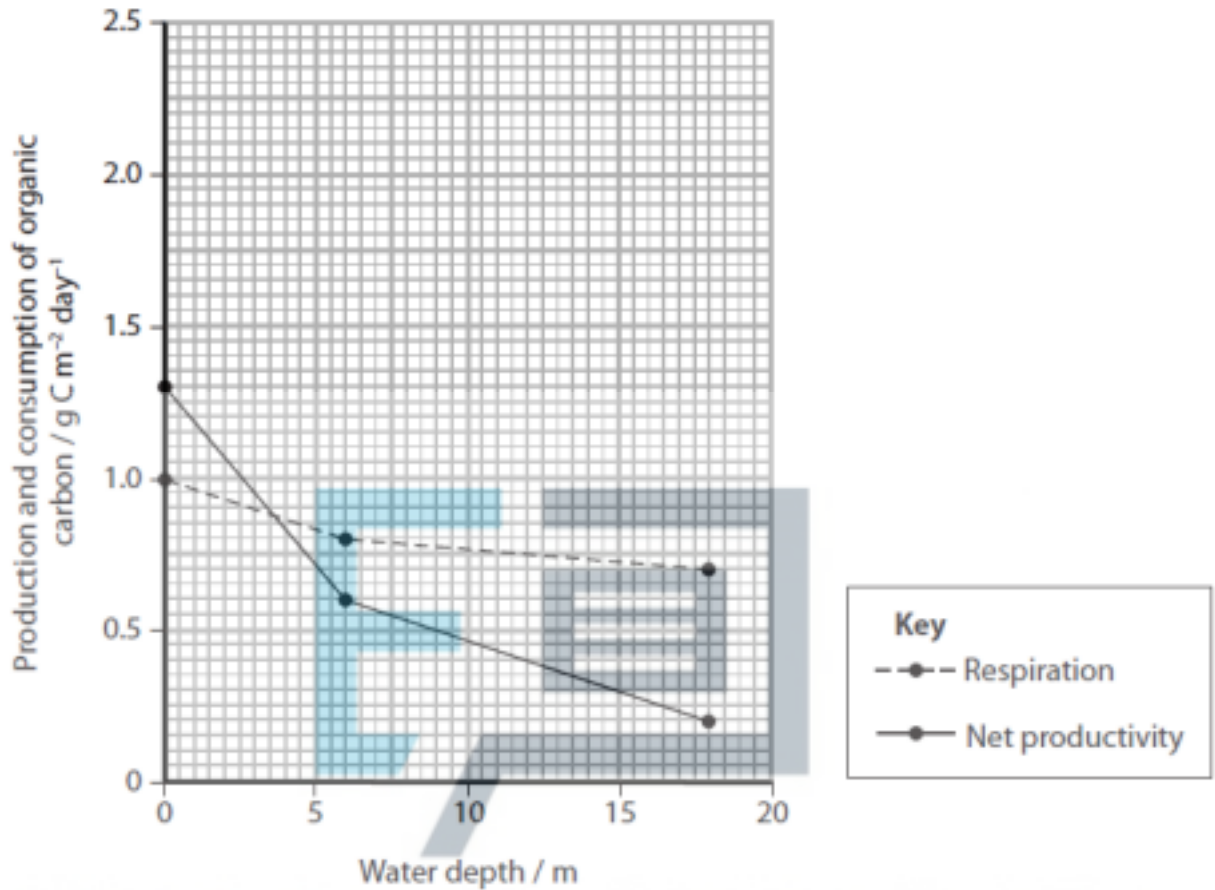
These algae deposit calcium carbonate in their cell walls to form encrusting and rock-like structures.

(a) (i) Write an expression that describes net productivity.

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(1)

(ii) The graph shows net productivity and respiration for one species of crustose coralline algae found at different water depths.



On the graph, plot the gross productivity for this species.

(1)

(iii) Analyse the data to explain the effect of water depth on net productivity.

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*(b) Scientists investigated the effect of water temperature and carbon dioxide concentration on the growth of one species of crustose coralline algae.

The growth was measured by recording the percentage cover of the algae on a surface. The results of this investigation are shown in the table.

Growth conditions		Percentage cover (%)
Temperature / °C	CO ₂ concentration / ppm	
17	400	100
17	700	70
20	400	100
20	700	35

The normal temperature and carbon dioxide concentration in the natural habitat of this species are 17°C and 400 ppm CO₂.

Analyse the data in the graph and the table to assess the possible impact of the continued burning of fossil fuels on crustose coralline algae.

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(Total for question = 11 marks)

Q5.

Anthropogenic activities are contributing to global warming.

Scientists from the IPCC (Intergovernmental Panel on Climate Change) say that changes to diet can have a major impact on greenhouse gas emissions. The method of farming affects the level of impact.

The Paris Agreement of 2015 committed countries to reduce carbon emissions.

How many of the following statements about global warming are correct?

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(1)

- global warming is caused by a reduction in greenhouse gases
- deforestation may contribute to global warming
- global warming is leading to the melting of sea ice
- global warming may lead to a change in rainfall patterns
- global warming is affecting only the ice caps

A 2

B 3

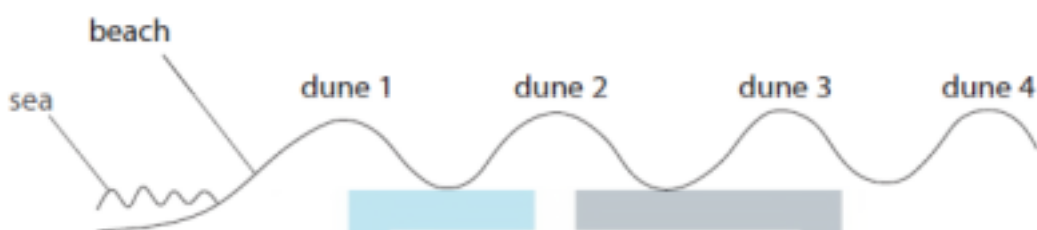
C 4

D 5

(Total for question = 1 mark)

Q6.

Sand dunes are a habitat that can often be found by the edge of the sea. An investigation was carried out to study the variety of plant species found on sand dunes. Four adjacent sand dunes from the sea to further inland were selected, as shown in the diagram.



Each species of plant present on dune 1 was recorded along with the total number of each species of plant present. This was repeated for dunes 2, 3 and 4 and the results are shown in the table.

Plant species	Number of each plant species present			
	dune 1	dune 2	dune 3	dune 4
A	169	9	0	0
B	5	123	19	0
C	0	0	126	182
D	1	44	0	0
E	0	0	5	2
F	0	0	20	10
G	0	0	86	35
H	0	0	0	62
I	0	0	32	17
J	0	0	0	119

Devise a procedure that you could use to find out if the percentage cover of species B is different on the tops of dunes than in between the dunes.

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Q7.

Scientists are concerned that climate change may be affecting the Arctic environment and the polar bears that live there.

Birds, such as barnacle geese, use the land on Spitsbergen as nesting sites.

Polar bears usually hunt for seals from sea ice. They have also been seen feeding on eggs from barnacle geese nests.

Assess the relationship between the presence of sea ice and the number of eggs taken by polar bears since 2000.

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(Total for question = 4 marks)

Q8.

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Lipids and carbohydrates are found in both plants and animals.

The carbohydrate content of vegetables ranges from 3 to 35%. However, meat contains little to no carbohydrate. Milk is the only food source from animals that contains a significant amount of carbohydrate.

Although plant material contains a higher proportion of carbohydrate than animal tissues, it has been claimed that carbohydrates are more important to animals than they are to plants.

Assess the relative importance of carbohydrates to plants and animals.



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(Total for question = 9 marks)



Q9.

Sand dunes are a habitat that can often be found by the edge of the sea. An investigation was carried out to study the variety of plant species found on sand dunes. Four adjacent sand dunes from the sea to further inland were selected, as shown in the diagram.



Each species of plant present on dune 1 was recorded along with the total number of each species of plant present. This was repeated for dunes 2, 3 and 4 and the results are shown in the table.

Plant species	Number of each plant species present			
	dune 1	dune 2	dune 3	dune 4
A	169	9	0	0
B	5	123	19	0
C	0	0	126	182
D	1	44	0	0
E	0	0	5	2
F	0	0	20	10
G	0	0	86	35
H	0	0	0	62
I	0	0	32	17
J	0	0	0	119

(i)

The diversity index was calculated for dunes 1, 2 and 3 using this equation.

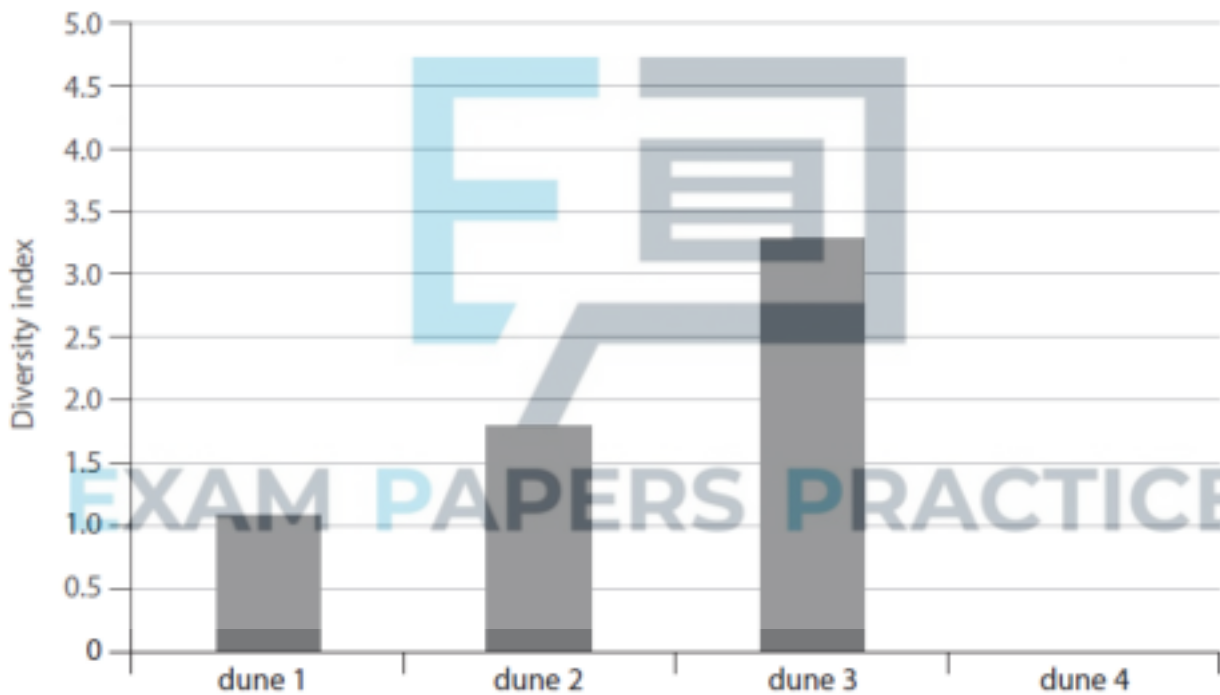


$$\text{Diversity index } (D) = \frac{N(N-1)}{\sum n(n-1)}$$

Where N is the total number of all individuals of all species in each dune. Use the table and diversity index equation to calculate the diversity index for dune 4.

Plot your answer on the bar chart.

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(ii) Explain how the data demonstrate the process of succession.

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Q10.

The carbon cycle describes the movement of carbon within an ecosystem.

In this cycle, carbon neutral processes do not change the concentration of carbon dioxide in the atmosphere.

The table below shows the main sources and combustion products of some fuels.

Fuel	Main sources	Main combustion products
Biodiesel	Oils from crops such as soya beans, rape seeds, palm seeds	Carbon dioxide and water vapour
Ethanol	Fermented sugars from crops such as sugar cane, sugar beet	Carbon dioxide and water vapour
Hydrogen	Catalysis of methane from fossil deposits or biogas generation using waste biomass	Water vapour
Methane	Extracted from fossil deposits or biogas generation using waste biomass	Carbon dioxide and water vapour
Propane	Refining of crude oil from fossil deposits	Carbon dioxide and water vapour

(a) Place a cross in the box next to the names of the four fuels, shown in the table, that could be considered to be biofuels.

(1)



- A** biodiesel, ethanol, hydrogen, methane
- B** biodiesel, ethanol, hydrogen, propane
- C** biodiesel, ethanol, methane, propane
- D** biodiesel, hydrogen, methane, propane

*(b) Large areas of land may need to be cleared in order to produce biofuels. This might involve deforestation.

Discuss why the production of biofuels may not be carbon neutral.

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(c) Explain how the combustion products, from the burning of fuels, may lead to global warming.

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(Total for Question = 10 marks)

Q11.

First generation biofuels are made from sugars and vegetable oils found in food crops.

(a) Some countries are replacing small percentages of petrol and diesel with first generation biofuels to reduce the effect of greenhouse gases on global warming.

(i) Place a cross in the box next to a pair of greenhouse gases.

(1)

- A** carbon dioxide and methane
- B** carbon dioxide and carbon monoxide
- C** carbon monoxide and nitrogen
- D** methane and nitrogen

(ii) Suggest why using first generation biofuels instead of petrol and diesel could reduce global warming.

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(b) Second generation biofuels are now being developed. These will use non-food parts of crops that contain the polymers cellulose and lignin.

Bacteria can be used to synthesise ethanol from these polymers. However, enzyme treatment is necessary before the bacteria can use these polymers.

(i) Name a part of a plant stem that would contain these polymers.

(1)

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(ii) Suggest why cellulose has to be treated with enzymes before the bacteria can use it as an energy source.

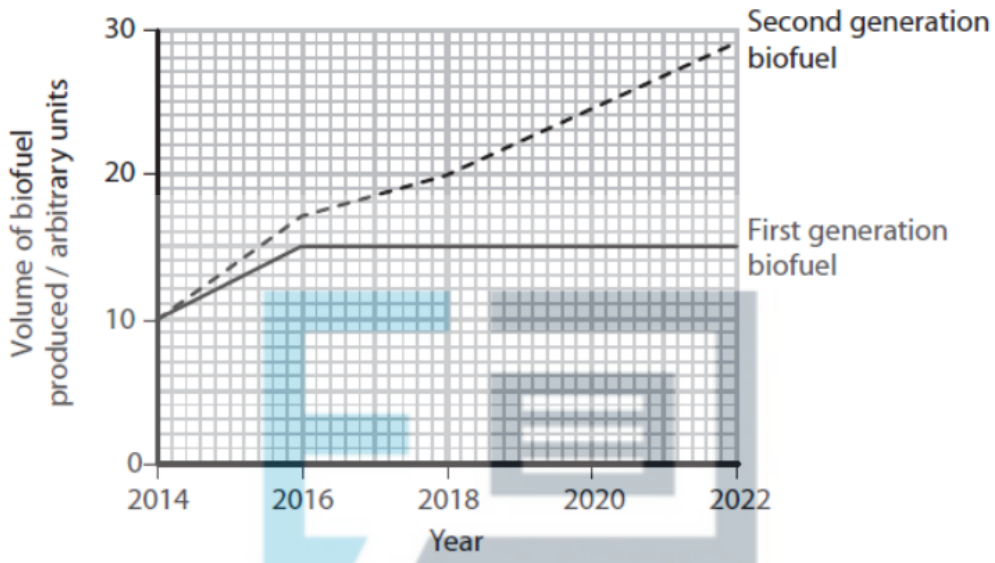
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(c) The graph below shows how the global production of first generation and second generation biofuels could change in the future.



Using the information in the graph, describe the expected changes in the production of first generation and second generation biofuels. Suggest reasons for these changes.

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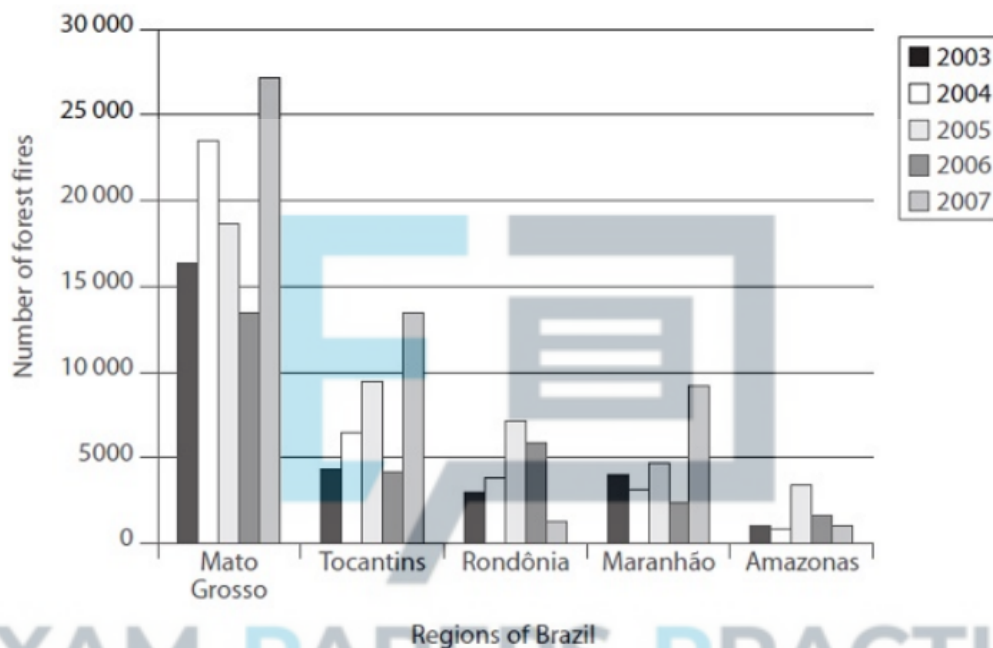
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(Total for question = 11 marks)

Q12.

Global warming is a worldwide problem that affects climate and the environment. (a) The graph below



shows the number of forest fires in five regions of Brazil, for 2003 to 2007.

(i) Place a cross in the box next to the best conclusion that can be drawn from these results about the number of forest fires in Brazil.

- A** The number of forest fires has generally decreased
- B** The number of forest fires has generally increased
- C** The number of forest fires in Mato Grosso each year is always higher than in other areas
- D** There are no clear trends

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*(ii) Explain how forest fires may lead to global warming.

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(b) (i) Explain why the use of biofuels may help to reduce global warming.

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(ii) Explain **one** disadvantage of using biofuels to reduce global warming.

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(Total for Question = 11 marks)

Q13.

Biofuels are being developed to reduce the effect of greenhouse gases on global warming. (a) The list below shows some of the gases found in the atmosphere:

- carbon dioxide
- helium
- methane
- nitrogen
- oxygen

Place a cross in the box next to the number of greenhouse gases in this list.

A 1

B 2

C 3

D 4

(b) Biofuels are produced from crop plants.

Bioethanols are produced from carbohydrates, such as corn starch and sugar.

Biodiesels are produced from lipids, such as soybean oil and rapeseed oil. (i)

Describe the structure of lipids.



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(ii) The table below gives some information about the **production** of biofuels from four different crop plants.

Crop plant	Carbon dioxide emissions from the production of biofuels / kg per MJ of energy produced	Level of resources used in production of biofuels		
		water	fertilisers	pesticides
Corn	81 to 85	High	High	High
Sugar cane	4 to 12	Medium to low	High	Medium
Soy	49	High	Low to medium	Medium
Rape	37	High	Medium	Medium

Using the information in the table, discuss the advantages of producing biodiesels instead of bioethanols.

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(iii) Fertilisers contain inorganic ions. Name **three** inorganic ions that could be contained in the fertilisers and explain how these would improve the yield of the crop plants.

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(Total for question = 10 marks)

Q14.

Forests are important habitats.

The effect of cutting down trees on the number of bird species observed in two different forest habitats was investigated.

(i) Give two biotic factors, other than cutting down trees, that could affect the number of bird species observed in a forest.

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(ii) Some of the results of the investigation are shown in the table.

Forest	Number of bird species in areas of the forest where no trees are cut down	Number of bird species in areas of the forest where some trees are cut down
A	35	19
B	16	10

Calculate the Chi-squared value (χ^2) for forest B using the formula shown.

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

Answer

(3)

(iii) The table gives some critical values for the Chi-squared test.

Probability level	Critical value
0.05	3.84
0.01	6.64
0.001	10.83

The Chi-squared value for forest A is 4.74.

Deduce the effect of some trees being cut down on the number of species of birds in these two forests.

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(Total for question = 7 marks)

Q15.

Anthropogenic climate change is linked to an increase in carbon dioxide in the atmosphere. The World Meteorological Association recorded carbon dioxide levels of 405 ppm in 2017. This is an increase of 46% since 1817.

Calculate the level of carbon dioxide in 1817.

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(Total for question = 2 marks)

Q16.

A student investigated the effect of salt concentration on the growth of one species of brine shrimp.

The student placed 100 shrimp eggs in a beaker containing 1dm³ of 3% salt solution. Three days after the eggs hatched, 10 shrimps were collected and their lengths measured. Seven days after hatching, another 10 shrimps were collected and their lengths measured.



The procedure was repeated using a 5% salt solution. All other variables were kept constant. The results are shown in the table.

Specimen number	Length of specimen in 3% salt solution / mm		Length of specimen in 5% salt solution / mm	
	3 days after hatching	7 days after hatching	3 days after hatching	7 days after hatching
1	0.75	1.00	0.75	0.98
2	0.78	1.25	0.73	0.95
3	0.66	1.10	0.61	0.93
4	0.73	1.03	0.63	0.83
5	0.85	1.15	0.53	0.98
6	0.78	1.08	0.60	1.08
7	0.90	1.13	0.52	0.95
8	0.90	1.05	0.81	1.03
9	0.80	1.18	0.58	0.88
10	0.85	1.05	0.68	0.88
Mean	0.800	1.102		0.949

(i) Calculate the mean length of shrimp three days after hatching in the 5% salt solution. Give your answer to an appropriate number of significant figures.

(1)

Answer mm

(ii) Explain how these data can be used to show the effect of salt concentration on the rate of growth of brine shrimps.

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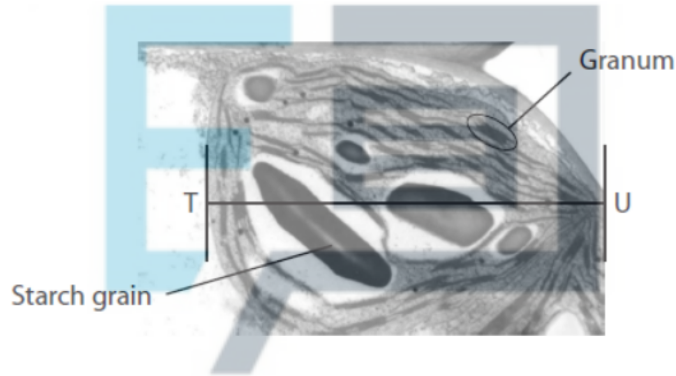
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(Total for question = 3 marks)

Q17.

Photosynthesis is a process that occurs in all green plants.

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



(i) The labelled starch grain in the chloroplast is 2.2 μm long.

Calculate the width of this chloroplast between T and U.

(2)

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(ii) Explain the relationship between the structure and functions of a granum in photosynthesis.

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(Total for question = 5 marks)

Q18.

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.

State what is meant by the phrase 'fix carbon into biomass' (paragraph 4).

EXAM PAPERS PRACTICE

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(Total for question = 2 marks)

Q19.

Climate change has been linked to the release of carbon dioxide from some power stations. Some power stations burn wood chips instead of fossil fuels to produce electricity. The photograph shows wood chips at a power station.



© Mr. Amarin Jitnathum/Shutterstock

It is thought that burning wood chips is more beneficial to the environment because in the long term it does not add carbon dioxide to the atmosphere.

Explain why burning wood chips does not increase carbon dioxide to the atmosphere in the long term.

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(Total for question = 4 marks)

Q20.

Climate change has been correlated with changing atmospheric carbon dioxide levels.

Scientists measured the productivity of two types of forest and recorded the mass of carbon taken up per square metre per year ($\text{gC m}^{-2} \text{y}^{-1}$).

The table shows data on the mean net primary productivity (NPP) and mean gross primary productivity (GPP) of these two types of forest.

Type of forest	Mean NPP / $\text{gC m}^{-2} \text{y}^{-1}$	Mean GPP / $\text{gC m}^{-2} \text{y}^{-1}$	Ratio of NPP to GPP
Boreal	322	1013	0.32
Temperate deciduous	1301	2165	0.60

(i) Calculate the percentage increase in mass of carbon released due to respiration by temperate deciduous forests compared with that by boreal forests.

(3)

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(ii) The ratio of net primary productivity to gross primary productivity is a measure of the ability of forests to transfer carbon from the atmosphere into biomass.



Scientists concluded that temperate deciduous forests would reduce levels of carbon dioxide in the atmosphere more than boreal forests.

Justify this conclusion.

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(Total for question = 6 marks)

Q21.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Climate change has been linked to the release of carbon dioxide from some power stations.

The main reason that carbon dioxide acts as a greenhouse gas is because it

(1)

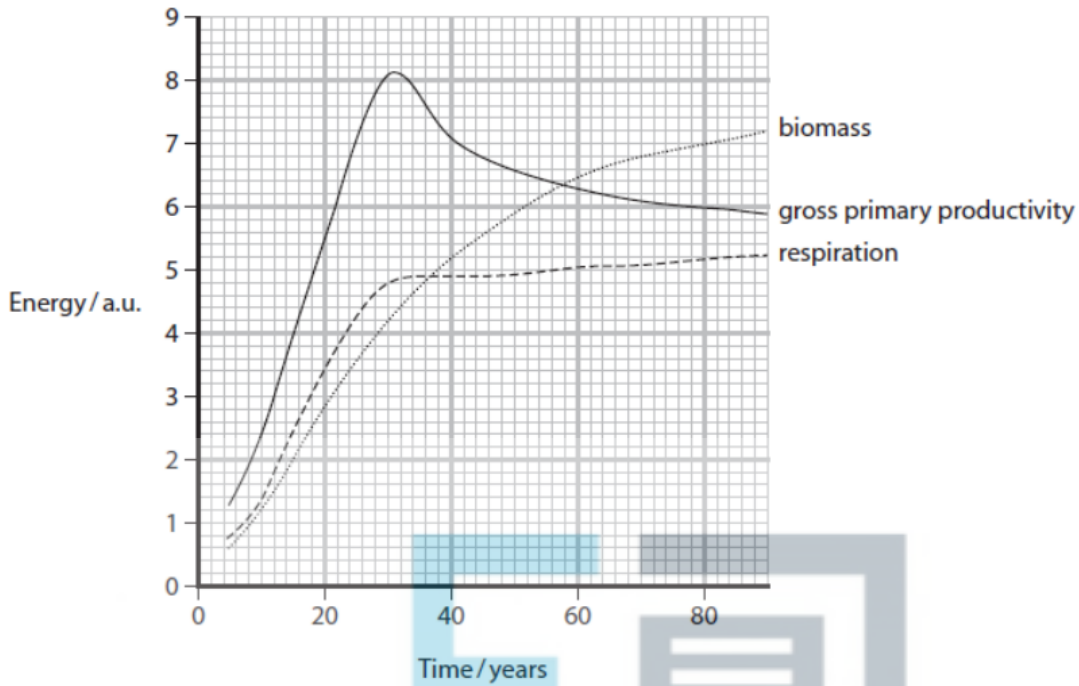
- A absorbs infrared radiation reflected by the surface of the Earth
- B absorbs ultraviolet radiation reflected by the surface of the Earth
- C reflects infrared radiation absorbed by the surface of the Earth
- D reflects ultraviolet radiation absorbed by the Earth's atmosphere

(Total for question = 1 mark)

Q22.

Eukaryotic cells contain membrane-bound organelles.

The graph shows the changes in biomass, gross primary productivity and the energy used in respiration during succession from grassland to mature forest.



(i) Add shading to the graph to show the area that represents net primary productivity.

(1)

(ii) Describe what is meant by the term succession.

(2)

EXAM PAPERS PRACTICE

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(iii) Deduce the effect of succession on the level of carbon dioxide in the atmosphere.

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(Total for question = 6 marks)

Q23.

Some plants are adapted to grow in shady conditions.

A study was carried out to compare the effect of growing in different light intensities on rates of photosynthesis of plants.

The plants are rated for levels of shade tolerance.

Plant seedlings of nine species were grown in either 25% or 5% of full sunlight. All other abiotic factors were controlled.

These seedlings were grown for six weeks and then exposed to full sunlight for 15 minutes. The rate of photosynthesis was measured during the exposure to full light.

The table shows the results of this investigation for four species of plant.



Species	Shade tolerance	Rate of photosynthesis / a.u.	
		Seedlings grown in 25% of full sunlight	Seedlings grown in 5% of full sunlight
A	Intolerant	410	415
B	Intermediate	300	275
C	Tolerant	180	210
D	Very tolerant	150	215

(i) Determine which species had the greatest percentage change in rate of photosynthesis when grown in lower light intensities.

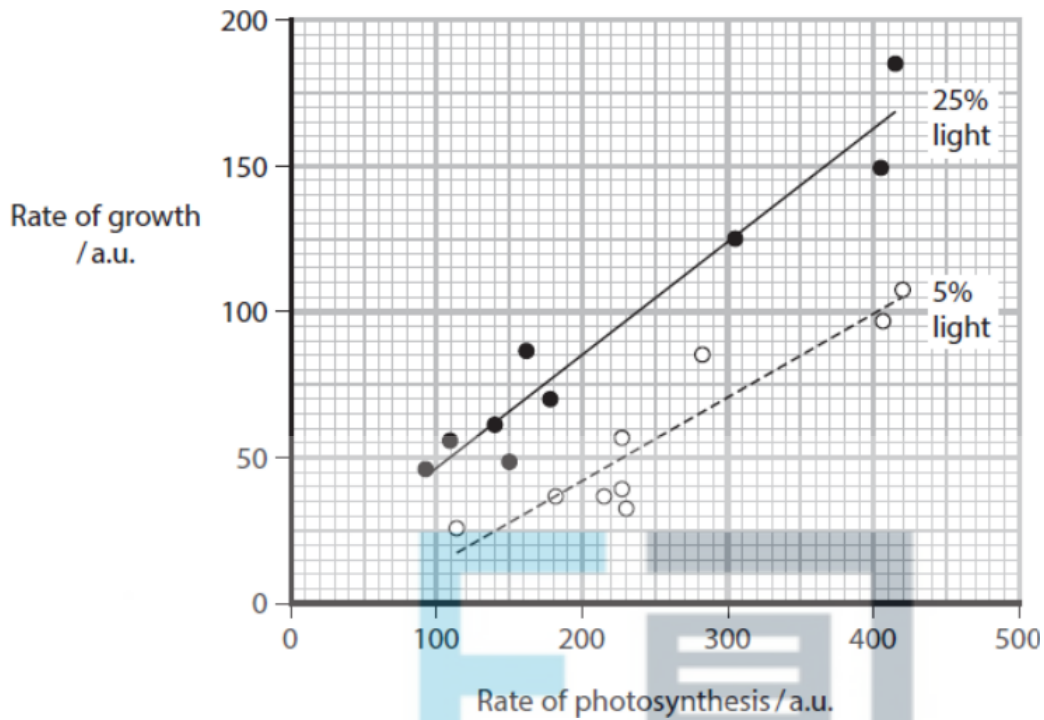
(2)

..... Answer

(ii) The rate of growth for all nine species of plant was also measured.

The graph shows the effects of the rate of photosynthesis on the rate of growth of these plants.

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Explain the effect of light intensity during the first six weeks of growth on the growth rate of these species of plant.

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(Total for question = 6 marks)

Q24.

Some plants are adapted to grow in shady conditions.

A study was carried out to compare the effect of growing in different light intensities on rates of photosynthesis of plants.

The plants are rated for levels of shade tolerance.

Plant seedlings of nine species were grown in either 25% or 5% of full sunlight. All other abiotic factors were controlled.

These seedlings were grown for six weeks and then exposed to full sunlight for 15 minutes. The rate of photosynthesis was measured during the exposure to full light.

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		Seedlings grown in 25% of full sunlight	Seedlings grown in 5% of full sunlight
A	Intolerant	410	415
B	Intermediate	300	275
C	Tolerant	180	210
D	Very tolerant	150	215

* Differences in the rate of photosynthesis may be due to the light-dependent reactions in chloroplasts.

Devise an investigation to compare the rate of the light-dependent reaction in shade tolerant and shade intolerant plants grown at different light intensities.

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(Total for question = 6 marks)

EXAM PAPERS PRACTICE

Q25.

Climate change has been linked to the release of carbon dioxide from some power stations.

Name the plant organelle that fixes carbon dioxide from the atmosphere.

(1)

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(Total for question = 1 mark)