AVAILABLE MARKS

**3** **(a)** **(i)** lipase [1]

**(ii)** lipid/fat/oil/substrate + enzyme (lipase) (need both for 1 mark) [1]

**(iii)** Any two from:
- Volume of solution/fat/concentration/amount of substrate/ amount of water/amount of substances
- Concentration of enzyme/volume of enzyme
- At the required temperature before mixed
- pH [2]

**(iv)** fatty acids; glycerol [2]

**(v)**
- Enzyme 1 works best/has optimum temperature at 30 °C;
- Enzyme 2 works best/has optimum temperature at 40 °C;
- Enzyme 1 works fastest at all temperatures;
- Enzyme 2 very slow to break down fat at 60 °C/only breaks down some fat at 60 °C/within washing cycle;
- Because it is denatured;
- Enzyme 1 works slowest at 60 °C;
- Because it is denatured; (only award denatured mark **once**)
- At low temperatures Enzyme 1/2/both enzymes work slowly;
- Because of fewer collisions/less kinetic energy of the molecules;
- Save energy/money sing enzyme 1;
- Enzyme 1 is more thermostable/enzyme 2 less theremostatable;

| Response | Mark |
|---|---|
| Candidates must use appropriate specialist terms throughout using at least 5 of the above points to describe the properties of the two enzymes and explain with reasons which one should be added to washing powder.<br>Candidates use good spelling, punctuation and grammar and the form and style are of a high standard. | [5-6] |
| Candidates must use some appropriate specialist terms throughout using at least 3 of the above points to describe the properties of the two enzymes and explain with reasons which one should be added to washing powder.<br>Candidates use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard. | [3-4] |
| Candidates describe one or two of the properties of the enzymes or explain with a reason which one should be added to washing powder. They use limited spelling punctuation and grammar and they have made little use of specialist terms. | [1-2] |
| Response not worthy of credit | [0] |

[6]

**(b) (i)** amylase [1]

**(ii)** amylase is substrate specific/lipase is only specific to fat/amylase is only specific to starch/shapes are not complementary/not fit/ active site does not match [1]

AVAILABLE MARKS

14



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| | | | | AVAILABLE MARKS |
|---|---|---|---|---|
| 4 | (a) | (i) | (Symptom) high blood glucose/thirst/lethargy/urinates a lot/tired<br><br>(Long-term effect) kidney/eye damage/CHD/stroke/loss of limbs/amputation/leg ulcers/blurred vision/circulatory problems/ problems with feet. [2] | |
| | | (ii) | reduce weight/eat less sugar/less fat in diet/less alcohol; exercise [2] | |
| | (b) | (i) | Benedicts;<br>heat;<br>blue to brick red/orange/red [3] | |
| | | (ii) | Dye did not change colour/dye stays pink/negative result; no glucose in urine/is not a diabetic [2] | |
| | | (iii) | no heating required/no laboratory equipment needed/fast/ handy/easier/convenient/hygienic [1] | |
| | | (iv) | enzyme on Clinistix is specific to glucose/only glucose fits into enzyme active site [1] | 11 |
| 5 | (a) | (i) | more plant species at area C than at A or B or converse/more variety or type of plants at C or away from sea or inland/fewer species closer to the sea)<br>higher total % cover at area C (than at A or B); or converse<br>higher total % as you go inland or lowest total % cover closer to the sea [2] | |
| | | (ii) | Any one from:<br>• too much wind at A/less wind at C<br>• lack soil/minerals at A/more at C<br>• lack fresh water at A/more at C<br>• soil pH at A different from C<br>• warmer inland<br>• too salty near the sea<br>• could be washed away by tide [1] | |



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**(b)** Indicative content

- Use quadrat
- Identify plant species in each quadrat
- Use a key to identify species
- Estimate % cover for each plant species in each quadrat
- Carry out at three areas (or at A, B and C)/line transect/belt transect/place quadrat next to each other/
- Repeat for reliability/use class results
- Name physical factor:- light, wind, pH levels, temperature, edaphic factors e.g. soil humus content, rain
- Describe how to measure a physical factor e.g. light meter/light sensor/anemometer/wind gauge/pH probe/meter/pH indicator/ thermometer/temp. probe/rain gauge/measuring cylinder
- Record/write down results

| Response | Mark |
|---|---|
| Candidates must use appropriate specialist terms throughout, using at least 5 of the above points, to describe how they would have carried out this investigation and explain, in a logical sequence how the pupils would have obtained these results. They use good spelling, punctuation and grammar and the form and style are of a high standard. | [5-6] |
| Candidates must use some appropriate specialist terms, using 3 or 4 of the above points, to describe how they would have carried out this investigation and partially explain, in a logical sequence, how the pupils would have obtained these results. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard. | [3-4] |
| Candidates describe using 1 or 2 of the above points how they would have carried out this investigation or explain how the pupils would have obtained these results using some or all of the above points. However these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. | [1-2] |
| Response not worthy of credit | [0] |

[6]

AVAILABLE MARKS

9

| | | | | | AVAILABLE MARKS |
|---|---|---|---|---|---|
| 6 | (a) | (i) | muscles | [1] | |
| | | (ii) | x axis and y axis scaled (must be over $\frac{1}{2}$ the graph) and correct way round;<br>correct labels on both axes (must include full units);<br>all points correctly plotted including 0,0;<br>points joined by *straight* lines | [4] | |
| | | (iii) | $6.33/6\frac{1}{3}$ | [1] | |
| | | (iv) | 2.4 | [1] | |
| | | (v) | build up is quicker than breakdown;<br>not enough oxygen/tissue runs out of oxygen;<br>tissue resorts to anaerobic respiration | [3] | |
| | (b) | (i) | keep out oxygen/keep/maintain anaerobic conditions | [1] | |
| | | (ii) | yellow<br>because $CO_2$ (produced) | [2] | 13 |
| | | | | **Total** | **70** |



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New Specification

Rewarding Learning

Centre Number

| 71 | |
|---|---|

Candidate Number

| |
|---|
| |

General Certificate of Secondary Education
2011–2012

# Double Award Science: Biology

## Unit B1

## Higher Tier

**[GSD12]**

GSD12

**MONDAY 27 FEBRUARY 2012**
**9.30 am–10.30 am**

**TIME**

1 hour.

**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.
Answer **all seven** questions.

**INFORMATION FOR CANDIDATES**

The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in questions **3(c)**, **5(b)** and **6(b)**.

| For Examiner's use only | |
|---|---|
| Question Number | Marks |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| Total Marks | |

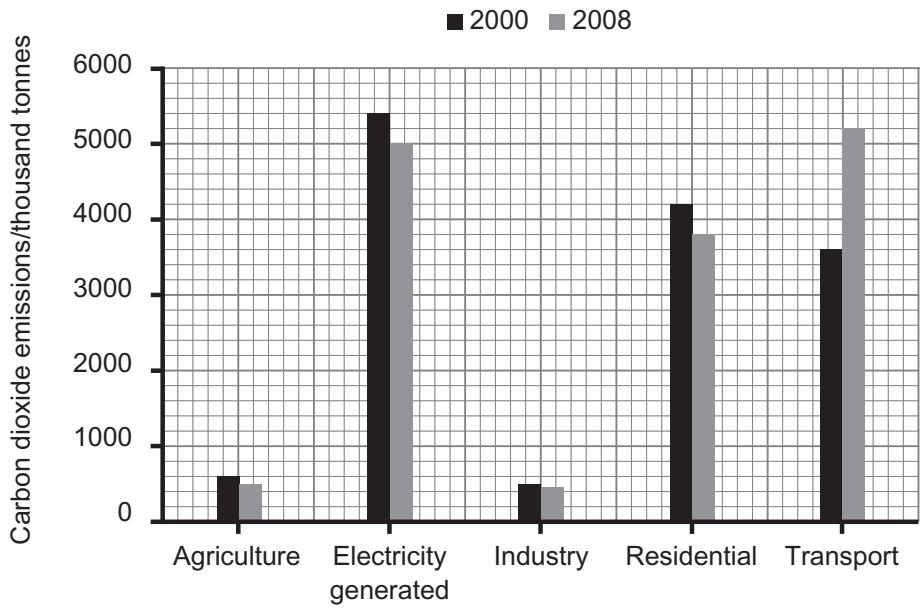


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| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**1** Graph A shows the carbon dioxide emissions from various sources in Northern Ireland for the two years, 2000 and 2008.

**Graph A**




© Crown copyright

Use the information in Graph A and your knowledge to answer the following questions.

**(a) (i)** Name the **three** main sources of carbon dioxide emissions.

_____ [1]

**(ii)** 4200 thousand tonnes of carbon dioxide were produced from the "residential" source in 2000. This had fallen to 3800 thousand tonnes in 2008. Calculate the percentage decrease in carbon dioxide produced.

(Show your working out.)

_____% [2]



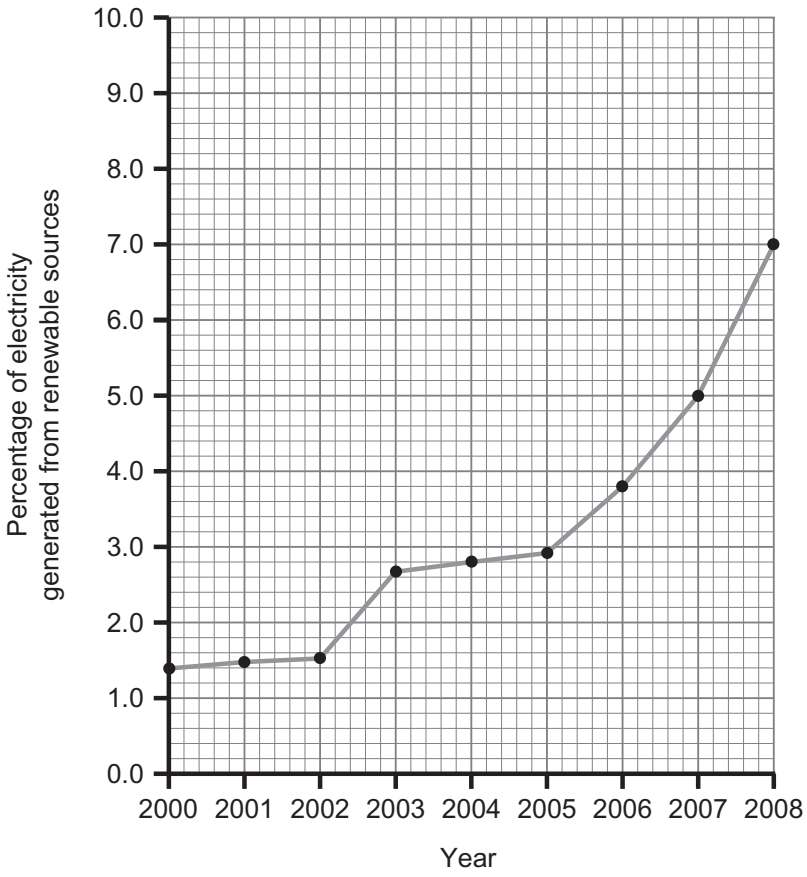
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**(iii)** Suggest a reason for the decrease in carbon dioxide emissions between 2000 and 2008 in the "residential" source.

_____ [1]

Graph B shows the percentage of electricity generated from renewable sources in Northern Ireland between 2000 and 2008.

**Graph B**




*© Crown Copyright - Department of Enterprise, Trade and Investment*

**(iv)** Describe and explain the relationship between the trend in **Graph B** and the level of carbon dioxide emissions from electricity generation between 2000 and 2008 (as shown in **Graph A**).

_____

_____

_____

_____ [3]

Examiner Only

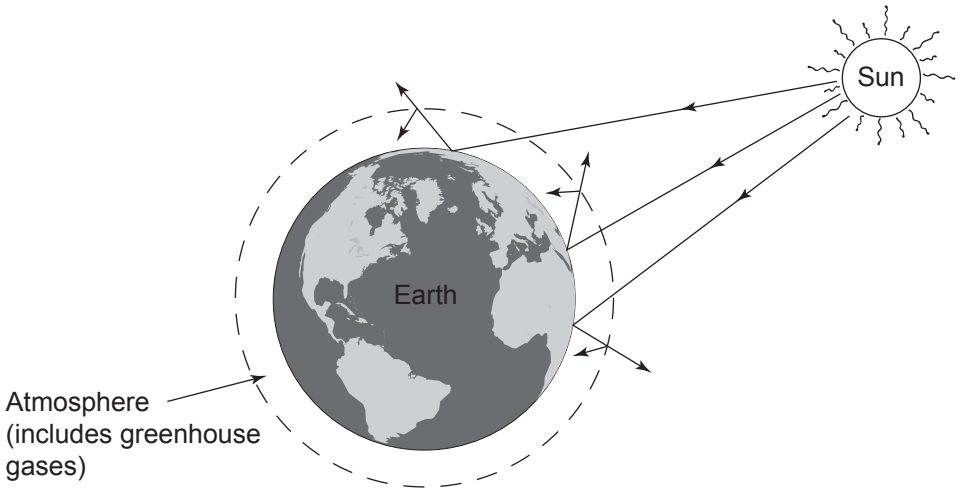
| Marks | Remark |
|---|---|
| | |

| Examiner Only | |
|---|---|
| Marks | Remark |

**(b)** The carbon dioxide level in the atmosphere is an example of an abiotic factor. What is meant by an abiotic factor?

_____ [1]

**(c)** The diagram shows how global warming occurs.




*© GCSE Single Award Science for CCEA by T Laverty, J Napier & R White, page 84, published by Hodder Murray, 2006. ISBN 9780340926000.*

Use the diagram and your knowledge to explain how an increase in carbon dioxide levels leads to an increase in global warming.

_____

_____

_____ [2]

**(d)** Explain why it is important to monitor the levels of carbon dioxide in the air.

_____ [1]



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**(Questions continue overleaf)**

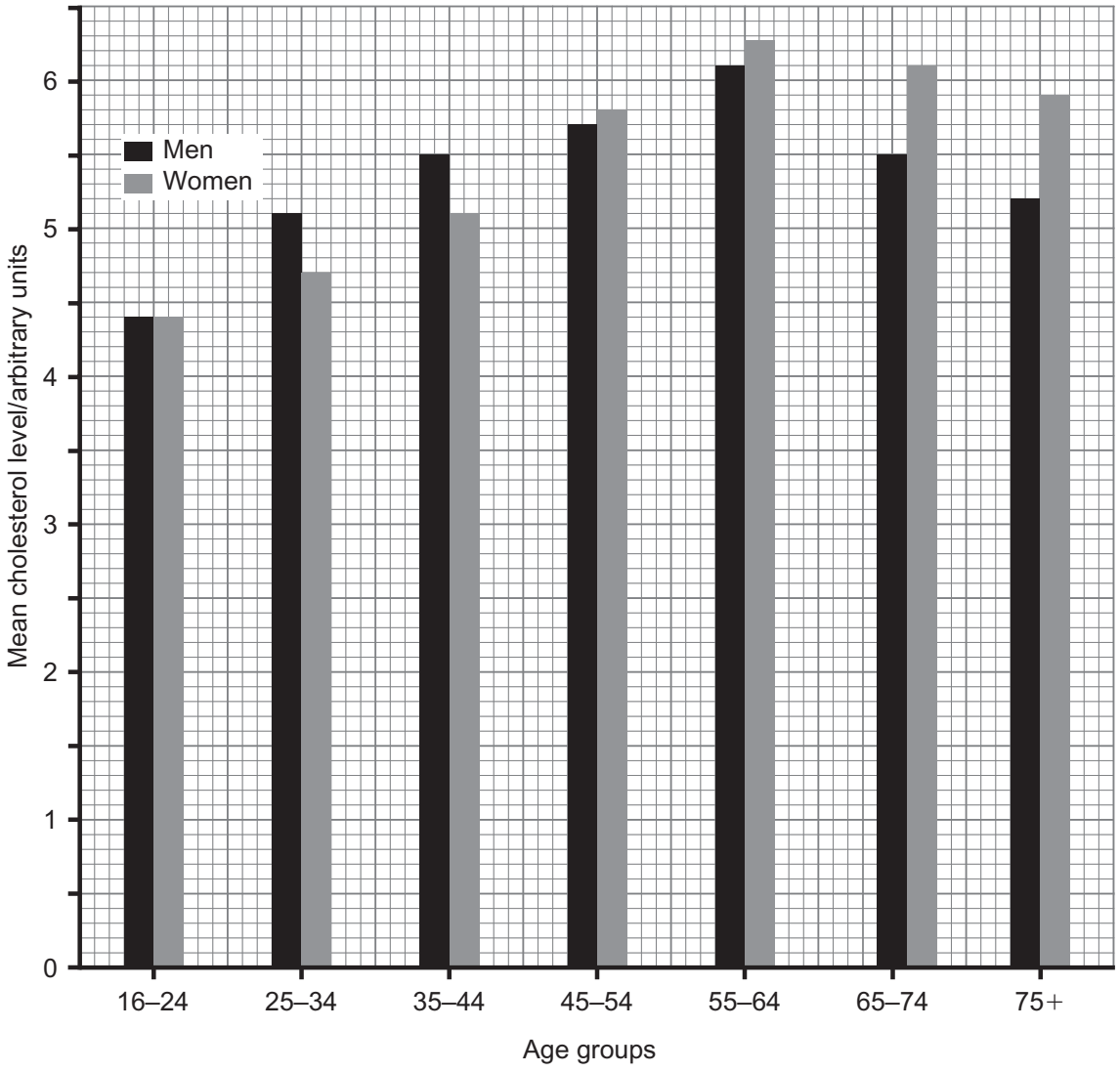

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| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**2** Cholesterol is a fatty substance. A build up of cholesterol can result from eating a fat-rich diet. It can result in circulatory illnesses such as heart disease and strokes.

Graph X shows the mean cholesterol levels for men and women in Northern Ireland in various age groups.

**Graph X**




*© Crown copyright - DHSSPS Health and Social Wellbeing Survey 1997*

**(a)** Describe **three** trends in Graph X.

1. _____

_____

2. _____

_____

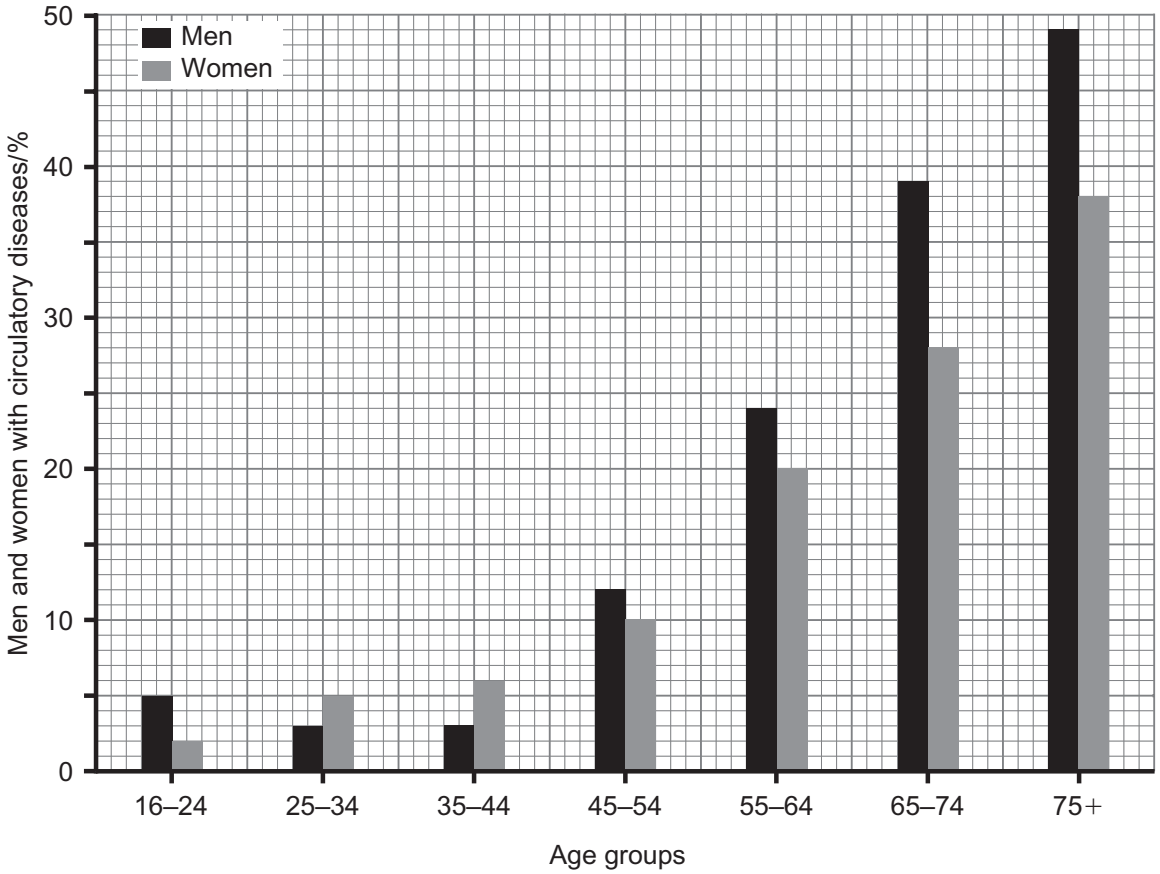
3. _____

_____ [3]

| Examiner Only | |
|---|---|
| Marks | Remark |

**(b)** Graph Y shows the percentage of men and women with circulatory illnesses (heart attacks and strokes) in different age groups in Northern Ireland.

**Graph Y**




© Crown copyright - DHSSPS Health and Social Wellbeing Survey 1997

Using the information in **Graphs X** and **Y**, describe the relationship between mean cholesterol levels and the occurrence of circulatory illnesses (heart attacks and strokes) for people up to the age of 64.

_____

_____

_____

_____ [2]

**(c)** An unhealthy diet can result in circulatory illnesses such as heart disease and strokes. State **two** other impacts of an unhealthy diet on general health.

1. _____

2. _____ [2]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

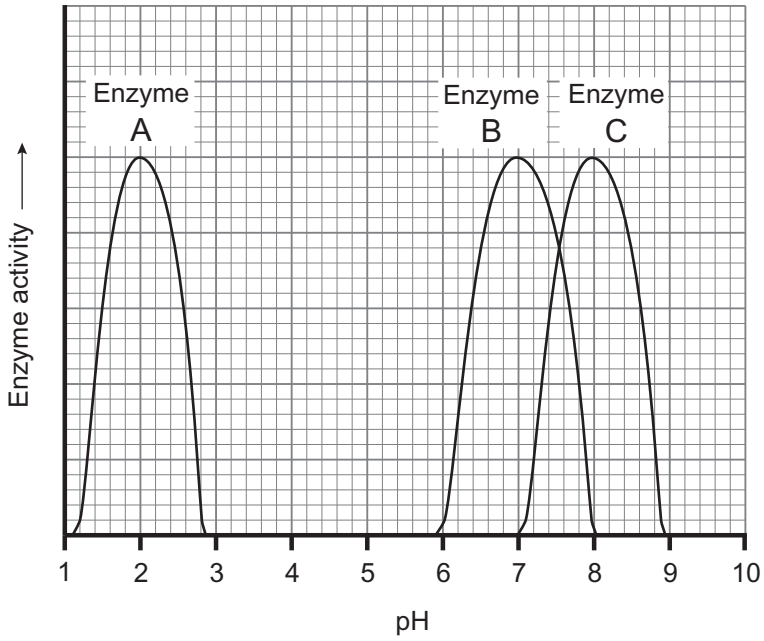
**3** **(a)** Describe the function of enzymes in digestion.

_____

_____

_____ [3]

**(b)** The graph shows the effect of pH on the activity of three enzymes that act in different regions of the digestive system.




Use the graph and your knowledge to explain which of the three enzymes is present in the stomach.

_____

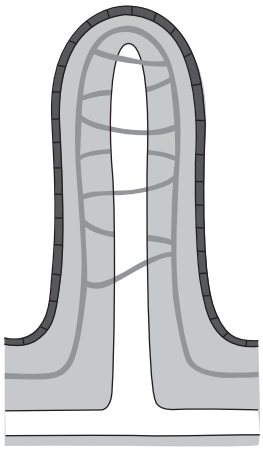
_____ [2]



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**(c)** The wall of the small intestine (ileum) is lined with numerous microscopic structures called villi.

The diagram shows a section of a single villus.



Describe and explain how the structure of a villus is adapted for the efficient absorption of digested food molecules.

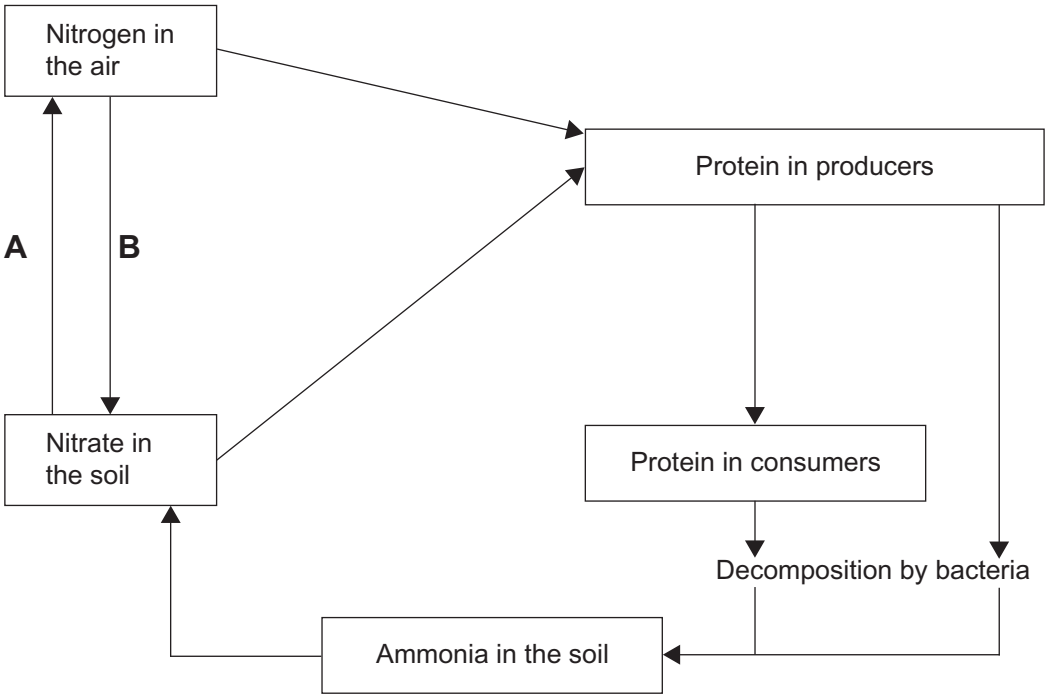
**In this question, you will be assessed on your written communication skills, including the use of specialist science terms.**

[6]

Examiner Only

| Marks | Remark |
|---|---|
| | |

**4** The diagram shows an outline of the nitrogen cycle.




**(a)** Use the diagram and your knowledge to name the two processes, **A** and **B**.

**A** _____

**B** _____ [2]

**(b)** The table below gives information on some sources of nitrate in the rivers that flow into Lough Neagh for the periods 1971–1976 and 1994–1999.

| Nitrate source | Tonnes nitrate/year | |
|---|---|---|
| | **1971–1976** | **1994–1999** |
| Towns | 362 | 388 |
| Nitrification | 482 | 482 |
| Agricultural land | 2938 | 5615 |
| Rough grazing and forestry | 128 | 128 |
| Total | | |

*Source: www.doeni.gov.uk/niea/de/darddoeoct.02.pdf*

Examiner Only

| Marks | Remark |
|---|---|
| | |



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Use the information in the table and your knowledge to answer the following questions.

Examiner Only

| Marks | Remark |
|---|---|
| | |

**(i)** Calculate the total **increase** in nitrate entering the rivers from all sources between the periods 1971–1976 and 1994–1999.

(Show your working out.)

_____ tonnes nitrate/year [2]

**(ii)** One source of nitrate entering rivers is nitrification in nearby soils.

Describe the process of nitrification.

_____

_____ [2]

**(iii)** Increased nitrate in the rivers causes eutrophication.

The process begins with a rapid increase in the growth of algae and other plants in the rivers. Explain how this eventually leads to the death of fish in these rivers.

_____

_____

_____

_____

_____ [3]

Photograph 1 shows farmyard manure which is a natural fertiliser.
Photograph 2 shows a farmer spreading artificial fertiliser.

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**1**



*Copyright © 1999 – 2012 Living Countryside*

**2**



*© Crown copyright – Department of Agriculture and Rural Development*

**(c)** Use the photographs and your knowledge to describe **two** advantages and **two** disadvantages of a farmer using farmyard manure (FYM) compared to artificial fertilisers.

Advantages

1. _____

_____

2. _____

_____

Disadvantages

1. _____

_____

2. _____

_____ [4]

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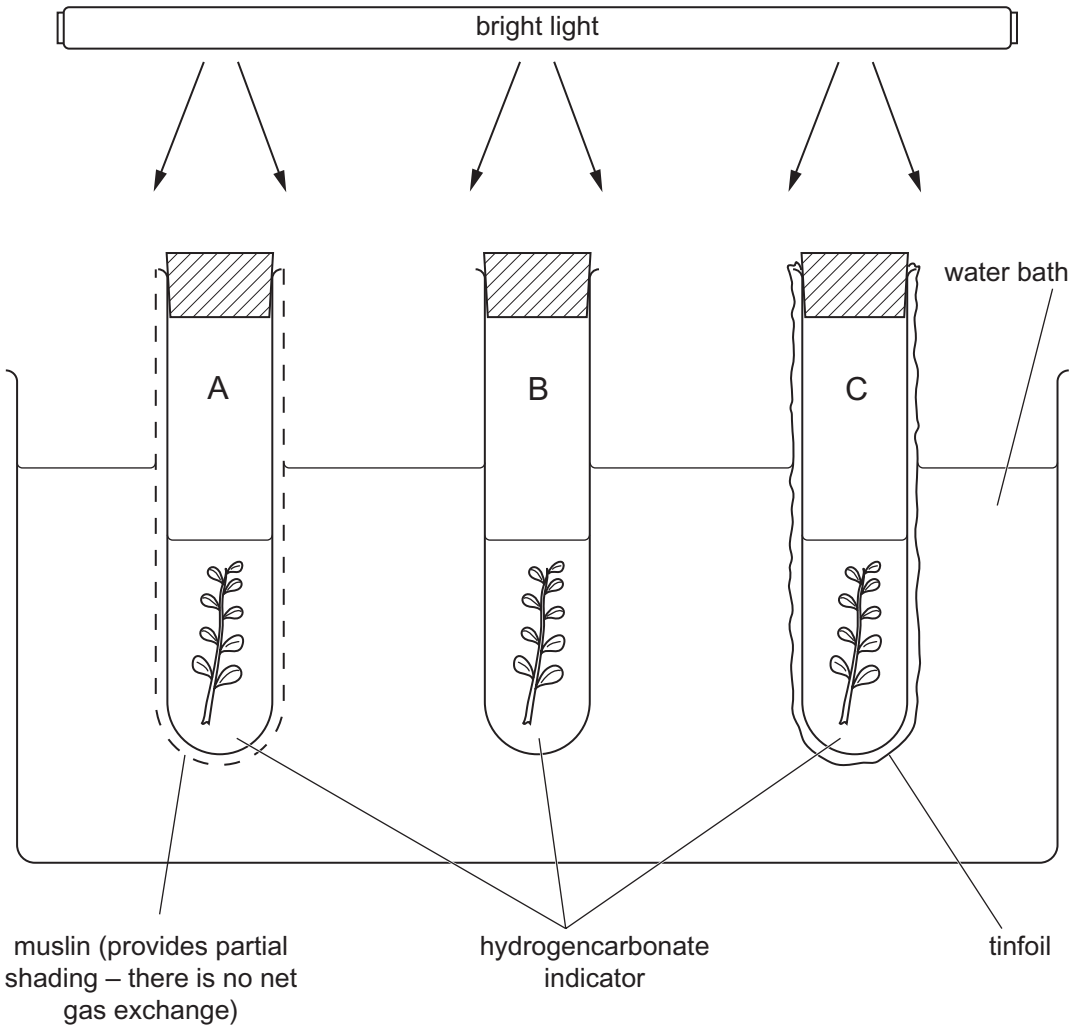
**(Questions continue overleaf)**


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| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**5** The diagram shows apparatus used to investigate gas exchange in a water (aquatic) plant. Hydrogencarbonate indicator was used to show any changes in the carbon dioxide level.

At normal levels of atmospheric carbon dioxide, the hydrogencarbonate indicator is red in colour.




The experiment was left for one hour in bright light.

**(a)** What is the function of the water bath?

_____ [1]

**(b)** Describe and explain the colour changes, if any, you would expect in each of test tubes A, B and C.

**In this question you will be assessed on your written communication skills, including the use of specialist science terms.**

[6]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |



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| Examiner Only | |
|---|---|
| Marks | Remark |

**6** The photographs show two different types of grassland that are open and not shaded.



*Source: Principal Examiner*

**Grassland A**

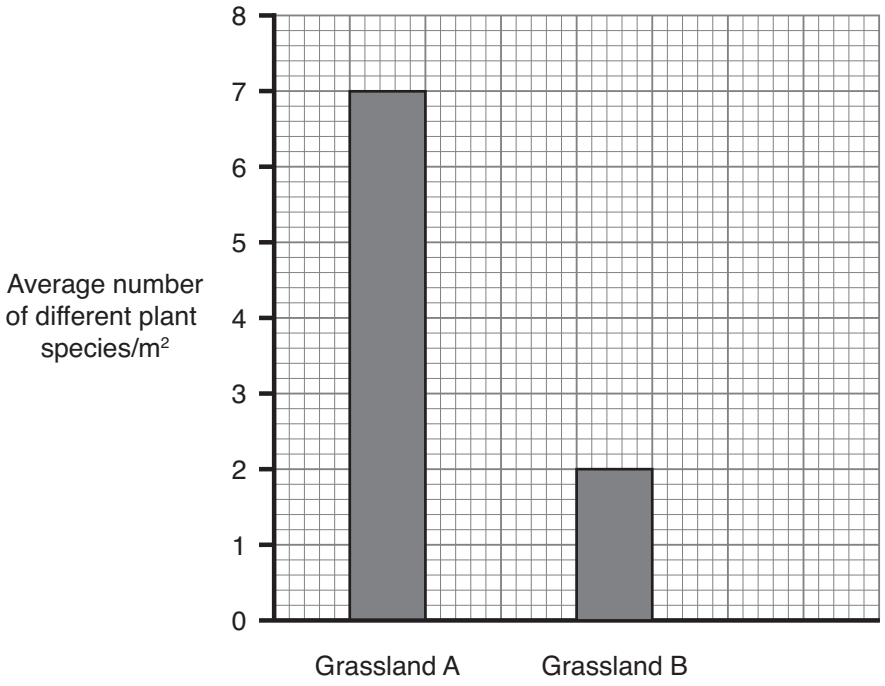


*Source: Principal Examiner*

**Grassland B**

The bar chart shows the results obtained by a class during an investigation in Grasslands A and B.

The pupils estimated the number of different plant species in a 1 $m^2$ quadrat.




**(a) (i)** Use the bar chart to describe why Grassland A has the higher biodiversity.

_____ [1]

**(ii)** Suggest **one** environmental factor that could account for the difference in the results between the two grasslands.

_____ [1]



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**(b)** Describe how the pupils would have carried out this investigation and explain how they would have obtained these results.

**In this question, you will be assessed on your written communication skills, including the use of specialist science terms.**

[6]

Examiner Only

| Marks | Remark |
|---|---|
| | |

**(c)** Flowers are sources of a sugary substance called nectar. Butterflies visit flowers to feed on the nectar.

A sample of butterflies in each grassland was captured and the number of each species counted. The results are shown in the table.

| Butterfly species | Grassland A | Grassland B |
|---|---|---|
| Meadow Brown | 21 | 0 |
| Large White | 17 | 2 |
| Red Admiral | 8 | 0 |
| Ringlet | 7 | 1 |

**(i)** Name the sampling equipment used to capture the butterflies.

_____ [1]

**(ii)** Use the photographs and the bar chart (on page 16) to explain the difference in the number of butterflies captured in Grasslands A and B.

_____

_____

_____ [2]

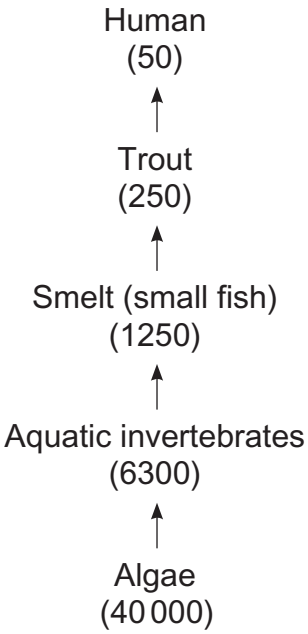
Examiner Only

| Marks | Remark |
|---|---|
| | |



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**(d)** The food chain shows the amount of energy (kJ/m$^2$/year) available at each trophic level for a lake.




**(i)** Name the energy source for this food chain.

_____ [1]

**(ii)** At what trophic level do primary consumers feed?

_____ [1]

**(iii)** Give two reasons why not all of the energy in the trout is transferred to humans.

1. _____

_____

2. _____

_____ [2]

Examiner Only

| Marks | Remark |
|---|---|
| | |

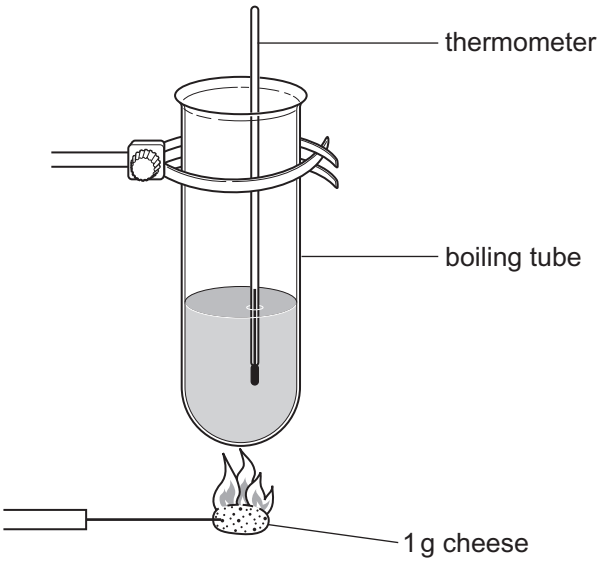
| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**7** **(a)** Name the reagent used to test for fats and give the end colour for a positive result.

_____

_____ [2]

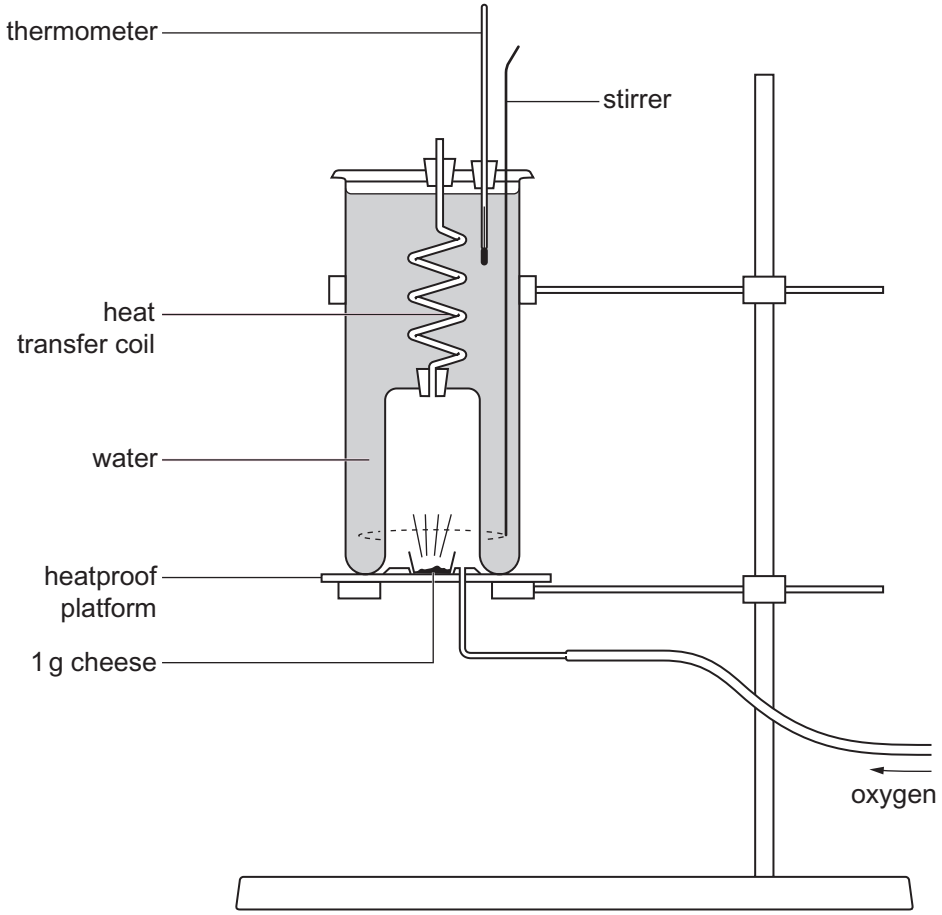
**(b)** The diagram below shows the apparatus a group of pupils used to calculate the energy released from one gram of cheese.




© *The Nuffield Foundation*

The energy released when one gram of cheese was burnt was calculated as 9.8 kJ.

The diagram below shows apparatus (calorimeter) a different group of pupils used to calculate the energy released from one gram of cheese.




© The Nuffield Foundation

The energy released when one gram of cheese was burnt in the calorimeter was calculated as 27.2 kJ.

Use the diagrams and the information provided to explain three reasons why the group of pupils using the calorimeter obtained a higher value for the energy in one gram of cheese.

1. _____

_____

2. _____

_____

3. _____

_____ [3]

Examiner Only

| Marks | Remark |
|---|---|
| | |

**(c)** Burning food is one form of energy release. Energy can also be released from food in respiration. Respiration can be aerobic or anaerobic.

Give the word equation for anaerobic respiration in mammalian muscle.

_____ [1]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

## THIS IS THE END OF THE QUESTION PAPER

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New Specification

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General Certificate of Secondary Education
2012–2013

# Double Award Science: Biology

Unit B1

Higher Tier

**[GSD12]**

**MONDAY 27 FEBRUARY 2012**
**9.30 am–10.30 am**

# MARK SCHEME



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AVAILABLE MARKS

**1** **(a)** **(i)** electricity generated, Residential, Transport
(all three needed for mark) [1]

**(ii)** $\frac{400}{4200} \times 100 = 9.5\%$ decrease Correct answer – award 2 marks
(400 = 1 mark
/4200 × 100 = 1 mark) [2]

**(iii)** more houses use natural gas/double glazing/cavity wall insulation/ roof insulation/solar panels/less coal fires/less fossil fuels/using more renewable/more efficient/conserve energy/become more economical/people more aware
(Do **not** accept: milder winters, global warming) [1]

**(iv)** graph B shows a steady increase (in the percentage of electricity from renewable sources);
this means less fossil fuels being burned to generate electricity;
so the Electricity generated data (Graph A) show a decrease in carbon dioxide emissions between 2000 and 2008/Graph A less electricity generated/less $CO_2$ produced from 2000 to 2008/less $CO_2$ produced because more coming from renewable; [3]

**(b)** non-living/physical factors
(Do **not** accept an example on its own such as wind etc) [1]

**(c)** Any two from:
- carbon dioxide (and other greenhouse gases) act as a blanket/ acts as a greenhouse
(Do **not** accept: ozone, hole in ozone layer)
- allow sun's rays to reach the Earth's surface
- but prevent the escape of heat from the Earth's surface/traps heats/keeps heat/traps sunlight/prevents sun's rays from leaving
- hence the temperature of the atmosphere and Earth's surface increases [2]

**(d)** to set targets to reduce global warming/so that not too much pollution/ to check or reduce or prevent global warming/prevent climate change/ in case there is an increase
accept a consequence such as melting polar ice caps [1] 11


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| | | AVAILABLE MARKS |
|---|---|---|
| **2** | **(a)** Any three from:<br>● men up to age 44 years higher cholesterol than women/younger men have higher cholesterol than women (comparison needed)<br>● from age 45 years and older women always have higher cholesterol than men/older women have higher cholesterol than men<br>● cholesterol increases in men up to 55–64 years then declines<br>● cholesterol increases in women up to 55–64 years then declines<br>● women have higher cholesterol levels when older<br>● 55–64: highest cholesterol levels for both **or** both same at 16–24. [3] | |
| | **(b)** reference to graph Y: increases circulatory illnesses;<br>reference to graph X: because of increasing cholesterol levels [2] | |
| | **(c)** Any two from:<br>● obesity<br>● high blood pressure<br>● diabetes.<br>(Do **not** accept: heart disease, strokes) [2] | 7 |



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AVAILABLE MARKS

**3** **(a)** Any three from:

- biological catalyst/speeds up rate of reaction
- enzymes break down (**not** digest as given in question)
- large molecules into small or smaller molecules
- Insoluble molecules into soluble molecules
- so that the products can be absorbed/for absorption/pass into blood
- example substrate of starch/fat protein [3]

**(b)** enzyme A;
because works best in acid conditions
(found in the stomach) [2]

**(c)** Indicative content

- each villus is a finger-like shape
- this increases the surface area
- single layer of cells in wall/thin wall
- short diffusion distance (for absorption)
- has network of blood capillaries/good blood supply/connect to blood stream
- sugars and amino acids enter blood capillaries/products enter blood capillaries
- lacteal present
- digested fats absorbed into lacteals
- presence of microvilli [6]

11

| **Response** | **Mark** |
|---|---|
| Candidates use appropriate specialist terms throughout using at least 5 of the above points to describe the structure of a villus and explain how the structures are adapted for absorption. They use good spelling, punctuation and grammar and the form and style are of a high standard. | [5–6] |
| Candidates use some appropriate specialist terms throughout using 3 or 4 of the above points to describe the structure of a villus and they partially explain how some of the structures are adapted for absorption. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard. | [3–4] |
| Candidates partially describe using 1 or 2 of the above points the structure of a villus and partially explain how it is adapted for absorption using some of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. | [1–2] |
| Response not worthy of credit. | [0] |



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| | | AVAILABLE MARKS |
|---|---|---|
| **4** | **(a)** denitrification/denitrifying bacteria;<br>nitrogen-fixation/fixing or nitrogen fixing bacteria; [2] | |
| | **(b)** **(i)** 6613 – 3910 = 2703<br>correct answer gets 2 marks<br>correct totals get 1 mark (ok if in boxes) [2] | |
| | **(ii)** ammonium converted into nitrate (**must** have ammonia or ammonium);<br>involves nitrifying bacteria/needs oxygen/well aerated soil [2] | |
| | **(iii)** Any three from:<br>● algae on surface so less oxygen<br>● these plants and algae eventually die<br>● decomposition of plants and algae<br>● by microorganisms/bacteria<br>● uses up oxygen;<br>● fish cannot respire/suffocate/can't breathe<br>(**not** fish die as given in question) [3] | |
| | **(c)** Advantages – Any two from (all points relate to FYM):<br>● FYM is cheaper<br>● makes use of an animal byproduct or "waste"<br>● helps retain soil moisture<br>● slow release of nutrients<br>● improves soil structure or improves drainage or improves crumb structure or adds humus to the soil<br>● free/costs less<br>● organic<br>(Do **not** accept: natural, is not harmful to the environment, can only be spread at certain time of the year/time of application) | |
| | Disadvantages – Any two from (all points relate to FYM):<br>● FYM is smelly **or** mucky to apply<br>● the nutrient content varies or is not known as precisely<br>● slow release of nutrients i.e. not fast enough for the crop to grow<br>● uses up more space for storage than bags of artificial fertiliser<br>● seepage from storage pits can cause water pollution<br>● more difficult to apply or takes longer to put out manure<br>● don't know nutrient content<br>● don't know what is in it/might have harmful bacteria<br>● could be harmful to the environment/seepage/run-off [4] | 13 |



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AVAILABLE MARKS

**5** **(a)** to prevent temperature fluctuations/keep temperature constant (**not** keep water) [1]

**(b)** **Indicative content**

tube A

- colour will be red/no colour change/stays same colour
- rate of photosynthesis equals rate of respiration/$CO_2$ absorbed equals $CO_2$ given out

tube B

- purple
- rate of photosynthesis exceeds rate of respiration/more $CO_2$ taken in than given out

tube C

- yellow
- only respiration occurs (no photosynthesis)/increase in $CO_2$ [6] 7

| **Response** | **Mark** |
|---|---|
| Candidates must use appropriate specialist terms throughout using 5 of the above points to describe the results they would expect and explain, in a logical sequence, the results. They use good spelling, punctuation and grammar and the form and style are of a high standard. | [5–6] |
| Candidates must use some appropriate specialist terms throughout using 3 or 4 of the above points to describe results they would expect and partially account for, in a logical sequence, the results. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard. | [3–4] |
| Candidates describe the results they would expect or account for these results using 1 or 2 of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. | [1–2] |
| Response not worthy of credit. | [0] |



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AVAILABLE MARKS

**6** **(a)** **(i)** more species in grassland A/more types of plants/more flowers (Do **not** accept more plants) [1]

**(ii)** soil moisture/soil fertility or nutrient status/soil pH/temperature (Do **not** accept light) [1]

**(b)** Indicative content

- for grassland A, set down two tape measures at right angles
- generate random co-ordinates (random number tables or computer)/throw at random
- set quadrat
- record number of plant species within the quadrat/record types of plants (**not** % cover)
- identify plant species/use keys
- record/write down the results
- repeat/throw several times
- divide total numbers (in each quadrat) by number of quadrats/ calculate average number of species per quadrat
- repeat for Grassland B/other area [6]

| **Response** | **Mark** |
|---|---|
| Candidates must use appropriate specialist terms throughout using at least 5 of the above points to describe how they would have carried out this investigation and explain, in a logical sequence, how the pupils would have obtained these results. They use good spelling, punctuation and grammar and the form and style are of a high standard. | [5–6] |
| Candidates must use appropriate specialist terms throughout using 3 or 4 of the above points to describe how they would have carried out this investigation and partially explain, in a logical sequence, how the pupils would have obtained these results. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard. | [3–4] |
| Candidates describe using 1 or 2 of the above points how they would have carried out this investigation or explain how the pupils would have obtained these results using some or all of the above points. However, these are not presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. | [1–2] |
| Response not worthy of credit. | [0] |

| | | | AVAILABLE MARKS |
|---|---|---|---|
| **(c)** | **(i)** | net/sweep net [1] | |
| | **(ii)** | Any two from:<br>● grassland A has more flowering plants (photograph) or higher biodiversity (bar chart)<br>(accept reference that A has more flowers or more plants than B)<br>● so more nectar sources/more food<br>● so more butterflies [2] | |
| **(d)** | **(i)** | sun/sunlight [1] | |
| | **(ii)** | second trophic level/trophic level 2 [1] | |
| | **(iii)** | Any two from:<br>● trout loses heat energy (in respiration) (**not** breathing)<br>● trout uses up energy to swim/move<br>● energy lost from trout in defaecation/excretion<br>● bones/scales/fins/gills are not eaten/parts not eaten<br>● not all trout get caught/trout die/decompose [2] | 15 |
| **7** | **(a)** | ethanol;<br>white (emulsion) [2] | |
| | **(b)** | Any three from:<br>● higher value for calorimeter because<br>● less heat lost to the air/atmosphere/heatproof platform prevents heat escape<br>● food is more completely burned in the oxygen which aids combustion<br>● stirrer circulates heat through the water and temperature increase is thus more accurate<br>● heat transfer coil results in heat being effectively transferred to the water<br>● no heat used up heating up the glass<br>● no heat loss by conduction along mounted needle<br>● all energy absorbed/less heat lost<br>(**not** difference only – must be justified)<br>● more oxygen for burning [3] | |
| | **(c)** | Glucose ⟶ Lactate/lactic acid + energy [1] | 6 |
| | | **Total** | **70** |

New Specification

Rewarding Learning

Centre Number

| 71 | |
|---|---|

Candidate Number

| |
|---|
| |

General Certificate of Secondary Education
2011–2012

# Double Award Science: Biology

## Unit B1

## Higher Tier

**[GSD12]**

GSD12

**TUESDAY 8 NOVEMBER 2011**
**1.30 pm–2.30 pm**

**TIME**

1 hour.

**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.
Answer **all seven** questions.

**INFORMATION FOR CANDIDATES**

The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in **questions requiring extended answers**.

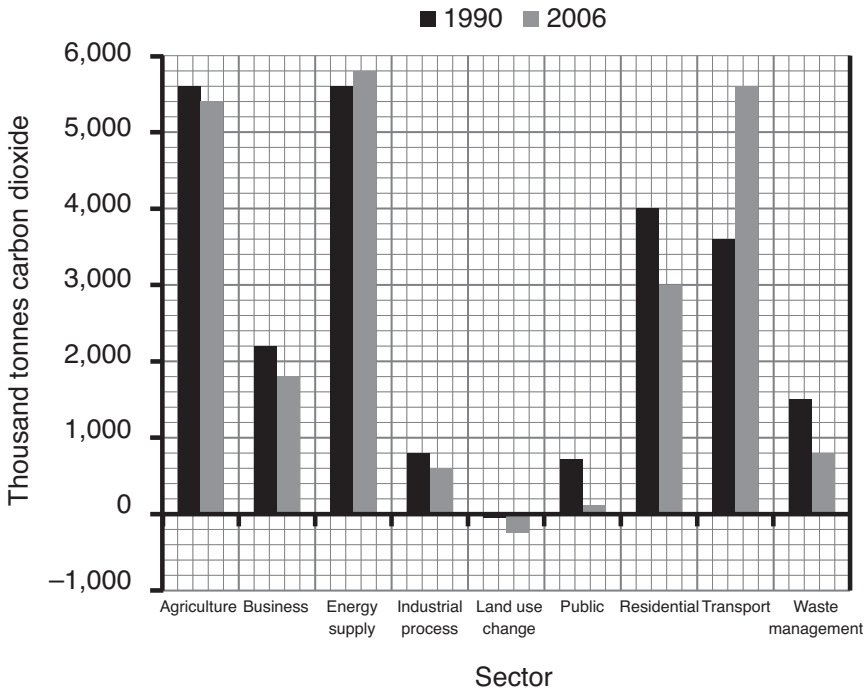
| For Examiner's use only | |
|---|---|
| Question Number | Marks |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| Total Marks | |



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| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**1** Carbon dioxide is a greenhouse gas. The graph shows the levels of greenhouse gas emissions from different sources in Northern Ireland in 1990 and 2006.




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Use the information in the graph and your knowledge to answer the following questions.

**(a)** What are the **three** main sectors that contributed to greenhouse gas emissions in 2006?

_____ _____ _____ [1]

**(b)** What is the general trend for greenhouse gas emissions in the time period from 1990 to 2006? Give any examples of exceptions to this trend.

_____

_____

_____ [2]



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**(c)** Suggest **one** reason why it is difficult to reduce greenhouse gas emissions.

_____ [1]

**(d)** Why is it important to monitor greenhouse gas emissions?

_____ [1]

**(e)** Explain **one** harmful consequence of global increases in greenhouse gases on:

climate _____ [1]

plants _____

_____ [1]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**2** Energy is released from food in respiration.

**(a)** Complete the word equation for aerobic respiration.

oxygen + [ ] → carbon dioxide + water + [ ]

[2]

**(b)** In the space below, draw the assembled apparatus you would use to investigate anaerobic respiration in yeast.

[3]

**(c)** List three differences between the products of anaerobic respiration in mammalian muscle cells and in yeast. Clearly indicate whether your answer refers to muscle or to yeast.

1. _____

2. _____

3. _____ [3]



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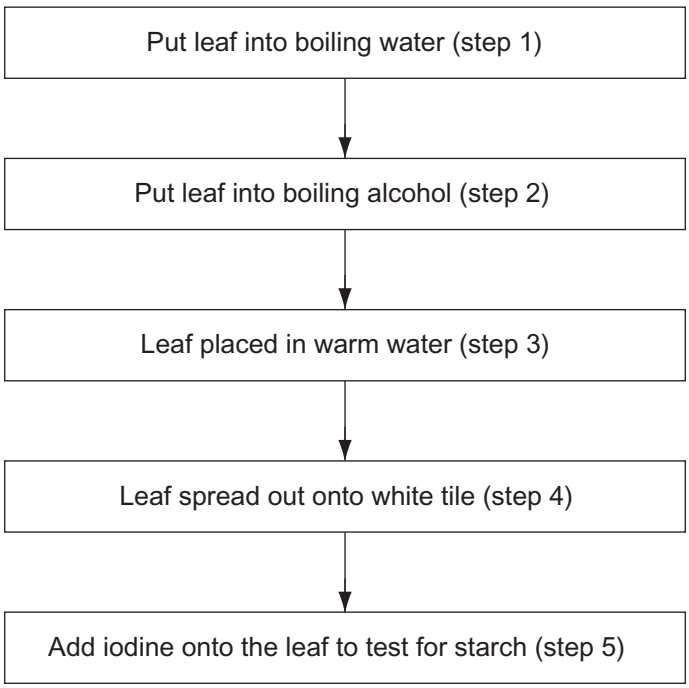
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**(Questions continue overleaf)**


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| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**3** The flow diagram shows the steps involved in testing a leaf for starch.




**(a)** What safety precaution must be taken during step 2?

_____ [1]

**(b)** Explain the significance of step 3.

_____ [1]

**(c)** After step 5, what colour will the leaf be if starch is present?

_____ [1]

**(d)** The overall equation for photosynthesis is given below.

$$\text{carbon dioxide} + \text{water} \xrightarrow[\text{by chlorophyll}]{\text{Light absorbed}} \text{glucose} + \text{oxygen}$$

As well as being converted to starch for storage, describe two other ways in which the glucose is used by the plant.

1. _____

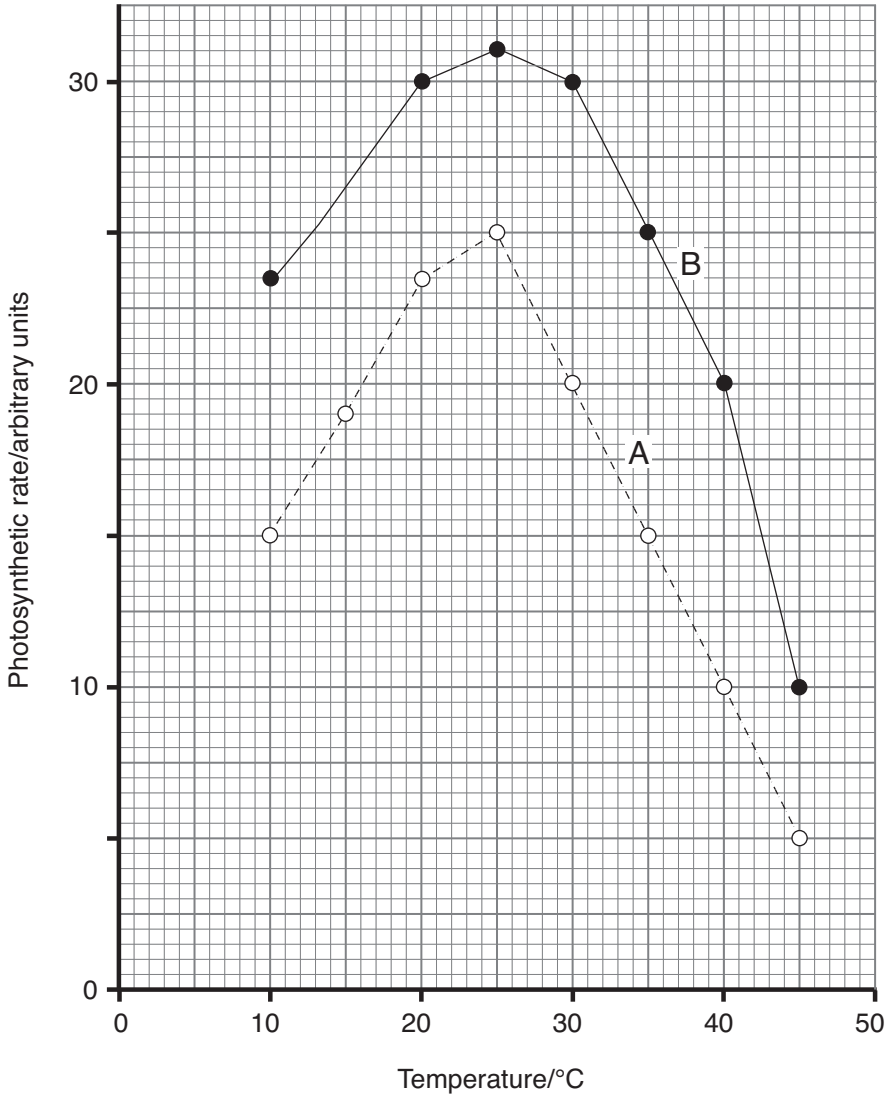
2. _____ [2]



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| Examiner Only | |
|---|---|
| Marks | Remark |

**(e)** The graph below shows the effect of temperature on the photosynthetic rate of two tomato plants, A and B. Seedling A was planted two weeks later than seedling B. The plants were well watered with plenty of sunlight and carbon dioxide. The investigation was carried out early in the growing season.




**(i)** Suggest appropriate units of measurement for the photosynthetic rate of the tomato plants.

_____ [1]

**(ii)** Suggest and explain why plant B has a higher rate of photosynthesis at all temperatures compared to plant A.

_____

_____

_____ [2]

**(iii)** In many plants growing in this country the optimum (best) temperature for photosynthesis is 25 °C. Suggest why the photosynthetic rate declines above 25 °C.

_____

_____ [2]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

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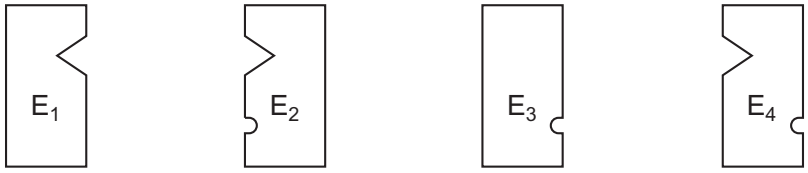
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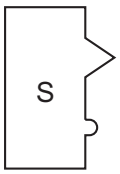
| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**4** **(a)** The diagram shows a substrate along with several enzymes and possible products. The letters E, S and P refer to enzyme, substrate and product respectively.

**Enzymes:**




**Substrate:**




**Possible products:**




**(i)** From the diagrams pick the enzyme that would react with the substrate.

_____ [1]

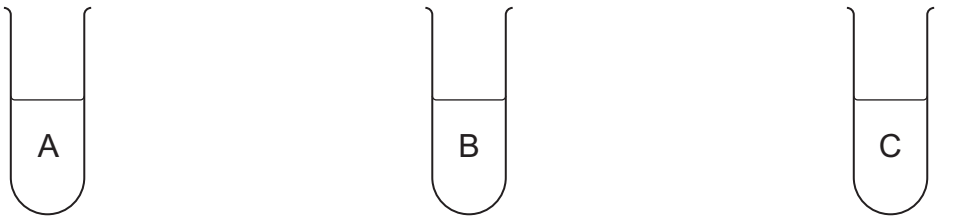
**(ii)** Choose from the diagram the products that would be formed when the substrate reacted with the enzyme.

_____ and _____ [2]

**(iii)** Name this model of enzyme action.

_____ [1]

**(b)** Three test tubes were placed in a water bath at 30 °C for 20 minutes and then samples were removed from the test tubes and their pH tested. The results are shown in the table.




| lipase + milk | boiled cooled lipase + milk | water + milk |
|---|---|---|



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Results

| A | B | C |
|---|---|---|
| pH 5 | pH 7 | pH 7 |

Describe and account for the results for test tubes **A**, **B** and **C**.

**In this question you will be assessed on your written communication skills, including the use of specialist science terms.**

[6]

**(c)** During the process of digestion the body produces bile salts that are emptied into the small intestine. They convert fats into smaller globules of fat.

Suggest how the results from the experiment would have differed if bile salts had been added to test tube **A** at the start of the experiment. Explain your answer.

[3]

Examiner Only

| Marks | Remark |
|---|---|
| | |

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**5** Nitrate must be present in the soil for crop growth.

**(a)** Explain why nitrate uptake by plant roots is faster in well oxygenated (aerated) soils.

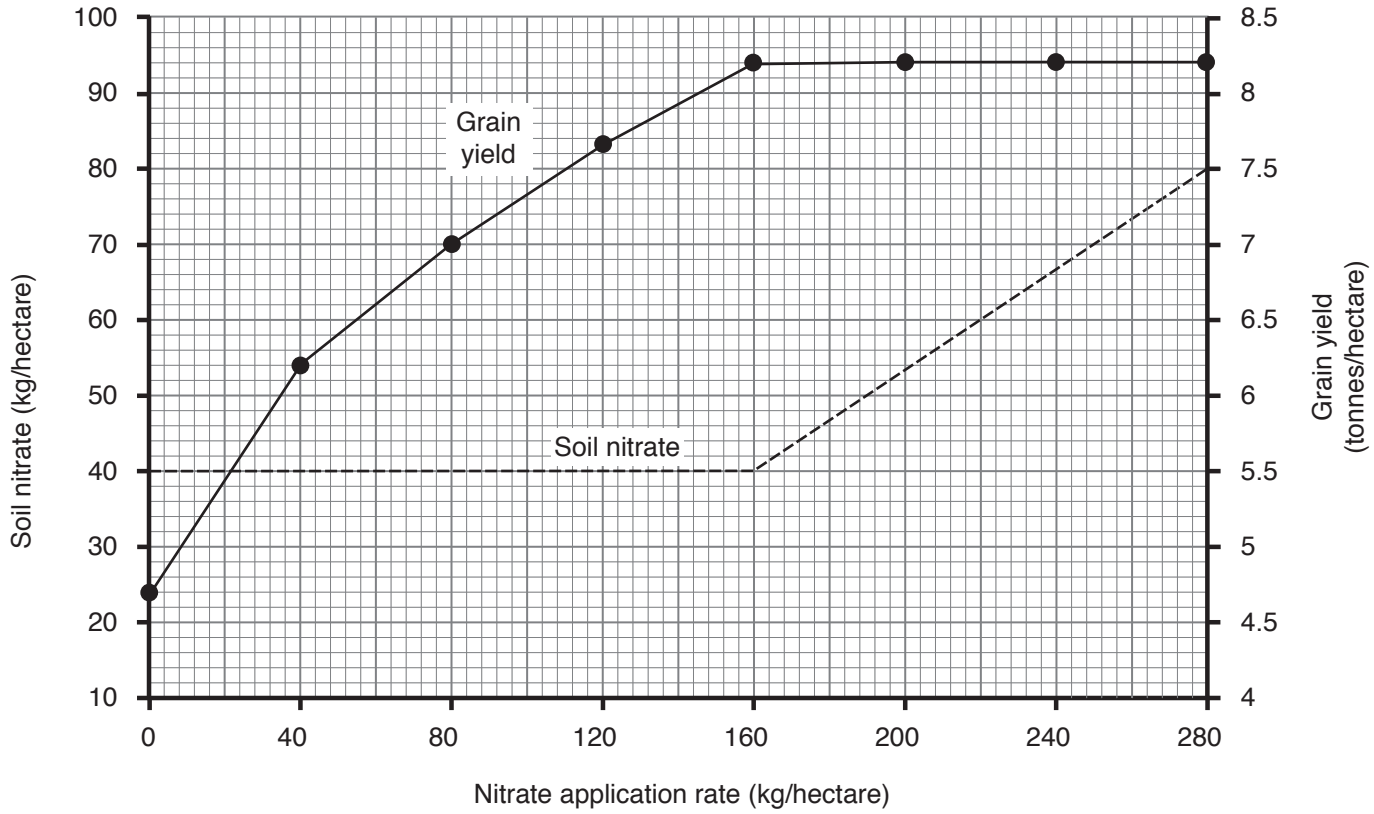
_____

_____

_____

_____ [3]

**(b)** The graph shows the effect of nitrate fertiliser application rate on the grain yield of wheat. One hectare is an area of 10 000 $m^2$. The amount of nitrate in the soil is also shown at the different nitrate applications.




© Agricultural Industries Confederation Ltd

| Examiner Only | |
|---|---|
| Marks | Remark |

**(i)** Use the graph to determine the optimum nitrate application rate for the crop.

_____ kg/hectare [1]

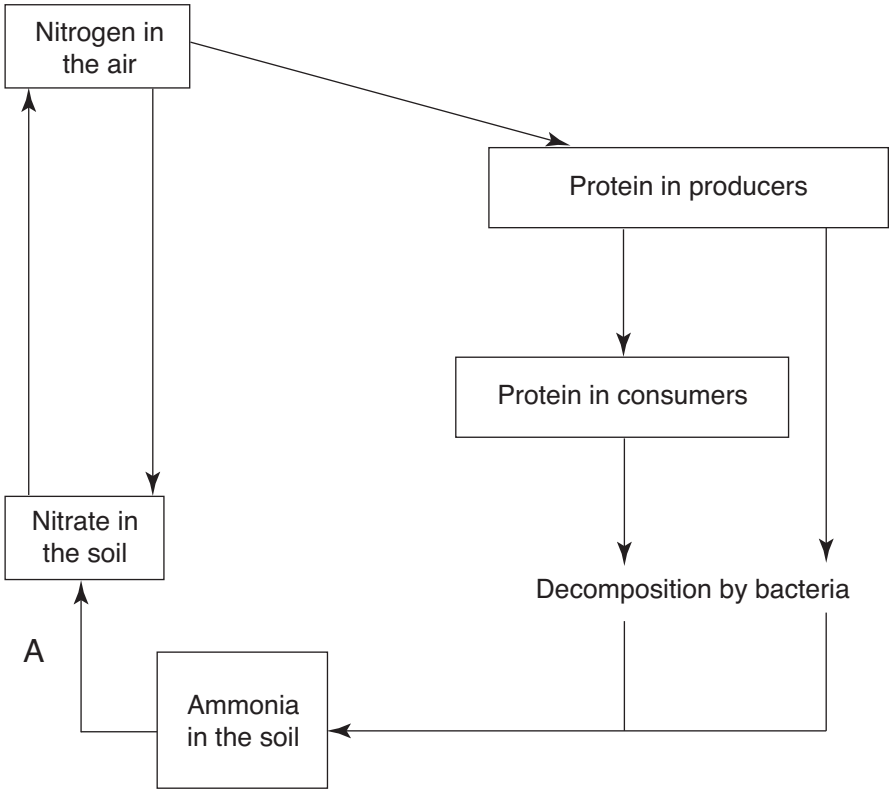
**(ii)** Suggest why the soil nitrate increases at application rates above 160 kg/hectare.

_____

_____

_____ [2]

**(c)** An outline of the nitrogen cycle is shown below.




**(i)** Name process A.

_____ [1]

**(ii)** Explain how nitrate is lost from waterlogged soils.

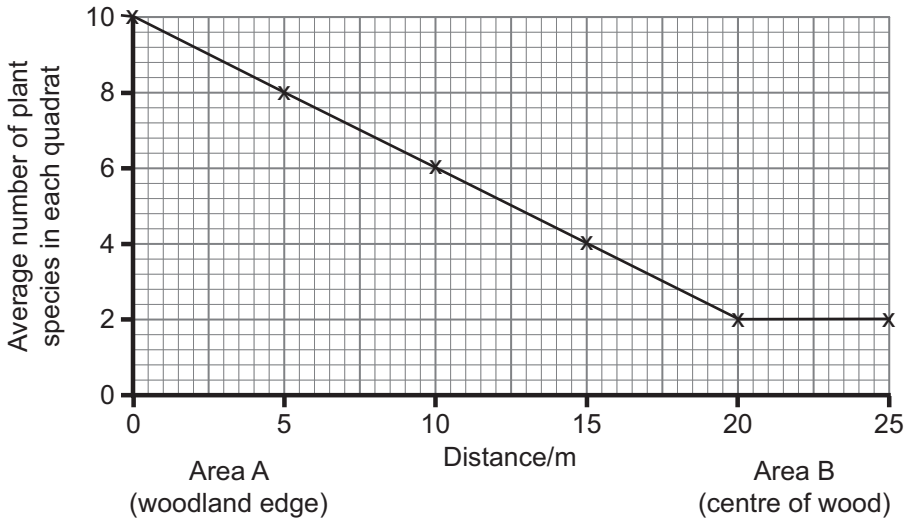
_____

_____

_____ [2]

| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**6** The graph shows the results obtained by a class during a woodland investigation.




**(a)** The pupils sampled plants across an area of woodland from Area A (woodland edge) to Area B (centre of wood) and then calculated the average number of plant species/quadrat at 5 m intervals.

**(i)** Describe the trend shown on the graph from Area A to Area B.

_____ [1]

**(ii)** Suggest **one** environmental condition that could account for the difference in the results between Area A and Area B.

_____ [1]

**(b)** Describe how the pupils would have carried out this investigation and explain how they would have obtained these results.

**In this question you will be assessed on your written communication skills, including the use of specialist science terms.**

_____

_____

_____

_____

_____

_____



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[6]

**(c)** The table gives the numbers of organisms from a woodland food chain.

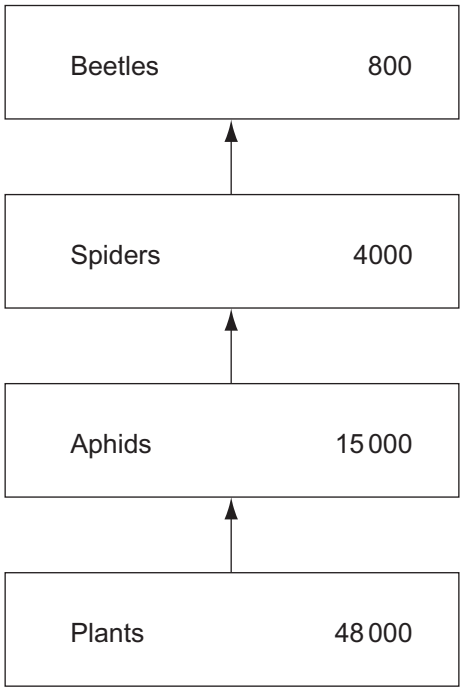
Plants → Aphids → Spiders → Beetles

| Name of organism | Numbers |
|---|---|
| Beetles | 6 |
| Spiders | 50 |
| Aphids | 2000 |
| Plants | 10 |

Sketch a pyramid of biomass for this food chain in the space below.
Label each trophic level with the name of the organism.

[2]

**(d)** The diagram shows the energy at different trophic levels in a food chain (kJ/m$^2$/yr).




**(i)** Calculate the percentage energy passed on from the plants to the primary consumer.

Show your working.

_____ % [2]

**(ii)** Give two ways the spiders lose energy.

_____ and _____ [2]

**(iii)** Suggest what happens in the next step in the food chain to the energy contained in the beetles.

_____ [1]

Examiner Only

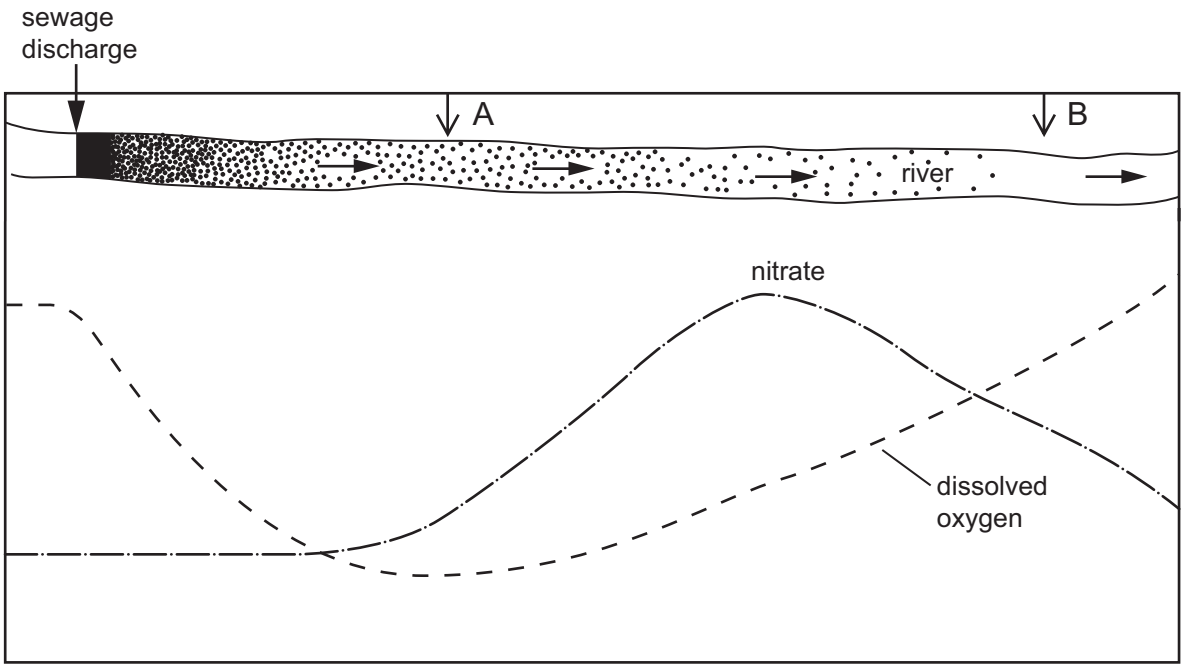
| Marks | Remark |
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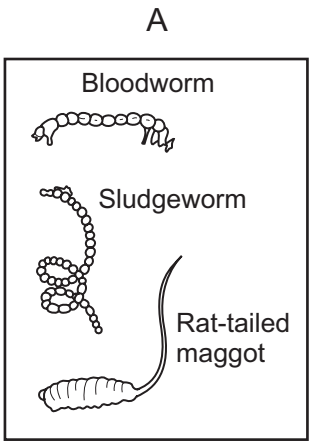
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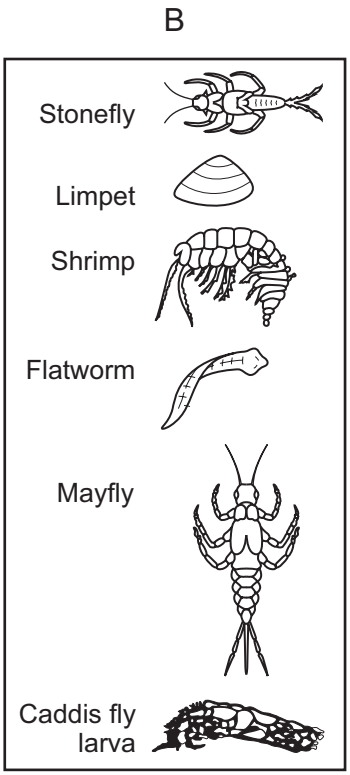
**(Questions continue overleaf)**


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**7** Untreated sewage is a serious potential pollutant of rivers. The diagram shows the effect of a sewage discharge on the nitrate levels and the dissolved oxygen content of a river. The animal species found at two points, A and B, along the river are also shown.



| Examiner Only | |
|---|---|
| Marks | Remark |
| | |

**(a)** **(i)** Bloodworms are present in very large numbers near the source of the pollution. What term is used to describe species like this that show the presence of pollution?

_____ [1]

**(ii)** Suggest how the bloodworm can tolerate high pollution levels.

_____ [1]

**(b)** Explain why there are fewer animal species at point A than at point B.

_____

_____

_____

_____ [3]

**(c)** Describe the process of eutrophication.

_____

_____

_____

_____ [3]

**THIS IS THE END OF THE QUESTION PAPER**



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New Specification

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General Certificate of Secondary Education
2011–2012

# Double Award Science: Biology

Unit B1

Higher Tier

**[GSD12]**

**TUESDAY 8 NOVEMBER 2011**
**9.30 am–10.30 am**

# MARK SCHEME



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| | | | | AVAILABLE MARKS |
|---|---|---|---|---|
| **1** | **(a)** | energy transport and agriculture | [1] | |
| | **(b)** | decreases from 1990–2006/increases from 2006 to 1990;<br>exceptions transport and energy (need both); | [2] | |
| | **(c)** | increased use of cars/increased energy consumption/removal of forests | [1] | |
| | **(d)** | so that know what the levels are/see changes/so that can regulate/ to meet targets/global warming | [1] | |
| | **(e)** | floods/coastal erosion/arctic ice melts/changing weather patterns;<br>too hot/cold/too wet/drought/too stormy – for current plant growth | [1]<br>[1] | 7 |
| **2** | **(a)** | Glucose;<br>Energy | [2] | |
| | **(b)** | Apparatus assembled as in the drawing<br>1 mark for apparatus boiling tube, bung, delivery tube to test tube; (into liquid);<br>1 mark for oil either labelled or as layer (present) but not labelled;<br>1 mark for presence of liquid in right hand tube (needs to be connected); | [3] | |
| | **(c)** | Lactic acid/lactate in muscle;<br>Ethanol in yeast;<br>Carbon dioxide in yeast/no carbon dioxide in the muscle | [3] | 8 |
| **3** | **(a)** | No naked flames/no Bunsen burner on/alcohol flammable | [1] | |
| | **(b)** | To soften the leaf/make less brittle<br>(not remove alcohol on its own) | [1] | |
| | **(c)** | Blue–black/blue/black<br>*(not purple, not purple/black)* | [1] | |
| | **(d)** | Used in respiration/provide energy/active transport;<br>make cellulose/make protein/fat or oils/make chlorophyll not food | [2] | |
| | **(e)** **(i)** | $mm^3$ $CO_2$ absorbed/$m^2$/plant<br>or $O_2$ produced per unit time per plant<br>or volume $CO_2$ absorbed/time<br>or volume $O_2$ produced/time | [1] | |
| | **(ii)** | Any **two** from:<br>• B is more developed/older/mature/has been growing longer<br>• Bigger leaves/larger surface area/taller/roots bigger<br>• More light/more $H_2O$ | [2] | |
| | **(iii)** | Process controlled by enzymes;<br>which are denatured at the higher temperatures (not killed) | [2] | 10 |



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AVAILABLE MARKS

**4** **(a)** **(i)** E2 [1]

**(ii)** P1; and P4 [2]

**(iii)** Lock and key [1]

**(b)** Indicative content
A – lipase has broken down fats/lipase reacts with fat;
fatty acids produced;
lower pH/acidic (**not** pH5 on its own)
B – heat has denatured the enzyme/lipase (**not** killed enzyme);
fats not broken down/no fatty acids produced;
pH stays the same (**not allow** pH is neutral on its own) **not** pH7
C – no lipase present/no enzymes present;
fats not broken down/no fatty acid produced;
pH stays the same as start – (but only award once in B or C **not both**) **not** pH7 [6]

| **Response** | **Mark** |
|---|---|
| Candidates must use appropriate specialist terms throughout to describe the results they would expect and account for the results, using at least 5 of the above points in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard. | 5–6 |
| Candidates must use some appropriate specialist terms to describe the results they would expect and partially account for these results, using at least 3 of the above points in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard. | 3–4 |
| Candidates describe one of the results they would expect or account for one of these results, using at least one of the above points. However, these may not be presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. | 1–2 |
| Response not worthy of credit. | 0 |

**(c)** pH3/lower pH/more acidic;
faster rate/more breakdown;
larger surface area for enzyme; lipase action;
award 1 mark for lipase but only if mentioned in connection with surface area; max. [3] [3]

13



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| | | AVAILABLE MARKS |
|---|---|---|
| **5** | **(a)** Any **three** from:<br>• Oxygen needed for respiration;<br>• This provides energy;<br>• For uptake against a concentration gradient/from low concentration to high concentration in plant;<br>• By active transport. [3] | |
| | **(b)** **(i)** 160 [1] | |
| | **(ii)** Nitrate no longer limits crop growth/extra nitrate not needed;<br>So is not being used by the crop/remains in the soil/not being taken up by roots; [2] | |
| | **(c)** **(i)** Nitrification [1] | |
| | **(ii)** Any **two** from:<br>• Leached/washed out by rain<br>• Action of denitrifying bacteria/denitrification<br>• That convert nitrate to nitrogen gas [2] | 9 |
| **6** | **(a)** **(i)** more species in quadrats in area A than B/more plants in A or B not decrease by 5 at a time [1] | |
| | **(ii)** light/water levels/pH levels/type of soil/mineral levels/rain/ temperature [1] | |



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**(b)** Indicative content

- Set out (belt) transect/line/or put down tape measure;
- Use quadrats;
- Identify plant species;
- Use a key (to identify species);
- Count the number of (different) species in each quadrat;
- Repeat at (5 m) intervals across the transect;
- Work out the average/mean;
- Record/write results down;

| Response | Mark |
|---|---|
| Candidates must use appropriate specialist terms throughout to describe how they would have carried out this investigation and explain how the pupils would have obtained these results, using at least 5 of the above points in a logical sequence. They use good spelling, punctuation and grammar and the form and style are of a high standard. | 5–6 |
| Candidates must use some appropriate specialist terms throughout to describe how they would have carried out this investigation and partially explain how the pupils would have obtained these results, using at least 3 of the above points in a logical sequence. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard. | 3–4 |
| Candidates describe how they would have carried out the investigation, using at least 1 of the above points. However, these may not be presented in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. | 1–2 |
| Response not worthy of credit. | 0 |

[6]

**(c)** plants at bottom and widest bar labelled;
rest in correct order and progressively smaller bars;
allow one mark for all labels correct but triangle drawn. [2]

**(d)** **(i)** $\frac{15\,000 \times 100}{48\,000} = 0.3125$
$= 31.25\%$ [2]

**(ii)** Any **two** from:
Movement;
Excretion;
Respiration;
Egestion [2]

**(iii)** Eaten by birds/badgers/foxes or passed to detritivores/ decomposers/eaten by animals [1]

AVAILABLE MARKS

15



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| | | | | AVAILABLE MARKS |
|---|---|---|---|---|
| 7 | (a) | (i) | Indicator species [1] | |
| | | (ii) | Can tolerate very low oxygen levels/respire anaerobically at low oxygen levels [1] | |
| | (b) | | high sewage at A;<br>because less oxygen;<br>because decomposers (used up oxygen);<br>Aquatic invertebrate die/animals die; [3] | |
| | (c) | | Any **three** from:<br>• Promotes growth of algae/algal blooms<br>• Rapid death rate of algae due to shading/death of algae<br>• Algae decomposed (by bacteria)<br>• Uses up oxygen [3] | 8 |
| | | | **Total** | **70** |



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