WJEC GCSE BIOLOGY

# BIOLOGY



## EXAM QUESTION PACK

UNIT B2 HIGHER TIER 4471 PAPERS

STEMUP

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| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4471/02

S16-4471-02

## ADDITIONAL SCIENCE/BIOLOGY

# BIOLOGY 2
## HIGHER TIER

P.M. TUESDAY, 17 May 2016

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **5** | |
| **2.** | **5** | |
| **3.** | **4** | |
| **4.** | **4** | |
| **5.** | **6** | |
| **6.** | **6** | |
| **7.** | **7** | |
| **8.** | **3** | |
| **9.** | **8** | |
| **10.** | **6** | |
| **11.** | **6** | |
| **Total** | **60** | |

4471 020001

### ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **5** and question **11**.

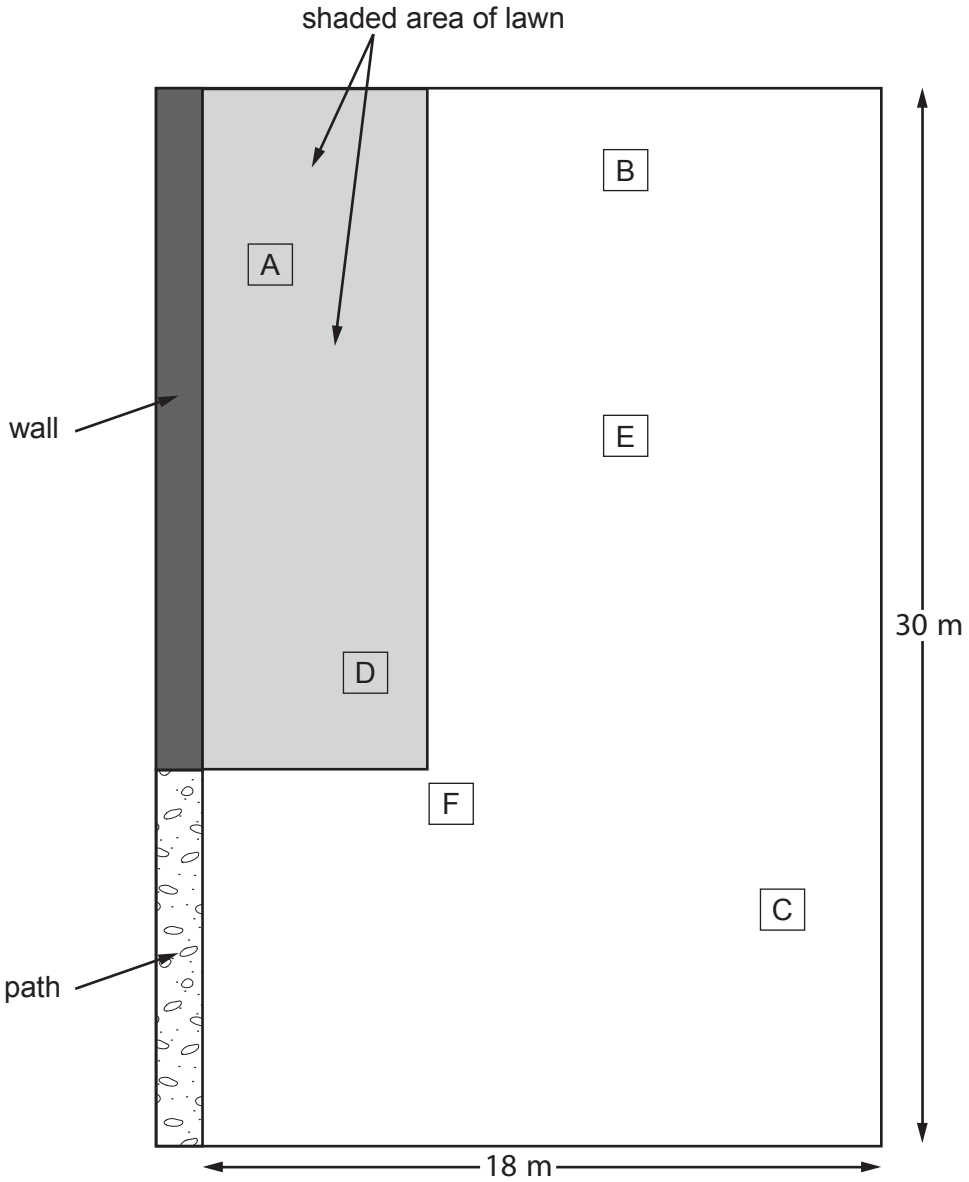
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*Answer* **all** *questions.*

**1.** Some students investigated the number of dandelion plants on a lawn. The diagram shows the lawn and the location of 6 quadrats (A to F) which the students had placed at random on the lawn.




Key: ☐ quadrat

The students counted the number of dandelions in each quadrat and recorded their results in the table below.

| quadrat | number of dandelions |
|---|---|
| A | 7 |
| B | 2 |
| C | 1 |
| D | 6 |
| E | 2 |
| F | 0 |

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*(a)* Each quadrat measured $1\,m^2$.
Calculate the mean number of dandelions per square metre for the 6 quadrats. [1]

Mean number of dandelions = .....

*(b)* Calculate the area of the lawn. [1]

Area of lawn = .....

*(c)* Use your answers from parts *(a)* and *(b)* to estimate the total number of dandelions on the lawn. [1]

Estimated total number of dandelions = .....

*(d)* In fact, the **actual** number of dandelions on the lawn is 1250.
Use the formula below to calculate the percentage error of the estimate in part *(c)* above. [1]

$$\text{percentage error} = \frac{\text{estimated number of dandelions} - \text{actual number of dandelions}}{\text{actual number of dandelions}} \times 100$$

percentage error = ..... %

*(e)* How could the strength of evidence in the investigation be improved? [1]

.....

.....

5



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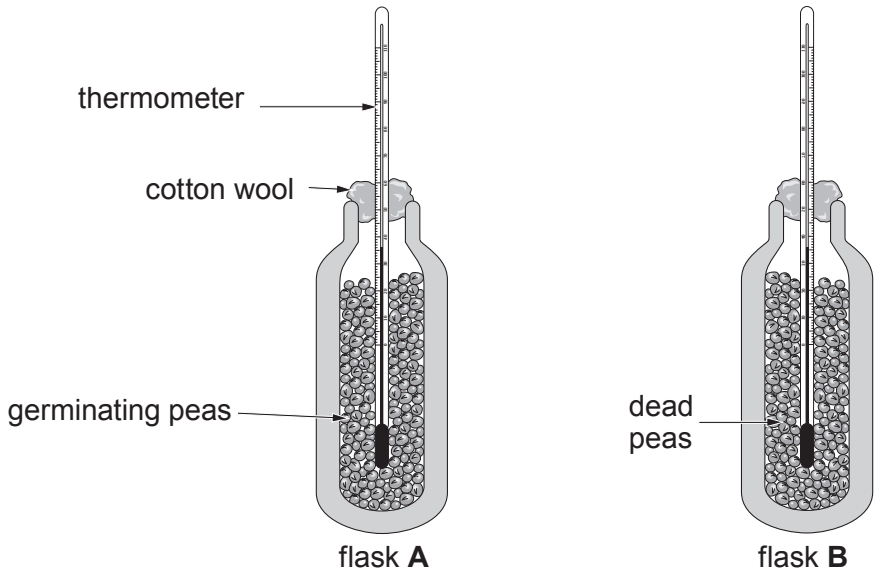
**Turn over.**

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**2.** Dan and Beth investigated the heat released by germinating peas.

The diagram below shows their experiment.




*(a)* The temperature of the peas in each flask was recorded at the start of the experiment and after two days. The results are shown in the table below.

| flask | temperature (°C) | |
|---|---|---|
| | start | after two days |
| **A** | 21 | 28 |
| **B** | 21 | 21 |

Describe and explain the results for **both** flasks. [3]

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*(b)* The students did not disinfect the peas before setting up the experiment.
Explain the importance of disinfecting the peas in order to make a valid conclusion. [2]

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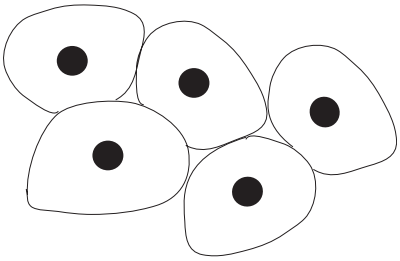
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**3.** *(a)* The drawing below shows human embryonic stem cells.



What features of stem cells could make them useful in treating many different medical conditions? [2]

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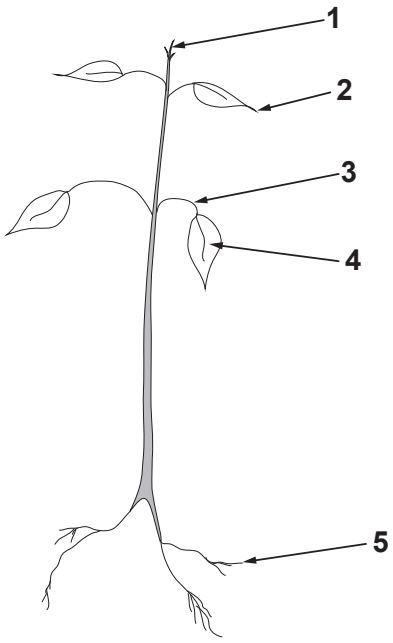
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*(b)* A laboratory in Japan has recently developed stem cells from human adult skin cells. Suggest why using human adult stem cells might be preferred to using human embryonic stem cells. [1]

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*(c)* Plants also have stem cells.




Which **two** numbered parts (**1** to **5**) of the plant shown above contain stem cells? [1]

..... and .....



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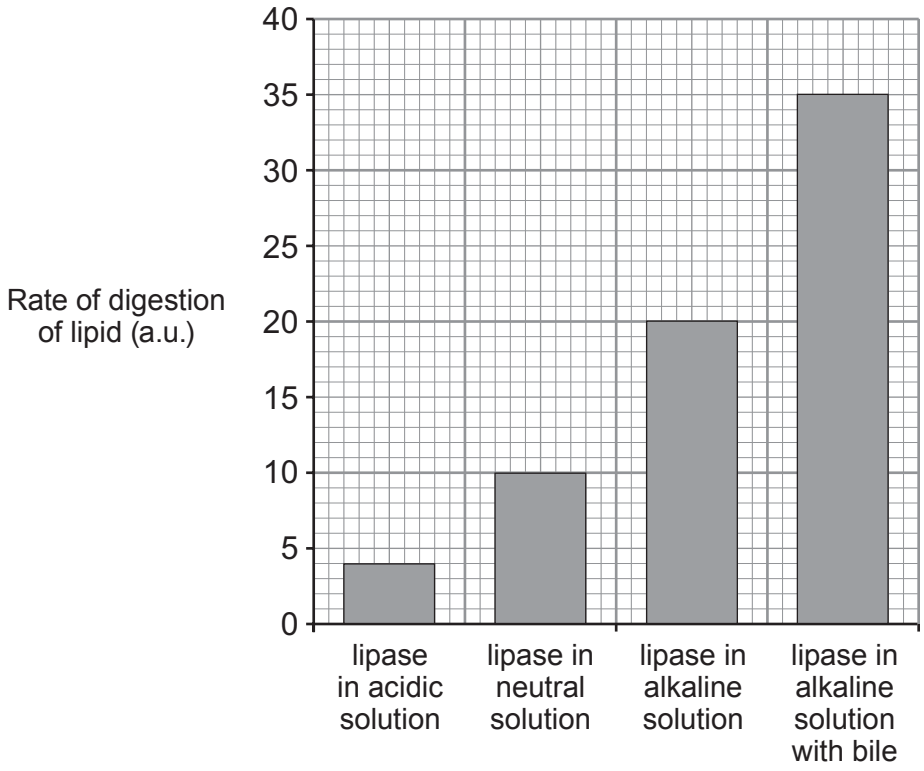
Examiner only

**4.** *(a)* Why do we need to digest large food molecules? [1]

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*(b)* The graph below shows the rate of digestion of lipids by lipase under different conditions.




(i) Describe the effect of pH on the rate of digestion of the lipids. [1]

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(ii) Explain the effect of bile on the rate of digestion of the lipids. [2]

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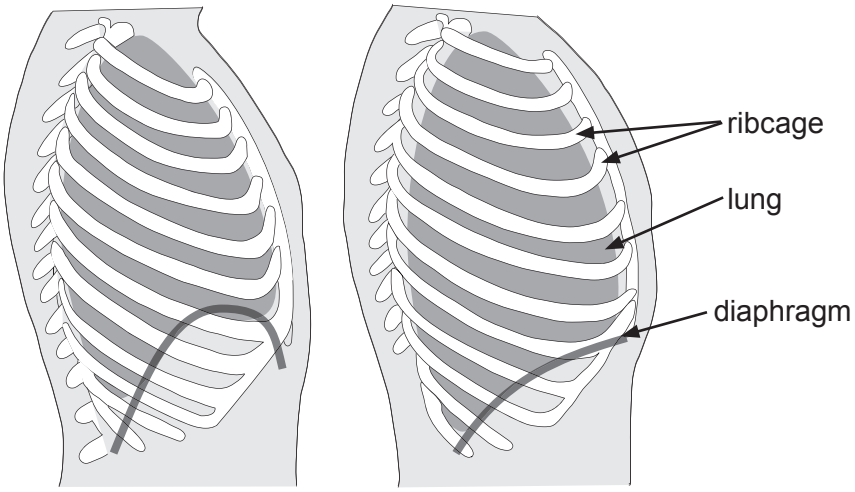
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**5.** The diagrams below show side views of the chest cavity before and after inspiration (breathing in).




Using both diagrams, explain how the movements of the **diaphragm and ribcage** bring about inspiration (breathing in). [6 QWC]

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**Turn over.**

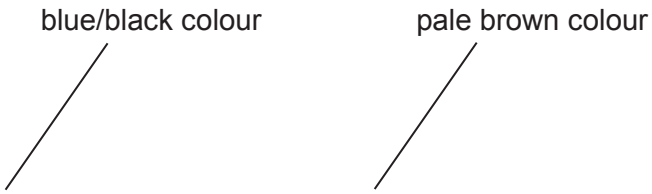
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**6.** *(a)* Complete the word equation for photosynthesis. [2]

..... + ..... ⟶ glucose + .....

*(b)* A leaf from each of two plants (**X** and **Y**) was tested for the presence of starch using iodine solution.
The results are shown in the diagrams below.




Leaf from plant **X** Leaf from plant **Y**

Plant **X** had been growing in the light before testing. Plant **Y** had been taken from the light and placed in the dark for 48 hours before the test.
Explain the results for both leaves. [4]

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**7.** The relative masses of bases in DNA, in three different animals, are shown in the table.

| | mass of base /a.u. | | | |
|---|---|---|---|---|
| source of DNA | adenine | guanine | thymine | cytosine |
| human | 30.9 | 19.9 | 29.4 | 19.8 |
| salmon | 29.7 | 20.8 | 29.1 | 20.4 |
| sheep | 29.3 | 21.4 | 28.3 | 21.0 |

*(a)* How do the data above give evidence for base pairing? [2]

.....

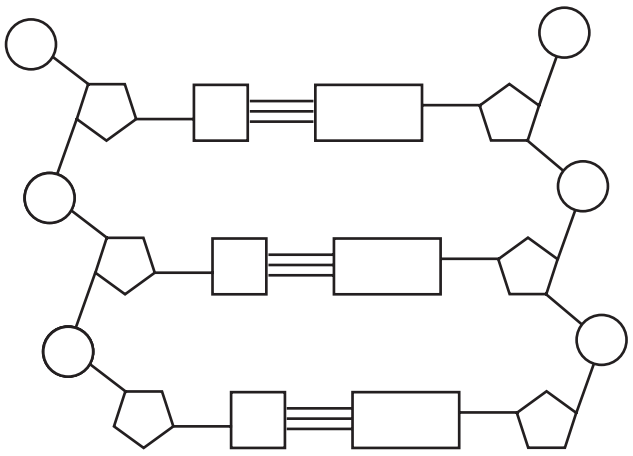
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*(b)* The diagram below shows part of a DNA molecule.
Add labels to this diagram to show the position of: [2]

(i) the sugar and phosphate molecules;

(ii) a base molecule.



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*(c)* Scientists have discovered a gene which, when defective, causes a genetically inherited disease. The normal gene controls the production of an essential protein.
The relevant base sequence in the normal gene is:

TAGTAGAAACCACAA

The relevant base sequence in the gene of people with the genetically inherited disease is:

TAGTAGCCACAA

Explain why the DNA in people with the genetically inherited disease will not be able to produce the essential protein. [3]

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**8.** The table below shows the concentration of lactic acid in the blood of two athletes, Anjum and Tudor, before and after vigorous exercise that lasted 10 minutes.

The concentration of lactic acid was measured at 10 minute intervals after the exercise for the next 50 minutes.

| | lactic acid concentration (mg / 100cm$^3$) | |
|---|---|---|
| time (min) | Anjum | Tudor |
| 0 | 20 | 20 |
| 10 | 80 | 90 |
| 20 | 78 | 90 |
| 30 | 60 | 80 |
| 40 | 50 | 75 |
| 50 | 38 | 60 |
| 60 | 25 | 50 |

*(a)* Use the data to give reasons why Anjum appears to be fitter than Tudor. [2]

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*(b)* Give a reason why a marathon runner relies almost totally on aerobic respiration and produces very little lactic acid. [1]

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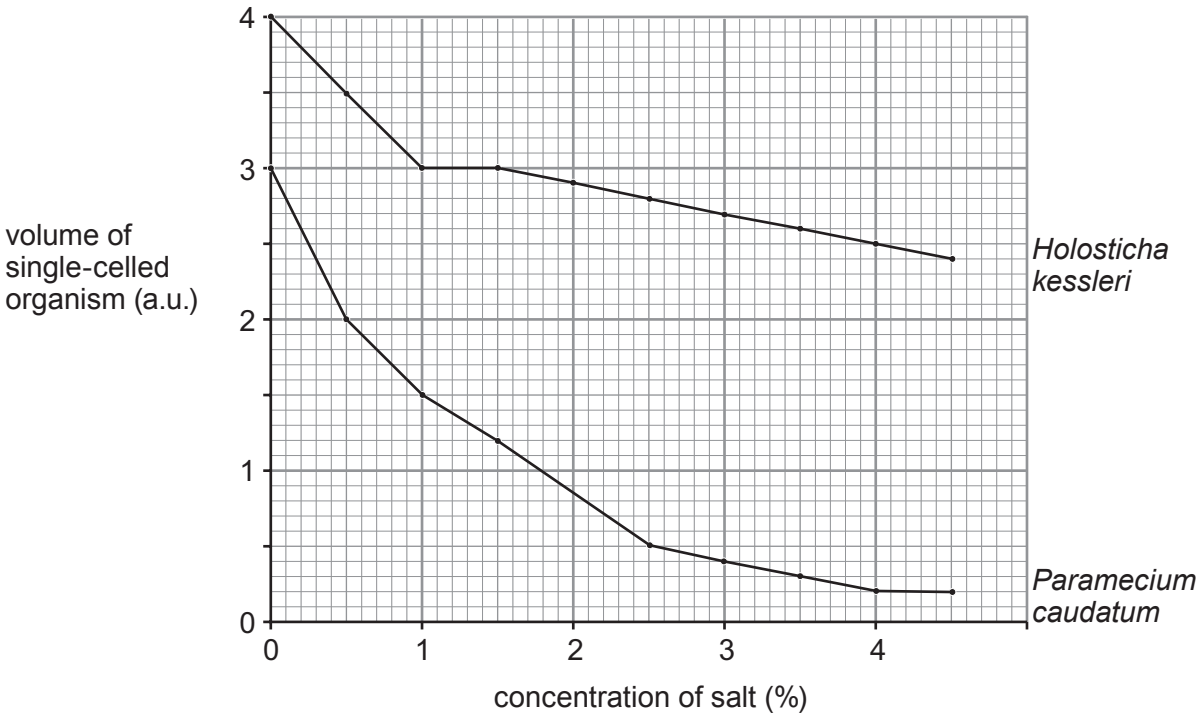
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**9.** An investigation into the role of cell membranes in diffusion was carried out using two similar species of single-celled organisms, *Paramecium caudatum* and *Holosticha kessleri*. Both species were the same volume (3 a.u.) at the start of the investigation. The two species were then placed in water containing different concentrations of salt for 30 minutes. The volumes of the single celled organisms were then measured again using a microscope fitted with a microscale. The results are shown in the graph below.




*(a)* How do the graphs provide evidence that

(i) *Paramecium caudatum* cannot live in sea water? [1]

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(ii) *Holosticha kessleri* normally lives in salt solutions of concentration between 1% and 1.5%? [1]

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*(b)* State **two** factors that should have been kept constant during this investigation for it to have been a fair comparison. [2]

(i) .....

(ii) .....

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*(c)* State the name of the type of diffusion taking place and explain fully how it affects *Paramecium caudatum* in sea water. [4]

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**Turn over.**

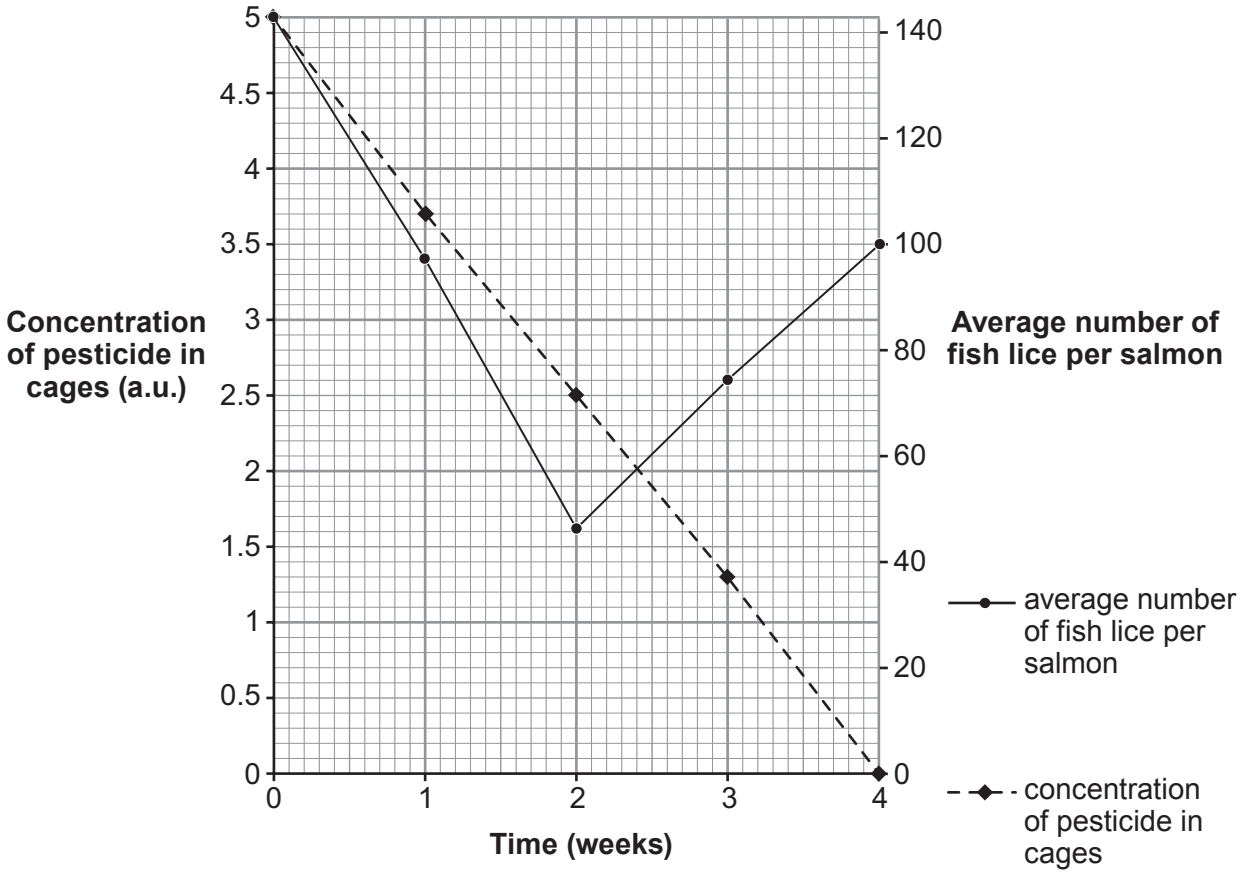
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**10.** Farmed salmon are kept in large numbers in sea cages. They are often infested by small invertebrate pests called fish lice.



**fish louse**

Fish lice damage the skin of the salmon and sometimes kill them by affecting the gills and brain. Fish farmers add pesticides to the sea cages to kill the fish lice.
The graph shows the concentration of pesticide in cages and the average number of fish lice per salmon over a period of four weeks.




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*(a)* What conclusions can be drawn from this graph? [2]

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*(b)* The goldsinny wrasse, *Centrolabrus rupestris* eats fish lice.



In the 1980s, trials called the Ecofish Project took place in some fish farms in Norway and Scotland. 600 goldsinny wrasse were added to sea cages containing 26 000 salmon. Over a four week period, these salmon did not need any treatment with pesticides but a control group had to be treated several times.

(i) What is the name given to this method of control using living organisms to kill a pest? [1]

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(ii) Before the goldsinny wrasse are used more widely, suggest **three** observations that would have to be made during extended trials. [3]

I. .....

II. .....

III. .....

6

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**Turn over.**

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**11.** Write an account of some of the different methods of protecting endangered species of animals and plants around the world. Include the use of legislation in your answer. [6 QWC]

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**END OF PAPER**

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# GCSE MARKING SCHEME

**SUMMER 2016**

**SCIENCE – BIOLOGY 2**
**4471/01/02**

## INTRODUCTION

This marking scheme was used by WJEC for the 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

# GCSE Biology 2 – Foundation only questions

| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **1** | | (a) | (i) | | 1 | Forest; | trees | | |
| | | | (ii) | | 2 | Agriculture;<br>Building /Towns; | Farms/ farmland/ use of land to grow crops | | deforestation |
| | | | (iii) | | 1 | Surrounded by agricultural land/<br>smaller area (at Kawanga);<br>it = Kawanga | reverse argument for Jozani | | Near to agricultural land |
| | | | (iv) | | 2 | 1600/2 -150;<br>Answer 650;<br>(Incorrect answer, correct method =1)<br>Correct answer , no working =2) | 649.92/ 649.9 | | |
| | | (b) | | | 1 | Any one from:<br>• {prevent /work against/ control/ ban/ stop} selling monkeys to other countries/<br>• stop exporting of monkeys/<br>• stop trafficking of monkeys; | | | Hunting/ poaching/ selling monkeys unqualified |
| | | Total Mark | | | 7 | | | | |



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| Question Number | | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | | | | | | | | |
| **2** | | (a) | (i) | | 1<br>1<br>1 | <u>Cell</u> wall;<br>Cytoplasm;<br>Vacuole; | <br><br>Cell sap | | |
| | | | (ii) | | 1 | {Allow/ control/ lets/ enables } entry and exit of molecules/substances/ particles/ 'things'; | Controls what goes in and out (of the cell) | protection | |
| | | (b) | (i) | | 1 | A **and** C; | | | |
| | | | (ii) | | 1 | cytoplasm/nucleus/cell membrane; | | | |
| | | Total Mark | | | 6 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **3** | | (a) | | | 1<br>1 | Mitosis; correct spelling<br>Any one from:<br>• two <u>daughter/ new</u> cells/<br>• <u>daughter</u> cells have same chromosome number as the mother cell; | There is only one division | Genetically identical to mother cell/ there are only two cells | |
| | | (b) | (i) | | 1 | Column 1 80<br>Column 2 23<br>Both correct for **1 mark** | | | |
| | | | (ii) | | 2 | 4;<br>Gametes/ sperm/ egg; | | | |
| | | (c) | (i) | | 1<br><br>2 | Correct scale (must include 0 at origin and go up to at least 110);<br><br>all plots correct and labelled (2 marks);; tolerance ±½ small square<br>1 error = 1 mark<br>More than one error = 0 marks<br>Joining plots with line = 1 error<br>Missing 1 label = 1 error<br>Missing more than1 label = 2 errors | | | |
| | | | (ii) | | 1 | B; | | | |
| | | Total Mark | | | 9 | | | | |



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| Question Number | | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
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| FT | HT | | | | | | | | |
| **4** | | (a) | | | 1<br>1 | Light;<br>Water **and** Oxygen; | sunlight | | Sun/ solar |
| | | (b) | i | | 2 | increase then {plateau/ levels off};<br>plateau occurs at 4%; | Range of 3-4% | Reference to figures from *y*-axis | |
| | | | ii | | 1<br>1 | 34 – 20;<br>14;<br>( correct answer but no working shown = 2)<br>( incorrect answer but correct readings = 1) | | | |
| | | (c) | | | 2 | Iodine (solution);<br>{Yellow/Orange/Brown} to {blue-black / black}; | Iodide | | |
| | | Total Mark | | | 8 | | | | |



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| Question Number | | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | | | | | | | | |
| **5** | | (a) | | | 1 | {Warnings/ notice/ information/ pictures} {<u>on packets/ on the back</u>}; | 'Smoking kills' on the packet | | |
| | | (b) | (i) | | 2 | Tar content increases (rates of lung) cancer increases;<br>Large increase at 11(mg) tar; | ORA | | |
| | | | (ii) | | 1 | Increases (rate of lung cancer); | | | |
| | | (c) | | | 2 | Emphysema/ description of emphysema/ COPD;<br>Coughing/shortness of breath / short of oxygen ;<br>**OR**<br>Heart disease/ CVD;<br>Heart attack/ heart failure/ thrombosis<br>**OR**<br>Stroke;<br>Mobility/ paralysis/ speech difficulties<br>**OR**<br>Angina;<br>Chest pain/ mobility issues | Damage to alveoli | | |
| | | Total Mark | | | 6 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **6** | **1** | (a) | | | 1 | 3; | 3 per $m^2$<br>$3/m^2$<br>3 $m^{-2}$ | | $3m^2$ |
| | | (b) | | | 1 | 540$m^{2;}$<br>unit needed | | | |
| | | (c) | | | 1 | 1620;<br>allow ecf from (a) and (b) | | | |
| | | (d) | | | 1 | 29.6;<br>allow ecf from (c) | 30 | | |
| | | (e) | | | 1 | Any one from:<br>• increase {number/ area/ size} of quadrats/<br>• repeat investigation /<br>• do two separate studies – one of shaded area and one in the full sunlight area; | Use a bigger sample size/ throw quadrat more often | Throw the quadrat more | Use transects |
| | | Total Mark | | | 5 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **7** | **2** | (a) | | | 3 | • (only) living things respire/ {germinating/ living} peas respire (dead do not)/ peas in A respire;<br>• producing heat (linked to respiration);<br>• so temperature rose in flask A but not in flask B; | ORA | | |
| | | (b) | | | 2 | • (disinfectant) kills {microorganisms/ bacteria/ fungi};<br>Any one from:<br>• which would {respire/ release heat}/<br>• so you can be confident that the {heat release/respiration} is from the peas; | Destroys | get rid of | Denatures/ stops them growing |
| | | Total Mark | | | 5 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **8** | **3** | (a) | | | 2 | undifferentiated/ not specialised;<br>can turn into/grow into/ change into/ can differentiate into different kinds of {cells/tissues/organs}; | Named cell/ tissue/ organ | | |
| | | (b) | | | 1 | Any one from:<br>• Destruction of life/ destruction of embryos/<br>• {reduced/no} {ethical/ moral} issues / {less/no} public disquiet; | Religious issues/ embryos do not have a choice | | playing god |
| | | (c) | | | 1 | 1 **and** 5; | | | |
| | | Total Mark | | | 4 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **9** | 4 | (a) | | | 1 | Any one from:<br>• (small enough) to be absorbed/<br>• to make food soluble/<br>• to pass {into the blood/ through the intestine wall}; | ORA | To make them smaller | |
| | | (b) | i | | 1 | the rate (of digestion) increases when {pH/ alkalinity} increases;<br>it = rate of digestion | ORA<br>At high pH it is faster | | |
| | | | ii | | 2 | bile emulsifies fat/ bile turns fat into {droplets/ globules};<br>bile creates greater surface area for {lipase/enzyme} to work on; | Bile breaks down fats into droplets | Bile breaks down fats | |
| | | Total Mark | | | 4 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **10** | 5 | | | | 6<br>QWC | Indicative content:<br>*diaphragm*<br>• contracts<br>• flattens/ moves down<br>*ribcage*<br>• moves up **and** out<br>• volume of chest/ thorax increases<br>• air pressure in chest/ thorax falls<br>• lung volume increases/ lungs inflate<br>• external air pressure is now higher<br>• so air rushes/is pushed in<br>**5-6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br>**3-4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br>**1-2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant inaccuracies in spelling, punctuation and grammar.<br>**0 marks** | | | |
| | | Total Mark | | | 6 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **6** | (a) | | | 2 | carbon dioxide + water; ⟶ *glucose* + oxygen; | Correct symbols | | |
| | | (b) | | | 4 | 1. **X** has photosynthesised;<br>2. **X** has starch;<br>3. **Y** no photosynthesis;<br>4. starch {turned (back) into glucose/used up}/ destarched; | | | Reference to stored glucose |
| | | | | | | | | | |
| | | Total Mark | | | 6 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **7** | (a) | | | 2 | Ratio of A:T approximately equal;<br>Ratio of G:C approximately equal; | Similar masses/ similar ratio | | Similar results/ numbers/ amount |
| | | (b) | | | 2 | Sugar phosphate label pointing to sides of structure;<br><br>Base molecule pointing to square/ oblong; | arrow to phosphate labelled sugar and vice versa/ arrow to bond | | Arrow to hydrogen bond |
| | | (c) | | | 3 | {AAA/ codon/ three bases/ triplet} {are/is} missing;<br>{Triplet code / three bases} determine amino acid;<br>Amino acids determine the protein; | | | |
| | | Total Mark | | | 7 | | | | |



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| Question Number | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **8** | (a) | | | 2 | Anjum produces less lactic acid/ concentration of lactic acid is lower;<br>It is broken down quicker / removed quicker / repays oxygen debt quicker/ needs a shorter time to recover; | | | |
| | | (b) | | | 1 | The marathon runner does not need to release energy {quickly / in a short time} (like a sprinter); | | | |
| | | Total Mark | | | 3 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **9** | (a) | (i) | | 1 | Loses {water/ volume} when placed in salt solution; | | | |
| | | | (ii) | | 1 | Does not gain or lose {water/ volume} in this range/ stays the same in these concentration/ no net movement of water; | | | |
| | | (b) | | | 2 | Any two from:<br>• pH;<br>• Temperature;<br>• Volume of solution; | | | Ph/ ph<br>Heat |
| | | (c) | | | 4 | • Water passes out;<br>• by osmosis;<br>• from the cell where water is in higher concentration to sea water where it is in lower concentration;<br>• Via semi-permeable membrane; | | | |
| | | Total Mark | | | 8 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **10** | (a) | | | 2 | Any two from:<br>• Pesticide becomes {diluted/ less concentrated}/ pesticide has to be added every two weeks;<br>• does not kill all fish lice;<br>• pesticide kills the lice if above 2.5 concentration ; | | | |
| | | (b) | (i) | | 1 | biological / biocontrol; | | | bio |
| | | | (ii) | | 3 | Any three from:<br>• Effect of wrasse on biodiversity/ would wrasse {harm/ effect} other species/ become pests;<br>• Would wrasse reproduce/ survive;<br>• Would {salmon/ other predators} eat the wrasse;<br>• Would wrasse spread disease;<br>• Could enough wrasse be obtained / bred to meet demand;<br>• The cost of wrasse is less than the cost of pesticides;<br>• Check wrasse do not leave cages; | | | |
| | | Total Mark | | | 6 | | | | |



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| Question Number | | | |
|---|---|---|---|
| FT | HT | Mark | Answer |
| | **11** | 6<br><br>QWC | *Indicative content:*<br><br>**Reference to international trade in species** -Legislation aims to prevent trade in endangered species.<br><br>**Sites of special scientific interest** -Allow ecosystems to develop unharmed.<br><br>**Captive breeding** - Endangered spp. can be reintroduced to their habitats.<br><br>**National parks/ nature reserve** - Allow large scale management of ecosystems via controlled ecotourism/ stop destruction of habitat<br><br>**Seed banks** - Preservation of rare species for future planting.<br><br>**Legislation of fishing quotas** - Prevents over fishing and allows build-up of stocks.<br><br>**Prevent poaching/ hunting of animals** - increase in legislation to stop hunting<br><br>**Educational awareness e.g. WWF** – make people aware of advantages of conservation<br><br>**Legislation against pollution/ litter –** relevant examples<br><br>**5-6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br>**3-4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br>**1-2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant inaccuracies in spelling, punctuation and grammar.<br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit. |
| Total Mark | | 6 | |



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| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4471/02

W16-4471-02

## ADDITIONAL SCIENCE/BIOLOGY

# BIOLOGY 2
## HIGHER TIER

A.M. THURSDAY, 7 January 2016

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **4** | |
| **2.** | **7** | |
| **3.** | **7** | |
| **4.** | **6** | |
| **5.** | **6** | |
| **6.** | **8** | |
| **7.** | **7** | |
| **8.** | **9** | |
| **9.** | **6** | |
| **Total** | **60** | |

4471
020001

### ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **4** and question **9**.

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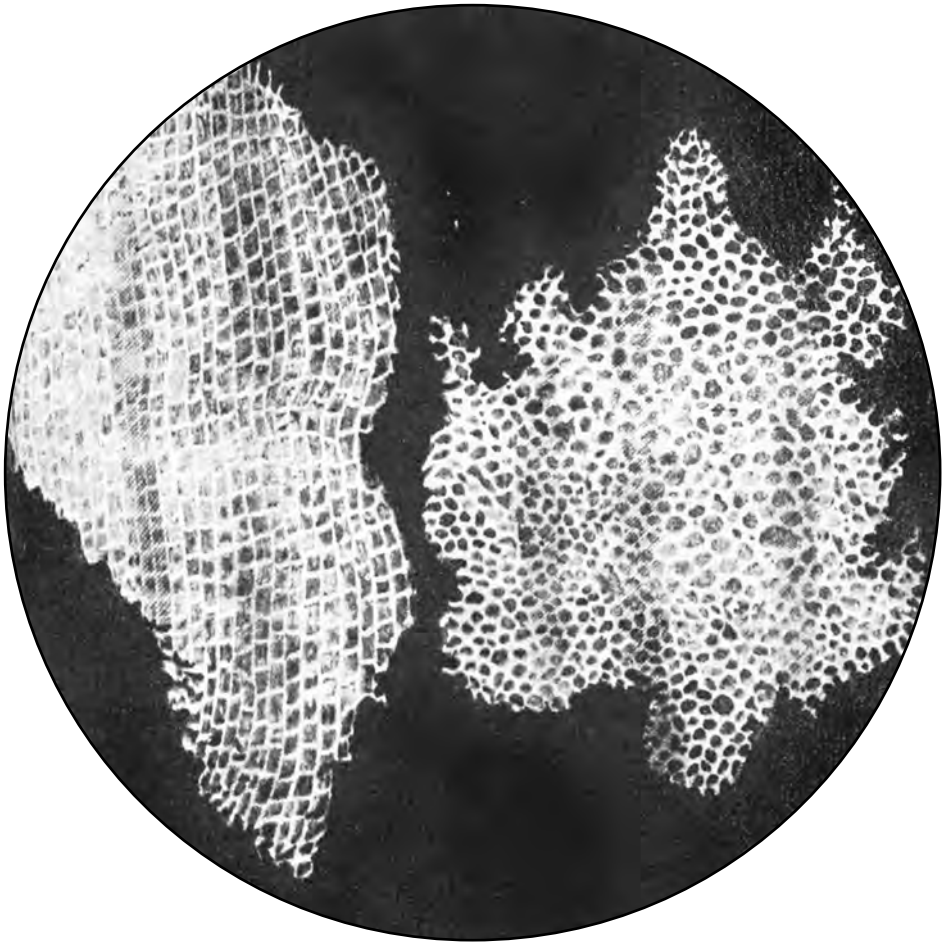
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Examiner only

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

**1.** Robert Hooke (1635 – 1703) was an English scientist who studied the structure of living organisms using one of the first light microscopes. In 1665 Hooke viewed a thin cutting of cork (tree bark) and discovered empty spaces, surrounded by walls, which he called cells. The work of Hooke and other scientists led to the development of the Cell Theory.

*Hooke's drawing of cork as viewed under the light microscope*



*(a)* What does the Cell Theory state? [1]

.....

.....

*(b)* Viruses were discovered in the 1950s. State **two** reasons why viruses are not thought to be living organisms. [2]

(i) .....

(ii) .....

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*(c)* You are provided with a sample of pond water containing single-celled swimming organisms. Which microscope would you use to observe the swimming action of these organisms? Place a tick (✓) in the box under the microscope you would choose and state the reason for your choice. [1]

Light microscope
(magnification up to x 1 500)



☐

Electron microscope
(magnification up to x 500 000)



☐

Reason .....

.....

4



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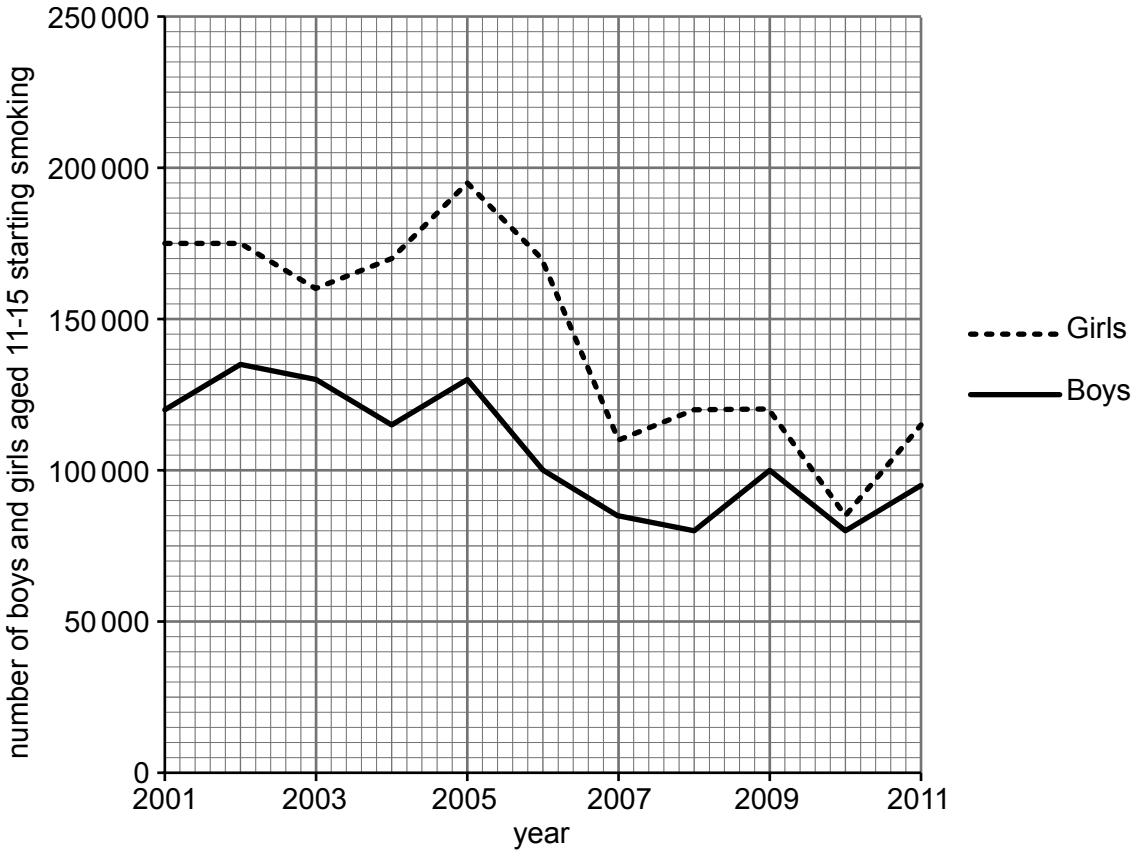


**Turn over.**

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Examiner only

**2.** The graph below shows the number of boys and girls aged 11 – 15 who started smoking each year between 2001 and 2011 in the UK.




*Cancer Research UK*

*(a)* (i) Give **two** trends which are shown in the graph. [2]

I. .....

II. .....

(ii) In 2009 the population of the UK was estimated at 62 million. In the same year, 102 000 people died in the UK from tobacco smoking related disease.
Calculate the percentage of the UK population who died from tobacco smoking related disease in 2009. Show your working. [2]

Percentage of population = ..... **%**

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*(b)* Cotinine is a chemical found in tobacco smoke. It is found in the saliva and urine of tobacco smokers. Simple test kits are available which can test for the presence of cotinine in saliva and urine.

In 2011 the percentage of 15 year old boys and girls in the UK who admitted smoking tobacco regularly was:

Boys 8% Girls 10%

However, based on cotinine test results of volunteer 15 year old boys and girls, the figures are more likely to be:

Boys 21% Girls 19%

*(All data Cancer Research UK)*

Suggest why the admitted levels of smoking amongst 15 year old boys and girls is almost 50% less than the results indicated from the cotinine tests. [1]

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*(c)* Explain how the smoking related disease, emphysema, affects the function of the lungs. [2]

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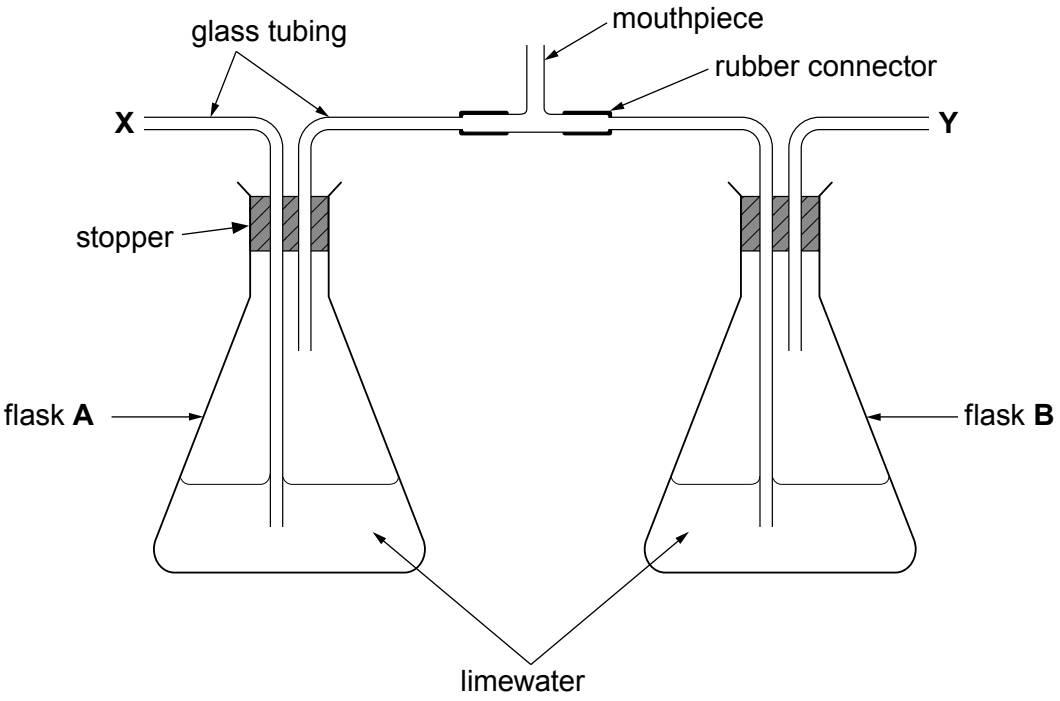
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**3.** Mair set up the following apparatus in a school laboratory in order to investigate the difference between inspired and expired air.




*(a)* Draw an arrow at **X** and another at **Y** to show the direction of air flow through the apparatus when air is gently breathed in and out at the mouth piece. [2]

*(b)* Mair breathed gently in and out through the mouthpiece for 1 minute.

(i) Complete the table below to show the expected **appearance** of the limewater after 1 minute. [2]

| | flask **A** | flask **B** |
|---|---|---|
| appearance of limewater after 1 minute | ..... | ..... |

(ii) Explain the **difference** in the appearance of the limewater after 1 minute. [2]

.....

.....

*(c)* If Mair had breathed gently in and out through the mouthpiece for 5 minutes, how would the results she obtained have been different? [1]

.....



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**4.** A student ate a chicken sandwich made from bread, butter and chicken for lunch. Describe fully what happens to the food in the sandwich from the time it enters the **mouth** to the time it leaves the **stomach**.

[6 QWC]

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**Turn over.**

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Examiner only

**5.** *(a)* What is meant by the term *biological control*? [2]

.....

.....

.....

*(b)* The following table contains data relating to the development and use of chemical and biological control agents.

| | chemical control | biological control |
|---|---|---|
| number of agents tested | >3.5 million | 3 000 |
| success ratio | 1:200 000 | 1:20 |
| development costs per agent | 180 million US dollars | 2 million US dollars |
| development time per agent | 10 years | 10 years |
| risk of resistance to agent | large | very small |
| harmful side effects | many | few |
| how specific is the agent to the job it has to do? | not very | very |

*The Royal Society*

(i) The development time is the time between the selection of the agent and its use in the field. Suggest what scientists have to do during this 10-year period. [2]

.....

.....

.....

(ii) I. The success ratio of the development of biological control agents is 1:20. State what this means. [1]

.....

.....

II. Select **one** piece of information from the table which helps to explain why the success ratio of chemical control agents is so low. [1]

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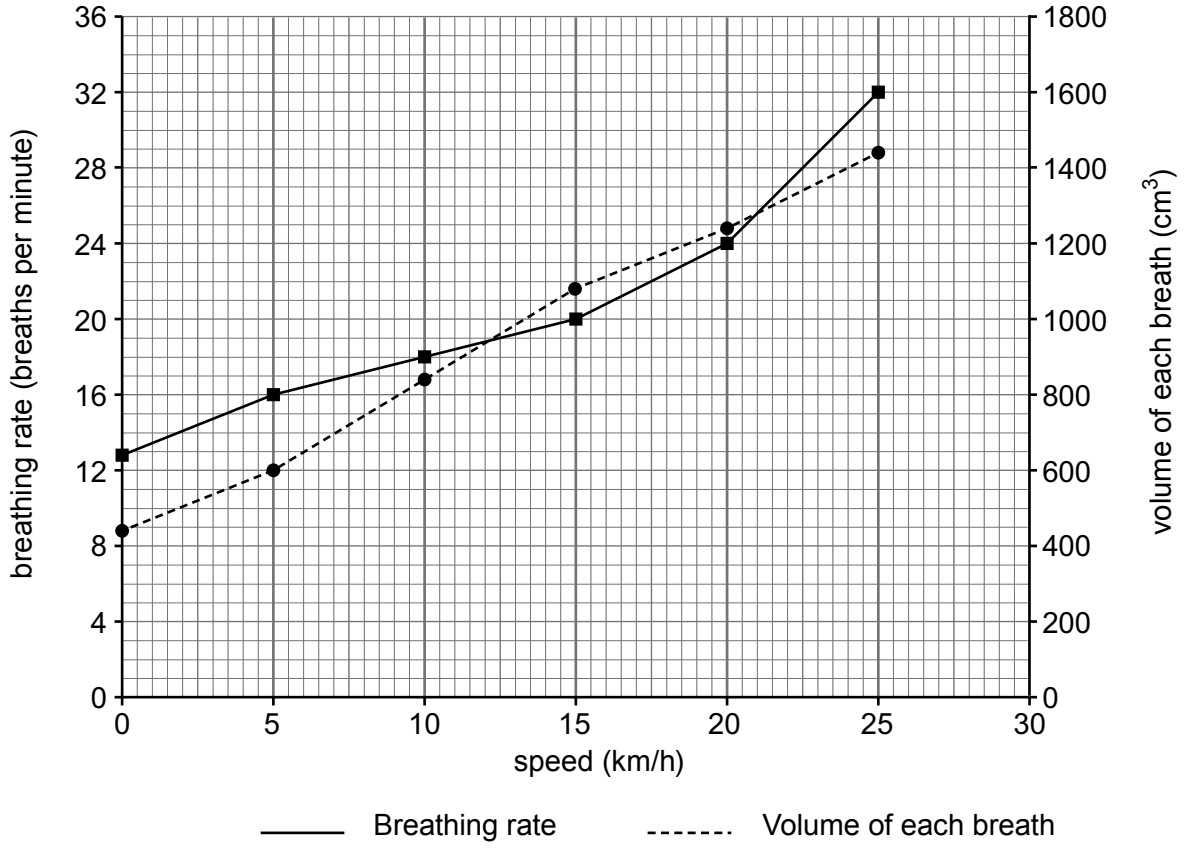
Examiner only

**6.** *(a)* State **two** ways in which anaerobic respiration and aerobic respiration in humans are similar. [2]

(i) .....

(ii) .....

*(b)* When athletes run faster, they breathe faster and the volume of each breath increases. The graph shows these changes for an athlete running a race.




(i) How many breaths per minute were taken when the athlete was running at 10 kilometres per hour? [1]

.....

(ii) What was the volume of each breath when the athlete was running at 15 kilometres per hour? [1]

.....

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(iii) Calculate the volume of air entering the lungs each minute when the athlete was running at 20 kilometres per hour. Show your working. [2]

Volume = .....

*(c)* Describe the benefits of increasing the breathing rate and the volume of each breath when the level of activity increases. [2]

.....

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8

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**Turn over.**

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**7.** The concentration of glucose in oak leaves was measured and recorded as a percentage of the (dry) mass of the leaves. The concentration was measured at 4 hour intervals throughout 24 hours. The results are shown in the table:

| time in hours (24 h clock) | concentration of glucose (% dry mass) |
|---|---|
| 04.00 | 0.45 |
| 08.00 | 0.60 |
| 12.00 noon | 1.75 |
| 16.00 | 2.00 |
| 20.00 | 1.40 |
| 24.00 midnight | 0.50 |

*(a)* State **two** environmental factors that would limit the production of glucose between 20.00 h and 24.00 h. [1]

(i) .....

(ii) .....

*(b)* Explain fully the results for:

(i) 04.00 h [3]

.....

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.....

(ii) 16.00 h [3]

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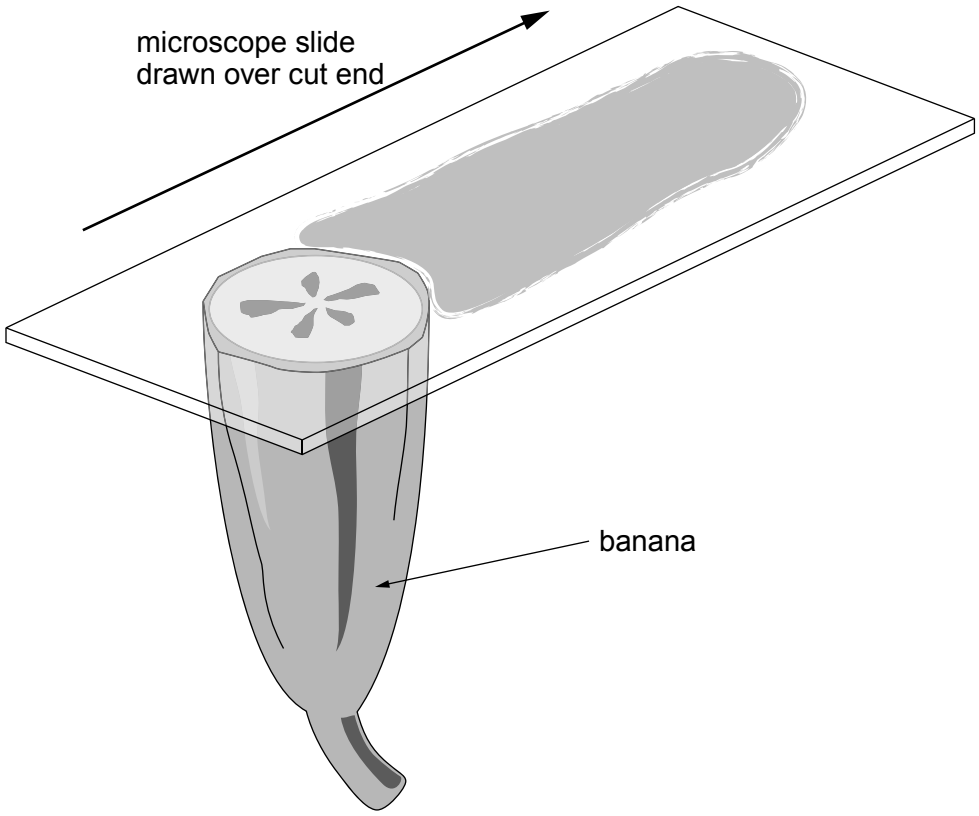
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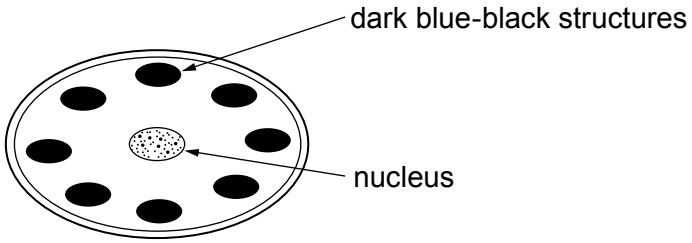
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**8.** An unripe banana was cut across and a microscope slide was drawn over the cut end as shown in the diagram below.



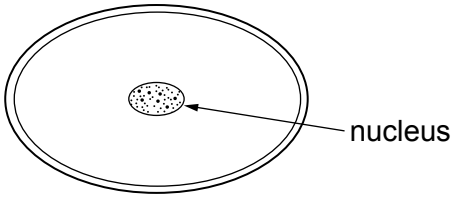

This procedure caused cells from the banana to be smeared onto the microscope slide. A drop of iodine solution was added to the cells on the microscope slide and the cells were then viewed with a microscope at high power magnification. A drawing of one of the cells is shown below.

Diagram **A**




The procedure, described above, was repeated using an over-ripe banana. A drawing of one of its cells is shown below.

Diagram **B**




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A sample of the over-ripe banana was liquidised in a food blender. Some of the liquidised banana was placed in a boiling tube and an equal volume of Benedict's solution added. The mixture was then heated to 90 °C. The colour of the mixture changed from light blue to brick red.

*(a)* Explain the observations in diagrams **A** and **B** opposite and the results in the paragraph above. [3]

.....

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.....

*(b)* A piece of unripe banana was weighed and put into a beaker containing 200 $cm^3$ of 0.2 M sugar solution. This was repeated for the over-ripe banana using a separate beaker. After 30 minutes both pieces of banana were removed, dried with a paper towel and weighed again. The percentage change in mass was calculated for each piece of banana. This procedure was then carried out three more times and the mean percentage change in mass calculated. The results are shown below.

| | unripe banana | over-ripe banana |
|---|---|---|
| mean % change in mass | –10 | 0 |

Explain the results in terms of osmosis for

(i) the unripe banana; [3]

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.....

(ii) the over-ripe banana. [2]

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.....

*(c)* State the reason for carrying out the procedure three more times and calculating the mean. [1]

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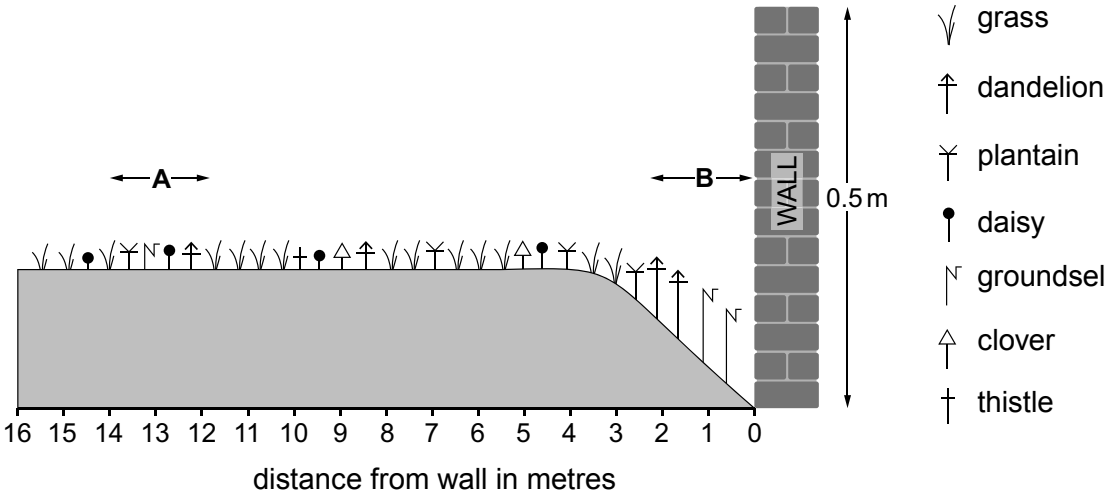


**Turn over.**

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**9.** A survey was made to show the heights and distribution of the plants growing on a school playing field. The results are shown in the diagram of the profile. The heights of the plants are shown by the sizes of the symbols used for each plant.




Describe the technique that you would use to obtain the results shown above. Suggest why the plants at point **A** are shorter than those at point **B**. [6 QWC]

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**END OF PAPER**

6

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# GCSE MARKING SCHEME

**JANUARY 2016**

**SCIENCE – BIOLOGY 2**
**4471/01/02**

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## INTRODUCTION

This marking scheme was used by WJEC for the January2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

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# Biology 2 Foundation Tier

| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **1** | | (a) | i | | 3 | four bars correct height;;;<br>(3 = 2marks 2= 1mark) | ½ small square tolerance on height | | |
| | | | ii | | 3 | I woodland/ seashore;<br>II river/farmland;<br>III farmland; | | | |
| | | | iii | | 1 | woodland; | | | most birds |
| | | (b) | i | | 1 | 240 000 **and** 3500; | | | |
| | | | ii | | 1 | loss of habitat/ habitat destruction/ loss of nest sites; | cutting down {hedges/ trees}/ monoculture/ pesticides/ herbicides/ insecticides | farmland destroyed/ deforestation/ more predators/ hunting/ climate change/ pollution/ building | quarrying/ dumping/ landfill/ |
| | | Total Mark | | | 9 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **2** | | (a) | i | | 3 | A cell membrane;<br>B cytoplasm;<br>C cell wall; | | | |
| | | | ii | | 1 | fungi; | | | |
| | | (b) | | | 1 | nucleus; | | | |
| | | (c) | | | 1 | budding; | | | |
| | | (d) | | | 1 | {divide/ split} in <u>two</u>; | binary fission | separate | doubled/ mitosis/ split in half |
| | | Total Mark | | | 7 | | | | |



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| Question Number | | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | | | | | | | | |
| **3** | | (a) | i | | 1 | sugar **and** phosphate; | | | |
| | | | ii | I | 1 | T C G (any order);<br>**1 mark** | | | |
| | | | | II | 2 | **Any two from:**<br>A-T;<br>C-G;<br>they are in pairs; | | triplet code/<br>double helix | |
| | | (b) | | | 1 | C; | | | |
| | | (c) | | | 1 | nucleus; | chromosome | | |
| | | Total Mark | | | 6 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **4** | | (a) | | | 2 | carbon dioxide;<br>oxygen; | $CO_2$<br>$O_2$ | | $CO^2$/ CO2<br>O2/ $O^2$ |
| | | | | | | | | | |
| | | (b) | | | 2 | {contains/ has} chlorophyll/ chlorophyll is found in chloroplast;<br><br>Absorbs light ; | <br><br>{traps/ takes in} light | | Chlorophyll alone<br><br>attracts light |
| | | | | | | | | | |
| | | (c) | i | | 2 | (rate ) increases then {plateaus/ stays the same};<br>at 3 a.u. light intensity; | | | |
| | | | | | | | | | |
| | | | ii | | 2 | 80 - 50;<br>30; | Correct answer = 2 marks | | |
| | | | | | | | | | |
| | | Total Mark | | | 8 | | | | |



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| Question Number | | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | | | | | | | | |
| **5** | | (a) | | | 1 | (ragwort/ weedkiller) are poisonous; | cattle are killed | | cattle are harmed |
| | | (b) | | | 2 | alien (species);<br>Plume moth; | | | |
| | | (c) | | | 1 | biological (control)/ biocontrol; | | | bio |
| | | (d) | | | 1 | more parts of plant eaten/ it eats all parts of the plant<br>reproduction rate high/<br>reproduced quickly;<br>it = plume moth | weed beetle ate less parts of the plant /<br>weed beetle only ate leaves and stems/<br>weed beetle reproduced slower<br>**must be comparative** | | |
| | | (e) | | | 1 | to check that Plume moth did not {attack/ eat/ destroy/ harm} other {species/ organisms/ animal/ OWTTE}/<br>did not compete with other (native) {species/ organisms/ plant / animal/ OWTTE}( for resources )/<br>does not carry disease/<br>does not become a pest itself; | | | find out if there are problems |
| | | Total Mark | | | 6 | | | | |



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| Question Number | | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | | | | | | | | |
| **6** | **1** | (a) | | | 1 | cell is the basic unit of life<br><br>all living things are made of cells/<br><br>new cells are created from old cells (OWTTE); | cells make up all organisms<br><br><br><br>cells divide into new cells | <br><br><br><br>cells can split and divide | |
| | | (b) | | | 2 | **Any two from:**<br>¶ do not have a cellular structure;<br>¶ require a host to make new viruses/can only reproduce <u>inside</u> a cell;<br>¶ do not grow;<br>¶ do not produce waste;<br>¶ do not respond to stimuli;<br>¶ do not have an energy metabolism/ do not respire (OWTTE);<br>¶ can be crystallised | not made of cells | <br><br><br><br><br><br><br>do not have metabolism | do not have a nucleus/ membrane/ cell wall/ DNA/ RNA |
| | | (c) | | | 1 | light microscope **and**<br>**Reason –** <u>living</u> organisms cannot be observed under the EM/ EM can only observe <u>dead</u> organisms;<br>**Both for 1 mark** | | | Electrons kill organisms |
| | | Total Mark | | | **4** | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **7** | **2** | (a) | i | | 2 | {number/ number of boys/ number of girls} <u>starting</u><br>smoking is decreasing;<br>difference between the number of boys and girls <u>starting</u> smoking is narrowing ; | | | More girls start smoking than boys/ less boys start smoking than girls |
| | | | ii | | 2 | 102 000/ 62 000 000 x100;<br>0.16/ 0.16451613/ 0.165/ 0.2%; | Correct answer = 2 marks | | 0.17 |
| | | | | | | | | | |
| | | (b) | | | 1 | smoking seen as anti-social/<br>smoking now known to affect non-smokers/<br>do not want {parents/ carers} to know/<br>smoking under age is illegal; | | Passive smoking | |
| | | (c) | | | 2 | reduces surface area of {alveoli/ air sac}/ {alveoli/ air sac} {tear/ rip open/ become smooth/ damaged}/<br>causes lungs to fill up with liquid;<br>reduces oxygen in {blood stream/ body}/ less gas exchange<br>**2nd mark is linked to 1st mark** | | | |
| | | Total Mark | | | **7** | | | | |



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<table>
<tr><th colspan="2">Question Number</th><th colspan="3" rowspan="2">Sub-section</th><th rowspan="2">Mark</th><th rowspan="2">Answer</th><th rowspan="2">Accept</th><th rowspan="2">Neutral answer</th><th rowspan="2">Do not accept</th></tr>
<tr><th>FT</th><th>HT</th></tr>
<tr><td>8</td><td>3</td><td>(a)</td><td></td><td></td><td>2</td><td>both arrows pointing → 1 mark each ;;</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>(b)</td><td>i</td><td></td><td>2</td><td><table><tr><td></td><td>Flask A</td><td>Flask B</td></tr><tr><td>Appearance of limewater after 1 minute</td><td>clear/ colourless/ transparent/ slightly cloudy;</td><td>cloudy/milky/ chalky/ white;</td></tr></table></td><td></td><td></td><td>flask A - no change</td></tr>
<tr><td></td><td></td><td></td><td>ii</td><td></td><td>2</td><td>expired air contains more carbon dioxide than inspired air;<br>therefore turns (the limewater) {cloudy quicker/ more cloudy};</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>(c)</td><td></td><td></td><td>1</td><td>limewater in flask A would also have turned cloudy/limewater in both flasks would have turned {cloudy/ cloudier};<br>must relate to answer given in table</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Total Mark</td><td></td><td>7</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>



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| FT | HT | Mark | Answer |
|---|---|---|---|
| **9** | **4** | 6<br><br>QWC | **Indicative content**<br><br>**Mouth** (reference to teeth is not irrelevant)<br>¶ starch in the bread<br>¶ is digested to sugars/ glucose/ maltose<br>¶ by carbohydrase/ amylase<br>¶ from saliva<br>**Oesophagus/gullet**<br>¶ food passes along the oesophagus/gullet<br>¶ by peristalsis/ description of peristalsis<br>**Stomach** (reference to pH is not irrelevant)<br>¶ protein in chicken<br>¶ digested to amino acids<br>¶ by protease<br>**Butter/ fat**<br>¶ Correct reference to butter not being digested until after the stomach<br><br>**5-6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3-4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1-2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit. |
| Total Mark | | 6 | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **5** | (a) | | | 2 | the use of a {living organism/ predator/ animal/ plant/ living thing/ parasite} to {control/ kill/ destroy/ limit};<br><br>{alien species / pest/ weed}; | alien species (in correct context) | | |
| | | (b) | i | | 2 | **Any two from:**<br>¶ check that target species is being {destroyed/ controlled};<br>¶ check that it does not become a pest itself;<br>¶ ensure that no other species are harmed;<br>¶ check that it can survive in the environment;<br>¶ check that it does not carry disease; | | | affects food chain |
| | | | ii | I | 1 | for every twenty biological control agents {selected/ tested} only one is used/ 1 in {20/21} is successful ; | | | |
| | | | | II | 1 | **any one from:**<br>¶ risk of {target/pest species} becoming resistant to {chemical control agent/ it};<br>¶ (chemical control agent) has many harmful side effects;<br>¶ (chemical controlled agent) is not very specific/also {kills/ harms} not target species; | | | affect target species |
| | | Total Mark | | | 6 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **6** | (a) | | | 2 | both {require/ break down/ use/ need} glucose;<br>both release energy/ produce ATP; | provide energy/ release heat energy | involve glucose | {produce/ create/ make/ generate} energy |
| | | (b) | i | | 1 | 18; | | | |
| | | | ii | | 1 | any figure between:1050 - 1100 ($cm^3$); | | | |
| | | | iii | | 2 | 24 x {1240/1250};<br>(1240) = 29 760 $cm^3$<br>(1250)= 30 000 $cm^3$ ;<br>answer without unit = 1 mark | range of figures1240-1250 Correct answer = 2 marks<br>$30dm^3$ | | |
| | | (c) | | | 2 | **Any two from:**<br>¶ oxygen reaches {muscles/ blood} quicker/carbon dioxide is removed from {muscles/ blood} quicker;<br>¶ {more oxygen/greater volume of oxygen} reaches {muscles/ blood} ;<br>¶ reference to lactic acid/ oxygen debt/ less anaerobic respiration/ more aerobic respiration; | | | amount of oxygen |
| | | Total Mark | | | 8 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **7** | (a) | i+ ii | | 1 | **both for 1 mark**<br>light **+** temperature; | | | carbon dioxide/ dark/ cold |
| | | (b) | i | | 3 | **Any three from:**<br>¶ {least/lowest} glucose (produced);<br>¶ because no {light/ sunlight}/ it is dark;<br>¶ so no photosynthesis;<br>¶ glucose {changed into starch/ used in respiration/ used in energy} ; | lack of light | | sun/ less light |
| | | | ii | | 3 | {max/ highest} glucose (produced);<br>{high/ most/ more} light;<br>photosynthesis occurs ; | | | light present |
| | | Total Mark | | | 7 | | | | |



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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **8** | (a) | | | 3 | starch was present in {**A**/ unripe banana};<br><br>{sugar/ glucose} was present in {**B/** ripe banana};<br><br>starch is {broken down/ digested/ changed} to sugar; | | | |
| | | (b) | i | | 3 | water moved out of the {banana/ cells/ OWTTE} (by osmosis);<br><br>from high concentration of water to low concentration of water/ idea of {passing down a gradient or correct solute potential idea};<br><br>via Semi Permeable Membrane; | | | |
| | | | ii | | 2 | idea of dynamic equilibrium expressed as equal rate of movement of water in and out/<br>no net {movement/ flow};<br><br>there was no gradient of water concentration/solute potential was equal/ concentrations were equal; | | | no osmosis<br><br>similar concentrations |
| | | (c) | | | 1 | increase confidence in results; | repeatability/ {identify/ rule out} anomalous results | reliable/ validity | accuracy/ reproducibility/ fair testing |
| | | Total Mark | | | 9 | | | | |



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| Question Number | | | |
|---|---|---|---|
| FT | HT | Mark | Answer |
| | **9** | 6<br><br>QWC | **Indicative content**<br>¶ A transect is used.<br>¶ Stretch a {rope/ tape measure} marked at regular intervals along the length of the field<br>¶ Identify/ record the plant at each point<br>¶ Measure/ record the height of each plant<br>¶ Record {profile/ OWTTE}<br>¶ Plants are shorter at A than at B because:<br>- More water collects at B than at A<br>- Plants are trampled/ mown/cut at A<br>- Plants at B grown longer towards light/ phototropism<br>- Or other sensible reasons e.g. Wall retains heat so higher temperature/ plants {at B/ by the wall} are protected from the wind<br><br>**5-6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3-4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1-2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit. |
| | | 6 | |



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| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4471/02

S15-4471-02

## ADDITIONAL SCIENCE/BIOLOGY

# BIOLOGY 2
## HIGHER TIER

P.M. TUESDAY, 12 May 2015

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **6** | |
| **2.** | **8** | |
| **3.** | **4** | |
| **4.** | **6** | |
| **5.** | **6** | |
| **6.** | **6** | |
| **7.** | **5** | |
| **8.** | **6** | |
| **9.** | **7** | |
| **10.** | **6** | |
| **Total** | **60** | |

4471 020001

### ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **4** and question **10**.

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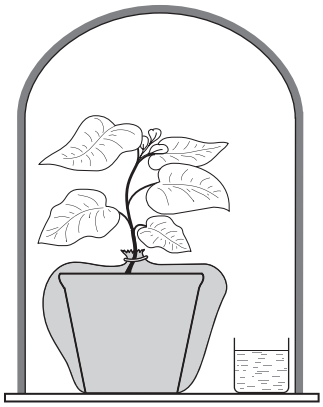
*Answer* **all** *questions.*

**1.** *(a)* Complete the word equation for photosynthesis shown below. [2]

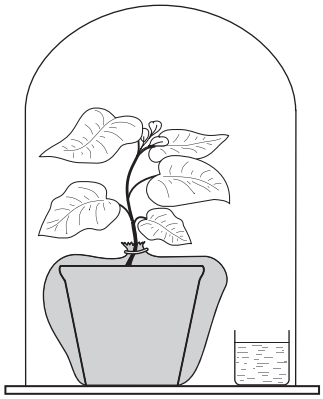
carbon dioxide + ..... → glucose + .....

*(b)* The diagrams below show four experiments used to investigate the conditions needed for photosynthesis. Four well-watered potted green plants were placed in glass bell jars, which were sealed onto greased glass plates. The soil in each pot was covered with a polythene sheet. Each apparatus was then subjected to different environmental conditions.

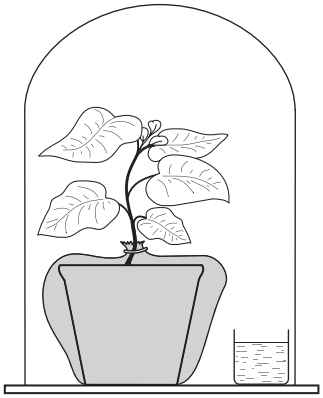
**Experiment A**
- Bell jar covered in thick black paper
- Beaker contains a chemical that **produces** carbon dioxide



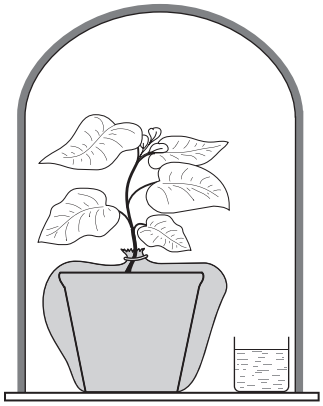
**Experiment B**
- Beaker contains a chemical that **produces** carbon dioxide



**Experiment C**
- Beaker contains a chemical that **absorbs** carbon dioxide



**Experiment D**
- Bell jar covered in thick black paper
- Beaker contains a chemical that **absorbs** carbon dioxide



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(i) After 3 days, leaves from each of the four plants were tested for starch. Complete the table below by placing a ✓ or a **X** in each box to show the presence or absence of starch. [2]

| experiment | presence or absence of starch ✓ or **X** |
|---|---|
| **A** | |
| **B** | |
| **C** | |
| **D** | |

(ii) The results from which **two** experiments should be compared to show that

I. carbon dioxide is needed for photosynthesis, [1]

..... .....

II. light is needed for photosynthesis? [1]

..... .....

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6

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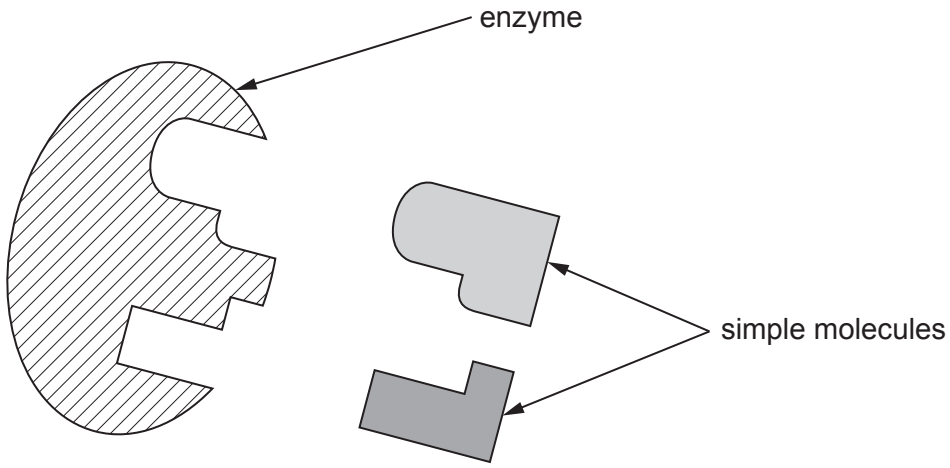


**Turn over.**

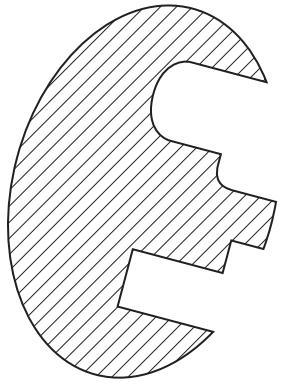
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**2.** *(a)* (i) The diagram shows an enzyme which builds up complex molecules from simple molecules.




Complete the diagram below to show the next stage in the reaction between this enzyme and the two simple molecules shown above. [2]



(ii) What name is given to this **model** of enzyme action?

[1]

.....

(iii) Explain how boiling would affect the action of the enzyme shown in the diagrams above. [2]

.....

.....

.....

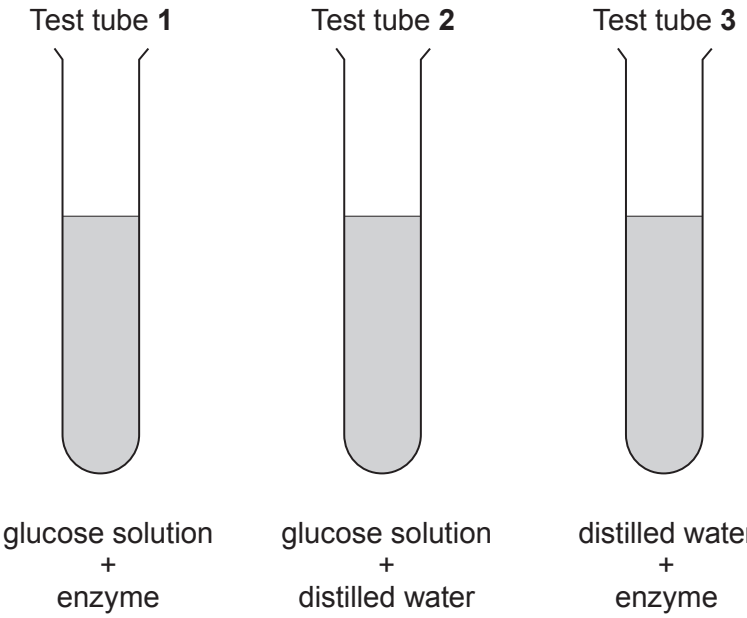
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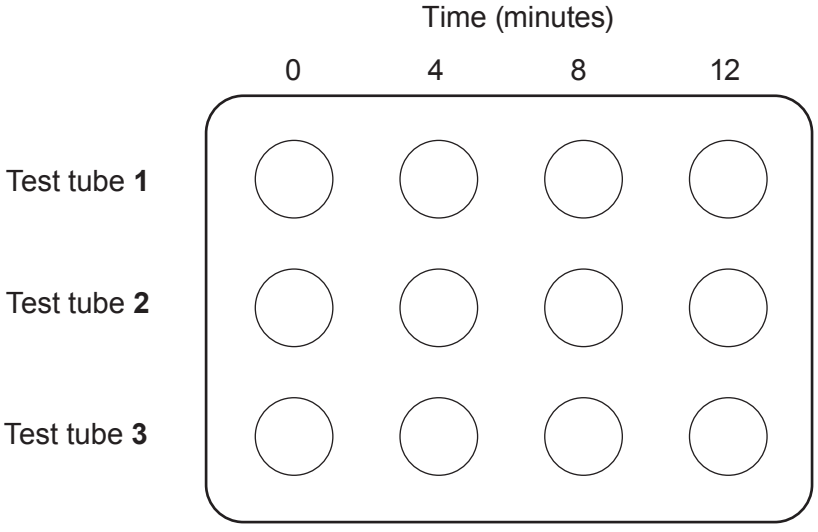
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*(b)* Potatoes contain an enzyme which converts glucose molecules into starch molecules. In the following experiment three test tubes were set up as shown in the diagram below.




At the start of the experiment, and at four minute intervals, samples from each of the test tubes were added to each of the cavities in a spotting tray and then iodine solution was added to each sample.

Complete the diagram below by shading the cavities you would expect to show the presence of starch when tested with iodine solution. [3]

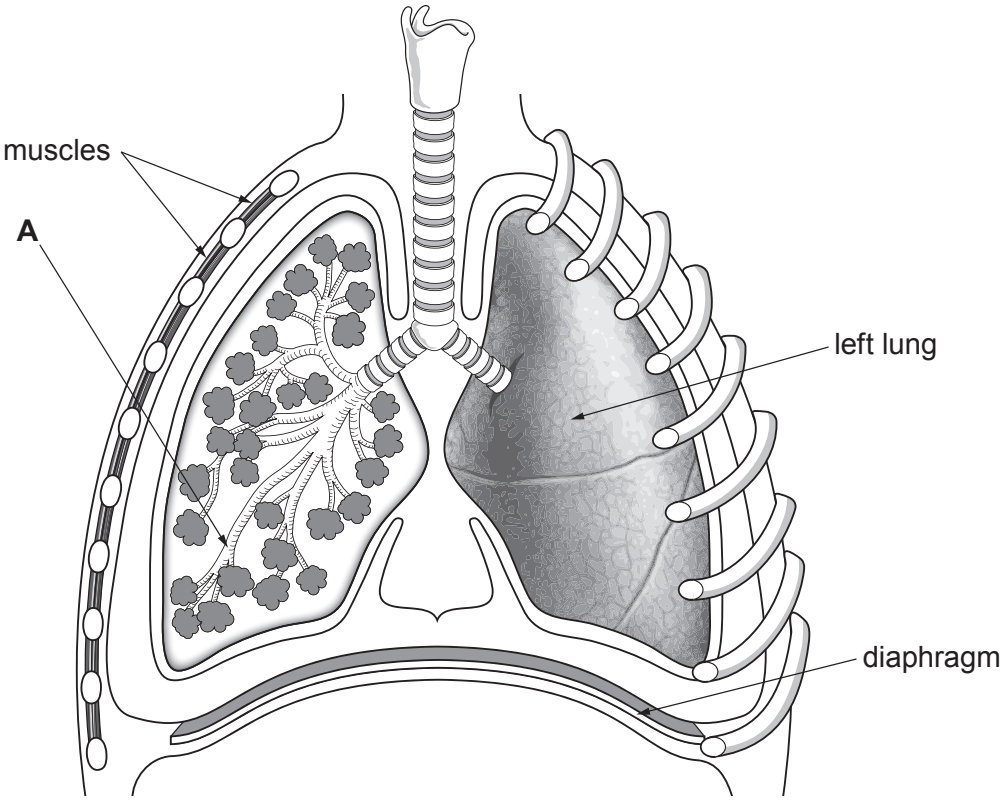



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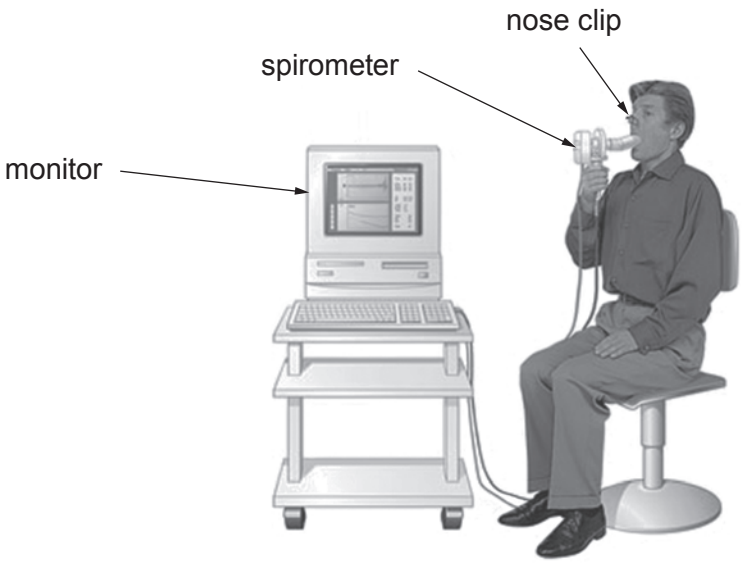
**3.** The diagram below shows the human respiratory system.




*(a)* Name structure **A** on the diagram. [1]

.....

*(b)* A person's breathing rate was measured on a spirometer for 120 seconds.

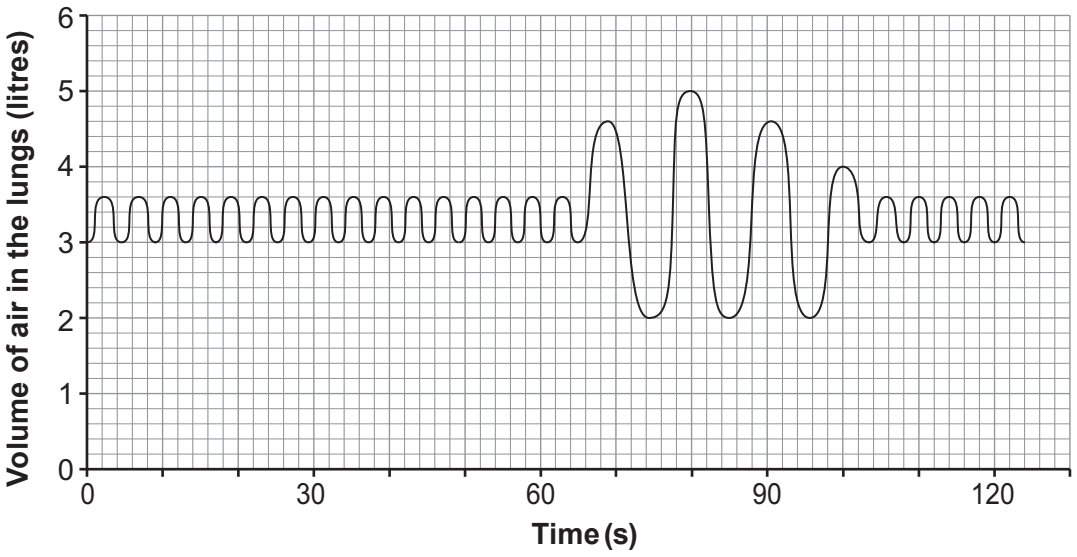



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The person breathed normally, then took deep breaths and then breathed normally again. A graph of this breathing pattern was printed and is shown below.




Use the graph to:

(i) calculate the normal breathing rate for this person, [1]

normal breathing rate = ..... breaths per minute

(ii) calculate the difference between the volume of air inspired during a single normal breath and the **second** deep breath taken. [2]

difference in volume = .....

4



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**Turn over.**

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**4.** Describe, in detail, how you would show that living peas produce heat. The apparatus and materials for this investigation are listed below. Your account must refer to the order in which you set up the equipment, including a suitable control. **Diagrams will not gain credit in your answer**.

[6 QWC]

2 Thermos (vacuum) flasks
2 thermometers
cotton wool
liquid disinfectant
living peas
dead peas

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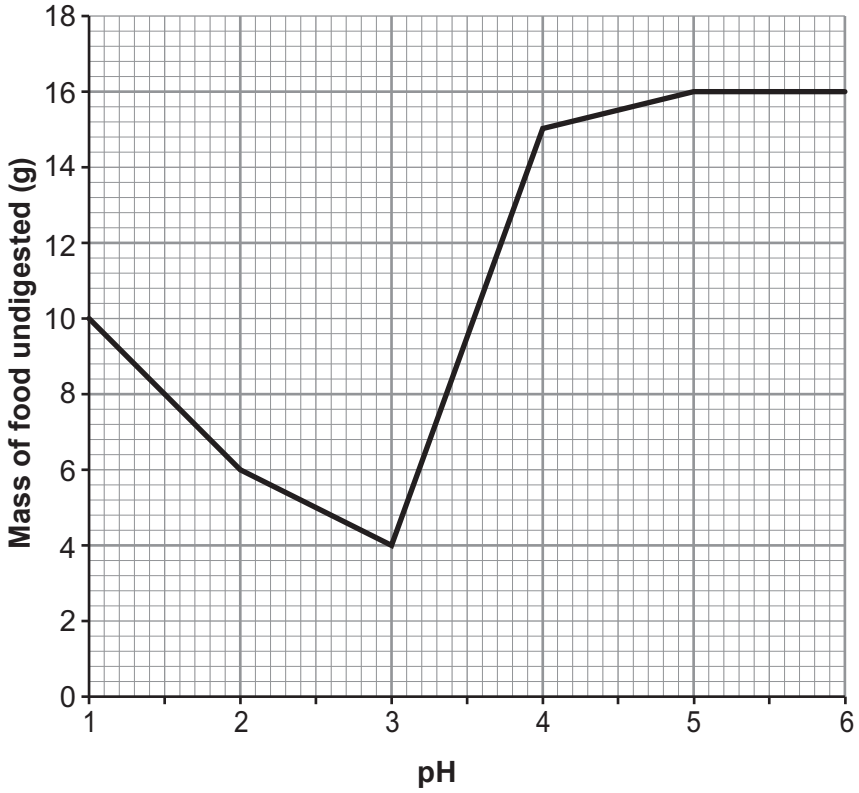
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**5.** *(a)* The following statement refers to a process that occurs in the digestive system.
*'The muscles in front of the food relax whilst the muscles behind the food contract.'*

Name the process being described. [1]

.....

*(b)* The graph shows the results of an investigation into the activity of an enzyme at various pH levels. The enzyme was acting on a food substance and the mass of this food substance remaining undigested at each of the pH levels was recorded.




(i) State what happens to the mass of undigested food from pH3 to pH6. [2]

.....

.....

.....

(ii) State the optimum pH of this enzyme. [1]

.....

(iii) Name the organ in the human body where this enzyme is found and name the class of food it acts on. [2]

organ .....

food substance .....

6



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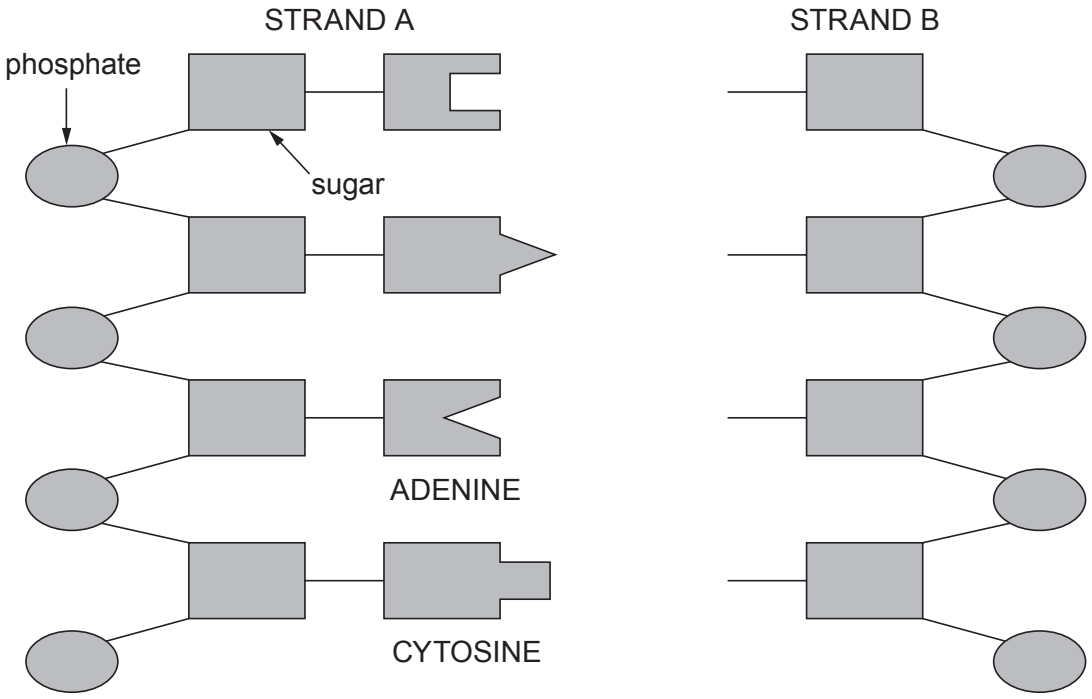
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**6.** A DNA molecule consists of two coiled strands. When cells divide, the two strands in the DNA separate. The bases of each strand pair with complementary bases to make new DNA.

*(a)* Complete the diagram below to show the sequence of complementary bases that would appear in this DNA molecule by:

(i) drawing the shapes of the **four** missing complementary bases in strand B; [2]

(ii) label **each** of them with their correct **names**. [2]




*(b)* Describe how a section of DNA can control the formation of a protein. [2]

.....

.....

.....

.....

6

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**7.** Tom jogged for twenty minutes. The table below shows data about the concentration of lactic acid in his blood during this period of exercise.

| time from start (min) | concentration of lactic acid in blood (mg/100 $cm^3$) |
|---|---|
| 0 | 4 |
| 2 | 15 |
| 4 | 29 |
| 6 | 44 |
| 8 | 42 |
| 10 | 39 |
| 12 | 30 |
| 14 | 22 |
| 16 | 20 |
| 18 | 18 |
| 20 | 16 |

Use the data given and your knowledge to answer the questions below.

*(a)* (i) How many minutes after the start of the exercise was the highest oxygen debt recorded? [1]

.....

(ii) What type of respiration results in oxygen debt? [1]

.....

(iii) When would Tom be releasing most energy per glucose molecule? Explain your answer. [2]

.....

.....

*(b)* Which type of cell would be producing lactic acid? [1]

.....

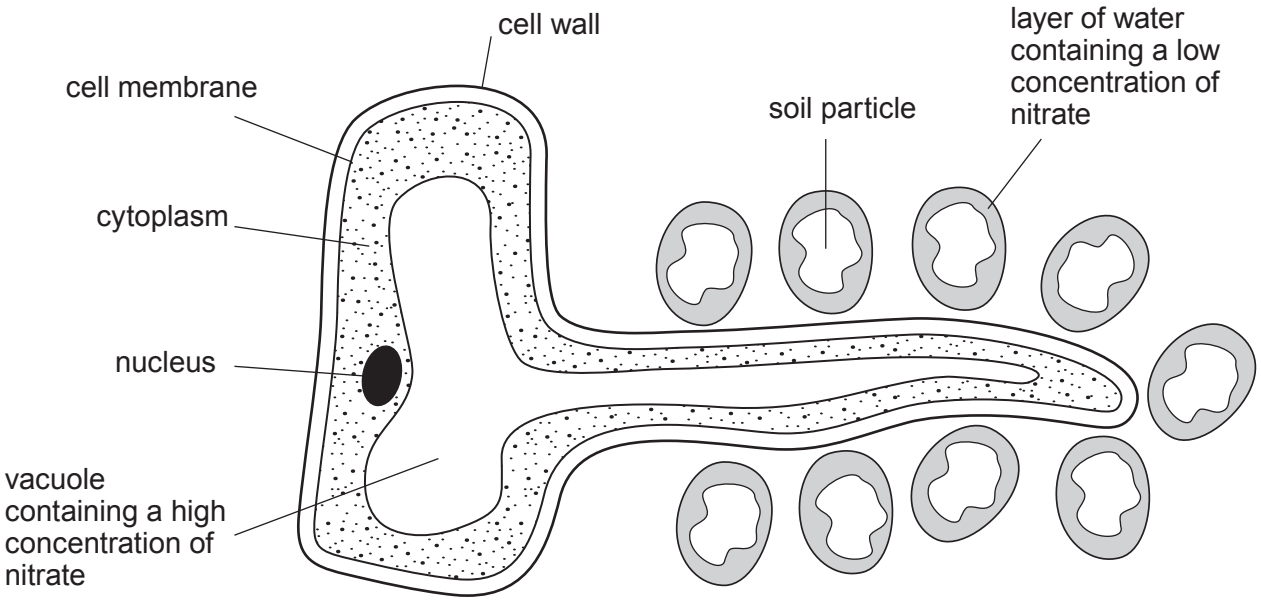
5



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**8.** The diagram below shows a **section** through a root hair cell in well-watered soil.




*(a)* State the method used by the root hair cell to take up nitrate from the soil. [1]

.....

*(b)* Gardeners dig soil to let more air into it. Explain why this increases the uptake of nitrate by root hair cells. [2]

.....

.....

.....

.....

*(c)* Describe how the root hair cell takes up water by osmosis. [3]

.....

.....

.....

.....

.....

.....

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**9.** The Rose-bay willow-herb, *Epilobium angustifolium* is a plant that produces wind dispersed seeds.



The survival of this plant in its natural habitat was studied by counting the number of

- seeds found on the ground,
- seedlings,
- fully grown plants.

The counts were completed every 2 metres away from the parent population.

All counts were taken in the direction of the prevailing wind (direction in which the wind mainly blows).

The results are shown in the table:

| distance from parent population (m) | seeds (per $m^2$) | seedlings (per $m^2$) | fully grown plants (per $m^2$) |
|---|---|---|---|
| 2 | 22 | 20 | 0 |
| 4 | 30 | 25 | 0 |
| 6 | 31 | 30 | 0 |
| 8 | 28 | 25 | 1 |
| 10 | 25 | 20 | 2 |
| 12 | 18 | 15 | 3 |
| 14 | 9 | 9 | 5 |
| 16 | 8 | 5 | 5 |
| 18 | 4 | 3 | 3 |

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*(a)* Name:

(i) the technique you would use to obtain the data shown in the table; [1]

.....

(ii) **two** items of apparatus used to make the necessary measurements for this technique. [2]

.....

*(b)* Calculate the percentage of seeds that survived to produce fully grown plants at 10 m from the parent plants. Show your working. [2]

Percentage of fully grown plants surviving = ..... %

*(c)* Explain why no fully grown plants are found within 6 m of the parent population. [2]

.....

.....

.....

.....

7

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**Turn over.**

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**10.** Describe how smoking tobacco harms the respiratory system and how and why attitudes to smoking have changed in recent years. [6 QWC]

6

**END OF PAPER**

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# GCSE MARKING SCHEME

## SCIENCE - BIOLOGY

## SUMMER 2015

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## INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2015 examination in GCSE SCIENCE - BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.


| | Page |
|---|---|
| B1 | 1 |
| B2 | 19 |
| B3 | 34 |


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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **1** | | (a) | i | | 2 | A Cell wall<br>B Chloroplast<br>C Nucleus<br>*3 correct = 2 marks*<br>*2 correct = 1 mark*<br>*0/1 correct = 0 marks* | A: cellulose wall | | |
| | | | ii | | 2 | 1 yeast<br>2 alga<br>3 bacteria/ alga<br>*3 correct = 2 marks*<br>*2 correct = 1 mark*<br>*0/1 correct = 0 marks* | | | Letters instead of names |
| | | (b) | i | | 1 | all organisms consist of one or more living cells; | | | |
| | | | ii | | 1 | A virus is not a cell; | has genes and protein coat <u>only</u> / no cytoplasm/ no cell membrane/ <u>only reproduces</u> inside <u>cell</u> | | No nucleus/ it requires a host |
| | | | iii | | 1 | light microscopes **and** electron microscopes; (in order) | laser imaging as alternative for light microscope | | |
| | | Total Mark | | | 7 | | | | |

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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **2** | | *(a)* | i | | 1 | Double helix; | | | |
| | | | ii | | 2 | T,G,C<br>*3 correct = 2 marks*<br>*2 correct = 1 mark*<br>*0/1 correct = 0 marks* | | | |
| | | *(b)* | | | 1 | Proteins **<u>and</u>** amino acids; | | | |
| | | Total Mark | | | 4 | | | | |

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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **3** | | (a) | | | 4 | Cells;<br>Oxygen;<br>Water;<br>Enzymes; | | | |
| | | (b) | | | 2 | carbon dioxide;<br>(Lime water)turns {cloudy/ milky/ white}; | $CO_2$<br>cream | | $CO^2$ |
| | | Total Mark | | | 6 | | | | |

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| Question Number | | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | | | | | | | | |
| **4** | | (a) | | | 1 | Honey (bee) **and** bumble (bee); | | | |
| | | (b) | i | | 1 | {Loss of/less} nectar/ food (from wild flowers)/<br>{Loss of/less} nest sites/<br>{Loss of/less} habitat; | | | Fewer wild flowers/ wild flowers eaten by other animals<br>Loss of space |
| | | | ii | | 2 | 480 000 **and** 180 000 OR 5 x 60 000;<br>= 300 000;<br>Correct answer = 2 marks | | | percentages |
| | | | iii | | 1 | honey bee pollinates {food plants/ veg/ fruit}/<br>honey bee produces {food/ honey}; | | | |
| | | (c) | | | 2 | (loss of solitary bees) results in loss of {a number of/ many/ 260} species;<br>(no pollination) – loss of species of wild flowers; | | | |
| | | Total Mark | | | 7 | | | | |

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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **5** | | (a) | i | | 2 | paralyse cilia/ cilia unable move;<br>mucus becomes {clogged/ dried}/ mucus builds up/ mucus thicker; | Mucus production increases | cilia {harmed/ don't work}/ mucus increases | cilia killed |
| | | | ii | | 1 | tar; | | | |
| | | (b) | i | | 1<br>2<br>1 | suitable scale, correctly labelled; plotting must start at *y* axis<br>all plots correct (½ small square tolerance);;<br>not extrapolated<br>(all correct = 2 marks, 1 error = 1 mark, >1 error = 0 marks)<br>line quality; drawn with ruler | | | |
| | | | ii | | 2 | Increase in number of cigarettes smoked increases <u>number of deaths</u> (from lung cancer);<br>Small increase to <u>20</u> then a sharp increase; | | | |
| | | | iii | | 1 | 60; | Ecf from graph | | |
| | | | iv | | 1 | Some lung cancer deaths for 0 cigarettes/ some people who do not smoke die from lung cancer; | | | |
| | | (c) | | | 1 | <u>Reference to {dangers/ harm}</u> of {passive smoking/ second hand smoke /secondary smoking}; | Passive smoking makes people ill | | second hand smoke **affects** people |
| | | Total Mark | | | 12 | | | | |

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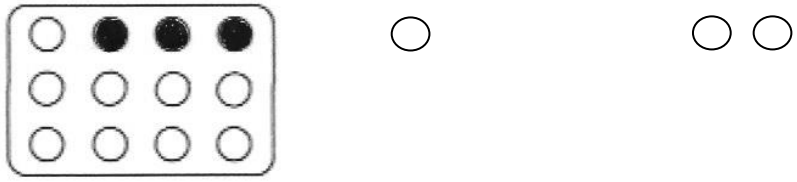
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<table>
<tr><th colspan="2">Question Number</th><th colspan="3" rowspan="2">Sub-section</th><th rowspan="2">Mark</th><th rowspan="2">Answer</th><th rowspan="2">Accept</th><th rowspan="2">Neutral answer</th><th rowspan="2">Do not accept</th></tr>
<tr><th>FT</th><th>HT</th></tr>
<tr><td>6</td><td>1</td><td>(a)</td><td></td><td></td><td>2</td><td>Water;<br>Oxygen;</td><td>$H_2O$<br>$O_2$</td><td>Sunlight or Chlorophyll on arrow</td><td>H2O<br>O2</td></tr>
<tr><td></td><td></td><td>(b)</td><td>i</td><td></td><td>2</td><td>All correct = 2 marks<br>1 error = 1 mark<br>> 1 error = 0 marks<br><table><tr><th>Apparatus</th><th>Presence or absence of starch<br>✓ or ×</th></tr><tr><td>A</td><td>×</td></tr><tr><td>B</td><td>✓</td></tr><tr><td>C</td><td>×</td></tr><tr><td>D</td><td>×</td></tr></table></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>ii</td><td>I</td><td>1</td><td>B and C;</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>II</td><td>1</td><td>A and B;</td><td></td><td></td><td></td></tr>
<tr><td colspan="5">Total Mark</td><td>6</td><td></td><td></td><td></td></tr>
</table>

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| Question Number | | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | | | | | | | | |
| **7** | **2** | (a) | i | | 2 | both substrate molecules having entered the enzyme;<br>an attempt to make them connect; | | | |
| | | | ii | | 1 | Lock and Key; | | Enzyme substrate complex | |
| | | | iii | | 2 | (Boiling) alters the shape of the {enzyme/active site}/ denatures enzyme; so the molecules do not fit into enzyme/ active site; | | | |
| | | (b) | | | 3 | 1 mark for each correct row;;;<br><br>**NB only allow marks if some cavities shaded** | | | |
| | | Total Mark | | | 8 | | | | |

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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| **8** | **3** | (a) | | | 1 | Bronchiole; | bronchioles | | |
| | | (b) | i | | 1 | 15; | | | |
| | | | ii | | 2 | 3 – 0.6 = 2.4 litres/ l;;<br>[NB unit required for 2 marks]<br>Correct readings but incorrect answer = 1 mark<br>2.4 but no units = 1 mark<br>No mark for correct unit only | L for litres | | |
| | | Total Mark | | | 4 | | | | |

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| Question Number | | | |
|---|---|---|---|
| FT | HT | Mark | Answer |
| **9** | **4** | 6<br><br>QWC | *Indicative content:*<br>▪ use of disinfectant to wash both sets of peas<br>▪ (fill) a Thermos flask with these living peas<br>▪ ref to dead peas **acting as control**<br>▪ same {mass/ volume/ number} of peas should be used in both flasks<br>▪ place a thermometer into the peas<br>▪ place/ put cotton wool into the neck of the flask<br>▪ record temperature at {regular intervals/ every hour/ every day/ stated times}<br>▪ compare temperatures in both flasks<br><br>**5-6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3-4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1-2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit. |
| Total Mark | | 6 | |

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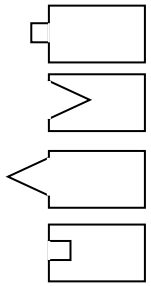
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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **5** | (a) | | | 1 | Peristalsis; | phonetic spelling | | |
| | | (b) | i | | 2 | (Mass of food remaining undigested) increases until pH5;<br>{levels off/ plateaus} at pH5;<br>It increases until pH 5 where it levels off (2 marks) | | | |
| | | | ii | | 1 | 3; | | | |
| | | | iii | | 2 | Stomach;<br>Protein; | | | |
| | | Total Mark | | | 6 | | | | |

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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **6** | (a) | i | | 2 | <br>Each shape needs an oblong + an indentation or a protrusion.<br>*4 shapes correct = 2 marks*<br>*3 shapes correct = 1 mark*<br>*0/1/2 shapes correct = 0 marks* | | | |
| | | | ii | | 2 | Cytosine<br>Adenine<br>Thymine<br>Guanine<br>**Spelling must be correct**<br>*4 names correct = 2 marks*<br>*3 names correct = 1 mark*<br>*0/1/2 names correct = 0 marks* | | | |
| | | (b) | | | 2 | Three bases form a <u>code</u>/ a triplet <u>code</u>;<br>(Code) determines the {order/ sequence} of the amino acids; | | | |
| | | Total Mark | | | 6 | | | | |

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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **7** | (a) | i | | 1 | 6; | | | |
| | | | ii | | 1 | Anaerobic; | | | |
| | | | iii | | 2 | At zero min/ between 0-2/ at beginning/ before exercise starts;<br>most aerobic respiration is occurring;<br>2nd mark linked to 1st | Least/ lowest lactic acid produced | Oxygen debt | |
| | | (b) | | | 1 | Muscle; | | | |
| | | Total Mark | | | 5 | | | | |

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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **8** | (a) | | | 1 | Active {transport/ uptake}; | | | |
| | | (b) | | | 2 | Oxygen is needed;<br>For respiration/ release of energy/ to make ATP;<br>2nd mark is linked to 1st | | | |
| | | (c) | | | 3 | Water passes from where it is in high concentration to where it is in low concentration / Water passes from where solute concentration is low to where solute concentration is high ;<br><br>Via a semi permeable membrane (or other correct description of membrane i.e. semi/ partially) ;<br><br>Indication of where the higher concentration of water/ solute is; | | SPM | |
| | | Total Mark | | | 6 | | | | |

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| Question Number | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| FT | HT | Sub-section | | | Mark | Answer | Accept | Neutral answer | Do not accept |
| | **9** | (a) | i | | 1 | Transect (correct spelling); | | | |
| | | | ii | | 2 | Quadrat (correct spelling);<br>Tape measure/<br>{Tape/ rope} marked at (2) m intervals; | | | Ruler/ meter stick |
| | | (b) | | | 2 | (2/25) x 100 = 8%<br>Method;<br>Answer;<br>Correct answer on its own = 2 | | | |
| | | (c) | | | 2 | There is <u>less</u> light/ water/ minerals/ ions/ nutrients;<br>Because of {<u>more/ most} competition</u> from the parent population; | | | Parent plant takes **all** (named resource) space |
| | | Total Mark | | | 7 | | | | |

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| Question Number | | | |
|---|---|---|---|
| FT | HT | Mark | Answer |
| | **10** | 6<br>QWC | Indicative content<br>¶ Harmful effects on cilia and mucus<br>¶ Tar/ carcinogens and lung cancer<br>¶ Smoke inhalation causes coughing<br>¶ Which can result in emphysema leading to shortness of breath due to alveoli damage<br>¶ Smoking is less/ not socially acceptable now because of proof of harmful effects<br>¶ Passive smoking<br>¶ Attempts at reduction include<br>▪ stopping adverts,<br>▪ banning smoking in public places,<br>▪ warnings on packets and increase in cost<br>▪ stopping the display of cigarettes in shops<br><br>**5-6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3-4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1-2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit. |
| Total Mark | | 6 | |

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| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4471/02

W15-4471-02

## ADDITIONAL SCIENCE/BIOLOGY

# BIOLOGY 2
## HIGHER TIER

A.M. WEDNESDAY, 7 January 2015

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **8** | |
| **2.** | **7** | |
| **3.** | **3** | |
| **4.** | **6** | |
| **5.** | **6** | |
| **6.** | **4** | |
| **7.** | **3** | |
| **8.** | **5** | |
| **9.** | **6** | |
| **10.** | **6** | |
| **11.** | **6** | |
| **Total** | **60** | |

4471 020001

### ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (QWC) used in your answers to questions **4** and **11**.

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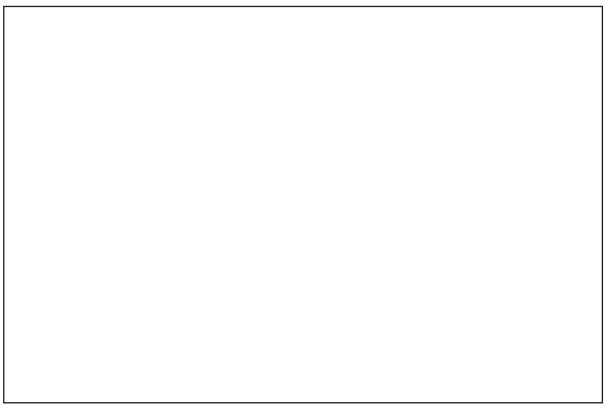
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*Answer* **all** *questions.*

**1.** The black-faced lion tamarin *(Leontopithecus caissara)* is a species of monkey living in the rainforests of South America.



*(a)* The black-faced lion tamarin is classified as Critically Endangered on the IUCN red list and listed on Appendix 1 of CITES. There are only about 400 individuals remaining in the wild.




(i) On the sliding scale above suggest what will happen to the black-faced lion tamarin unless measures are taken to conserve the species. [1]

.....

(ii) If conservation measures fail, state what will happen to the biodiversity of the habitat in which the black-faced lion tamarin lives. [1]

.....

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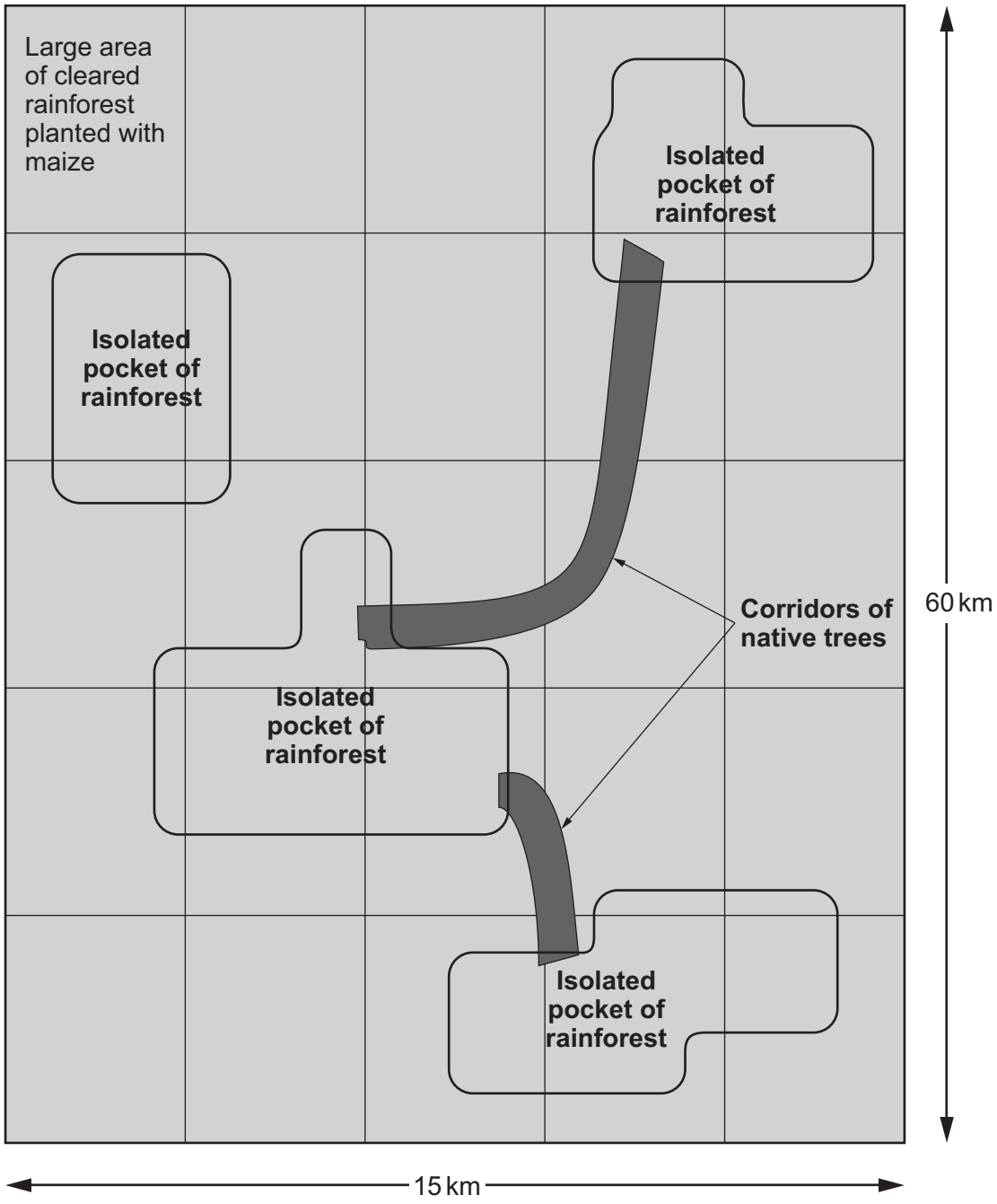


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*(b)* The rainforest habitat of the black-faced lion tamarin has been cleared to grow maize. Small populations of the monkey now live in isolated pockets of rainforest. The local people are being paid to start local plant nurseries and to plant corridors of native trees which link up the isolated pockets of rainforest.

The diagram shows an aerial view of 900 $km^2$ of rainforest which has been cleared and planted with maize.




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(i) Suggest **one** reason why the local people are prepared to give up some of their farmland in order to create the corridors of native trees. [1]

.....

(ii) Suggest ways in which the corridor system shown in the diagram opposite can be improved. [2]

.....

.....

.....

(iii) How will the corridor system help conserve and increase the numbers of the black-faced lion tamarin in the rainforest? [2]

.....

.....

.....

*(c)* State **one** *other* way in which endangered species can be conserved. [1]

.....

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8

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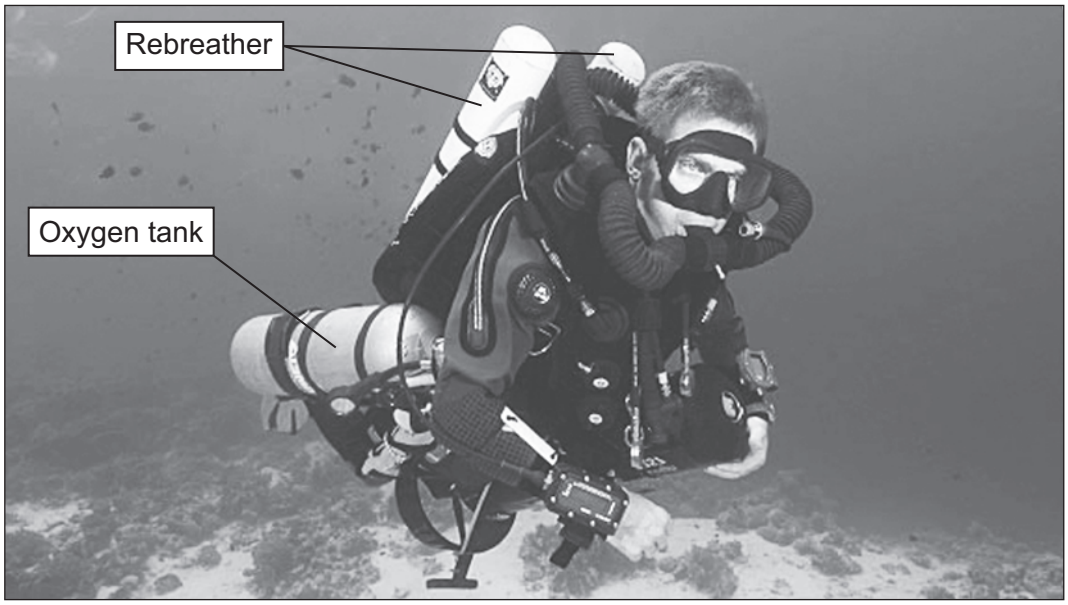
**Turn over.**

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**2.** Look, no bubbles!

SCUBA diver wearing a rebreather




In standard SCUBA equipment when you breathe in through the mouthpiece you get a lungful of fresh air from the tank on your back. When you breathe out, the expired air goes out from the equipment into the water in the form of bubbles.

Modern SCUBA equipment contains a rebreather. This allows you to breathe the same air many times and produces no bubbles.

*(a)* (i) Complete the following table to show the composition of inspired and expired air. [2]

| gas | inspired air (%) | expired air (%) |
|---|---|---|
| oxygen | ..... | 16 |
| carbon dioxide | ..... | 4 |
| nitrogen | 79 | ..... |
| water vapour | varies | 1 |

(ii) Use the table to state why it is possible for a diver to use a rebreather. [1]

.....

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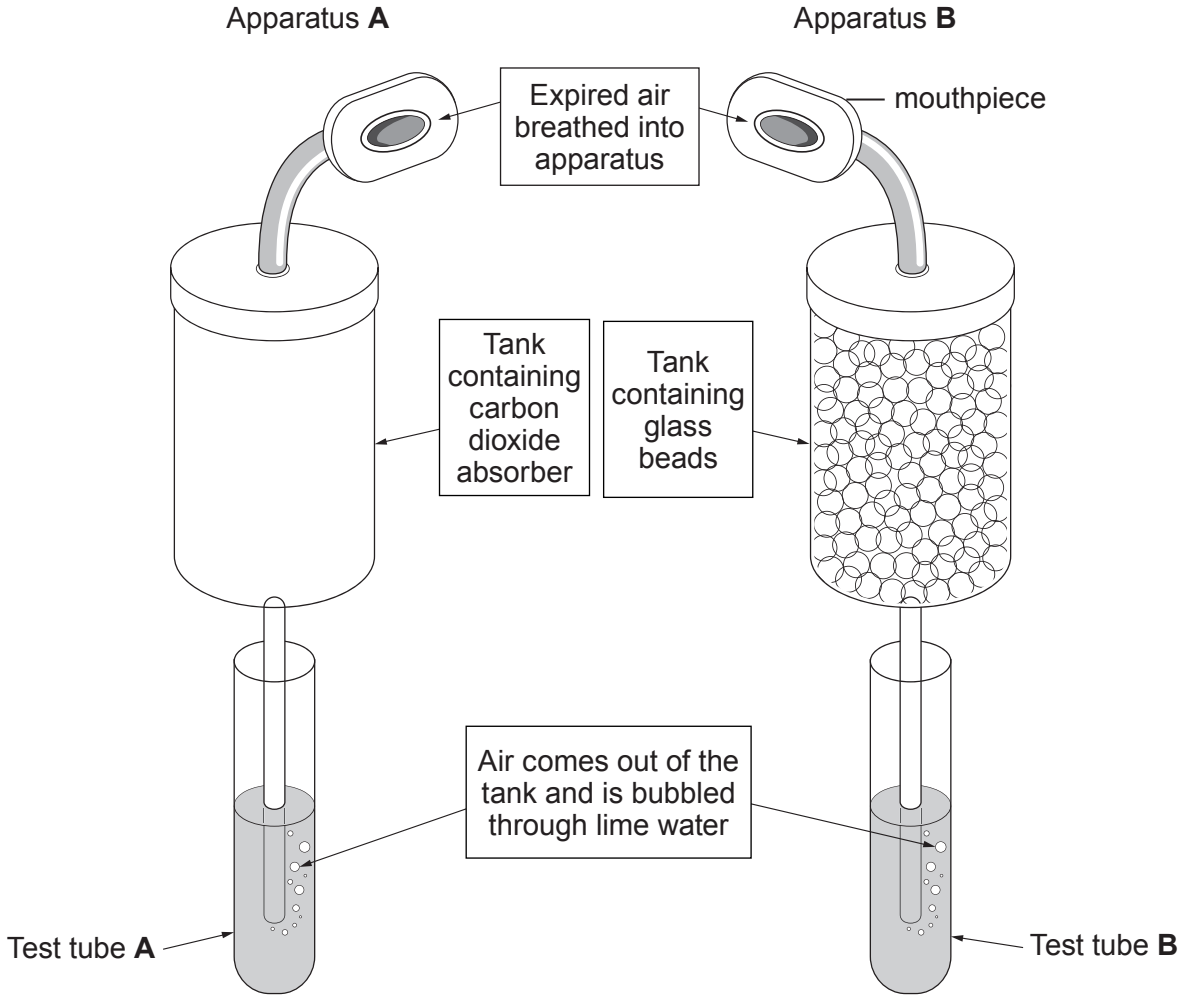
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(iii) Expired air contains 4% carbon dioxide. This concentration of carbon dioxide in air is poisonous. Rebreathers also contain a tank which absorbs the carbon dioxide making the air rebreathable for the diver.
Suggest the name of the chemical compound which absorbs the carbon dioxide. [1]

.....

A scientist tested the air coming out of the tank using apparatus **A** and **B** as shown below.




*(b)* What result would you expect to see in test tubes **A** and **B** after bubbling the expired air through lime water for 2 minutes? [2]

Test tube **A**

.....

Test tube **B**

.....

*(c)* Apart from not producing any bubbles, suggest **one** *other* advantage to a diver using a rebreather. [1]

.....

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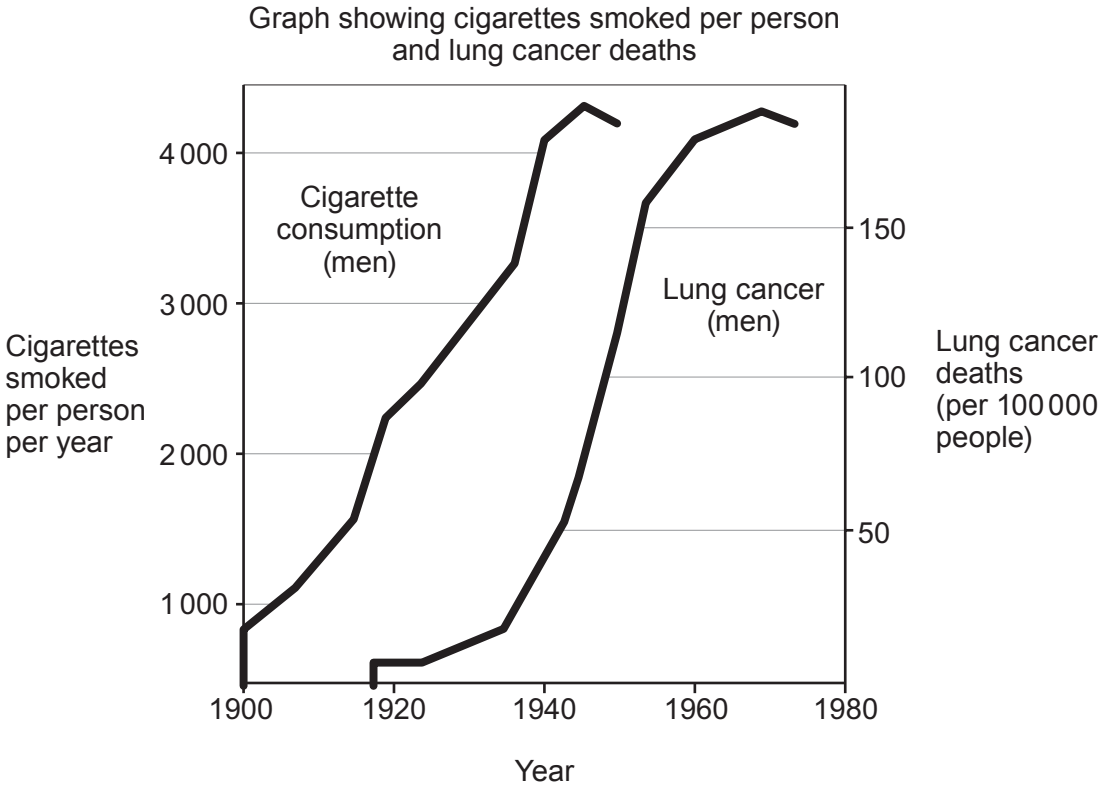
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**3.** The major rise in cigarette smoking amongst the UK population occurred at the start of the 20th century.




*(a)* From the graph, describe fully the relationship between cigarette smoking and lung cancer deaths in men. [2]

.....

.....

.....

*(b)* The link between smoking and lung cancer was first made by Sir Richard Doll, Professor of Medicine at the University of Oxford. Use the information in the graph to suggest when he first made the public aware of the link between cigarette smoking and lung cancer. [1]

.....

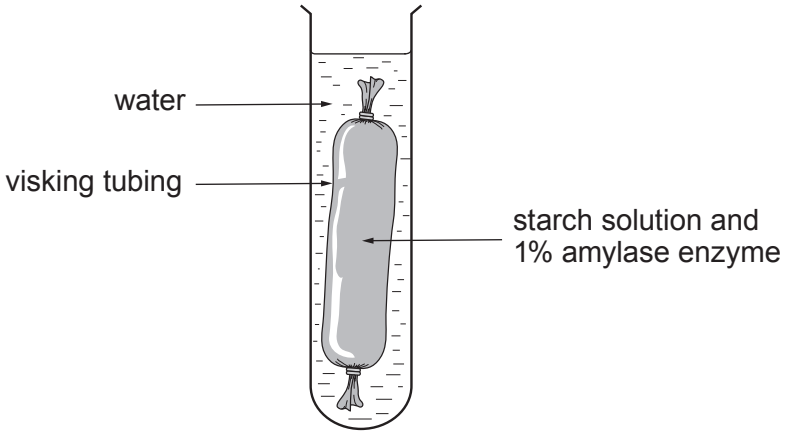
3

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**4.** An experiment was set up using visking tubing as a model gut. This is shown in the following diagram. The visking tubing was filled with a starch solution and 1% amylase enzyme. After 30 minutes the water surrounding the visking tubing was tested and found to contain glucose but no starch.




Explain why glucose appeared in the water surrounding the visking tubing but no starch was found. Include in your account a description of how the water was tested for glucose using Benedict's solution and for starch using iodine solution giving the expected observations.

[6 QWC]

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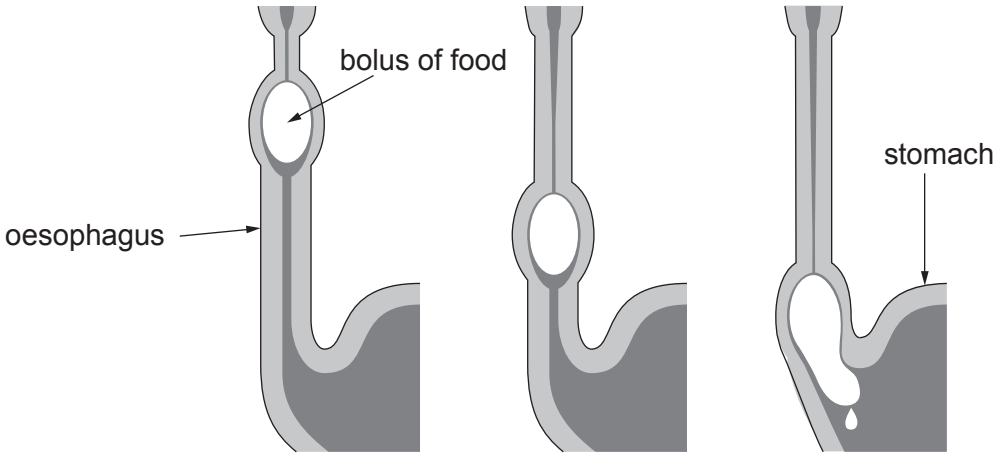
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**5.** The diagram shows a process occurring in the human digestive system.




*(a)* (i) Name the process shown in the diagram. [1]

.....

(ii) Explain how the bolus of food is moved along the oesophagus. [2]

.....

.....

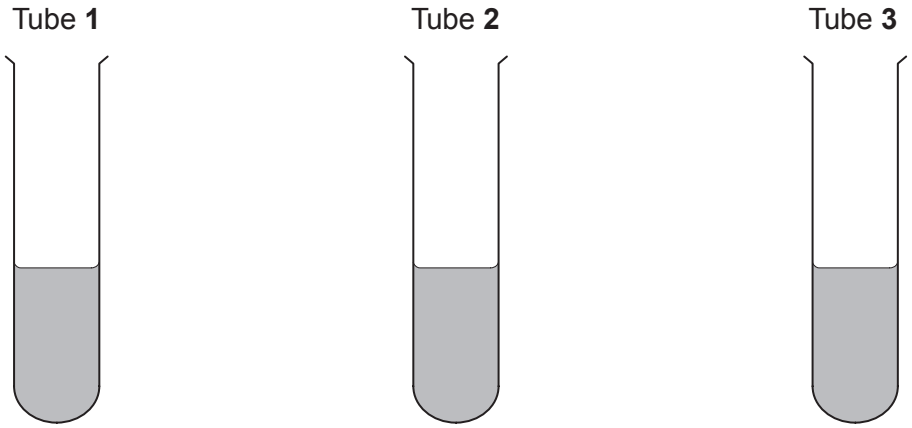
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The apparatus shown below was used to investigate the effect of washing-up liquid (detergent) on the digestion of fat by lipase.




| Contents Tube **1** | Contents Tube **2** | Contents Tube **3** |
|---|---|---|
| full fat milk ($50\,cm^3$) | full fat milk ($50\,cm^3$) | full fat milk ($50\,cm^3$) |
| washing-up liquid ($5\,cm^3$) | water ($5\,cm^3$) | washing-up liquid ($5\,cm^3$) |
| water ($5\,cm^3$) | 2% boiled lipase solution ($5\,cm^3$) | 2% lipase solution ($5\,cm^3$) |

The 3 tubes were left at 20 °C for 60 minutes and the pH of the contents of each tube was measured every 15 minutes. The results are shown in the table below.

| | pH | | |
|---|---|---|---|
| Time (minutes) | Tube **1** | Tube **2** | Tube **3** |
| 0 (start) | 8.5 | 6.7 | 8.5 |
| 15 | 8.5 | 6.7 | 7.4 |
| 30 | 8.5 | 6.7 | 6.6 |
| 45 | 8.5 | 6.7 | 6.3 |
| 60 | 8.5 | 6.7 | 5.9 |

*(b)* Explain the results for Tube **3**. [3]

.....

.....

.....

.....



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**Turn over.**

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**6.** *(a)* Name **two** scientists whose work led to the discovery of the structure of DNA. [2]

I. .....

II. .....

*(b)* A section of a single strand of DNA has the following sequence of bases:

**A T C T G T A C A G**

(i) What will be the complementary sequence of bases to that shown above? [1]

.....

(ii) State the maximum number of amino acids that could be coded by the sequence shown. [1]

.....

4

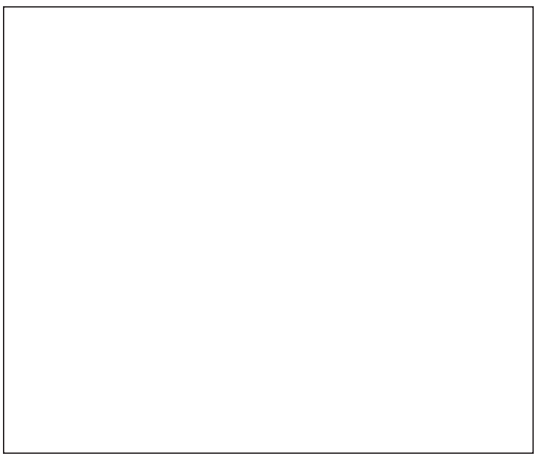
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**7.**



In 2012 specimens of the slug *Arion flagellus* were found in a garden in the Amman Valley in South Wales. The species had spread to Wales after being accidentally introduced on food imported from Spain. It eats other slugs and snails and other crop pests.

*(a)* What scientific term describes *Arion flagellus* as an invasive species introduced from another country? [1]

.....

*(b)* What would long term field trials need to find out about this species before it could be used to control crop pests in Wales? [2]

.....

.....

.....

.....

3

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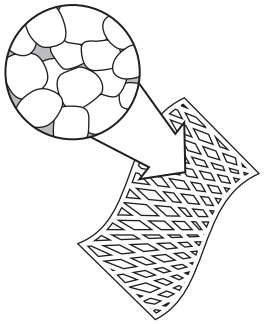
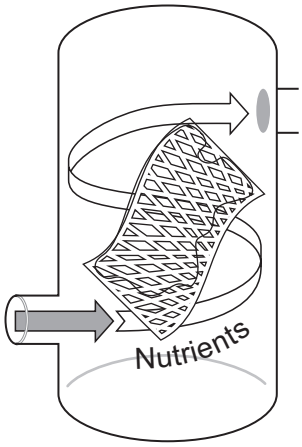


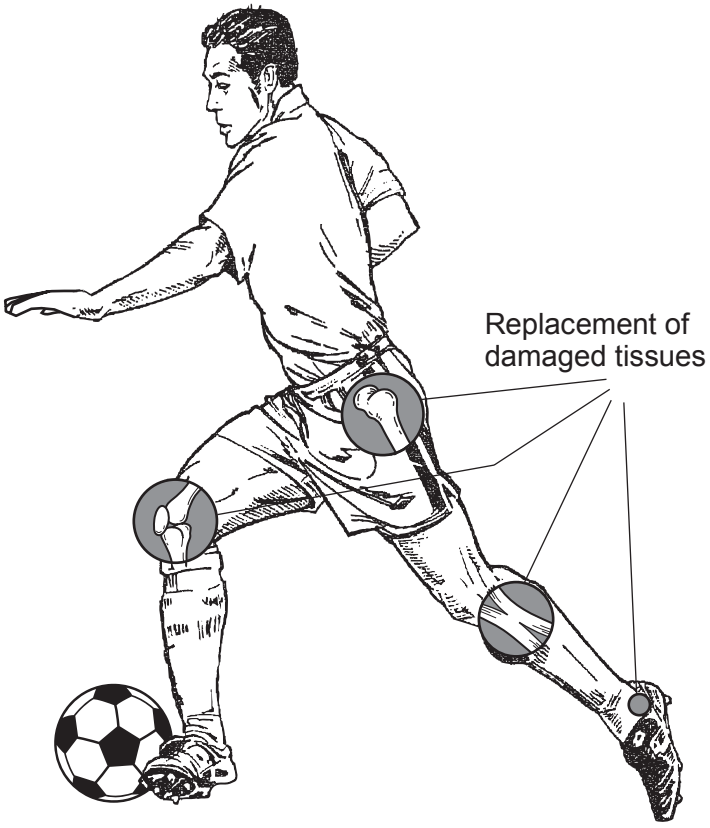
**Turn over.**

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**8.** The diagram shows how some parts of joints can be replaced. The stages in the procedure are shown in the left hand column.

| **STAGES** |
|---|
| <br>1. A cluster of embryonic human cells is laid on a support mesh. |
| <br>2. Mesh placed in incubator. |
| 3. Cells form new tissue. |
| 4. New tissue can be implanted in the body to repair damage. |




*(a)* What general name is given to cells such as the embryonic human cells shown in **Stage 1** of the diagram? [1]

.....

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*(b)* Tick (✓) **one** box in **each** column in the table below to identify some features of cell division that would take place in **Stage 3** in the diagram. [3]

| function of cell division | part of cell where control of cell division occurs | number of chromosomes in each cell |
|---|---|---|
| increases the number of cells ☐ | cytoplasm ☐ | twice as many as in the cells in Stage 1 ☐ |
| increases the size of each cell ☐ | nucleus ☐ | same number as in the cells in Stage 1 ☐ |
| keeps the number of cells the same ☐ | cell membrane ☐ | half as many as in the cells in Stage 1 ☐ |

*(c)* Suggest a possible ethical issue related to the technology shown in the diagram. [1]

.....

.....

5

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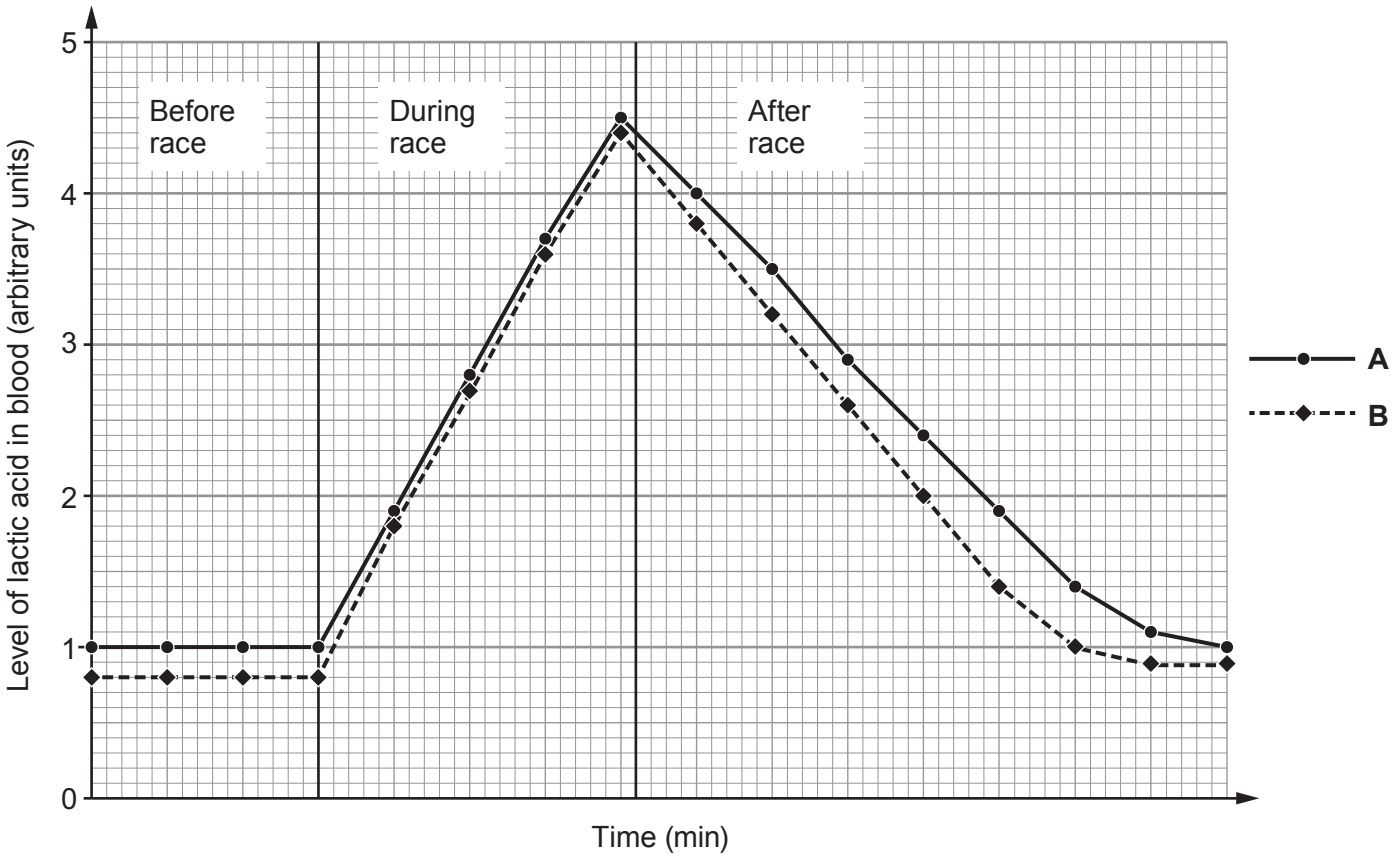


**Turn over.**

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**9.** The concentration of lactic acid in the blood of an athlete was measured before, during and after a race.
The athlete then followed a two week period of increased regular exercise to improve fitness.
The lactic acid measurements were then repeated, as before, for a race of the same distance.
The graph shows the results.




*(a)* Give reasons why line **B** shows evidence that it represents the results **after** the two week period of exercise. [2]

.....

.....

.....

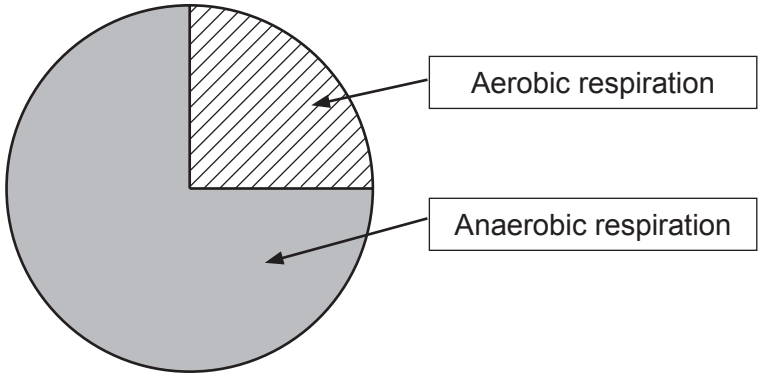
.....

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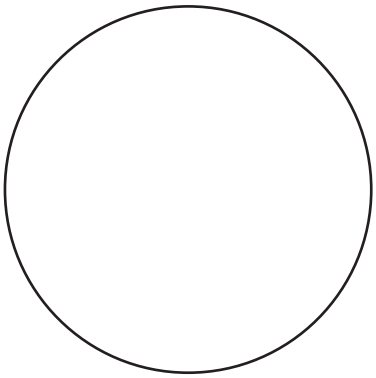
*(b)* The pie chart below shows the proportions of aerobic respiration and anaerobic respiration taking place in an athlete during a 100 m race.




(i) State the proportions as a ratio. [1]

..... anaerobic respiration : ..... aerobic respiration

(ii) Complete a pie chart, in the circle below, to suggest the expected proportions of aerobic and anaerobic respiration in an athlete during a **1 500 m race**. Use the same key as above. [1]



*(c)* Why is aerobic respiration more efficient than anaerobic respiration? [2]

.....

.....

.....

6

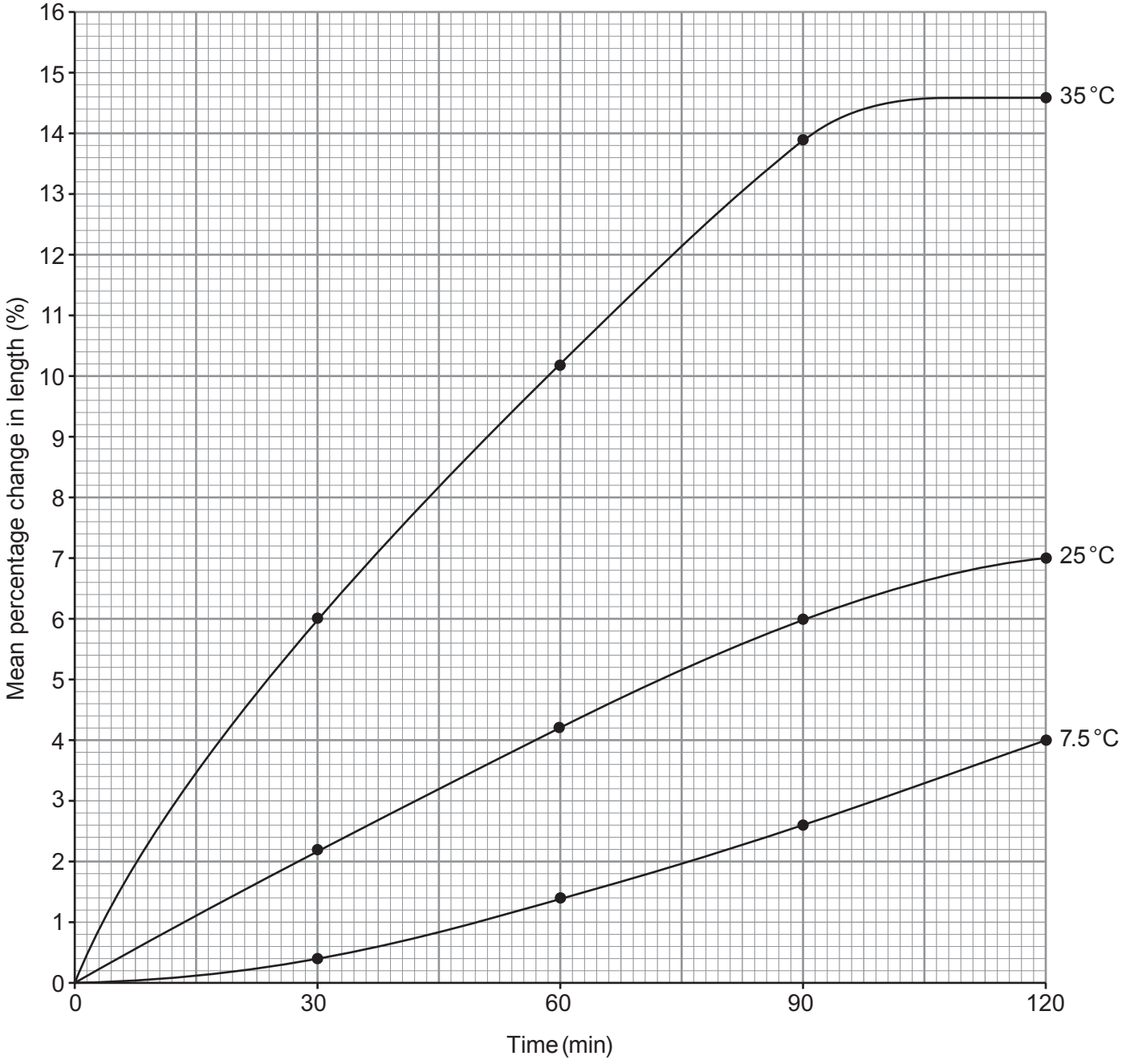
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**Turn over.**

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**10.** Five identical cylinders of potato were placed in water at each of the following temperatures: 7.5 °C, 25 °C and 35 °C.
After 30 minutes, they were removed and the length of each cylinder measured. This was repeated every 30 minutes for 120 minutes.
The mean percentage change in length for the cylinders was plotted on the graph below.




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*(a)* Explain why the cylinders increased in length and name the process involved. [4]

.....

.....

.....

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.....

.....

*(b)* Suggest why at 60 minutes the percentage increase in length of the cylinders at 35 °C is greater than the increase in length at 25 °C. [1]

.....

.....

*(c)* The cylinders at 35 °C have reached their maximum length by 120 minutes. State how this length is maintained. [1]

.....

.....

6

**Turn over for Question 11.**

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**11.** Describe the process of photosynthesis with reference to the production of materials in plant cells. In your account, identify relevant limiting factors. [6 QWC]

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6

**END OF PAPER**

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# GCSE MARKING SCHEME

## SCIENCE - BIOLOGY

## JANUARY 2015

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## INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2015 examination in GCSE SCIENCE - BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.


| | Page |
|---|---|
| UNIT B1 | 1 |
| UNIT B2 | 18 |


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**GCSE BIOLOGY - B2**

**JANUARY 2015 MARK SCHEME**

<table>
<tr><th colspan="3">Question</th><th>Marking details</th><th>Marks Available</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>
<table>
<tr><th>Features</th><th>Bacteria</th><th>Algae</th><th>Yeast</th></tr>
<tr><td>Cell wall</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>nucleus</td><td>×</td><td>✓</td><td>✓</td></tr>
<tr><td>Chloroplast</td><td>×</td><td>✓</td><td>×</td></tr>
<tr><td>Reproduce by budding</td><td>×</td><td>×</td><td>✓</td></tr>
</table>
1mark per correct row;;;<br>Assume blank = ×
</td><td>3</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Smaller;</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Cannot reproduce alone/needs a (living) cell for reproduction;<br>Accept – no cell membrane/no cytoplasm<br>NOT needs a cell to survive</td><td>1</td></tr>
<tr><td colspan="3"></td><td>Question 1 total</td><td>[5]</td></tr>
</table>

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **2** | *(a)* | | A trachea/cartilage ring; NOT windpipe<br>B alveoli/ alveolus; Accept air sac | 2 |
| | *(b)* | (i) | (Diaphragm) down/flattens; NOT contract (can be neutral)<br>(Ribs) up and out/ribcage expands; | 2 |
| | | (ii) | Decreases | 1 |
| | | | **Question 2 Total** | **[5]** |

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<table>
<tr><th colspan="3">Question</th><th>Marking details</th><th>Marks Available</th></tr>
<tr><td>3</td><td>(a)</td><td>(i)</td><td>Nucleus;</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><td>46,46;</td><td>23,23,23,23;</td></tr><tr><td>Growth/replacement of {worn out/damaged/old} cells/repair damaged tissue;<br>NOT producing new cells</td><td></td></tr><tr><td></td><td>Different/ non identical;</td></tr></table></td><td>4</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Gametes;</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Repair tissue/replace damaged tissues/{treat/cure} disease(named disease e.g. bone marrow transplants/ Parkinson’s/blindness/repairing {tendon/joint injury}/spinal cord repair);</td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Involves {destruction of/damaging} embryos/loss of potential life;<br>Leading to ethical/religious/moral objection;<br>2nd point linked to 1st point</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td>Question 3 Total</td><td>[9]</td></tr>
</table>

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **4** | *(a)* | | High **and** low; (1) both for one mark<br>Semi-permeable; (1) | 2 |
| | *(b)* | (i) | 3/ the strong solution of blackcurrant squash; | 1 |
| | | (ii) | All readings correct (20 (column 2) + 24 (column 3)); | 1 |
| | | (iii) | 2 bars of correct height in correct position; | 1 |
| | | (iv) | 2 **and** no change in <u>mass</u>/the potato chip was still 20g after 30 minutes; NOT weight | 1 |
| | | (v) | Water concentration was higher outside the chip;<br>Water {passes in/is absorbed}/chip gains water;<br>Marks can be linked in either direction | 2 |
| | | | **Question 4 Total** | **[8]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **5** | *(a)* | (i) | {Carbon dioxide/$CO_2$} **and** {oxygen/$O_2$}; | 1 |
| | | (ii) | Chlorophyll; | 1 |
| | *(b)* | (i) | Increases then {steady/plateau/reference to constant};<br>(increases) up to 4 a.u.; | 2 |
| | | (ii) | Two correct readings (13.5 & 16.5);<br>Correct calculation (3 a.u.);<br>Correct answer = 2 marks<br>Allow one mark for two correct readings if answer incorrect | 2 |
| | | (iii) | {Carbon dioxide/$CO_2$};<br>NOT light/ temperature | 1 |
| | *(c)* | | Starch;<br>(formation of) cell walls; | 2 |
| | | | **Question 5 total** | **[9]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **6/1** | *(a)* | (i) | extinct in the wild/ extinct; | 1 |
| | | (ii) | It will be {reduced/lower/smaller}/ there will be fewer species/less diverse; | 1 |
| | *(b)* | (i) | Because they are receiving payment/they do not want the monkey to become extinct/ stop it becoming extinct; | 1 |
| | | (ii) | Any **two** from<br>¶ Link up the remaining isolated pocket of rainforest (OWTTE);<br>¶ Extend the corridors outside the area shown in the diagram (OWTTE);<br>¶ {Widen/ thicken} corridors/ increase area of corridor; NOT larger<br>¶ More than one corridor to each area; | Max 2 |
| | | (iii) | Any **two** from:<br>monkey can extend its range/increased habitat/more {area/space} to live in/can {move/spread} to different areas;<br>breed with other monkeys outside its own pocket of rainforest;<br>correct ref to gene pool;<br>increase food {source/variety}/less competition for food;<br>escape predation;<br>isolated population have more chance of dying from disease; | Max 2 |
| | *(c)* | | Any **one** from:<br>SSSIs;<br>captive breeding programme; NOT breeding in zoos/wildlife parks alone<br>National parks;<br>seed banks;<br>{wildlife/nature} reserve;<br>Legislation on deforestation; | Max 1 |
| | | | **Question 6/1 Total** | **[8]** |

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<table>
<tr><th colspan="3">Question</th><th>Marking details</th><th>Marks Available</th></tr>
<tr><td>7/2</td><td>(a)</td><td>(i)</td><td>All correct 2 marks 1 error 1 mark, 2 errors 0 marks
<table>
<tr><td></td><td>Inspired air (%)</td><td>Expired air (%)</td></tr>
<tr><td>Oxygen</td><td>21</td><td>16</td></tr>
<tr><td>Carbon dioxide</td><td>0.03/0.04</td><td>4</td></tr>
<tr><td>Nitrogen</td><td>79</td><td>79</td></tr>
<tr><td>Water vapour</td><td>varies</td><td>1</td></tr>
</table></td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>(16%) oxygen in {expired air/air breathed out};</td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Sodium hydroxide/potassium hydroxide/soda lime;<br>Accept Sofnolime (trade name in diving community)</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>(The lime water in test tube A {remains/is}) {clear/colourless};<br>NOT no change/does not go cloudy/stays the same<br>(The lime water in test tube B would turn) milky/cloudy;</td><td>2</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Any one from<br>Can {remain submerged/stay down} for longer;<br>Smaller tank needed;<br><br>Question 7/2total</td><td>Max 1<br><br>[7]</td></tr>
</table>

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **8/3** | *(a)* | | The more cigarettes smoked the higher deaths. The more cigarettes smoked higher {incidence/ chances} of lung cancer (OWTTE);<br>{lag/delay/gap} {between commencement of/ time that they smoke/ smoking/ cigarette consumption} and possibility of (death from) lung cancer (OWTTE);<br>Accept the more cigarettes smoked, the higher the deaths from lung cancer and these are roughly 20 years apart = 2 marks | 2 |
| | *(b)* | | Accept any year between 1943 & 1947; | 1 |
| | | | **Question 8/3 total** | **[3]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 9/4 | | | **Indicative content:**<br><br>amylase digests/breaks down<br>starch to glucose<br>{pores/holes} in visking tubing/visking tubing is selectively permeable<br>too small for starch molecules/particles to pass through/or ref to molecule size<br>big enough to allow glucose molecules/ particles to diffuse through/or ref to molecule size<br>water heated strongly/boiled with Benedict's reagent<br>positive colour change (reference blue to green/orange/red)<br>iodine solution added to water<br>remains brown<br><br>**5 – 6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3 – 4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1 – 2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit.<br><br>**Question 9/4 Total** | 6<br><br>**[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **5** | *(a)* | (i) | Peristalsis; | 1 |
| | | (ii) | Muscles contract;<br>and push/force the food along;<br>2nd mark is linked to 1st mark | 2 |
| | *(b)* | | ¶ Washing-up liquid emulsifies the milk fat/ OWTTE;<br>¶ Increasing the surface area for the action of enzymes/ lipase;<br>¶ enzyme digests (milk) fat into fatty acids (and glycerol) which {lower pH/ more acidic};<br>2nd mark linked to 1st mark, 3rd mark is independent | 3 |
| | | | **Question 5 Total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **6** | *(a)* | | Any 2 from:<br>(James) Watson;<br>(Francis) Crick;<br>(Maurice) Wilkins;<br>(Rosalind) Franklin<br>Correct spelling for all names. If first name is attempted it must relate correctly to the second name. | 2 |
| | *(b)* | | TAGACATGTC | 1 |
| | *(c)* | | 3 | 1 |
| | | | **Question 6 Total** | **[4]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **7** | *(a)* | | Alien/exotic; | 1 |
| | *(b)* | | Any **two** from:<br>¶ All the types of food eaten/ effect on biodiversity or wildlife/ if it would become a pest itself/ make sure it does not eat non target species;<br>¶ If it survives/ reproduces (in Wales);<br>¶ If it carries disease/ parasites;<br>¶ If it has predators; | 2 |
| | | | **Question 7 total** | **[3]** |

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<table>
<tr><th colspan="3">Question</th><th>Marking details</th><th>Marks Available</th></tr>
<tr><td>8</td><td>(a)</td><td>(i)</td><td>Stem (cells);</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th>Function of cell division</th><th>Part of cell which controls cell division</th><th>Number of chromosomes in each cell</th></tr>
<tr><td>increases the number of cells; ✓</td><td>cytoplasm</td><td>twice as many as in the cells in Stage 1</td></tr>
<tr><td>increases the size of each cell</td><td>nucleus; ✓</td><td>same number as in the cells in Stage 1; ✓</td></tr>
<tr><td>keeps the number of cells the same</td><td>cell membrane</td><td>half as many as in the cells in Stage 1</td></tr>
</table>
</td><td>3</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Destruction of {embryonic cells/ embryos/ potential life} ;</td><td>1</td></tr>
<tr><td></td><td></td><td></td><td>Question 8 total</td><td>[5]</td></tr>
</table>

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **9** | *(a)* | | There is less lactic acid (in blood) (than A);<br>There is a faster {removal/ break down} of {lactic acid/payback of oxygen debt};<br>NOT faster return to normal | 2 |
| | *(b)* | (i) | 3:1; | 1 |
| | | (ii) | Should show some of each but more than 50% aerobic respiration; Accept alternative key if labels correct | 1 |
| | *(c)* | | Glucose is completely broken down;<br>Releases more energy/produces more ATP;<br>NOT produces more energy | 2 |
| | | | **Question 9 Total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **10** | *(a)* | | ¶ Osmosis;<br>¶ Movement of water into potato;<br>¶ From where water is in high concentration to low concentration/ down concentration gradient;<br>¶ Via semi permeable membrane;<br>*3rd marking point linked to 2nd marking point* | 4 |
| | *(b)* | | Water {<u>molecules/ particles</u>} {move faster at higher temperature/ have more energy}; | 1 |
| | *(c)* | | {Rate of/ volume} water passing in equals {Rate of/volume} of water passing out/no net {movement/flow} of water;<br>NOT concentration of water is the same inside and outside the potato/dynamic equilibrium | 1 |
| | | | **Question 10 Total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **11** | | | **Indicative content**<br><br>plants use chlorophyll to absorb light energy.<br>convert carbon dioxide and water<br>into glucose and oxygen<br>glucose can be changed to starch and stored<br>used to make cellulose/ proteins<br>light, temperature and carbon dioxide are limiting factors<br><br>**5 – 6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3 – 4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1 – 2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit.<br><br>**Question 11 Total** | 6<br><br>**[6]** |



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| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4471/02

## ADDITIONAL SCIENCE/BIOLOGY

# BIOLOGY 2
## HIGHER TIER

A.M. TUESDAY, 13 May 2014

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **7** | |
| **2.** | **6** | |
| **3.** | **5** | |
| **4.** | **6** | |
| **5.** | **6** | |
| **6.** | **9** | |
| **7.** | **7** | |
| **8.** | **8** | |
| **9.** | **6** | |
| **Total** | **60** | |

4471
020001

### ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to question **4** and question **9**.

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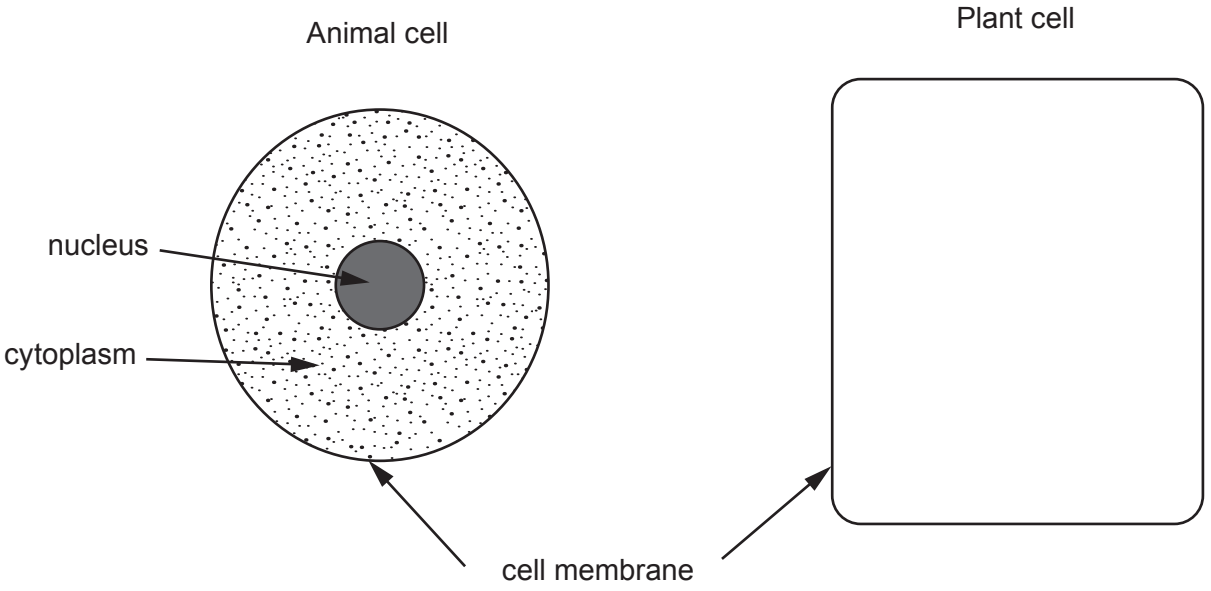


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*Answer* **all** *questions.*

**1.** *(a)* (i) The diagrams below show an animal cell and the **cell membrane** of a plant cell. Complete the drawing of the plant cell. *No labels are required.* [2]

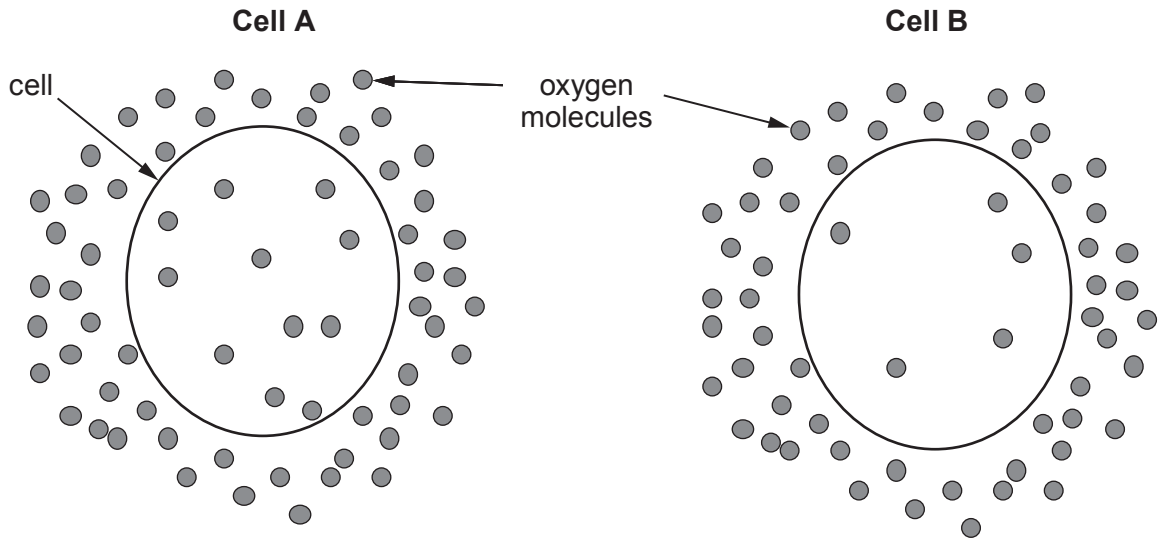



(ii) State the function of the cell membrane. [1]

.....

.....

*(b)* The diagrams below show two cells which are carrying out respiration. Oxygen molecules are shown inside and outside both cells.




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(i) Answer the following questions by placing a tick [✓] in the correct box. [3]

I. In cell **A** the oxygen molecules move:

into the cell ☐

out of the cell ☐

no net movement. ☐

II. In cell **B** the oxygen molecules move:

into the cell ☐

out of the cell ☐

no net movement. ☐

III. Into which cell could there be the greater net movement of oxygen:

cell **A** ☐

cell **B**? ☐

(ii) Name the process by which the oxygen molecules are moving. [1]

.....

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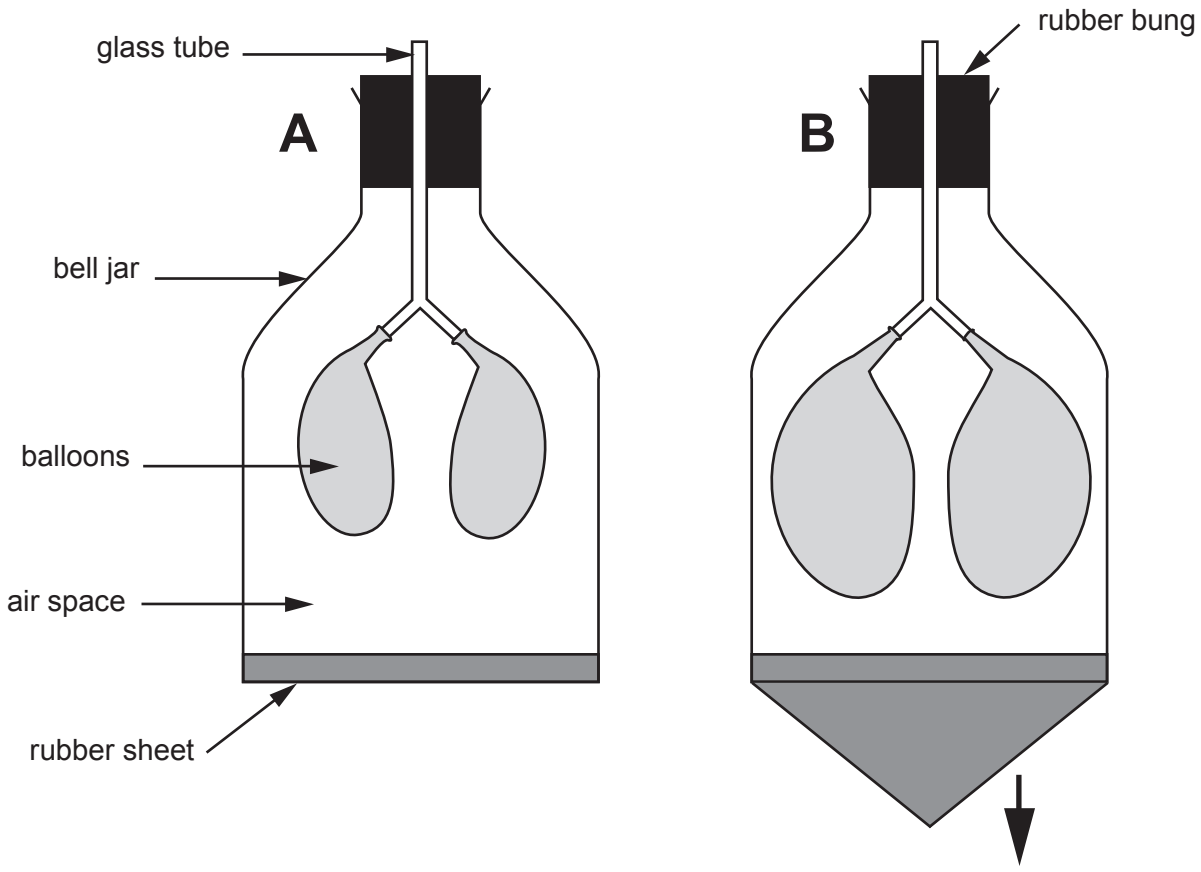


**Turn over.**

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**2.** The model below represents the human thorax (chest) during expiration and inspiration.




*(a)* Complete the following sentences by using one of the following choices. [4]

**the same** **greater** **less**

(i) Compared to diagram **A**, the 'lung' volume in diagram **B** is ..... .

(ii) Compared to diagram **A**, the 'lung' pressure in diagram **B** is ..... .

(iii) Compared to diagram **A**, the 'thoracic' volume in diagram **B** is ..... .

(iv) Compared to diagram **A**, the 'thoracic' pressure in diagram **B** is ..... .

*(b)* Give reasons why the bell jar model above is not a true representation of the human thorax. [2]

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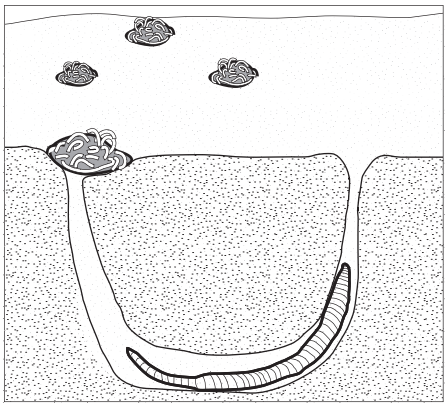


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**3.** Lugworms *(Arenicola marina)* live in burrows in the sand on beaches. At one end of the burrow is a hole and at the other end is a mound of sand, called the cast, which the lugworm has removed from the burrow. Each burrow is occupied by one lugworm only.

Burrow in section



Surface view



© Alan Gravell

Owen was asked by his teacher to estimate the number of lugworms, on a section of Whiteford Beach on Gower, by counting the number of casts.

Owen decided to use 1 $m^2$ quadrats to estimate the number of lugworms present in an area of the beach measuring 80 m × 40 m.

*(a)* Which of the following methods would be the correct way for Owen to use the quadrats to sample the number of lugworms? [1]

Tick (✓) the correct answer.

| method | tick (✓) |
|---|---|
| Place the quadrats where there are lots of casts | |
| Place the quadrats randomly within the sample area | |
| Place the quadrats carefully so as not to damage the casts | |



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*(b)* Owen counted the number of casts in 10 quadrat samples.
The table below shows his results.

| quadrat number | number of casts |
|---|---|
| 1 | 5 |
| 2 | 7 |
| 3 | 1 |
| 4 | 11 |
| 5 | 4 |
| 6 | 6 |
| 7 | 9 |
| 8 | 4 |
| 9 | 13 |
| 10 | 2 |
| Mean | ..... |

(i) Complete the table above by calculating the mean number of casts per quadrat of Owen's samples. [1]

(ii) Estimate the number of lugworms in the section of the beach by using the following equation: [2]

Estimated number of lugworms = Mean number of casts per quadrat × Area of section of beach

Estimated number of lugworms .....

*(c)* Suggest why this method of sampling would **not** be suitable for estimating the population of earthworms in an area of grassland. [1]

.....

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**Turn over.**

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**4.** Describe the method involved in testing a leaf for the presence of starch.
Each of the stages involved in the method should be described in sequence and the reason for carrying out each stage should be included.
Your description must include reference to the colour changes shown by the leaf and what these changes indicate. [6 QWC]

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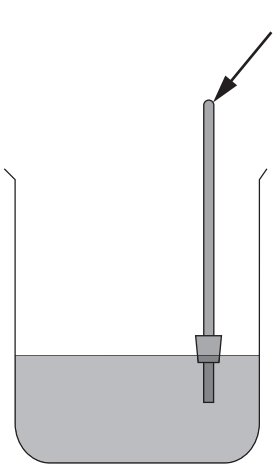
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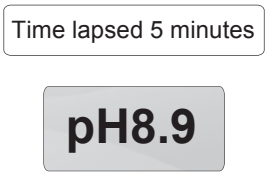
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**5.** An experiment was set up to investigate the digestion of fat in milk by lipase. The following apparatus was used.




Beaker containing milk and lipase




Laptop with pH readout from WiFi pH sensor

The beaker containing milk and lipase was kept at a constant temperature in a water bath.
The pH readout on the laptop was recorded every 5 minutes for 40 minutes.
The results are shown below.

| time (minutes) | pH |
|---|---|
| 0 | 9.1 |
| 5 | 8.9 |
| 10 | 8.8 |
| 15 | 8.7 |
| 20 | 8.6 |
| 25 | 7.5 |
| 30 | 7.0 |
| 35 | 6.4 |
| 40 | 5.9 |

*(a)* Explain why the pH changed during the experiment. [2]

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*(b)* (i) The average rate of fall in pH in the first 20 minutes is 0.025 pH units per minute. After 20 minutes bile was added to the beaker.
Calculate the average rate of fall in pH units per minute in the 20 minutes after the bile was added. [1]

..... pH units per minute

(ii) Explain why the rate of fall in pH **increased** when bile was added. [3]

.....

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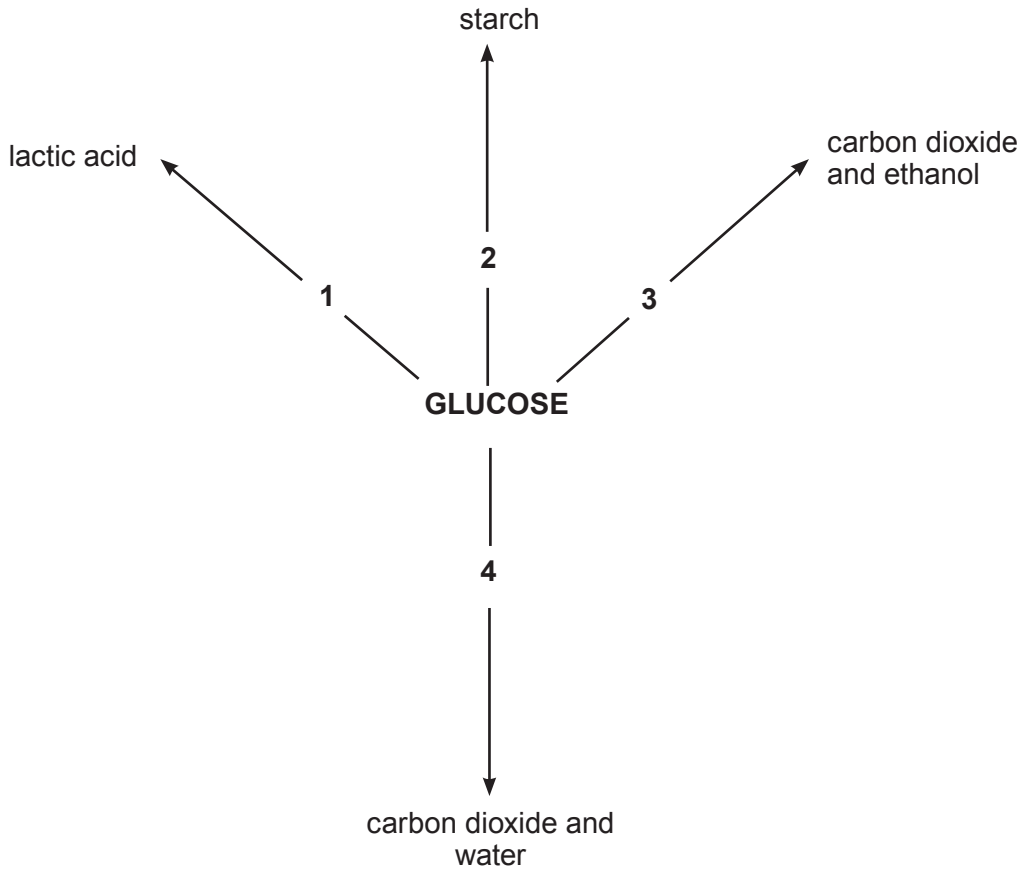


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**Turn over.**

Examiner only

**6.** The diagram below shows a summary of how glucose is used by different organisms.




*(a)* From the diagram above, use a number to show the process which [3]

(i) does NOT release energy; .....

(ii) releases most energy per molecule of glucose; .....

(iii) takes place in yeast without using oxygen. .....

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*(b)* An athlete ran a 100 m race. The table below shows events which occurred in her body from the start of the race to the end of the recovery period after the race.
The events below are given letters but are NOT in the correct order in which they occurred.

A She breathes oxygen rapidly and respires aerobically.

B Her oxygen debt is repaid.

C Her muscles ache.

D Lactic acid is produced.

E She begins anaerobic respiration in her muscles.

F She breathes slowly and respires aerobically.

Arrange the events above in the correct order in which they occurred by writing the correct letter in the appropriate box in the table below.
*One has been done for you.* [4]

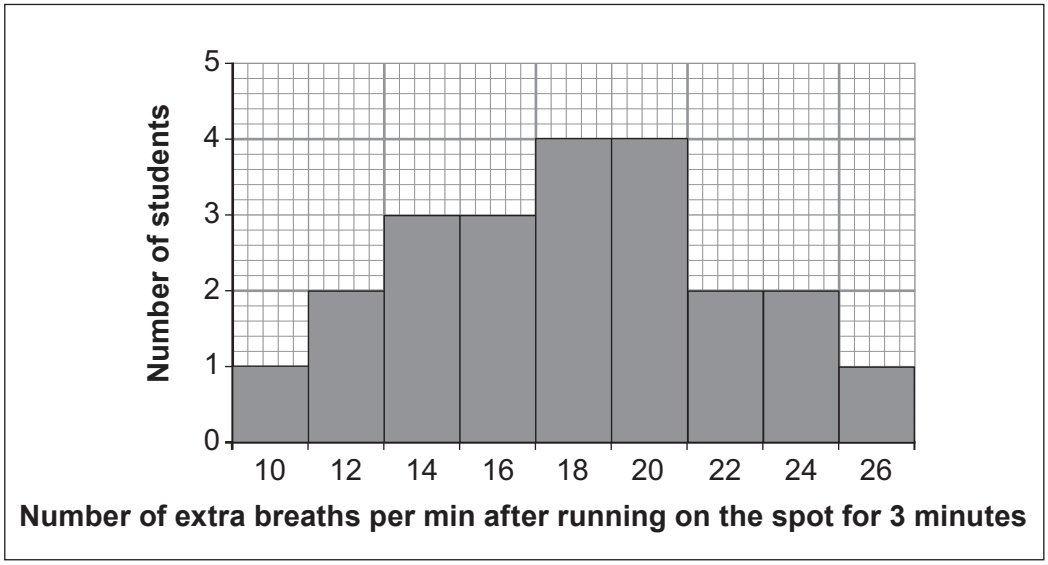
| order of events | letter |
|---|---|
| 1st | F |
| 2nd | |
| 3rd | |
| 4th | |
| 5th | |
| 6th | |

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*(c)* Some year 11 students had their rates of breathing measured before and after running on the spot for three minutes.
The following bar chart shows the increase in breathing rates of the students after they had finished running.




(i) How many students had their breathing rates measured? [1]

.....

(ii) The average breathing rate for a physically fit year 11 student is 18 breaths per minute at rest. This rises to 36 breaths per minute after running on the spot for three minutes.
Scientists consider that physically fit year 11 students take a maximum of 18 extra breaths per minute after running on the spot for three minutes.
Use the bar chart to calculate how many of the students may be physically **unfit**.[1]

..... students

9

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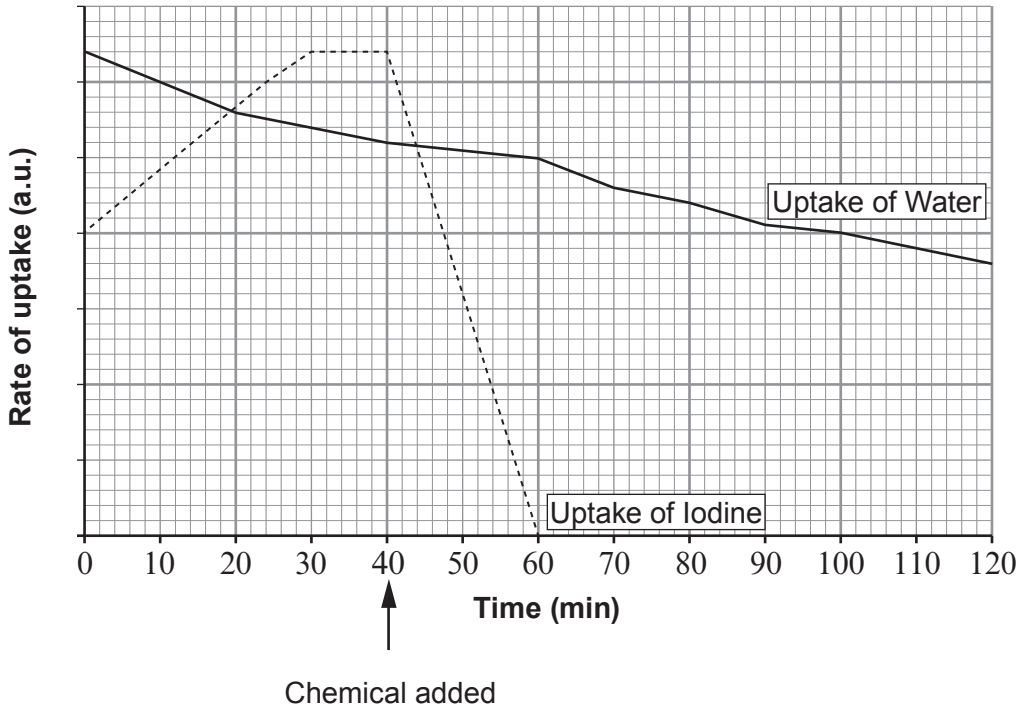
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**7.** Kelp, *Laminaria digitata*, is an alga which lives in the sea.

The graph below shows the rate of uptake of water and iodine from sea water into kelp in a laboratory.




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At forty minutes, a chemical was added to the sea water which stopped respiration taking place in the cells of the kelp.

*(a)* (i) Use the graph opposite to **describe** the effect of adding the chemical on the uptake of iodine **and** water. [3]

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(ii) **Explain** the effect of adding the chemical on the uptake of iodine. [3]

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*(b)* What process is responsible for the uptake of the water? [1]

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**Turn over.**

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**8.** *(a)* In DNA there is a genetic code which determines the order in which certain chemicals are linked together to form proteins.

(i) Name the **four** bases which make up the genetic code in DNA. [2]

..... ..... ..... .....

(ii) Name the types of chemicals which are linked together to form proteins. [1]

.....

*(b)* Name the type of cell division responsible for growth and describe its significance in organisms. [2]

.....

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In each cell some genes are active and some are not. The number of active genes in some types of cells are shown in the table below:

| types of cells | number of active genes |
|---|---|
| liver | 2091 |
| kidney | 712 |
| heart | 1195 |
| pancreas | 1094 |
| small intestine | 297 |

*(c)* Use the data above to suggest which type of cell produces the most enzymes and explain your answer. [3]

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**9.** A student used red blood cells to carry out an investigation into cell membranes. Red blood cells were placed in salt solutions at three different concentrations. A sample of red blood cells was then removed from each concentration and placed on a microscope slide. The cells were viewed using a microscope for a period of time. The observations were recorded in a table:

| concentration of salt solution (%) | observation of red blood cells |
|---|---|
| 0.0 | swell and burst |
| 0.9 | remain the same size |
| 3.0 | smaller and shrivelled |

Explain the observations shown in the table. [6 QWC]

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**END OF PAPER**

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# GCSE MARKING SCHEME

## SCIENCE-BIOLOGY

## SUMMER 2014

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## INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2014 examination in GCSE Science-Biology. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.


| | Page |
|---|---|
| B1 | 1 |
| B2 | 18 |
| B3 | 32 |


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**GCSE SCIENCE - BIOLOGY**

**B2**

**MARK SCHEME - SUMMER 2014**

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 1 | (a) | (i) | Any two **for one mark**<br>Disease;<br>Pests/fungus/mould;<br>Climate change;<br>*NOT pod rot* | 1 |
| | | (ii) | Insufficient/ not enough to meet demand (for chocolate)/OWTTE;<br>*NOT decrease unqualified*<br>Accept suitable reference to loss of income/ less money | |
| | (b) | | 15%; | 1 |
| | (c) | (i) | Microbe ; | 1 |
| | | (ii) | Biological control/ biocontrol; | 1 |
| | (d) | (i) | Fewer rotted pods than untreated;<br>Answer must be comparative | 1 |
| | | (ii) | Does not affect other organisms/ does not damage biodiversity; | 1 |
| | | (iii) | Very few rotted pods/ more effective at controlling pod rot/ less rotted pods than with {Trichoderma/ biological control}/ better at killing the mould; | 1 |
| | | | **Question 1 total** | **[8]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 2 | (a) | (i) | Bases; | 1 |
| | | (ii) | T and C in correct positions; | 1 |
| | (b) | (i) | Nucleus;<br>Accept chromosome | 1 |
| | | (ii) | Twisted/ helix;<br>NOT coil | 1 |
| | | | **Question 2 total** | **[4]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 3 | (a) | (i) | On diagram 46 **and** 46; | 1 |
| | | (ii) | Replace worn out cells/ repair damages tissue; | 1 |
| | (b) | (i) | Four;<br>Identical/ same; | 2 |
| | | (ii) | Gametes; | 1 |
| | | | **Question 3 Total** | **[5]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 4 | (a) | (i) | Peristalsis; | 1 |
| | | (ii) | B; | 1 |
| | (b) | | | 3 |

| Food | Enzyme | Digested food |
|---|---|---|
| **Starch/ carbohydrate**; | carbohydrase | glucose |
| fat | **Lipase;** | fatty acids and **Glycerol;** |

| | | | | |
|---|---|---|---|---|
| | (c) | | Absorbs water; | 1 |
| | | | **Question 4 Total** | **[6]** |

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| Question | | | | Marking details | Marks Available |
|---|---|---|---|---|---|
| 5 | (a) | (i) | | Protein;<br>Chemical; | 2 |
| | (b) | (i) | I | linear scale;<br>must include number at origin and encompass all readings | 1 |
| | | | II | plots;;<br>+/- ½ small square<br>-1 if line taken back to origin | 2 |
| | | | III | line; | 1 |
| | | (ii) | I | Increase then decrease;<br>Optimum pH7.5 (from data/ graph) ; | 2 |
| | | | II | Correct readings **from their graph** = 1 mark<br>Correct answer **from their graph** = 1 mark<br>If answer correct but no calculation = 2 marks | 2 |
| | | (iii) | | Temperature affects enzyme activity;<br>Accept reference to varying more than one variable not being a fair test | 1 |
| | (c) | | | Work at {lower/ low} temp (than non- enzyme powders };<br>Uses less energy/ more economic/ less costly;<br>NOT cleans better or eq. | 2 |
| | | | | **Question 5 Total** | **[13]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 6/1 | (a) | (i) | A line drawn **outside** cell membrane;<br>Nucleus, vacuole & chloroplasts (not dots) (all needed) correctly drawn;<br>Must be able to distinguish the three different organelles | 2 |
| | | (ii) | {Controls/regulates/selects} {the movement of substances /what} into and out of cell;<br>*NOT protect cell/maintain shape* | 1 |
| | (b) | (i) | I Into the cell ✓;<br>II Into the cell ✓;<br>III Cell B ✓; | 3 |
| | | (ii) | Diffusion; | 1 |
| | | | **Question 6/1 Total** | **[7]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 7/2 | (a) | (i) | Greater; | 1 |
| | | (ii) | Less; | 1 |
| | | (iii) | Greater; | 1 |
| | | (iv) | Less; | 1 |
| | (b) | | Any **two** from<br>Answers must compare bell jar and human<br>The {diaphragm/rubber sheet} in bell jar model is pulled down during inspiration, whereas in the thorax the diaphragm is flattened. (OWTTE);<br><br>The (wall of the) bell jar is {rigid/does not move}, whereas (the wall of the) {thorax/chest/ribs/ribcage} is {flexible/moves} (and moves during breathing). (OWTTE);<br>Accept {thorax/ ribcage} expands *NOT ribs expand*<br><br>The bell jar cavity is filled with air, whereas the thoracic wall is filled with body fluid. (OWTTE);<br><br>In the bell jar there's a large space around the 'lungs'/balloons in the thorax the space is very small. (OWTTE); | 2 |
| | | | **Question 7/2 total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 8/3 | (a) | | Place the quadrats randomly within the sample area; | 1 |
| | (b) | (i) | Mean = 6.2; | 1 |
| | | (ii) | Estimated no of lugworms = 6.2 x 3200;<br>= 19 840;<br>Allow ECF from (b)(i)<br>(If answer is correct award 2 marks directly) | 2 |
| | (c) | | Any ref to evidence not available on surface (to count)/hidden by grass/ {casts/holes/burrows} are <u>hidden by the grass</u>/ earthworms move/ earthworms do not stay in one burrow/ Accept ref to 3D aspect of population of earthworms ie there can be many earthworms at the same vertical point in the soil; | 1 |
| | | | **Question 8/3 total** | **[5]** |

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| Question | Marking details | Marks Available |
|---|---|---|
| 9/4 | *Indicative content:*<br><br>Drop leaf in boiling water to {kill the leaf/ burst the chloroplasts/ {burst/destroy} cell membranes/ to get rid of waxy cuticle}<br>Boil the leaf in ethanol/alcohol/methanol to remove the chlorophyll<br>Place the leaf in water to soften it<br>Spread the leaf on a white tile (or any suitable surface)<br>Add iodine solution to the leaf surface to test for starch<br>If leaf turns {blue-black/ black} starch is present<br><br>5 – 6 marks<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>3 – 4 marks<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>1 – 2 marks<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>0 marks<br>The candidate does not make any attempt or give a relevant answer worthy of credit.<br><br>**Question 9/4 Total** | 6<br><br>**[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 5 | (a) | | Lipase {digests/ breaks down/hydrolyses} fat (in milk) to fatty acids (and glycerol);<br>Fatty acids {decrease pH/ cause it to become acid};<br>2nd mark only given if 1st mark awarded | 2 |
| | (b) | (i) | 0.135; | 1 |
| | | (ii) | Bile breaks large globules of fat into smaller globules/ bile emulsifies fat;<br>(accept 'pieces', 'chunks', lumps' of fat but *NOT molecules*)<br>Increasing the surface area for (the action of) {lipase/ enzyme};<br>More fatty acids produced/ fatty acids produced faster;<br>3rd mark only awarded if 2nd mark awarded | 3 |
| | | | **Question 5 Total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 6 | (a) | (i) | 2; | 1 |
| | | (ii) | 4; | 1 |
| | | (iii) | 3; | 1 |
| | (b) | | <table><tr><td>1st</td><td>F</td></tr><tr><td>2nd</td><td>E</td></tr><tr><td>3rd</td><td>D</td></tr><tr><td>4th</td><td>C</td></tr><tr><td>5th</td><td>A</td></tr><tr><td>6th</td><td>B</td></tr></table><br>4 or 5 correct = 4 marks<br>3 correct = 3 marks<br>2 correct = 2 marks<br>1 correct = 1 mark | Max 4 |
| | (c) | (i) | 22; | 1 |
| | | (ii) | 9; | 1 |
| | | | **Question 6 total** | **[9]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 7 | (a) | (i) | (Rate of) uptake of iodine decreased;<br>to zero;<br>No effect on uptake of water; | 3 |
| | | (ii) | (Process of) {active transport/ active uptake};<br>Requires energy;<br>Energy release from respiration is stopped (by chemical); | 3 |
| | (b) | | Osmosis; | 1 |
| | | | **Question 7 total** | **[7]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 8 | (a) | (i) | Adenine<br>Thymine<br>Cytosine<br>Guanine<br>-1 for each error | 2 |
| | | (ii) | Amino acids; | 1 |
| | (b) | | Mitosis;<br>results in genetically identical cells/ same {chromosome/ genes};<br>NOT similar | 2 |
| | (c) | | Liver because it has the most active genes;<br>Genes control protein production;<br>Enzymes are proteins;<br>3rd mark only awarded if 2nd mark awarded | 3 |
| | | | **Question 8 Total** | **[8]** |

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| Question | Marking details | Marks Available |
|---|---|---|
| 9 | Indicative content | 6 |

Correct explanation for concentrations e.g.

- 0.0% - water passes in from where it is in high concentration/ water potential to where it is in low concentration/ water potential via Semi Permeable Membrane
- 0.9% - water passes in and out at the same rate.
- 3.0% - correct explanation for decrease in size i.e. opposite to explanation for 0.0%.
- A correct comment on bursting or shrivelling i.e. at extremes of concentration range - membrane is affected.

Top band must have correct explanation for the three concentrations.

5 – 6 marks
The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3 – 4 marks
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1 – 2 marks
The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks
The candidate does not make any attempt or give a relevant answer worthy of credit.

**Question 9 Total** **[6]**

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| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4471/02

## ADDITIONAL SCIENCE/BIOLOGY

# BIOLOGY 2
## HIGHER TIER

A.M. WEDNESDAY, 8 January 2014

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **6** | |
| **2.** | **4** | |
| **3.** | **7** | |
| **4.** | **7** | |
| **5.** | **6** | |
| **6.** | **5** | |
| **7.** | **7** | |
| **8.** | **4** | |
| **9.** | **8** | |
| **10.** | **6** | |
| **Total** | **60** | |

4471
020001

### ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to question **4** and question **10**.

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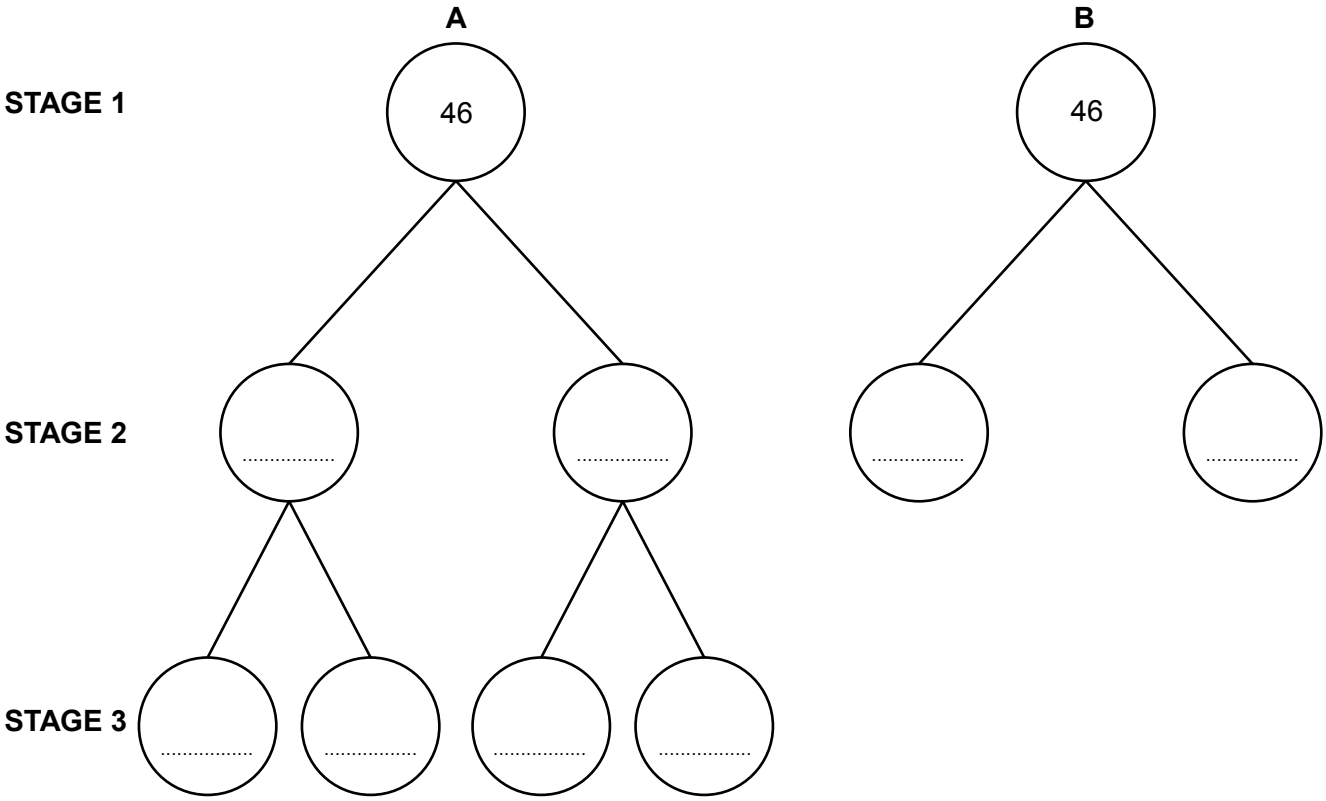


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*Answer* **all** *questions.*

**1.** The diagram below shows the two **different** types of cell division **A** and **B**, which occur in the human body.




*(a)* Name the type of cell division shown in diagram **A**. ..... [1]

*(b)* The cells in **STAGE 1** each contain 46 chromosomes. Complete the diagram by writing in the number of chromosomes found in ***each*** of the cells in **STAGE 2** and **STAGE 3**. [2]

*(c)* The cells drawn in **STAGE 3** develop into specialised cells. What name is given to these cells? [1]

.....

*(d)* Complete the sentence below by placing a **circle** around the correct word. [1]

All the cells in **STAGE 3** are genetically **identical** / **different**.

*(e)* Name **one** process during which the type of cell division shown in diagram **B** would occur. [1]

.....

6

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**2.** Some students wanted to estimate the number of dandelions on a school playing field. The playing field was too large to count every dandelion so they sampled a 10m × 10m area of the field using a quadrat.



*© Martyn F. Chillmaid/Science Photo Library*

*(a)* The stages the students used in their sampling technique are listed below in the **WRONG ORDER**. Write the numbers **1**, **2**, **3** and **4** in the table below to show the correct order. [3]

| ***Stage*** in the sampling technique | Number |
|---|---|
| Calculate the number of dandelions on the playing field | |
| Repeat the sampling 10 times | |
| Select a random sampling method | |
| Drop the quadrat and count the number of dandelions | |

*(b)* Why is it important that when the students sample in the chosen area of the field it is done randomly? [1]

.....

4



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**3.** Sian and Rhys were investigating the use of visking tubing as a model gut.
The following is an extract from their notebook showing the method they used.

(i) Soak a piece of visking tube in water for 10 minutes.

(ii) Tie a knot in one end of the visking tube.

(iii) Fill the visking tube with starch solution and tie the open end of the tubing.

(iv) Suspend the visking tubing in a beaker of water.

(v) Test the water in the beaker every 15 minutes for the presence of starch and glucose.

(vi) After 45 minutes inject amylase enzyme into the visking tubing.

(vii) Continue to test the water for starch and glucose every 15 minutes.

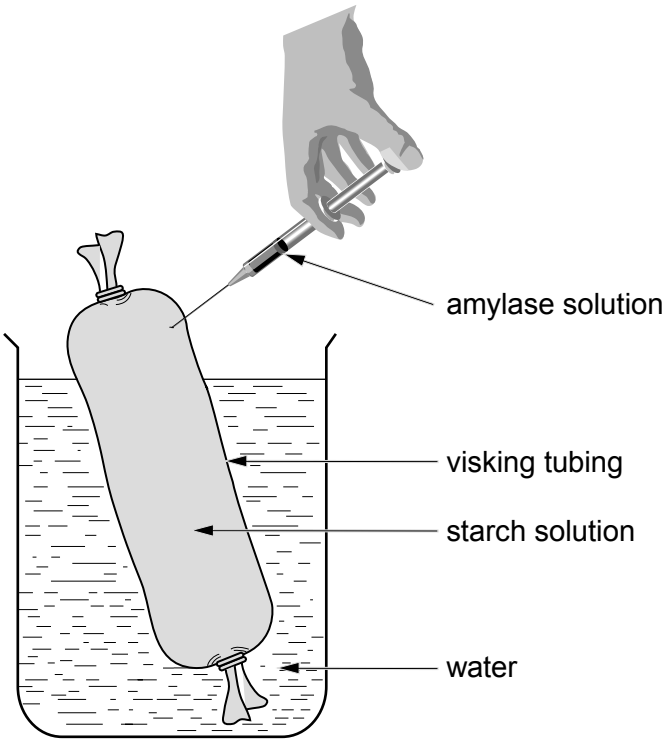



Table of results.

| Time (minutes) | Starch present | Glucose present |
|---|---|---|
| 0 | No | No |
| 15 | No | No |
| 30 | No | No |
| 45 | No | No |
| 60 | No | Yes |
| 75 | No | Yes |
| 90 | No | Yes |

Amylase added →

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*(a)* After the amylase was added, glucose was present in the sampled water. Explain this result. [3]

.....

.....

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*(b)* State why starch was not found in the sampled water. [1]

.....

.....

*(c)* In the model gut shown opposite what does the water surrounding the visking tubing represent in the living body? [1]

.....

*(d)* Complete the following table about food tests. [2]

| Substance tested for | Reagent used | Colour of reagent | Colour with positive result |
|---|---|---|---|
| | Iodine solution | | blue-black |
| Glucose | | blue | |



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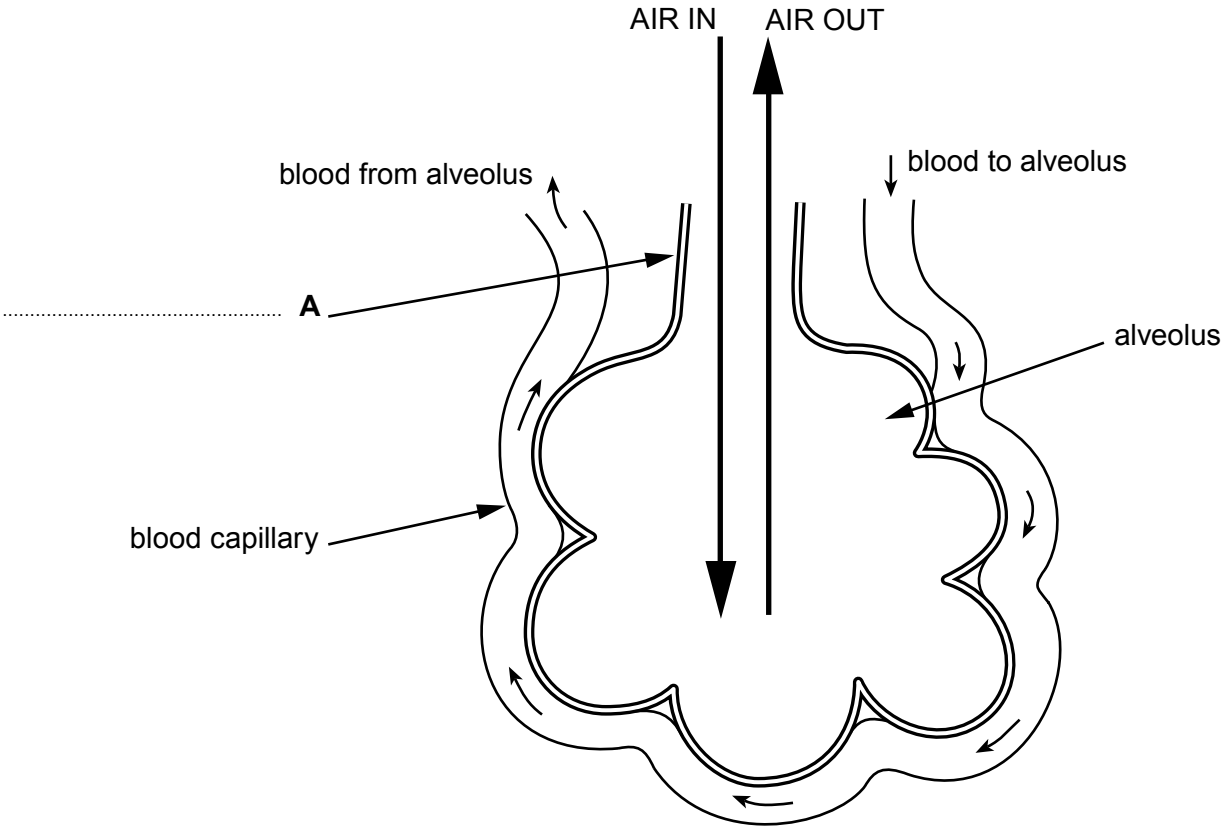


**Turn over.**

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**4.** The diagram shows an alveolus and its blood supply.




*(a)* Complete label **A** on the diagram above. [1]

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*(b)* Explain how gas exchange takes place between the alveolus and blood capillary. Include in your answer a description of how the alveolus is adapted to help this gas exchange. [6 QWC]



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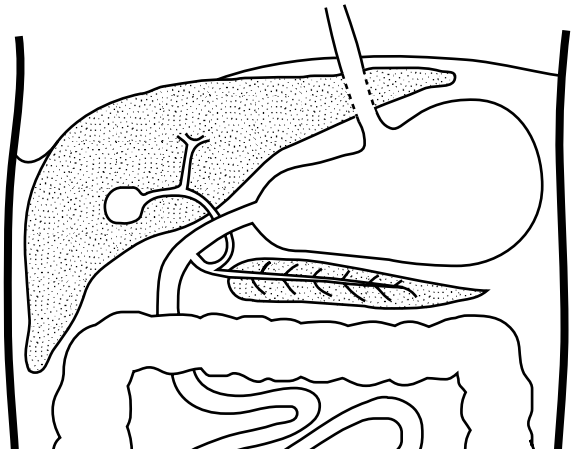


**Turn over.**

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**5.** The diagram shows part of the human digestive system.



*(a)* (i) Name the organ shown in the diagram above which: [1]

I. secretes bile; .....

II. label this organ on the diagram above.

(ii) Name the organ shown in the diagram above which: [1]

I. stores bile; .....

II. label this organ on the diagram above.

*(b)* The table below shows the results of an experiment to investigate the digestion of olive oil (a lipid). The contents of three test tubes are shown in the table. The contents of the test tubes were analysed for the presence of fatty acids every 5 minutes for a period of 30 minutes.

| | | **Time (minutes)** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Tube | Test samples | 0 | 5 | 10 | 15 | 20 | 25 | 30 |
| **1** | water + oil | **–** | **–** | **–** | **–** | **–** | **–** | **–** |
| **2** | water + oil + bile | **–** | **–** | **–** | **–** | **–** | **–** | **–** |
| **3** | water + oil + bile + lipase | **–** | **+** | **++** | **+++** | **++++** | **++++** | **++++** |

Key: **–** = no fatty acids present

**+** = fatty acids present

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(i) Bile plays a very important role in the digestion of lipids but the results in Tube **2** show that it is not directly involved in the production of fatty acids. Describe the role played by bile in the digestion of lipids. [2]

.....

.....

.....

.....

(ii) The production of fatty acids in Tube **3** did not increase after 20 minutes. Suggest a reason for this. [1]

.....

.....

(iii) Apart from fatty acids, name another product of lipid digestion which could have been tested for during this experiment. [1]

.....

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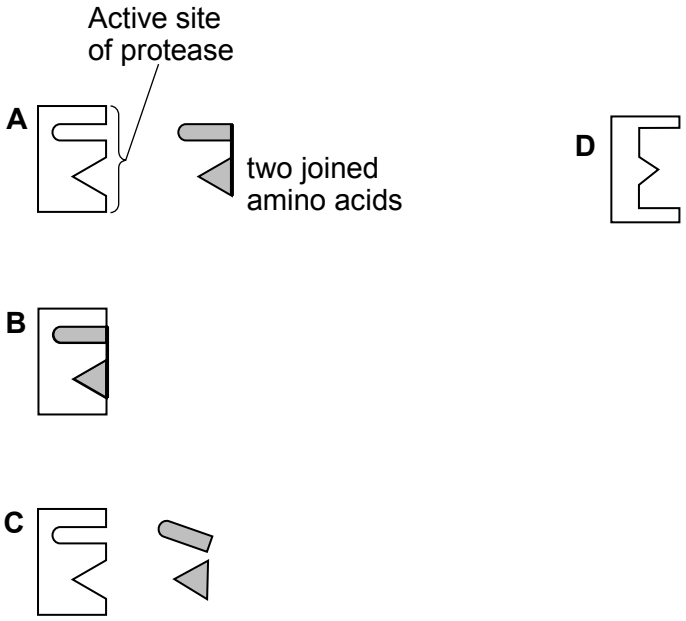


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**6.** Diagrams **A** - **C** illustrate the 'lock and key' theory of enzyme action. It shows how a protease is able to catalyse the separation of two joined amino acids. Diagram **D** shows the protease after it has been denatured.

The "lock and key" theory of enzyme action




*(a)* What name is given to the structure represented by diagram **B**? [1]

.....

*(b)* Explain why the denatured protease **D**, is unable to catalyse the separation of the two amino acids. [2]

.....

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.....

*(c)* State **two** factors which affect the rate of enzyme controlled reactions. [2]

I. .....

II. .....

5

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**7.** Some physical and chemical changes were measured in a rock pool on the sea shore at low tide. The measurements were made during daylight hours over a period of one week. The rock pool contained a high biodiversity of animals and algae.

The results are shown in the table below.

| | Physical and chemical conditions in rock pool water | | | |
|---|---|---|---|---|
| Time of day | Carbon dioxide (mg/l) | Oxygen (mg/l) | Temperature (°C) | Salt (%) |
| 10 am | 97.0 | 9.4 | 14.4 | 3.25 |
| 11 am | 84.7 | 10.9 | 14.7 | 3.26 |
| 12 noon | 74.3 | 13.9 | 15.6 | 3.27 |
| 1 pm | 60.6 | 14.0 | 20.8 | 3.29 |
| 2 pm | 50.8 | 17.4 | 21.3 | 3.41 |
| 3 pm | 65.1 | 15.1 | 19.6 | 3.33 |
| 4 pm | 85.0 | 13.2 | 15.3 | 3.26 |

*(a)* Which limiting factor of photosynthesis is influenced by the animals in the rock pool? [1]

.....

*(b)* Explain the effect of temperature on the salt concentration in the rock pool. [2]

.....

.....

.....

*(c)* Explain how the animals living in the rock pool could be affected by an increase in the salt concentration of the water. [4]

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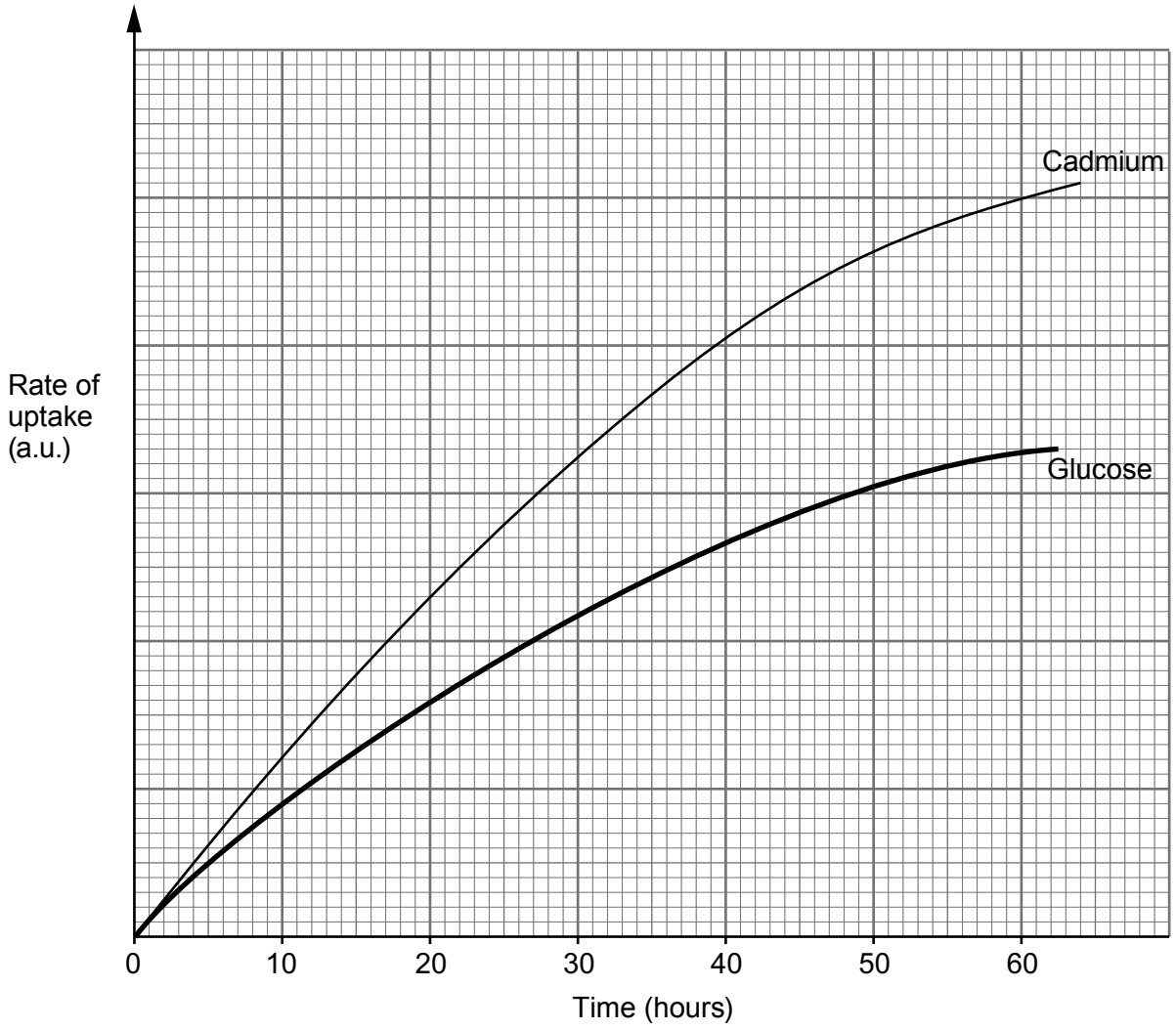
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**Turn over.**

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**8.** The fungus, *Aspergillus* has been used in Malaysia to extract the heavy metal, cadmium, from the waste produced in the production of palm oil. The graph below shows the rate of uptake of glucose and cadmium by *Aspergillus* over a sixty hour period.




The table below shows the effect of oxygen and glucose on the uptake of cadmium by *Aspergillus* over a sixty hour period.

| Conditions | Uptake of cadmium by Aspergillus over a sixty hour period (a.u.) |
|---|---|
| With glucose and oxygen | 50 |
| NO glucose or oxygen | 0 |
| With glucose but NO oxygen | 0 |

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What do you conclude from the data given in the graph and table opposite? [4]
Give a full explanation of your conclusion.

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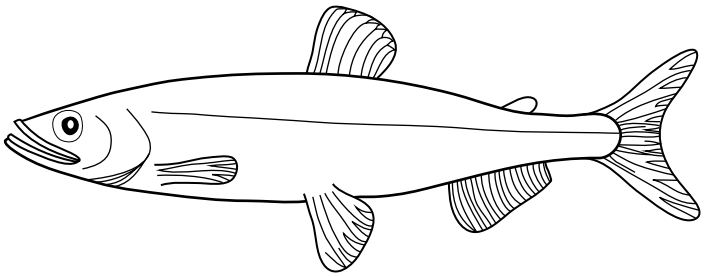


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**9.** In South Wales, a population of fish called smelt *(Osmerus eperlanus)* live in a lake, into which runs a stream.

Smelt, *Osmerus eperlanus*



An estimation of the population size of the smelt in the lake was made using a capture/recapture technique.

200 smelt were captured from one part of the lake and their tails were marked with a harmless blue dye. The marked smelt were then returned to the lake.

The next day, 200 smelt were again captured in the same part of the lake. 20 of these were found to have been marked with the dye and 180 were unmarked.

*(a)* Estimate the size of the population of smelt in the lake by using the formula [2]

$$\text{Population size} = \frac{\text{Number captured on first day} \times \text{number captured on the second day}}{\text{Number of marked smelt recaptured on second day}}$$

Show your working

Answer .....

*(b)* Which number, used in the formula, would be directly affected by emigration from the lake? [1]

.....

*(c)* Apart from emigration, suggest **three** *other* reasons why your estimate is unlikely to be an accurate indication of the actual population size of the smelt in the lake. [3]

(i) .....

(ii) .....

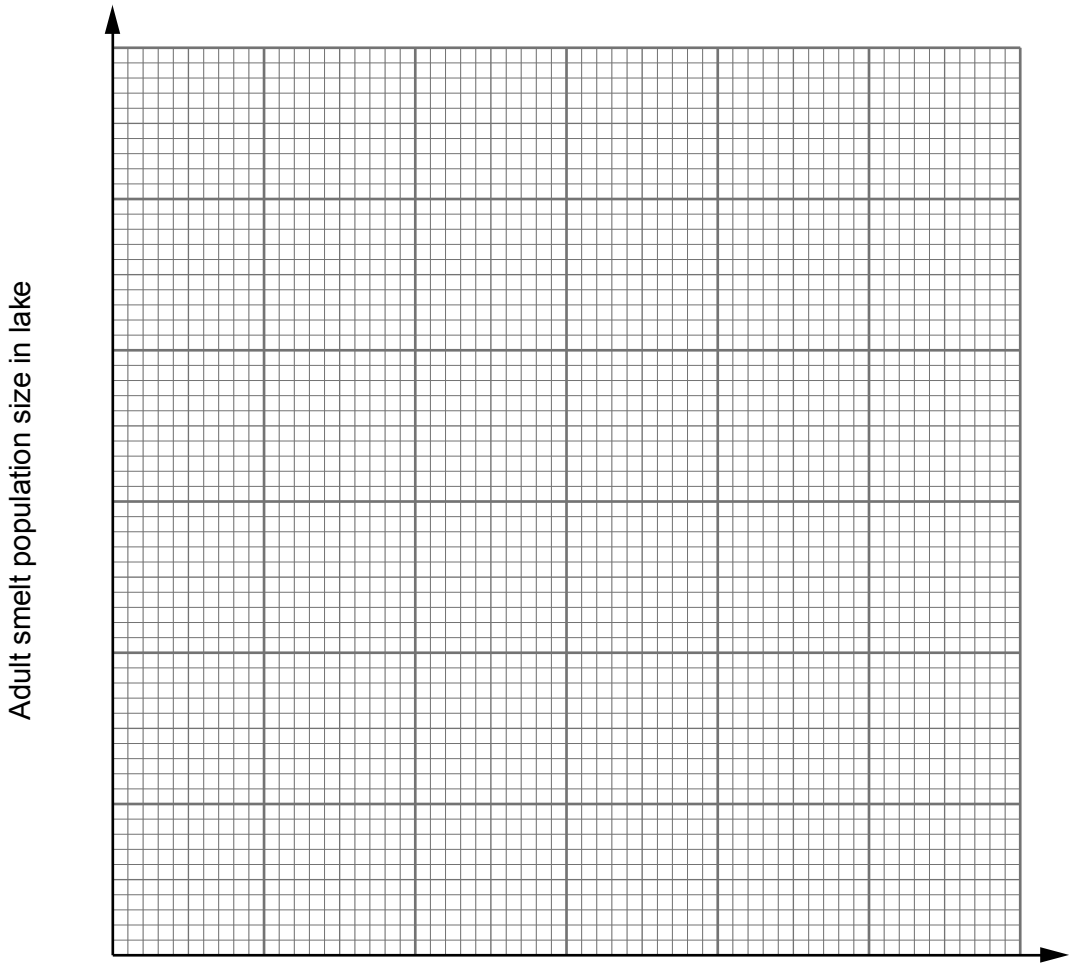
(iii) .....

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*(d)* Adult smelt begin to migrate from the sea into the fresh water lake in February to breed. They begin to migrate back to the sea in April.
Use the information above, to sketch a line graph, on the grid below, showing the expected change in the size of the population of adult smelt in a lake near an estuary over a period of a year.
Insert a scale on the horizontal axis showing the time in months. [2]




8

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**Turn over for Question 10.**

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**10.** Write an account of the similarities and differences between aerobic and anaerobic respiration in muscle cells. In your account, explain why aerobic respiration is more efficient than anaerobic respiration. [6 QWC]

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**END OF PAPER**

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# GCSE MARKING SCHEME

## SCIENCE - BIOLOGY

## JANUARY 2014

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## INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2014 examination in GCSE SCIENCE - BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.


| | Page |
|---|---|
| B1 - 4461 | 1 |
| B2 - 4471 | 18 |


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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **1** | *(a)* | (i) | Any two from<br>Bacteria(l);<br>Yeast;<br>Alga(l); | max 2 |
| | | (ii) | 1235; can be in any order<br>2345; can be in any order<br>1; | 3 |
| | *(b)* | (i) | Protein (coat); | 1 |
| | | (ii) | By multiplying inside a host cell; | 1 |
| | | | **Question 1 total** | **[7]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **2** | *(a)* | | X - gall bladder;<br>Y - stomach; | 2 |
| | *(b)* | (i) | Bile;<br>Lipase;<br>Glycerol; | 3 |
| | | (ii) | carries bile (into small intestine)/bile {travels/passes/flows/ transported} through/bile flows through;<br>NOT releases bile/this is the bile duct/connects gall bladder to intestine/carries bile to pancreas | 1 |
| | | | **Question 2 total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **3** | *(a)* | (i) | Carbon dioxide $CO_2$; NOT Co<br>Water/$H_2O$; | 2 |
| | | (ii) | Chlorophyll; | 1 |
| | *(b)* | (i) | I suitable scale; | 1 |
| | | | II all plots correct; (tolerance +/- 0.5 small square)<br>1 error = 1 mark, 2 errors = 0 mark | 2 |
| | | | III line quality; | 1 |
| | | (ii) | I rises/increases; | 1 |
| | | | II 22-25 | 1 |
| | | (iii) | Same plant/same time;<br>NOT – ref to repeating/reliability | 1 |
| | *(c)* | | Respiration/{release/ for}energy/cellulose/cell wall/(storage as) starch/ protein;<br>NOT {create/produce/make} energy<br>NOT food/growth (this could be neutral) | 1 |
| | | | **Question 3 Total** | **[11]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **4** | *(a)* | | Nucleus; | 1 |
| | *(b)* | (i) | Sugar and phosphate; | 1 |
| | | (ii) | A with T **and** G with C; | 1 |
| | | (iii) | Double helix; | 1 |
| | *(c)* | | Amino acids **+** Proteins; | 1 |
| | | | **Question 4 Total** | **[5]** |

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| Question | | | Marking details | | Marks Available |
|---|---|---|---|---|---|
| **5** | *(a)* | | Biological (control);<br>Accept bio control | | 1 |
| | *(b)* | (i) | *No mites present*<br>*With mites present* | July 380; (reject 380**cm$^2$**)<br>June 200; (reject 200**cm$^2$**) | 2 |
| | | (ii) | Reduces/decreases; | | 1 |
| | | (iii) | August – greatest difference in number/OWTTE; | | 1 |
| | *(c)* | (i) | Check whether it {affects/causes} {disease/damage} to {other organisms/ tomatoes} / does not become a pest itself;<br>NOT disease unqualified/causes disease to humans | | 1 |
| | | (ii) | Further work – need for repetition/check for repeatability/do it {again/ multiple times/three times};<br>NOT reproducibility *Q refers to same scientists* | | 1 |
| | | | **Question 5 Total** | | **[7]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **6/1** | *(a)* | Meiosis (correct spelling required); | 1 |
| | *(b)* | STAGE 2 - 23, 23, 46, 46;<br>STAGE 3 – 4 cells each containing 23; | 1<br>1 |
| | *(c)* | Gametes/sex cells/sperm/eggs/ova;<br>NOT daughter cells | 1 |
| | *(d)* | Different; | 1 |
| | *(e)* | Growth/cell replacement/repair (of damaged) {<u>tissues/cells</u>};<br>NOT asexual reproduction/mitosis/bacterial reproduction/ replication/ cloning | 1 |
| | | **Question 6/1 Total** | **[6]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **7/2** | *(a)* | 4 3 1 2<br>3 or 4 correct = 3 marks<br>2 correct = 2 marks<br>1 correct = 1 mark | 3 |
| | *(b)* | Make reference to {avoiding bias/validity};<br>NOT {fair test/reliability} (could be neutral)/ not to favour an area/give a true result | 1 |
| | | **Question 7 Total** | **[4]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **8/3** | *(a)* | ¶ Amylase digested/ broke down/hydrolysed; NOT turn/change | 1 |
| | | ¶ Starch to glucose; | 1 |
| | | ¶ which {diffused/ passed/ small enough to go} through the {visking tubing/membrane} (into the water); * | 1 |
| | | *Only accessed if second marking point awarded | |
| | *(b)* | Starch molecule too big to pass through {visking tubing/ membrane}; | 1 |
| | *(c)* | Blood/blood stream; | 1 |
| | *(d)* | 1 mark for each correct row | 2 |

| Substance tested for | Reagent used | Colour of reagent | Colour with positive result |
|---|---|---|---|
| **Starch** | Iodine | **Yellow-brown/ Orange/orange-brown/ yellow-orange NOT red/ yellow** | blue- black |
| Glucose | **Benedict's** | blue | **green/yellow/ orange/ /brown/brick red NOT red** |

**Question 8/3 Total** **[7]**

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **9/4** | *(a)* | Bronchiole | 1 |
| | *(b)* | **Indicative content:**<br><br>Air breathed in contains more oxygen than blood arriving at the alveolus. Oxygen dissolves in moisture (accept water) lining alveolus. Oxygen diffuses into blood through the thin alveolus wall. Blood in capillary arriving at alveolus contains more carbon dioxide than air in alveolus. Carbon dioxide diffuses into alveolus. Large surface area of alveolus means increased gas exchange.<br><br>**5 – 6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3 – 4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1 – 2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit. | 6 |
| | | **Question 9/4 Total** | **[7]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **5** | *(a)* | (i) | Liver – arrow **&** name; | 1 |
| | | (ii) | Gall bladder – arrow **&** name; | 1 |
| | *(b)* | (i) | Bile breaks {down/ up} large {lipid/fat/oil} drop(let)s <u>into</u> small drop(let)s;<br>Accept bile emulsifies lipid/fat/oil<br>**NOT** large molecules into small molecules<br>Ref to pH is neutral<br>for <u>increased/bigger/larger surface area</u> for enzyme/lipase action; | 2 |
| | | (ii) | All {lipid/ olive oil} digested/enzyme working flat out; | 1 |
| | | (iii) | Glycerol; | 1 |
| | | | **Question 5 total** | **[6]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **6** | *(a)* | Enzyme –substrate complex; | 1 |
| | *(b)* | Active site is {changed/distorted/altered}/bonds in active site are broken;<br>{Substrate/amino acid} cannot {fit/join/lock };<br>NOT match | 2 |
| | *(c)* | Temperature;<br>pH;<br>NOT PH/Ph<br>Concentration of substrate;<br>Concentration of enzyme;<br>Reject amount/volume/mass | Max 2 |
| | | **Question 6 total** | **[5]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **7** | *(a)* | Carbon dioxide/$CO_2$ | 1 |
| | *(b)* | As temperature increases salt concentration increases;<br>as water is evaporated; (only awarded if 1st mark awarded) | 2 |
| | *(c)* | ¶ Osmosis;<br>(reject if salt water or salt or solutions are moving) | 1 |
| | | ¶ (When salt concentration is high) – water is lost; | 1 |
| | | ¶ Correct statement about water potential/water moves {from where it is in high concentration to where it is in low concentration/ down a concentration gradient} (related to animals/surrounding solution); | 1 |
| | | ¶ Correct mention of selectively permeable membrane/ other correct form of words; | 1 |
| | | **Question 7 total** | **[7]** |

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| Question | Marking details | Marks Available |
|---|---|---|
| **8** | ¶ Active transport/uptake; | 1 |
| | ¶ Requires <u>both</u> oxygen and glucose; | 1 |
| | ¶ For respiration/release of energy; | 1 |
| | ¶ Rate of uptake of glucose follows rate of uptake of cadmium/Rate of uptake of cadmium follows rate of uptake of glucose/the more the rate of uptake the more glucose is used; | 1 |
| | **Question 8 Total** | **[4]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **9** | *(a)* | $\frac{200\times200}{20}$; | 2 |
| | | Answer = 2000; | |
| | | 2 marks for correct answer | |
| | *(b)* | 20/ number recaptured; | 1 |
| | *(c)* | Sample {size/area} may be too small/sample from only one part of lake; | Max 3 |
| | | Sampling needs to repeated (and averaged); | |
| | | Immigration; | |
| | | Predation may have reduced numbers marked/differential predation due to dye/dye makes fish more visible to predators; | |
| | | The dye adds bias to recapture/ dye makes fish easier to see to recapture; | |
| | | (ignore ref to time given to sampling) | |
| | *(d)* | Line rises <u>from February</u>, peaks in {March/April} + then drops; | 1 |
| | | one mark for 12 month scale; (accept letters/numbers for names of months) | 1 |
| | | **Question 9 Total** | **[8]** |

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| Question | Marking details | Marks Available |
|---|---|---|
| **10** | **Indicative content**<br><br>Similarities: both break down glucose and release energy.<br><br>Differences: muscle cells produce lactic acid and no carbon dioxide during anaerobic respiration. Aerobic respiration produces water and carbon dioxide. Aerobic uses oxygen and anaerobic does not. Anaerobic creates oxygen debt, aerobic does not.<br><br>Aerobic is more efficient because it releases more energy per glucose molecule than anaerobic because it completely breaks down glucose.<br><br>**5-6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3-4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1-2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit | |
| | **Question 10 Total** | **[6]** |



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| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# GCSE

4471/02

## ADDITIONAL SCIENCE/BIOLOGY

## BIOLOGY 2
## HIGHER TIER

A.M. TUESDAY, 14 May 2013

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1.** | **4** | |
| **2.** | **6** | |
| **3.** | **8** | |
| **4.** | **6** | |
| **5.** | **6** | |
| **6.** | **8** | |
| **7.** | **8** | |
| **8.** | **8** | |
| **9.** | **6** | |
| **Total** | **60** | |

4471
020001

### ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to question **4** and question **9**.

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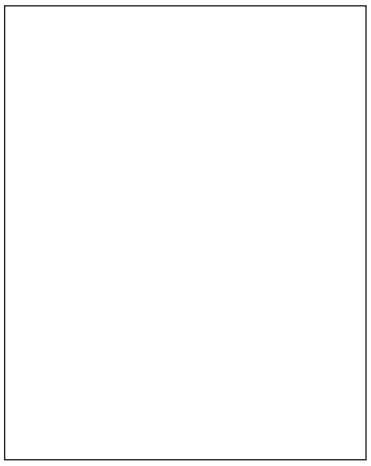


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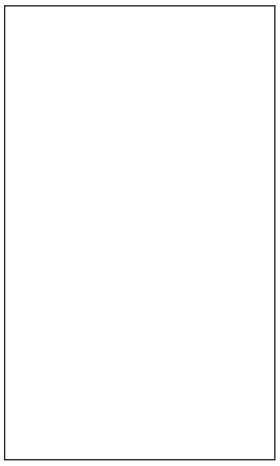
Examiner only

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

**1.** Barack Obama, the President of the United States of America, supports research into the use of embryonic stem cells. However Newt Gingrich, who was hoping to become President, said in February 2012, that he would **'ban embryonic stem cell research if he became President'**.



Barack Obama



Newt Gingrich

*(a)* Suggest why some people support embryonic stem cell research, whereas others do not. [2]

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.....

.....

.....

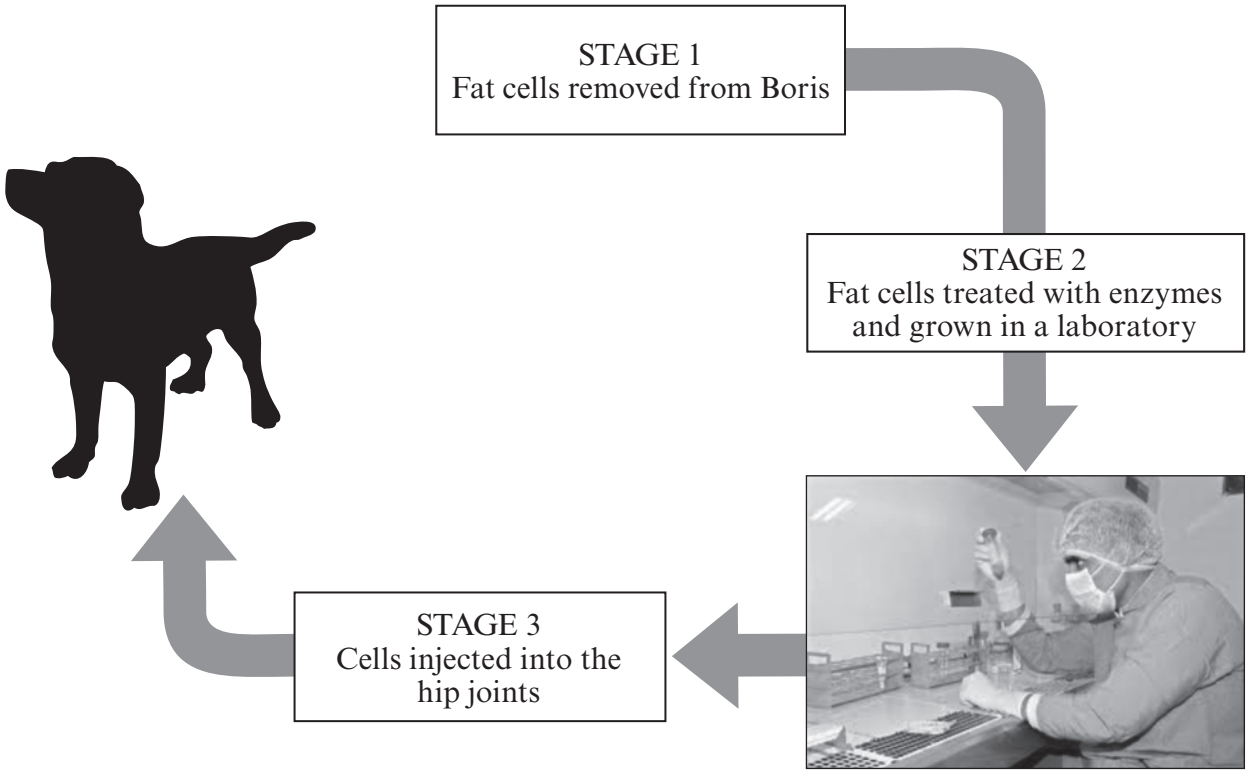
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*(b)* In December 2010, a dog named Boris was treated for severe arthritis of the hip joints in a veterinary clinic in West Michigan, USA. Some of the stages in the treatment are shown below.




Three months after treatment Boris was examined at the veterinary centre. His hips were found to have greatly improved and X-rays of the hip joints showed evidence of repair of the joint tissues.

(i) State what type of cells are injected in STAGE 3 in the diagram above. [1]

.....

(ii) State **one** advantage of this method of treatment over the use of embryonic stem cells. [1]

.....

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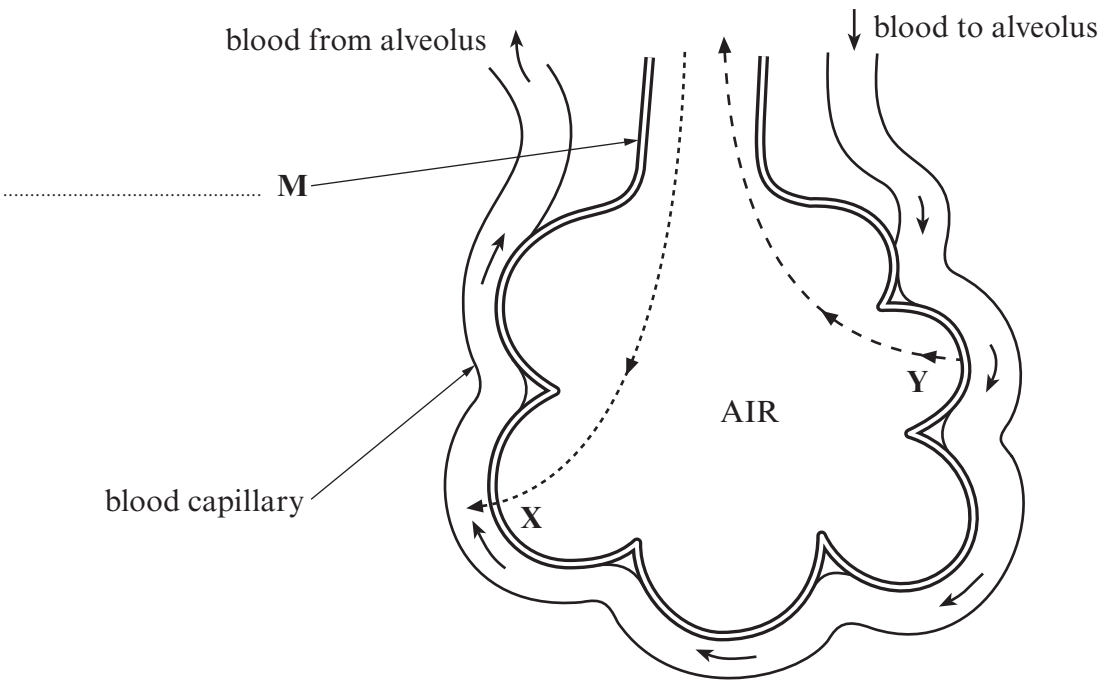
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**2.** The diagram shows an alveolus.




*(a)* (i) Label structure **M** on the diagram above. [1]

(ii) Name gas **Y** shown on the diagram above. ..... [1]

*(b)* Explain how gas **X** passes from the alveolus into the blood capillary. [2]

.....

.....

.....

.....

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*(c)* Complete the table below to show the differences between inspired and expired air. [2]

| Gas | Inspired air (%) | Expired air (%) |
|---|---|---|
| oxygen | 21 | ..... |
| carbon dioxide | ..... | 4 |
| nitrogen | 79 | 79 |
| water vapour | varies | 1 |

6



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**3.** A plant was destarched. A leaf on the plant was treated as shown in diagram **M** below. The plant was then placed in bright sunlight for 6 hours. The leaf was removed and tested for starch. The result is shown in diagram **N**.

Diagram **M**

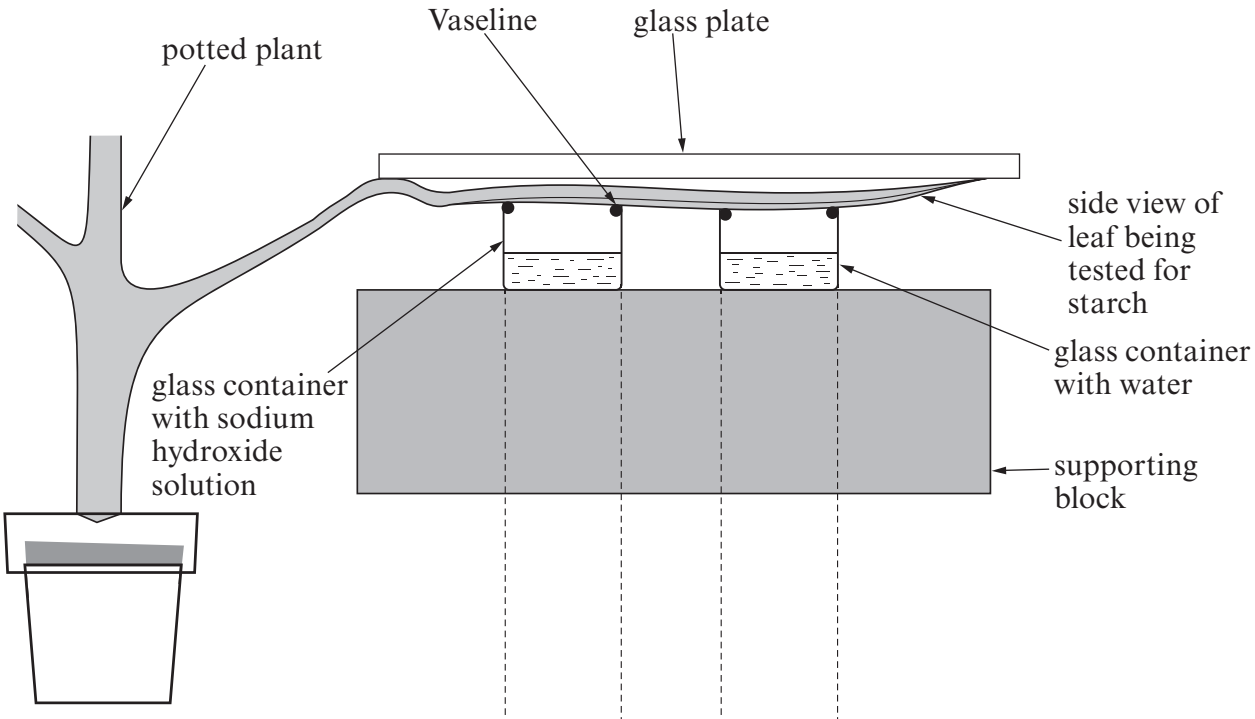
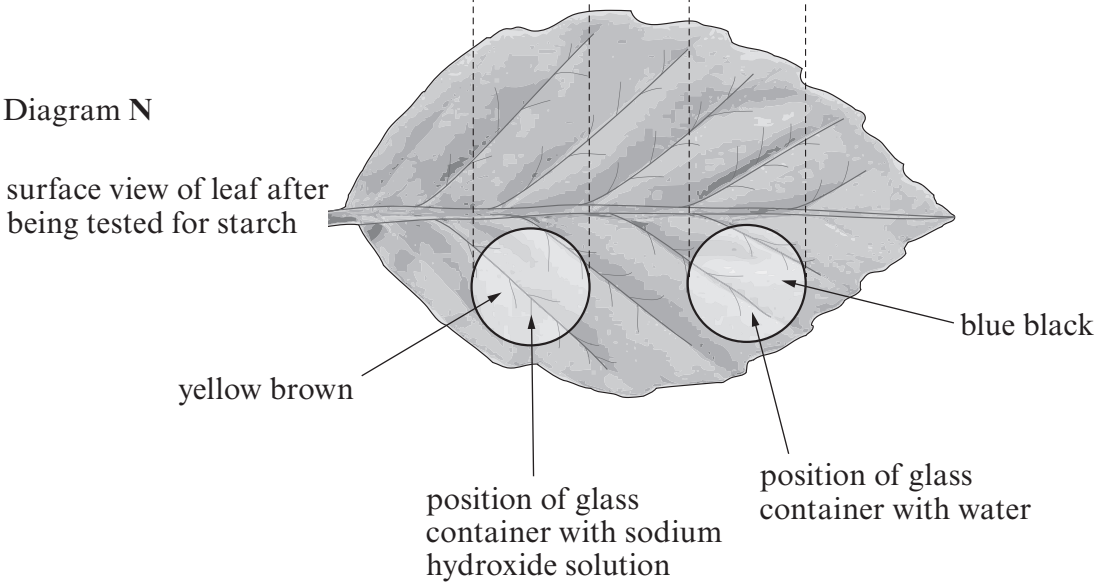



Diagram **N**




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*(a)* State what the investigation shown opposite demonstrates. [1]

.....

.....

*(b)* (i) How would you completely remove all the chlorophyll from the leaf before testing for starch? [1]

.....

.....

(ii) Name the chemical used to test for starch. [1]

.....

(iii) Explain why part of the leaf in diagram **N** is yellow-brown in colour. [3]

.....

.....

.....

.....

.....

*(c)* What was the purpose of the glass container with water? [1]

.....

*(d)* Why is it only possible to form a valid conclusion for this investigation if the glass plate and containers allow light through? [1]

.....

.....



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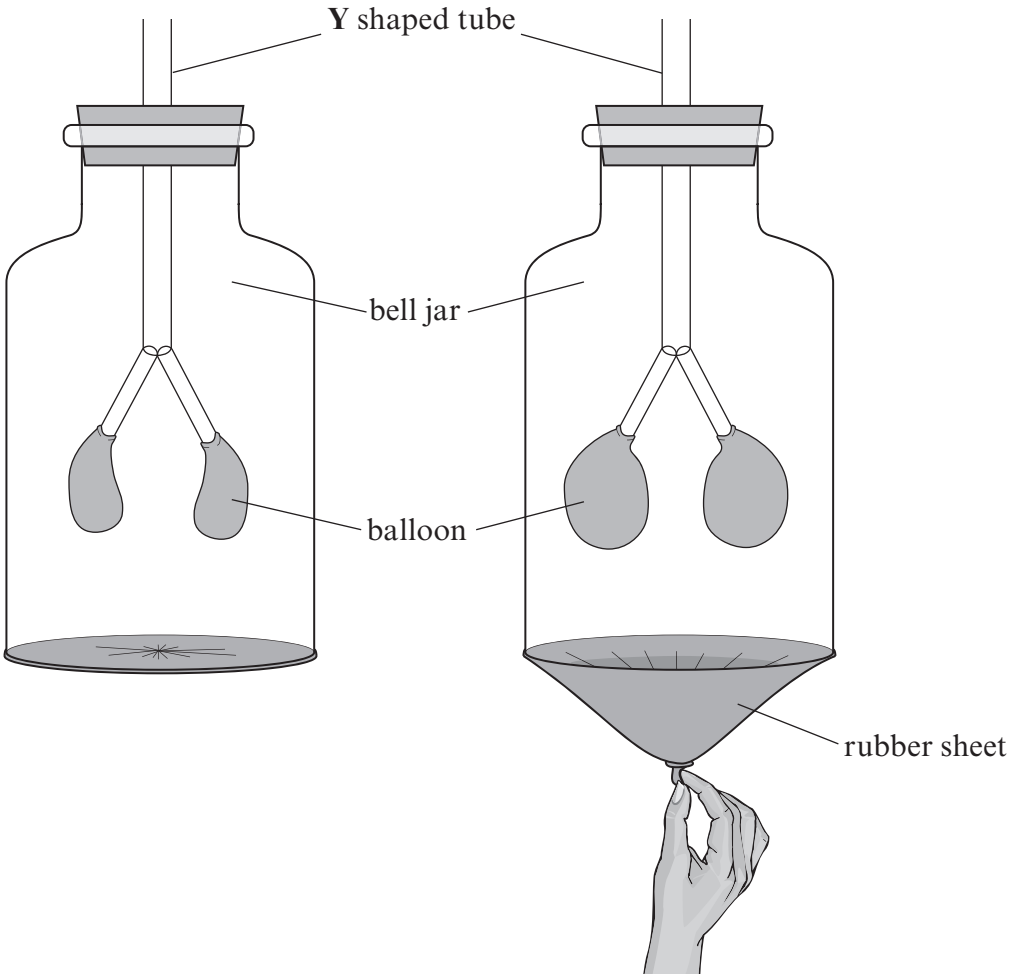


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**4.** Explain how the bell jar model shown below can be used to illustrate **inspiration** (breathing in). In your explanation you must state which organs in the body are represented by the balloons and rubber sheet in the model. [6 QWC]




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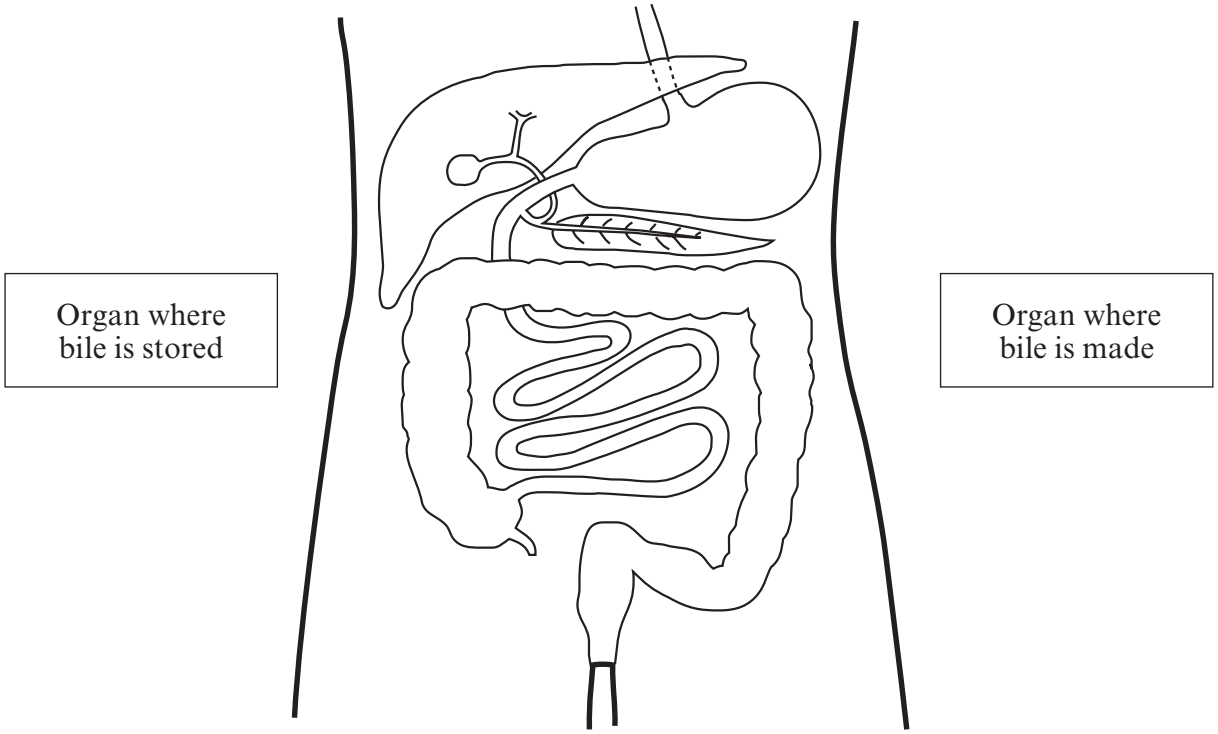


Turn over.

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**5.** The diagram below shows part of the digestive system.




*(a)* On the diagram above carefully draw an arrow from each box to show the organ where:

(i) bile is made; [1]

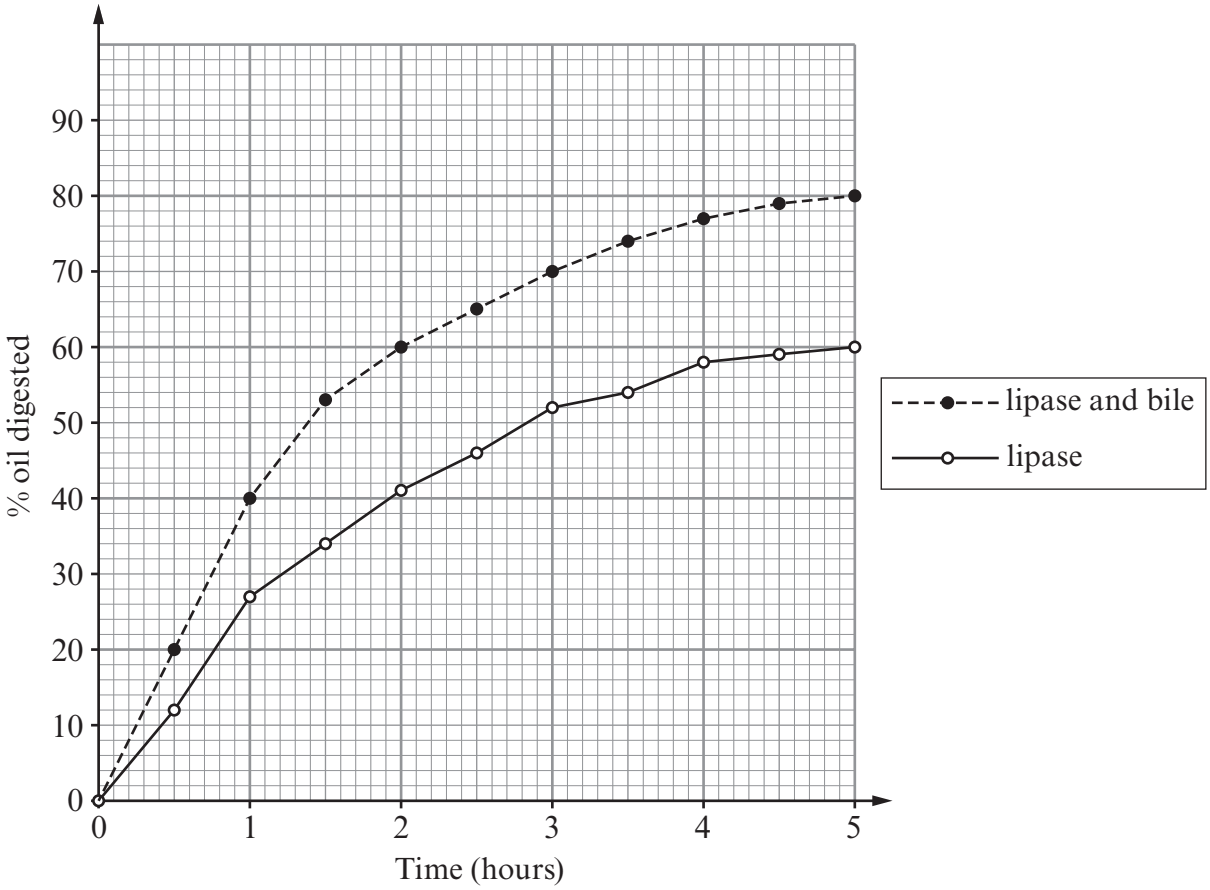
(ii) bile is stored. [1]

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*(b)* The graph below shows the digestion of olive oil (fat) by lipase enzyme at pH9 in the presence and absence of bile.




(i) Using only the information in the graph above **describe** the effect of bile on the rate of digestion of olive oil. [1]

.....

.....

(ii) **Explain** the effect of bile on the digestion of olive oil. [3]

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**Turn over.**

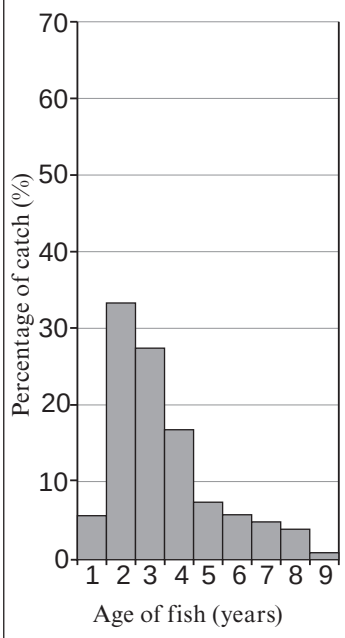
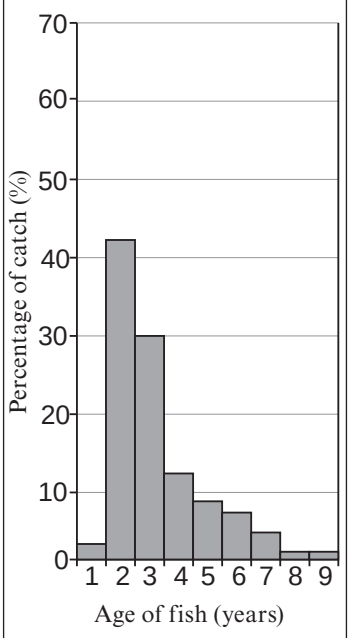
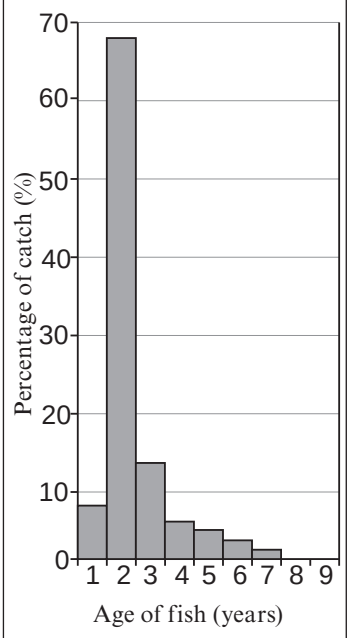
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**6.** There has been legislation by the European Union (EU) to conserve species of fish such as cod.

North Sea cod can grow to a length of 100 cm and a mass of 15 kg. They breed for the first time when they are 3 - 4 years old and 50 cm long. Cod eat other commercially important species of fish.

The data shown below were recorded by monitoring cod caught in the North Sea in three periods between 1958 and 1982.

| **Period** | 1958-62 | 1968-72 | 1978-82 |
|---|---|---|---|
| **Mean catch per year (tonnes)** | 23 352 | 47 223 | 53 383 |
| **Age composition of catch** |  |  |  |



*(a)* State **two** trends in the catch of cod shown in the data. [2]

(i) .....

(ii) .....

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*(b)* Responding to the trends shown in the data, the EU introduced the following limits on the fishing industry:

1. Minimum length of cod to be kept = 30 cm (smaller fish are thrown back)

2. Minimum net mesh size (gaps in fishing net) = 9.0 cm instead of 8.5 cm

By 2011 the population of cod in the North Sea was increasing.
Explain how the limits introduced by the EU helped conserve cod in the North Sea. [3]

.....

.....

.....

.....

*(c)* The EU placed one other limit on the fishing industry to try to conserve cod.
Suggest what this limit was. [1]

.....

.....

*(d)* State **two** reasons why some fishermen were against the legislation made by the EU. [2]

(i) .....

.....

(ii) .....

.....

8

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**Turn over.**

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**7.** • Certain micro-organisms can grow in stored food and may cause the food to spoil.

• Micro-organisms can only grow when they can take in enough water from the food by a type of diffusion.

*(a)* Name this type of diffusion and describe how the micro-organism takes in water. [3]

.....

.....

.....

.....

.....

In the food industry the amount of available water in food is called 'water activity'. Pure water has a water activity of 1.0.

**Table 1** below shows the water activity of some foods.

**Table 1**

| Food | Water activity |
|---|---|
| uncooked fish | 0.96 |
| fish covered in salt | 0.30 |
| strawberry jam | 0.83 |

**Table 2** below shows the lowest water activity at which three different types of micro-organisms can survive.

**Table 2**

| Micro-organism | Lowest water activity at which micro-organisms can survive |
|---|---|
| bacteria | 0.95 |
| yeasts (fungi) | 0.85 |
| moulds (fungi) | 0.70 |

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*(b)* Use the data in the tables opposite to:

(i) name the type of micro-organism that can survive in strawberry jam. [1]

.....

(ii) describe how salt acts as a preservative for fish. [2]

.....

.....

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.....

*(c)* State the methods of asexual reproduction used by: [2]

(i) bacteria; .....

(ii) yeast. .....

8

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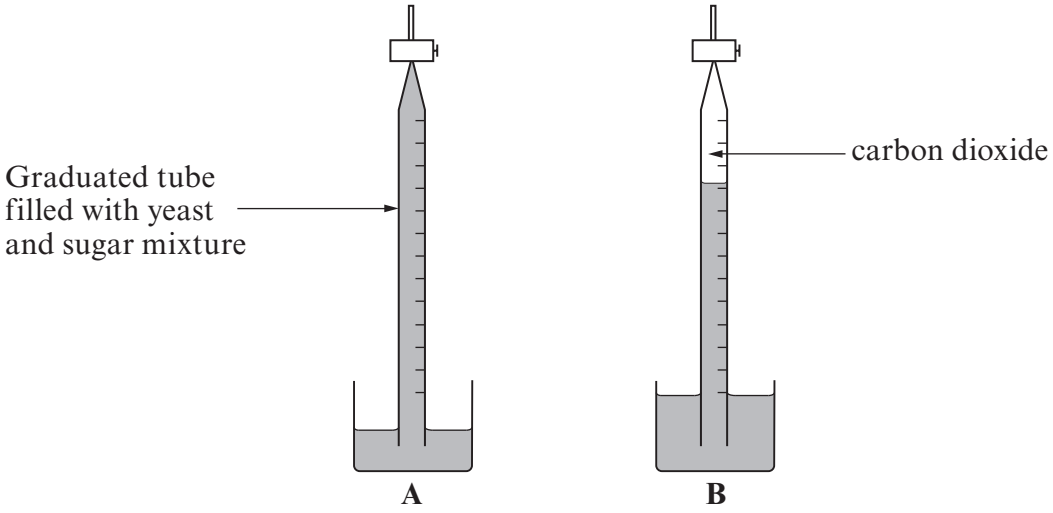


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**8.** Students investigated the production of ethanol from sugars by yeast. They used solutions of the same concentration of four different types of sugars, **P**, **Q**, **R** and **S**. For each sugar, they set up the apparatus as in diagram **A**. The volume of carbon dioxide was measured every five minutes for each apparatus as shown in diagram **B**.




The table below shows the results of the investigation.

| Mixture | Volume of carbon dioxide ($cm^3$) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 5 min | 10 min | 15 min | 20 min | 25 min | 30 min | 35 min |
| yeast + sugar **P** | 3.0 | 10.0 | 17.0 | 26.0 | 35.0 | 38.0 | 40.0 |
| yeast + sugar **Q** | 0.5 | 1.0 | 1.5 | 2.0 | 2.0 | 2.0 | 2.0 |
| yeast + sugar **R** | 0.5 | 1.0 | 1.0 | 1.5 | 1.5 | 1.5 | 1.5 |
| yeast + sugar **S** | 4.0 | 11.0 | 19.0 | 27.0 | 36.0 | 40.0 | 42.0 |
| yeast + water | 0.5 | 0.5 | 0.5 | 1.0 | 1.0 | 1.0 | 1.0 |

*(a)* (i) Suggest which sugar produced the most ethanol. .....

[1]

(ii) Suggest how the mixture of yeast and water was able to produce carbon dioxide.

[1]

.....

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(iii) Why did the rate of production of carbon dioxide eventually slow down in all of the graduated tubes? [1]

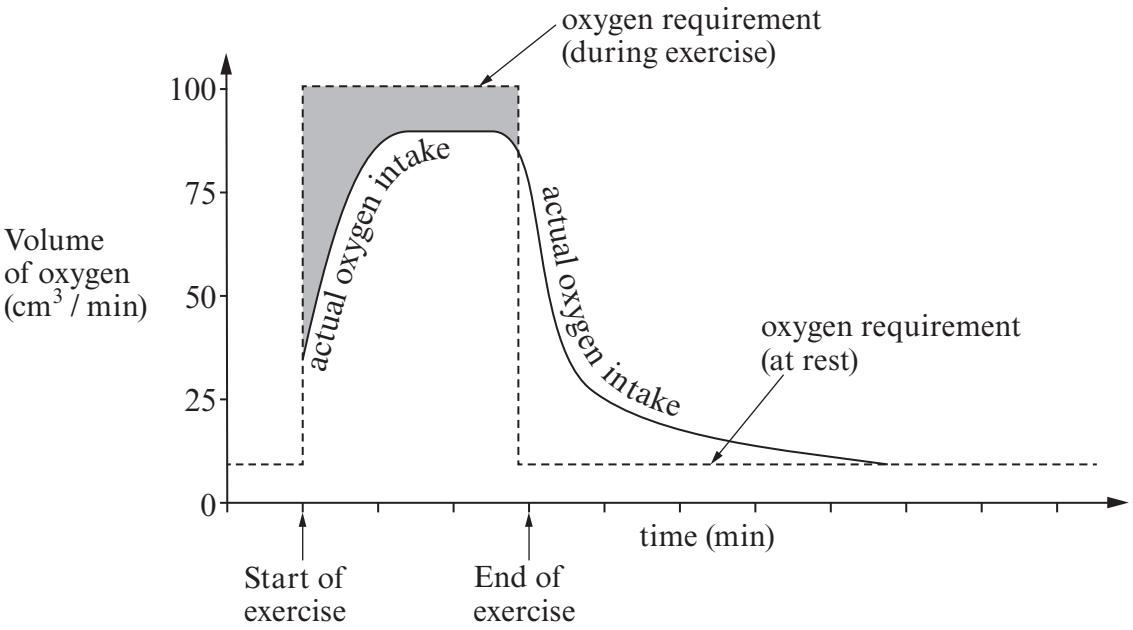
.....

(iv) Why was it important that the graduated tubes were **completely** filled with the yeast and sugar mixture at the start of the investigation? [1]

.....

.....

*(b)* The graph below shows the volume of oxygen required during exercise and the actual volume of oxygen taken in by an athlete.




(i) State the term used to describe the difference between the volume of oxygen required and the actual oxygen intake, as shown by the shaded area of the graph above. [1]

.....

(ii) State the chemical that is produced in the shaded area of the graph shown above. [1]

.....

(iii) How would you expect the shaded area in the graph above to be affected by a long period of regular training by an athlete? [1]

.....

(iv) State the type of respiration that takes place during rest. [1]

.....

8

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**9.** Outline the basic structure of DNA and explain the meaning and importance of the genetic code in the production of proteins. An account of protein synthesis is not required.

DO NOT USE DIAGRAMS. [6 QWC]

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**END OF PAPER**

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# GCSE MARKING SCHEME

## BIOLOGY

## SUMMER 2013

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## INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2013 examination in GCSE BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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**Science - Biology**

**B2**

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 1 | *(a)* | (i) | Selling to florists/ floral industry/ bouquets; | 1 |
| | | (ii) | Cutting too many leaves/ cutting too often/ removing too many leaves;<br>NOT cutting down | 1 |
| | *(b)* | | (Decrease)<br>loss of (animal) species/ species becoming extinct/ less or fewer species;<br>Reject animals haven't got enough food/ numbers decreasing/ species will die/ not enough food to feed all the species<br>Reject type instead of species | 1 |
| | *(c)* | | (Palm) tree slow growing/ long time needed to produce (enough) leaves (to sell)/ only two leaves are produced each year;<br>NOT two leaves are produced each year | 1 |
| | *(d)* | | Employment/ local economy/ lose source of money/ no crops for farmers/ can't sell them to make money/ ORA; | 1 |
| | | | **Question 1 total** | **[5]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 2 | *(a)* | (i) | protein – amino acids<br>starch – glucose<br>fats – fatty acids and glycerol<br><br>2/3 correct lines;;<br>(1 correct = 1 mark) | 2 |
| | | (ii) | For absorption/ pass through cell/ for getting into blood/ for use by cells/ pass through cell membrane; | 1 |
| | | (iii) | {for /to release / to get} source of energy;<br>NOT produce energy/ make energy | 1 |
| | *(b)* | (i) | I F<br>II G; | 1 |
| | | (ii) | C and E; | 1 |
| | *(c)* | | Benedicts (reagent);<br>Protein; | 2 |
| | | | **Question 2 total** | **[8]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 3 | *(a)* | (i) | Suitable scale properly labelled; | 1 |
| | | (ii) | Correct plots; ½ small square tolerance | 2 |
| | | | 1 error = 1 mark 2 errors = 0 | |
| | | | No extrapolation | |
| | | (iii) | Good quality line through the centre of the points with ruler; | 1 |
| | *(b)* | (i) | Rises then falls/ goes up and then goes down/ goes to maximum and then drops; | 1 |
| | | (ii) | Correct readings from graph shown in working; | 1 |
| | | | Ideally (51 – (Any reading between 23 and 24)) | |
| | | | Consequent correct answer; (27/ 27.5/ 28) | 1 |
| | | | Accept ecf | |
| | | | *If no working shown accept correct answer for 2 marks if consistent with graph* | |
| | *(c)* | (i) | 1 ($cm^3$) **and** 5 ($cm^3$); | 1 |
| | | | Fair test/ comparison; | 1 |
| | | (ii) | (Boiled) enzyme – denatured/ destroyed; | 1 |
| | | | NOT 'killed' | |
| | *(d)* | | Fat; | 1 |
| | | | **Question 3 Total** | **[11]** |

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| Question | | | Marking details | | Marks Available |
|---|---|---|---|---|---|
| 4 | *(a)* | | **A** Cytoplasm;<br>**B** Cell membrane; | | 2 |
| | *(b)* | (i) | **Part of algal cell** | **Function** | 3 |
| | | | nucleus | Controls cells (activities)/ holds or contains {chromosomes/ DNA/ genes/ genetic information} ; | |
| | | | Chloroplast; | photosynthesis | |
| | | | Cell wall | Shape/ support/ rigid structure/ stops cell expansion;<br>NOT protection/ structure unqualified/ keeps it strong/ gives stability | |
| | | (ii) | I chloroplast/ cell wall;<br>II nucleus/ chloroplast; | | 2 |
| | | | **Question 4 Total** | | **[7]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| 5 | *(a)* | B; | 1 |
| | *(b)* | Phosphate **and** sugar; (either order) | 3 |
| | | Bases; | |
| | | Helix; | |
| | *(c)* | Code (for amino acids); | 1 |
| | | NOT ‘code for life’ | |
| | | **Question 5 Total** | **[5]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 6/1 | *(a)* | | (Obama) believes that embryonic stem cell research will lead to the {treatment/ cure} of many diseases/ treat {damaged tissue/ or correct example}. (OWTTE); | 1 |
| | | | (Gingrich) – reference to the ethical issues involved eg destruction of {embryos/ foetus/ unborn children}/ life is lost/ destroying (potential human) life;<br>NOT - playing God | 1 |
| | *(b)* | (i) | stem cells; | 1 |
| | | (ii) | avoids ethical issues of {using/killing} {unborn children/ embryos/ foetus}/<br>cells more likely to be accepted by the body/less likelihood of rejection;<br>NOT less chance of transfer of disease/ nothing is killed/ less controversial unqualified | 1 |
| | | | **Question 6/1 Total** | **[4]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 7/2 | *(a)* | (i) | Bronchiole; | 1 |
| | | (ii) | carbon dioxide/$CO_2$ (not $CO^2$/$Co_2$/CO2 etc); | 1 |
| | *(b)* | | dissolves in {moist/ water} lining (of alveolus)(not dissolves in water vapour)/ passes in solution;<br>diffuses (no ref. to diffusion gradient required);<br>diffuses in solution = 2 marks | 2 |
| | *(c)* | | | 2 |

| *Gas* | *Inspired air (%)* | *Expired air (%)* |
|---|---|---|
| Oxygen | 21 | 16; |
| Carbon dioxide | 0.04; | 4 |
| Nitrogen | 79 | 79 |
| Water vapour | varies | 1 |

**Question 7/2 Total** **[6]**

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 8/3 | *(a)* | | carbon dioxide/$CO_2$ (not $CO^2$ or $Co_2$ etc) required for photosynthesis/starch manufacture; | 1 |
| | *(b)* | (i) | {Boil/ heat} in {alcohol/methanol/ethanol};<br>Boiling water = neutral | 1 |
| | | (ii) | Iodine (solution); | 1 |
| | | (iii) | no $CO_2$/ $CO_2$ absorbed by sodium hydroxide;<br>no photosynthesis;<br>no starch produced; | 3 |
| | *(c)* | | Control/ to make a comparison; | 1 |
| | *(d)* | | because you wouldn't know whether it was the lack of light or lack of carbon dioxide which prevented photosynthesis/starch production;<br>Answer must refer to both carbon dioxide and light limiting photosynthesis | 1 |
| | | | **Question 8/3 Total** | **[8]** |

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| Question | Marking details | Marks Available |
|---|---|---|
| 9/4 | **Indicative content**<br><br>The balloons represent lungs.<br>The rubber sheet represents diaphragm.<br>When rubber sheet is pulled down,<br>the volume of air-tight space around balloons increases<br>and pressure decreases/ drops/ goes down.<br>The balloons inflate/ expand/ blow up as<br>air is drawn in.<br><br>**5-6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3-4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1-2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit | 6 |
| | **Question 9/4 Total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 5 | *(a)* | (i) | arrow pointing to liver; | 1 |
| | | (ii) | arrow pointing to gall bladder;<br>(ends of arrows must touch or go into each organ) | 1 |
| | *(b)* | (i) | speeds up (digestion)/ allows more to be digested; | 1 |
| | | (ii) | Break down large droplets of oil (into small droplets)/ emulsifies;<br>NOT reference to molecules<br>NOT reference to digestion<br>increase surface area; Must be clear that it is in reference to oil droplets, especially if first mark is not given<br>for lipase to work/for enzyme action; (cannot be given alone) | 3 |
| | | | **Question 5 Total** | **[6]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| 6 | *(a)* | Mean catch/ mass caught increased;<br>{Number/ percentage} of {young fish/ two year old fish} caught increased/ {number/ percentage} of {older fish/ 4-9 year old fish} caught decreased; | 2 |
| | *(b)* | Larger mesh size means {smaller/ younger} fish are not {caught/escape}/ smaller fish thrown back;<br>young fish survive to {grow/ reach breeding age}/ young fish grow to 3-4 years of age;<br>So would {breed/ reproduce};<br>(third marking point cannot be given alone) | 3 |
| | *(c)* | {Reduce/ limit} the {quota/ size of catch/ mass of fish}/ Restrict {days/ time} fishing boats can be used/ reduce {surface area/ size} of net/ reduce length of fishing season/ introduce no fishing; | 1 |
| | *(d)* | Any two from<br>Reference to less employment;<br>Less fish sold/ reference to money;<br>reduction of other species because cod is a predator/ cod eat other commercially important species;<br>cost of buying new nets or equipment; | 2 |
| | | **Question 6 total** | **[8]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 7 | *(a)* | | Osmosis;<br>Movement (of water) {from where it is in high concentration to low concentration/ down a concentration gradient} <u>into</u> the micro-organism;<br>Via a semi permeable membrane; | 3 |
| | *(b)* | (i) | Mould(s)/ moulds (fungi); | 1 |
| | | (ii) | Removes water (from food)/ causes water to pass out (of food);<br>NOT salt absorbs water from fish<br>Until water activity is too low for micro-organisms ( or named micro-organism) to survive/ water activity is less therefore no micro-organisms can survive; | 2 |
| | *(c)* | | Bacteria by division/ dividing into two/ dividing/ splitting/ fission;<br>NOT mitosis<br>Yeast by budding; | 2 |
| | | | **Question 7 total** | **[8]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| 8 | *(a)* | (i) | S; | 1 |
| | | (ii) | Because of sugar stored in the yeast; | 1 |
| | | (iii) | Sugar was used up/ no sugar left/ alcohol poisoned (killed) yeast; | 1 |
| | | (iv) | To show any gas (carbon dioxide) production was caused by yeast/ eliminate oxygen/ prevent aerobic respiration/ to be able to measure from {the same starting point/ zero};<br>NOT so no gas present | 1 |
| | *(b)* | (i) | Oxygen debt; | 1 |
| | | (ii) | Lactic acid; | 1 |
| | | (iii) | Would be reduced; | 1 |
| | | (iv) | Aerobic; | 1 |
| | | | **Question 8 total** | **[8]** |

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| Question | Marking details | Marks Available |
|---|---|---|
| 9 | **Indicative content**<br><br>Two chains of alternating sugar and phosphate molecules connected by bases. The chains are twisted to form a double helix. There are 4 bases: adenine, thymine, cytosine and guanine. Base pairing occurs between A and T; C and G. Triplet codes determine types of amino acids. The order of amino acids will determine the particular protein produced.<br><br>**5-6 marks**<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>**3-4 marks**<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>**1-2 marks**<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>**0 marks**<br>The candidate does not make any attempt or give a relevant answer worthy of credit.<br><br>**Question 9 Total** | **[6]** |

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| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# New GCSE

4471/02

# ADDITIONAL SCIENCE
## HIGHER TIER
## BIOLOGY 2

A.M. WEDNESDAY, 9 January 2013

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1** | **2** | |
| **2** | **3** | |
| **3** | **5** | |
| **4** | **8** | |
| **5** | **6** | |
| **6** | **6** | |
| **7** | **7** | |
| **8** | **7** | |
| **9** | **7** | |
| **10** | **9** | |
| **Total** | **60** | |

4471
020001

### ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

### INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

### INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to question **5** and question **10**.

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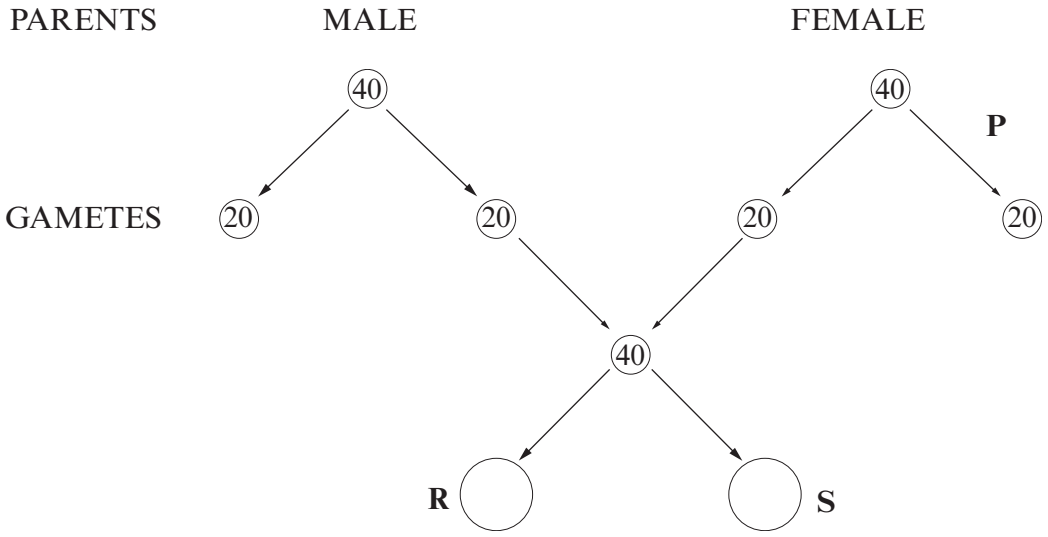


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*Answer* **all** *questions.*

**1.** The following diagram represents the stages in the life cycle of a mammal.
The numbers of chromosomes in cells at different stages in the life cycle are shown.




*(a)* Name the type of cell division taking place at letter **P**. [1]

.....

*(b)* Complete the diagram above by writing in the number of chromosomes found in **each** of the cells labelled **R** and **S** produced during growth. [1]

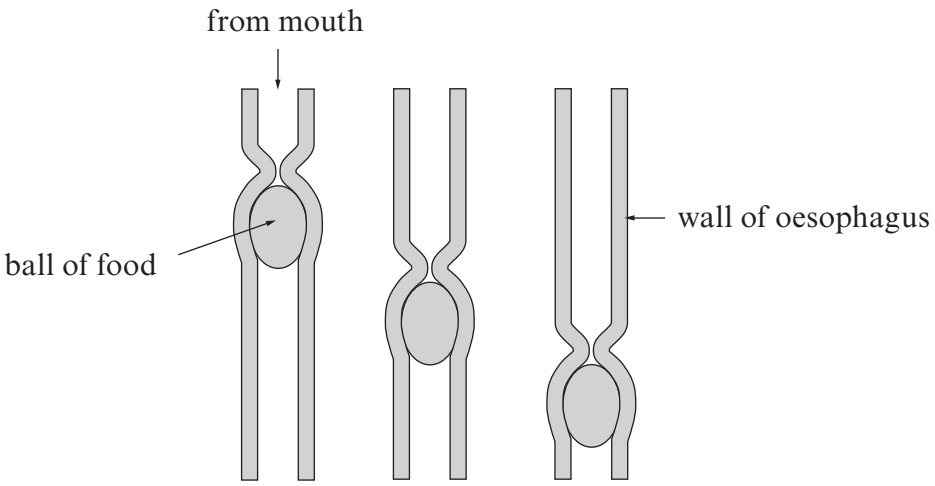
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**2.** The diagram shows a ball of food moving along the oesophagus (gullet).




*(a)* What name is given to this process? [1]

.....

*(b)* Explain how the ball of food is moved along the oesophagus. [2]

.....

.....

.....

3

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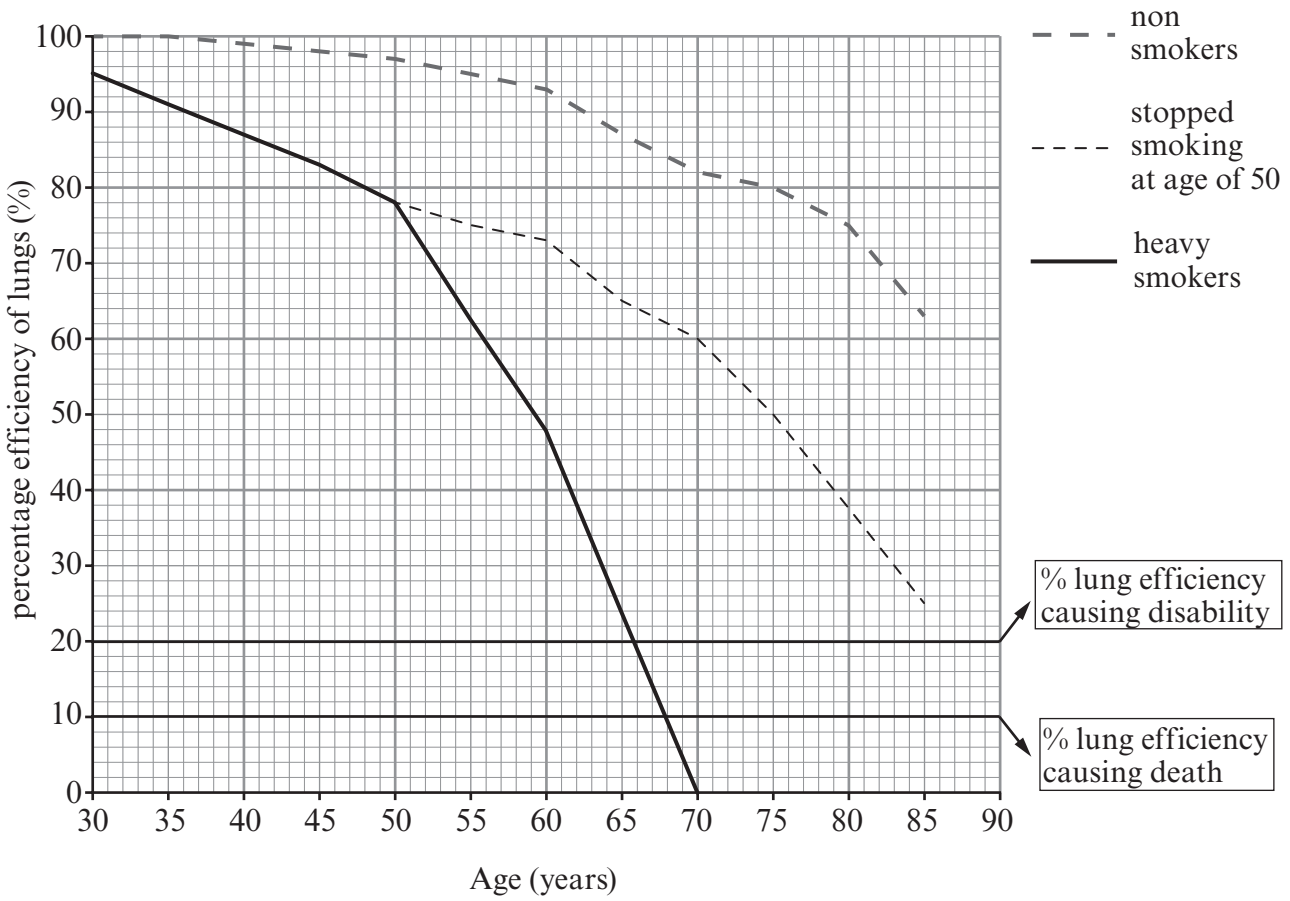


**Turn over.**

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**3.** The graph below shows the efficiency of the lungs (how well they work) in three different groups of people: non-smokers, smokers who stopped smoking at the age of 50 and heavy smokers.




*(a)* What is the difference in percentage efficiency of a 60 year old non-smoker and a 60 year old heavy smoker? [1]

..... %

*(b)* (i) Continuing to smoke heavily can damage the lungs and lead to disability. At what age does the graph above show this disability occurring? [1]

.....

(ii) Suggest what the lung damage mentioned in (i) could be. [1]

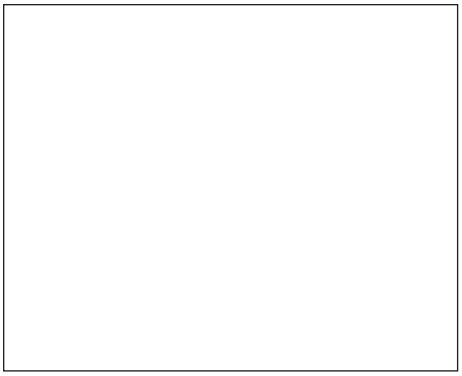
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*(c)* Susan is a 50 year old heavy smoker.



Use the graph opposite to suggest what Susan might expect to happen if she gives up smoking now. [2]

.....

.....

.....



5

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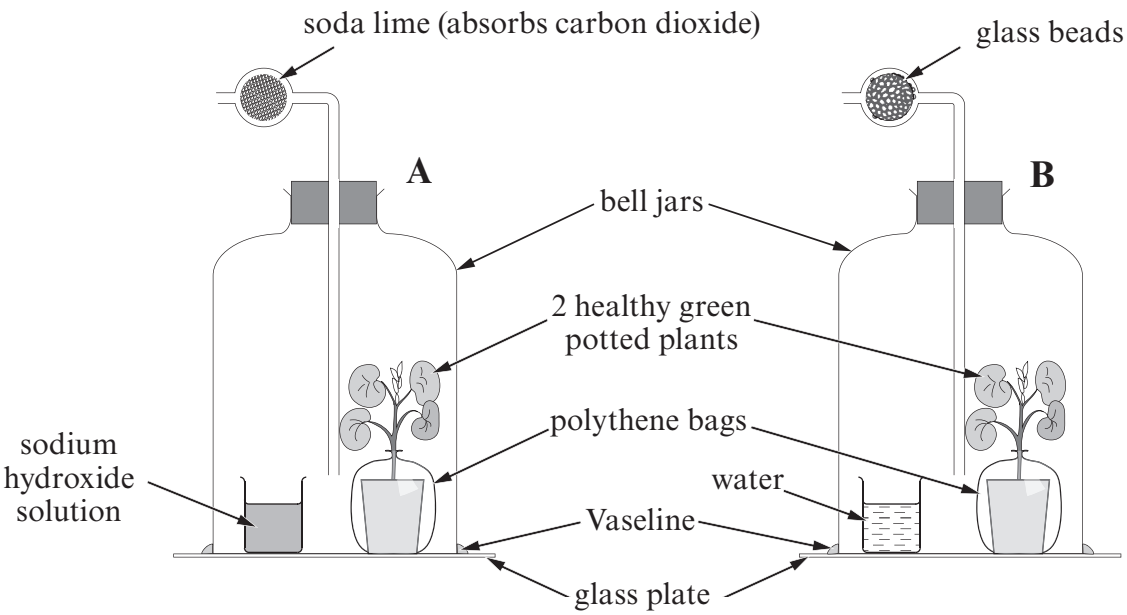


**Turn over.**

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**4.** The experiment was set up in a school laboratory using the apparatus shown below and left near a window for 4 days.




*(a)* State the purpose of the experiment. [1]

.....

*(b)* State the function of

(i) the polythene bag [1]

.....

.....

(ii) the sodium hydroxide solution [1]

.....

.....

(iii) the apparatus labelled **B**. [1]

.....

.....

(iv) the Vaseline. [1]

.....

.....

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*(c)* Explain why the plants were placed in the dark for 48 hours prior to the experiment. [1]

.....

.....

*(d)* At the end of the experiment a leaf was taken from each plant and tested for starch. State the colour observed for each leaf and the reason.

(i) Apparatus **A** [1]

colour observed .....

reason .....

.....

(ii) Apparatus **B** [1]

colour observed .....

reason .....

.....



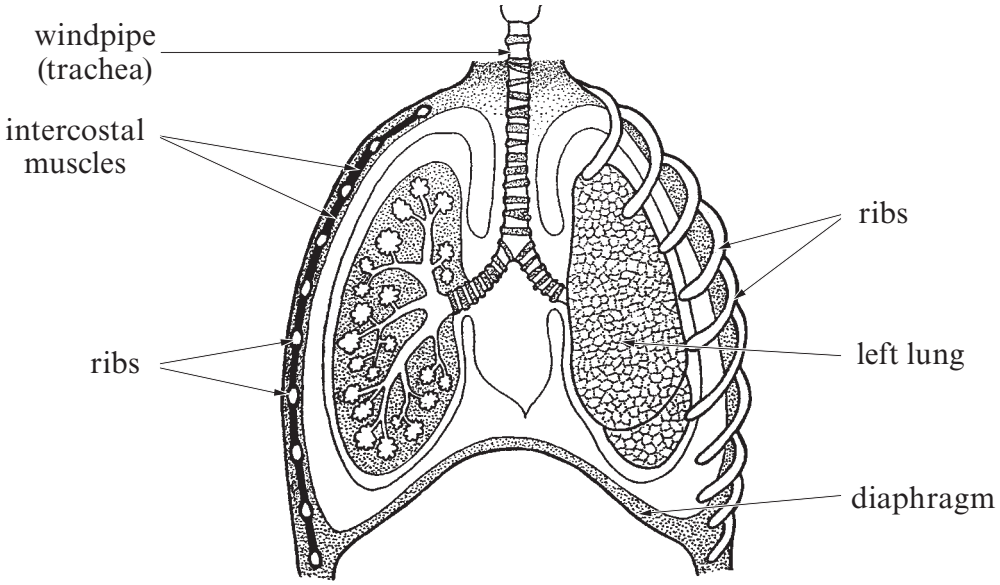
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**5.** The diagram below shows a section through the chest.




Use the above diagram **and your own knowledge** to explain how air is drawn into the lungs during inspiration (breathing in). [6 QWC]



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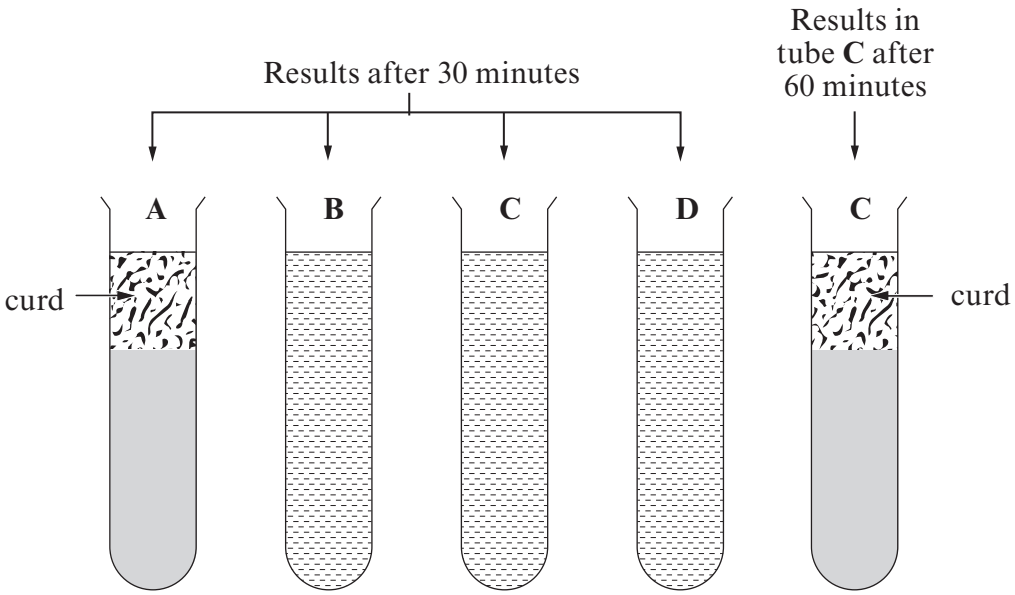


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**6.** Rennilase is an enzyme which acts on milk during cheese making. It turns milk protein into solid milk curd.
An experiment using rennilase was set up as shown by the table below.

| Tube | **A** | **B** | **C** | **D** |
|---|---|---|---|---|
| Contents of test tube at start | rennilase | rennilase | rennilase | boiled, cooled rennilase |
| | milk | milk | milk | milk |
| pH | 4.5 | 9 | 4.5 | 4.5 |
| Temperature (°C) | 30 | 30 | 15 | 30 |




*(a)* (i) State the effect of pH on the action of rennilase. [1]

.....

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(ii) Explain why no curd was produced in tube **D**. [1]

.....

(iii) Explain why no curd was produced in tube **C** after **30** minutes. [2]

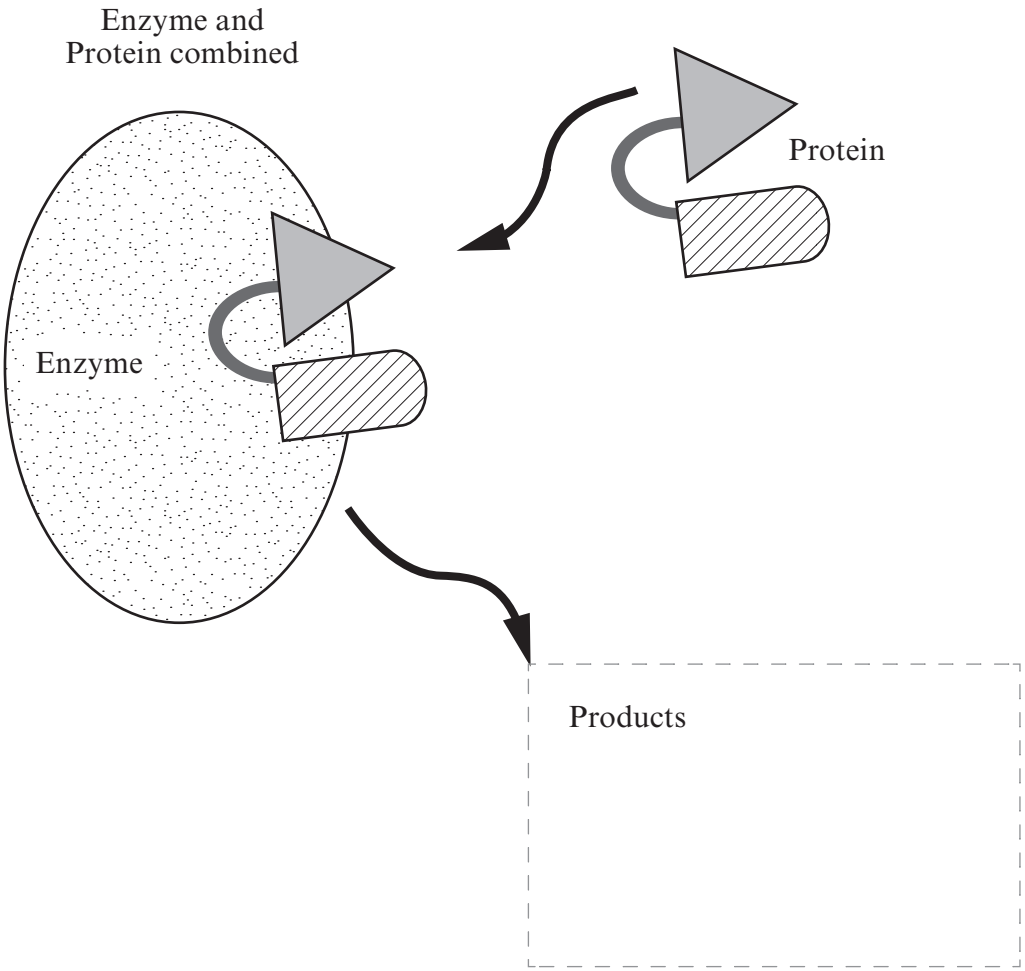
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*(b)* The diagram below shows a model of an enzyme reacting with a protein molecule.

(i) In the box below, sketch the products that would result from this enzyme reaction. [1]




(ii) State the name given to this model of enzyme action. [1]

.....

6

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**7.**

- Sheep and cattle can be infected with a disease caused by the bluetongue virus.
- The bluetongue virus is carried by biting insects called midges.
- Midges can be killed by insecticides.
- Researchers at Swansea University have discovered a fungus *(Metarhizium anisopliae)* that can kill midges under laboratory conditions.
- In 2011 field trials began to investigate if midges can be controlled by the fungus.

*(a)* (i) Describe the basic structure of a virus. [2]

.....

.....

.....

(ii) Underline the most accurate statement below concerning the reproduction of viruses: [1]

Viruses only reproduce in

I dead cells

II animal cells

III living cells

IV plant cells

*(b)* Suggest **one** disadvantage of the use of insecticides in killing midges. [1]

.....

*(c)* What term is used to describe the use of a fungus to kill midges? [1]

.....

*(d)* Suggest **two** possible problems which could prevent the fungus being used successfully in killing the midges in the field trials. [2]

I. .....

.....

II. .....

.....

7

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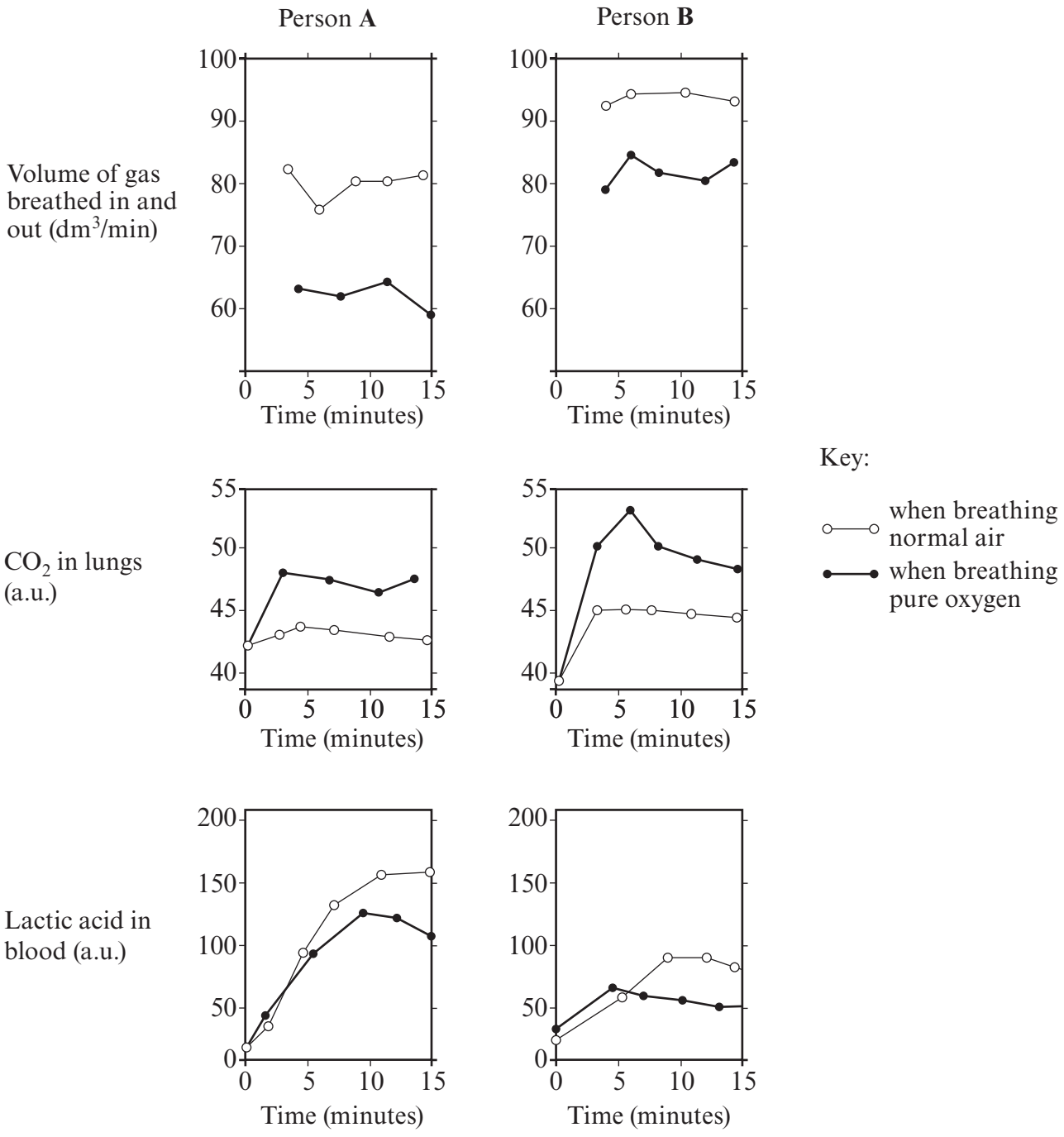
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**8.** Two people, **A** and **B**, exercised vigorously for 15 minutes. The following measurements were taken for each person during the exercise:

- volume of gas breathed in and out
- carbon dioxide in the lungs
- lactic acid in the blood

The people then rested and repeated the process while breathing pure oxygen. The results are shown in the following graphs.




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*(a)* (i) Use the graphs opposite to state the effect of breathing pure oxygen, compared to breathing normal air, on the **volume** of gas breathed in and out per minute. [1]

.....

(ii) Person **B** is a trained athlete; person **A** is not. Give **three** pieces of evidence from the graphs to support this. [3]

I. .....

.....

II. .....

.....

III. .....

.....

*(b)* State the chemical that is changed into lactic acid. [1]

.....

*(c)* Suggest why there is more carbon dioxide present in the lungs when pure oxygen is breathed rather than breathing normal air. [1]

.....

.....

.....

*(d)* Give a reason for the lower level of lactic acid when pure oxygen is breathed. [1]

.....

.....

.....

7

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**Turn over.**

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**9.**



*White clawed crayfish*

The population of the British white clawed crayfish, *Potamobius pallipes*, has been decreasing in Wales.
In order to conserve the species, scientists from the Environment Agency Wales (EAW) released 50 white clawed crayfish into the river Rhymney in South Wales in 2010.
Two years later, the population of *Potamobius pallipes* was estimated at the place where they were released using the following method:

56 were captured, marked and released. The next day, a total of 48 were captured, of which 16 had been marked on the previous day.

The size of the population for the area sampled can be calculated using the formula:

$$\mathbf{P = \frac{a \times b}{r}}$$

Where **P** = population
**a** = number captured, marked and released in the first sample
**b** = number captured in second sample
**r** = number recaptured

*(a)* Calculate the population of *Potamobius pallipes* in the area sampled. [2]
Show your working.

Answer = .....

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*(b)* What could the scientists do to be more confident of the results? [1]

.....

*(c)* In the calculation completed on the opposite page, what assumption is being made about the movement of individuals into (immigration) and out of (emigration) the area sampled? [1]

.....

.....

*(d)* Suggest **three** ways in which an introduced alien species of crayfish could increase the death rate of *Potamobius pallipes* in the river Rhymney. [3]

I. .....

.....

II. .....

.....

III. .....

.....

7

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**10.** In 2010, an accident happened at an offshore oil well in Louisiana. Many thousands of tonnes of oil leaked out and caused massive pollution to oyster fisheries.
Oysters live in sea water with a salt concentration of 2%.
In order to flush away the oil, fresh water was pumped over the oysters. This lowered the salt concentration to almost zero and caused most of the oysters to die.

*(a)* Explain why most of the oysters died. [6 QWC]

.....

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*(b)* Oysters need copper to make a chemical that carries oxygen around their bodies. The oysters concentrate the copper in their bodies from sea water where it is in a very low concentration.

(i) Name the process by which oysters concentrate the copper in their bodies. [1]

.....

(ii) State **two** ways in which this process differs from diffusion. [2]

I. .....

II. .....

**END OF PAPER**

9

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# GCSE MARKING SCHEME

## SCIENCE - BIOLOGY (NEW)

## JANUARY 2013

## INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2013 examination in GCSE SCIENCE - BIOLOGY (NEW). They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.


| Unit | Page |
|---|---|
| BIOLOGY 1 (NEW) FOUNDATION TIER | 1 |
| BIOLOGY 1 (NEW) FOUNDATION & HIGHER TIER | 7 |
| BIOLOGY I (NEW) HIGHER TIER | 13 |
| BIOLOGY 2 (NEW) FOUNDATION TIER | 19 |
| BIOLOGY 2 (NEW) FOUNDATION & HIGHER TIER | 25 |
| BIOLOGY 3 (NEW) HIGHER TIER | 31 |


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**GCSE BIOLOGY 2 (NEW) MARK SCHEME - JANUARY 2013**

**FOUNDATION TIER**

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.1** | (a) | | Turtle dove + greatest decrease/ decreased the most/ highest decrease; | 1 |
| | (b) | | 1040; | 1 |
| | (c) | (i) | Turtle dove/ Grey Partridge; | 1 |
| | | (ii) | Pied Flycatcher/ Cuckoo; | 1 |
| | (d) | | Decrease + {fewer/ less} species/ less biodiversity/ species die out/ fewer bird species;<br>NOT fewer birds/ not many species | 1 |
| | | | **Question Total** | **[5]** |

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| Question | | | Marking details | | Marks Available |
|---|---|---|---|---|---|
| **Q.2** | (a) | (i) | A cytoplasm;<br>B cell membrane;<br>C cell wall; | | 3 |
| | | (ii) | Chloroplast;<br>Photosynthesis; | | 2 |
| | | (iii) | Nucleus (allow chloroplast);<br>NOT vacuole | | 1 |
| | (b) | | EM for dead cells/ tissues only; | | 1 |
| | | | | **Question Total** | **[7]** |

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| Question | | Marking details | | Marks Available |
|---|---|---|---|---|
| **Q.3** | (a) | A oesophagus;<br>B pancreas;<br>C liver; | | 3 |
| | (b) | Carbohydrate/ starch;<br>Lipase;<br>glycerol; | | 3 |
| | (c) | Biuret solution (as specification); | | 1 |
| | | | **Question Total** | **[7]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.4** | (a) | | Oxygen <u>and</u> carbon dioxide; | 1 |
| | (b) | (i) | I scale; | 1 |
| | | | II correct plots; | 2 (-1 error) |
| | | | III line quality; | 1 |
| | | (ii) | I increase then plateau; | 1 |
| | | | II 4 – 6 days; | 1 |
| | | (iii) | Heat/ thermal; | 1 |
| | (c) | | No <u>respiration</u> (in dead peas); | 1 |
| | (d) | (i) | Avoid heat loss (or gain)/ avoid temperature change – due to environment/ retain heat/ prevent heat loss/ stop heat loss/ keep heat in/ insulation/ ORA e.g. glass flask allows heat to escape; NOT contain heat/ keep it warm; | 1 |
| | | (ii) | Prevent growth of micro-organisms/ kill bacteria/ ensure no living {bacteria/ microbe/ fungi/ micro-organism}/ destroy bacteria; NOT get rid of bacteria/ stop microbes respiring; | 1 |
| | | | **Question Total** | **[11]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.5** | (a) | (i) | Sugar;<br>base; | 2 |
| | | (ii) | A and T; | 1 |
| | | (iii) | Twisted/ (double) helix ( as spec)/ spiral; | 1 |
| | (b) | | Amino acids;<br>Protein; | 2 |
| | | | **Question 5 Total** | **[6]** |

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| Question | | Marking details | | Marks Available |
|---|---|---|---|---|
| **Q.6/1** | (a) | Meiosis – spelling correct; | | 1 |
| | (b) | 40 in each cell; | | 1 |
| | | | **Question Total** | **[2]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **Q.7/2** | (a) | peristalsis; | 1 |
| | (b) | Muscles in the wall of the oesophagus contract; | 2 |
| | | And {push/ force} the food (on to the next section); | |
| | | **Question Total** | **[3]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.8/3** | (a) | | 45/ 46%; | 1 |
| | (b) | (i) | 65.5/ 66 years; | 1 |
| | | (ii) | Lung cancer/ emphysema/ walls of alveoli rupture/ owtte/ correct ref to damage to cilia/ drying mucus;<br>NOT reference to tar alone/ bronchitis; | 1 |
| | (c) | | Live longer/ could expect to live to 85/ avoid earlier death;<br>NOT less chance of dying;<br>(Live longer) without a (smoking related) {disability/ cancer/ named damage}; | 2 |
| | | | **Question Total** | **[5]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.9/4** | (a) | | To show <u>carbon dioxide</u>/ $CO_2$ (not $CO^2$) is needed for <u>photosynthesis/ starch</u> production; | 1 |
| | (b) | (i) | To prevent <u>soil</u> organisms affecting the experiment (OWTTE); | 1 |
| | | (ii) | Absorb carbon dioxide / $CO_2$; | 1 |
| | | (iii) | Control/ correct ref to using B to compare to A/ to make a comparison; | 1 |
| | | (iv) | Form an air tight seal/ make the apparatus air tight / prevent {gases/ carbon dioxide/ air} going in or out of the apparatus; NOT oxygen (can be neutral); | 1 |
| | (c) | | Destarch/ remove starch; | 1 |
| | (d) | (i) | Apparatus **A**<br>Colour – brown/ iodine colour<br>+<br>Reason – <u>no starch</u> present/ no photosynthesis ∴<u>no starch;</u><br>(**both** required for one mark) | [1] |
| | | (ii) | Apparatus **B**<br>Colour – black/ blue black<br>+<br>Reason –<u>starch</u> present/ photosynthesis occurred ∴<u>starch</u> present<u>;</u><br>(**both** required for one mark); | [1] |
| | | | **Question Total** | **[8]** |

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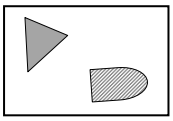
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| Question | Marking details | Marks Available |
|---|---|---|
| **Q.10/5** | *Indicative content*<br><br>Diaphragm contracts<br>Diaphragm flattens/moves down<br>Intercostals muscles contract<br>Rib cages moves up and out/raised<br>Thoracic volume/accept chest volume/accept space around the lungs increases<br>Pressure decreases<br>Lungs inflate<br>Air drawn into lungs through nose/nasal passages/trachea/windpipe<br><br>5-6 marks<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>3-4 marks<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>1-2 marks<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>0 marks<br>The candidate does not make any attempt or give a relevant answer worthy of credit | |
| | **Question Total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.6** | (a) | (i) | Enzyme works in {acid pH/ lower pH/ 4.5}/ (ORA);<br>NOT low pH | 1 |
| | | (ii) | Enzyme denatured or destroyed; | 1 |
| | | (iii) | Low temperature;<br>Meant few collisions between enzyme and {protein/ substrate}<br>/ takes {longer to make/ less} enzyme substrate complexes; | 2 |
| | (b) | | As below, ignore chemical bond if drawn;<br> | 1 |
| | (c) | | Lock and key; | 1 |
| | | | **Question Total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.7** | (a) | (i) | Description must include DNA / RNA/ genetic material/ genes/ nucleic acid; and protein {coat/ outside}; | 2 |
| | | (ii) | III; | 1 |
| | (b) | | Insects can become {resistant/ immune}/Could harm useful insects/ insecticides could enter food chain/ could bioaccumulate; | 1 |
| | (c) | | Biological control/ biocontrol; | 1 |
| | (d) | | May not be specific to target species (may use other words to convey this)/ could affect {useful/ other} insects/ could harm other animals;<br>May not be able to {survive/ reproduce} in {environmental factors/ climate}/ reproduce successfully;<br>Fungus could spread out of control/ could become a pest itself;<br>Midges could become immune to the fungus; | 2 |
| | | | **Question Total** | **[7]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.8** | (a) | (i) | Lowers/ decreases; | 1 |
| | | (ii) | Less lactic acid;<br>Greater volume of {air/ gas} breathed in (and out);<br>lactic acid level drops {faster/ sooner}; | 3 |
| | (b) | | glucose; | 1 |
| | (c) | | {Increased/ more} (rate of) aerobic respiration/ more carbon dioxide produced by aerobic respiration; | 1 |
| | (d) | | {More/ all} glucose completely broken down/ less anaerobic respiration (NOT no anaerobic respiration)/ more aerobic respiration/ no oxygen debt/ more oxygen available to repay oxygen debt/ extra oxygen breaks down lactic acid; | 1 |
| | | | **Question Total** | **[7]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.9** | (a) | (i) | P= $\frac{56 \times 48}{16}$ ; = 168;<br>Method (1) Answer (1) | 2 |
| | (b) | | Repeat the exercise/ take {more/ larger} samples; NOT take larger sample area. | 1 |
| | (c) | | They are balanced/ the same/ equal/ they don't happen; | 1 |
| | (d) | | Could eat them/ could be predators;<br>Could compete for food/ eat their food/ compete for breeding space;<br>Could introduce disease;<br>(in fact *Astacus fluviatilis*, the American red clawed crayfish, has introduced a fungal parasite) | 3 |
| | | | **Question Total** | **[7]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **Q.10** | (a) | | *Indicative content*<br><br>Fresh water decreased the concentration of salt to below the level in which oysters live. Osmosis caused water to pass into the oysters from where it was in high concentration to where it is in low concentration/ down a concentration gradient/ from a low solute potential to a high solute concentration through a selectively permeable membrane (accept semi permeable membrane). This diluted the body fluids/ blood resulting in death.<br><br>5-6 marks<br>The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.<br><br>3-4 marks<br>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.<br><br>1-2 marks<br>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.<br><br>0 marks<br>The candidate does not make any attempt or give a relevant answer worthy of credit | |
| | (b) | (i) | Active transport; | 1 |
| | | (ii) | Can carry salts/ ions against/ up a concentration gradient;<br>Requires energy; | 2 |
| | | | **Question Total** | **[9]** |



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| Surname | Centre Number | Candidate Number |
|---|---|---|
| Other Names | | 0 |

# New GCSE

4471/02

# ADDITIONAL SCIENCE
## HIGHER TIER
## BIOLOGY 2

A.M. TUESDAY, 15 May 2012

1 hour

| For Examiner's use only | | |
|---|---|---|
| **Question** | **Maximum Mark** | **Mark Awarded** |
| **1** | **5** | |
| **2** | **8** | |
| **3** | **7** | |
| **4** | **4** | |
| **5** | **6** | |
| **6** | **5** | |
| **7** | **6** | |
| **8** | **5** | |
| **9** | **8** | |
| **10** | **6** | |
| **Total** | **60** | |

4471
020001

**ADDITIONAL MATERIALS**

In addition to this paper you may require a calculator and a ruler.

**INSTRUCTIONS TO CANDIDATES**

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to question **2** and question **10**.

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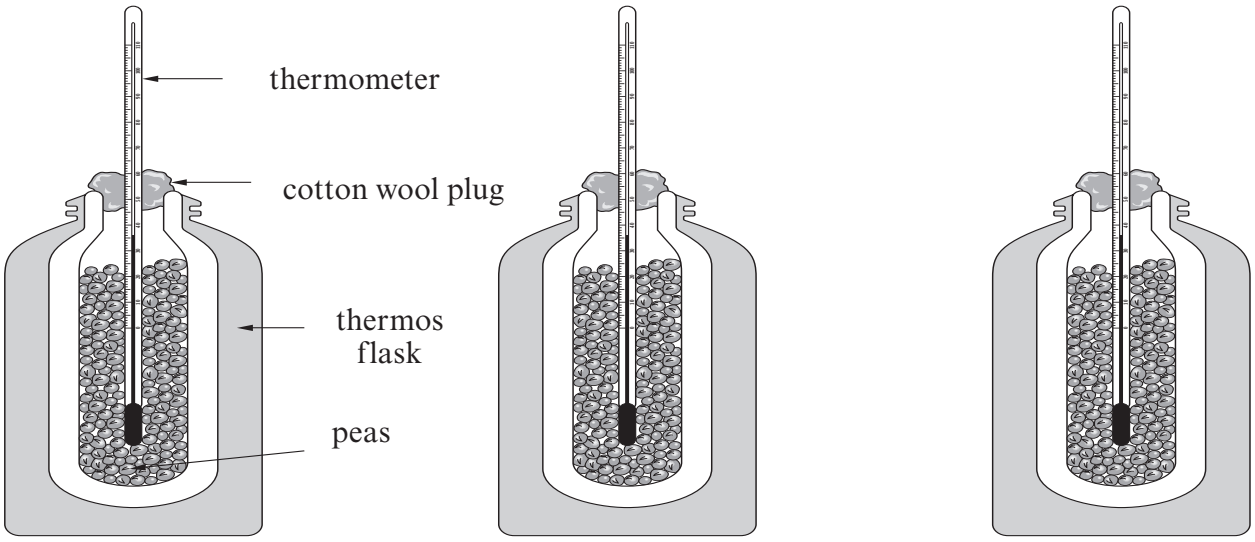


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*Answer* **all** *questions*

**1.** Siân set up the following investigation in a school laboratory. Before the start of the investigation all the peas were soaked in a very weak disinfectant.




Flask **A**
Living peas

Flask **B**
Boiled peas

Flask **C**
Boiled peas and strong disinfectant

Siân recorded the temperature in each flask at the start of the experiment (day 0) and at the same time of day for the next 6 days. She also recorded the room temperature. The results are shown below.

| | Temperature °C | | | |
|---|---|---|---|---|
| Day | Room | Flask **A** Living peas | Flask **B** Boiled peas | Flask **C** Boiled peas and strong disinfectant |
| 0 | 14 | 14 | 14 | 14 |
| 1 | 15 | 16 | 15 | 14 |
| 2 | 14 | 18 | 14 | 14 |
| 3 | 16 | 22 | 16 | 14 |
| 4 | 15 | 24 | 16 | 14 |
| 5 | 17 | 26 | 19 | 14 |
| 6 | 16 | 28 | 24 | 14 |

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*(a)* What process in the living peas caused the temperature to rise? [1]

.....

*(b)* (i) Why were all the seeds soaked in weak disinfectant before the start of the experiment? [1]

.....

.....

(ii) Explain fully the rise in temperature recorded in Flask **B**. [3]

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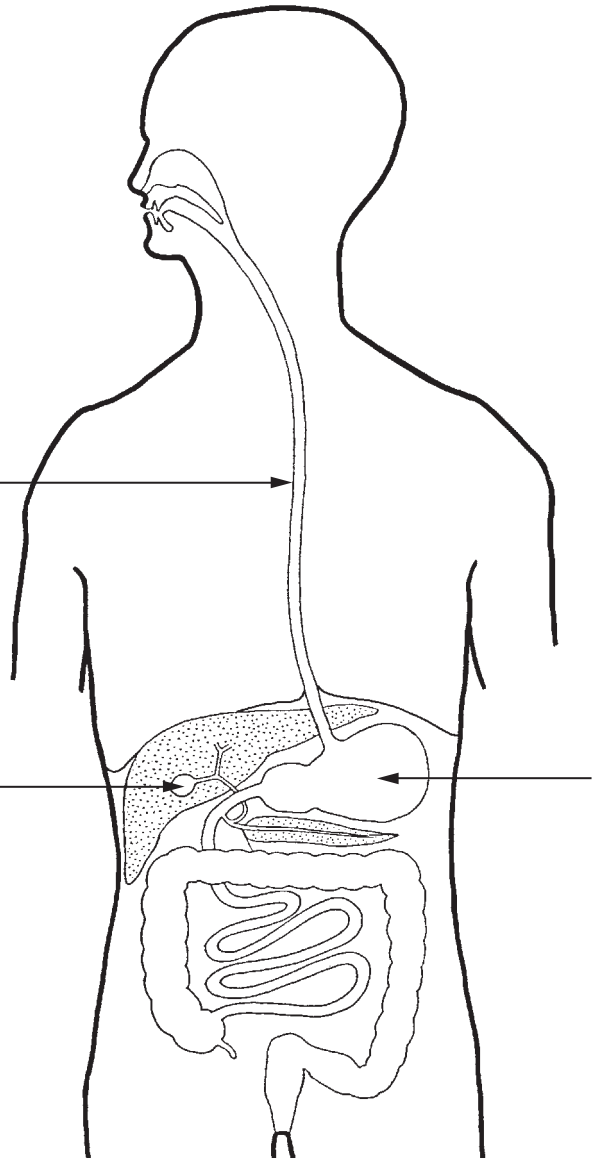




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**2.** The diagram below shows the human digestive system.




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*(a)* Label **A** and **B** on the diagram opposite. [2]

*(b)* Describe fully the processes involved in the chemical breakdown of food containing **fat** from the time it leaves the stomach. [6 QWC]

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8

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**Turn over.**

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**3.** The following information appeared in a newspaper in Wales in 2010.



- Some parents who smoke in the car with the window open when travelling with their children think that the smoke will have no effect on their children's health.
- The British Lung Foundation states that smoking just one cigarette, even with the car window open, creates a greater concentration of second-hand smoke than a whole evening's smoking in a pub or a bar.
- Levels of second-hand smoke in cars can be as much as 27 times greater than in a smoker's home.
- Young children breathe faster than adults, their lungs are smaller and are still growing.

*(a)* (i) Using the information above, explain why the lungs of young children in particular are in danger from breathing in second-hand smoke. [3]

.....

.....

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(ii) The Welsh Government is considering introducing strict new laws where parents who smoke while driving with their children face prosecution.
Using the information given previously suggest **two** *other* important pieces of evidence that the Welsh Government may consider in coming to a decision about introducing these new laws. [2]

.....

.....

.....

.....

*(b)* State **two** effects that cigarette smoke has on the cleaning mechanism of the lungs. [2]

(i) .....

(ii) .....





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**4.** The red spider mite is a pest on fruit trees. It increases in numbers quickly causing damage to the fruit crop.

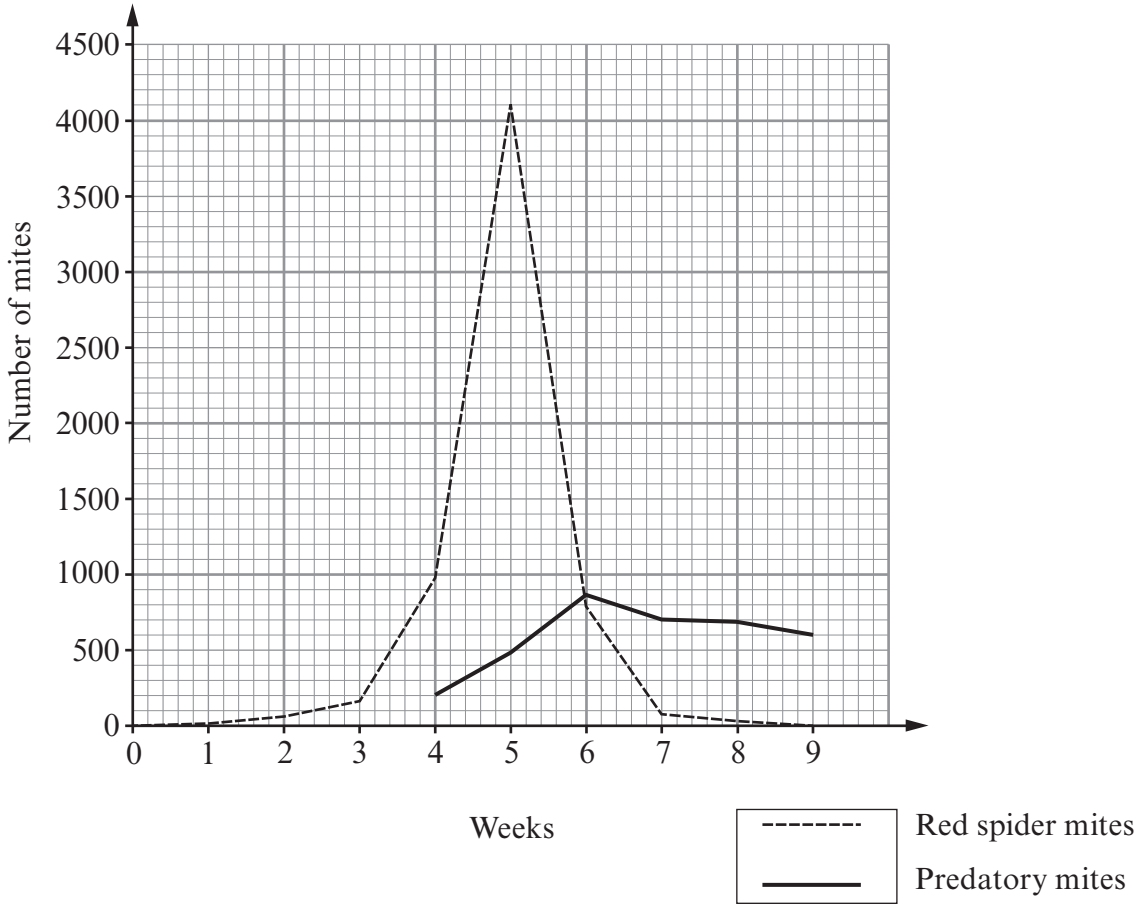
Red spider mite



Predatory mite



When the number of red spider mites was about 1000 per fruit tree, the farmer introduced predatory mites which eat the red spider mites. This happened on week 4 as shown in the graph below.




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*(a)* Use data from the graph to describe the effect that the introduction of the predatory mites has on the number of red spider mites. [2]

.....

.....

.....

.....

*(b)* What name is given to this type of pest control? [1]

.....

*(c)* At the end of 9 weeks there are still predatory mites present on the fruit trees. Explain how this could result in a problem. [1]

.....

.....





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**5.** The diagrams show side views of the chest cavity.

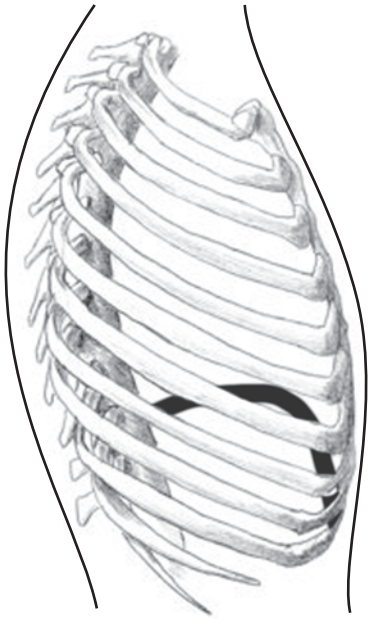


Diagram **A**

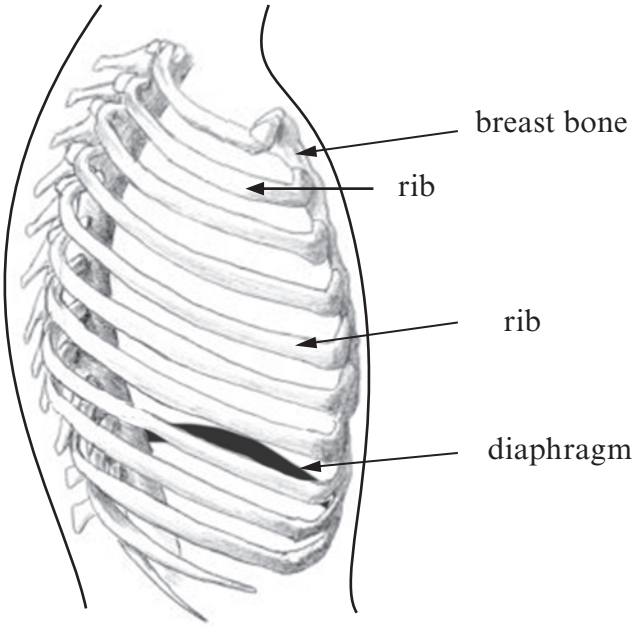



Diagram **B**

*(a)* State, with reasons, which of the diagrams **A** or **B** shows the chest after inspiration. [2]

Diagram .....

Reasons .....

.....

.....

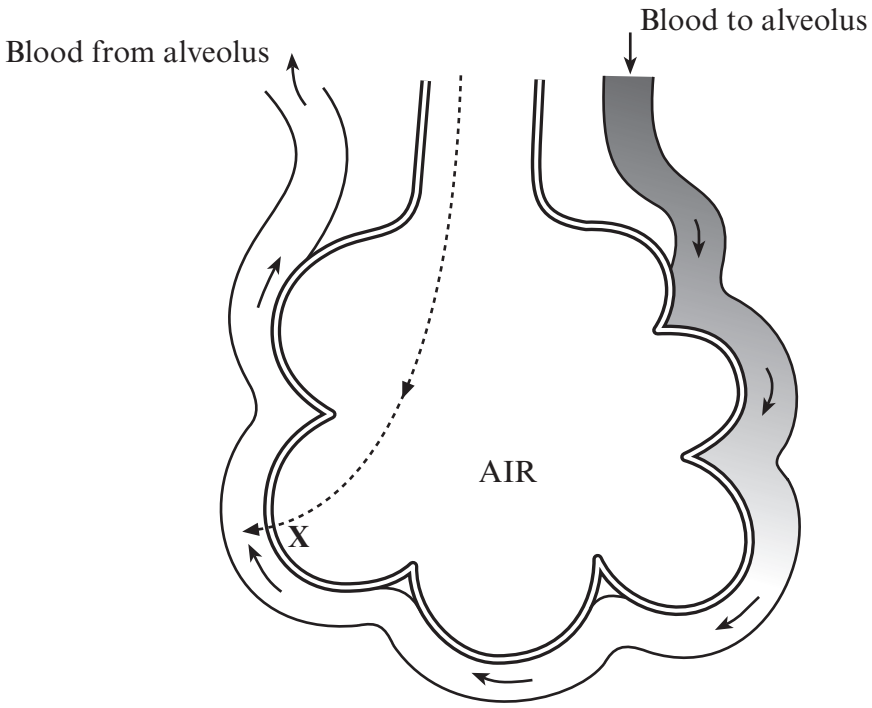
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*(b)* The diagram below shows an alveolus in a lung. The dotted line shows the movement of a gas.




(i) Describe what is happening at point **X** on the diagram. [2]

.....

.....

.....

.....

(ii) Explain how **two** of the adaptations of alveoli enable them to perform their function. [2]

I .....

.....

.....

II .....

.....

.....



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**Turn over.**

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Examiner only

**6.** The following are brief descriptions of two examples of stem cell technology.

**1.** 82 people who had been accidentally burned, causing blindness in one eye had stem cells from their good eye transplanted to their blind eye.

**2.** Stem cells from human embryos were genetically modified and injected into mice that had brain cancer. If the cancer is cured, scientists hope to carry out the same method in humans who have brain cancer.

*(a)* State **two** ethical reasons why the first example is more acceptable than the second. [2]

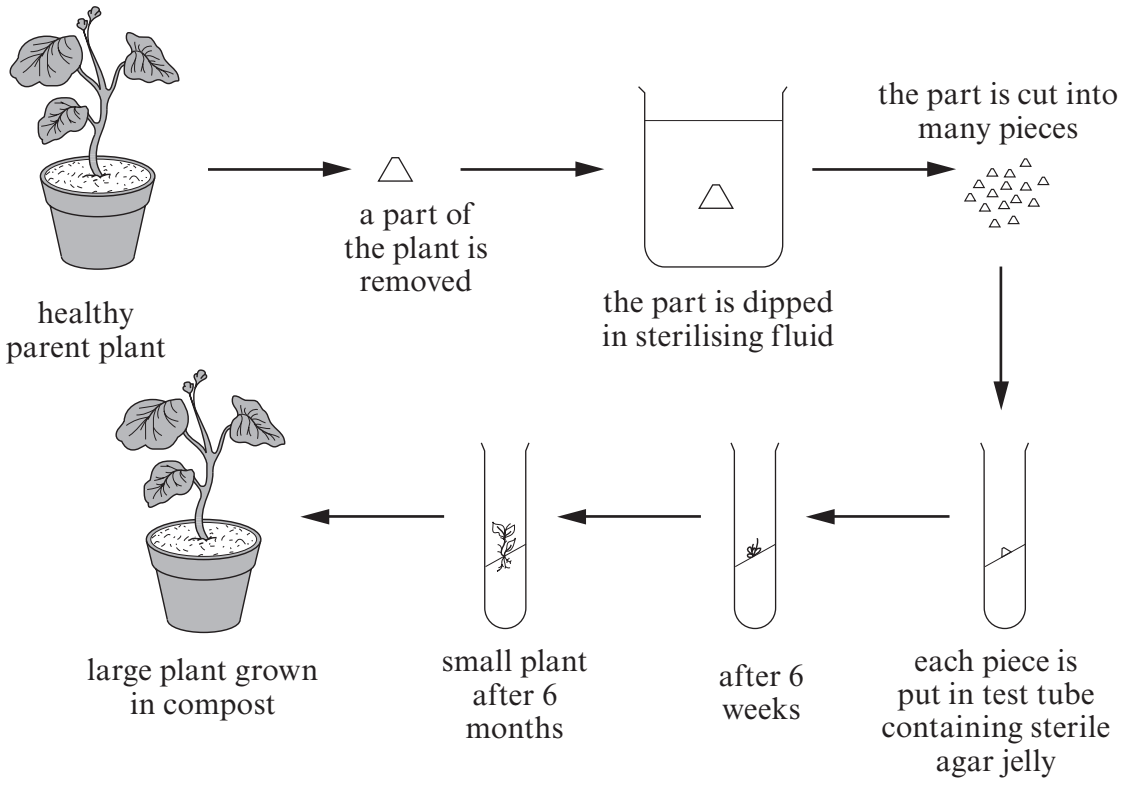
(i) .....

(ii) .....

*(b)* Name the type of cell division that takes place in stem cells. [1]

.....

*(c)* Palm oil plants can be mass produced by the process of tissue culture as shown in the diagram.




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(i) Where are stem cells found in plants? [1]

.....

(ii) If each cell of the adult palm oil plant has 20 chromosomes, how many chromosomes would you expect to be in each cell produced after 6 weeks? [1]

.....

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**7.** An investigation was carried out to measure the concentration of lactic acid in the blood of an athlete before, during and after vigorous exercise. The results are shown in the table below.

| Time (minutes) | Concentration of lactic acid in the blood (units) |
|---|---|
| 0 | 18 |
| 5 | 18 |
| 10 | 55 |
| 15 | 86 |
| 20 | 66 |
| 25 | 42 |
| 30 | 29 |
| 35 | 21 |
| 40 | 18 |
| 45 | 18 |

*(a)* After how many minutes from the start of the investigation did the exercise; [2]

(i) start; .....

(ii) end? .....

*(b)* For how long was the athlete in oxygen debt?

..... minutes [1]

*(c)* State why aerobic respiration is more efficient than anaerobic respiration. [1]

.....

.....

*(d)* Anaerobic respiration in muscle produces lactic acid. State **two** *other* ways in which anaerobic respiration in muscle differs from anaerobic respiration in yeast. [2]

(i) .....

(ii) .....

6

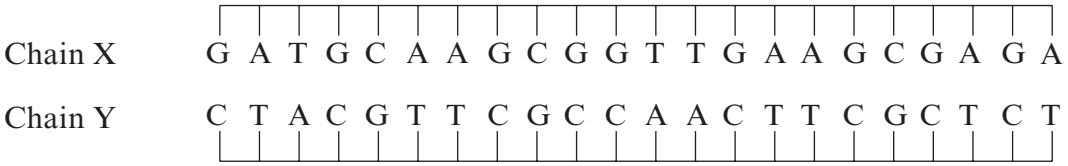
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**8.** The diagram shows the two chains of a DNA molecule which have been separated. The letters represent chemicals which code for units of protein. Three letters in a row code for a single unit of a protein.




*(a)* What group of chemicals is represented by the letters A, T, C, G? [1]

.....

*(b)* Name the units of a protein molecule. [1]

.....

*(c)* What is the maximum number of units of protein that can be coded by chain X? [1]

.....

*(d)* Normally the two chains are twisted around each other. What is the name for this shape of the DNA molecule? [1]

.....

*(e)* Name a group of proteins which have an important function in the body. [1]

.....



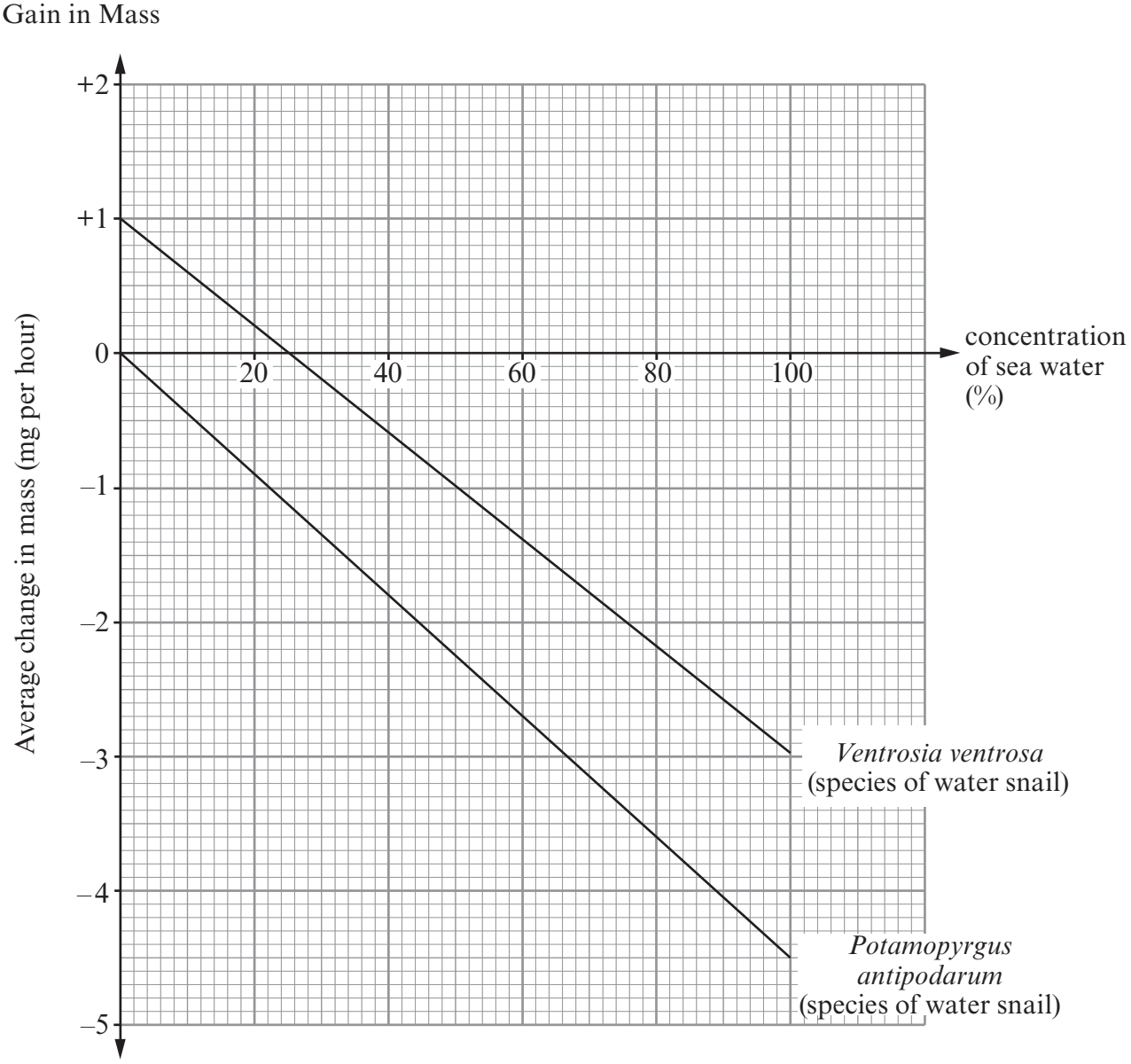
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**9.** The graphs show the average change in mass per hour of samples of two different species of water snails when they were placed in sea water of different concentrations.




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*(a)* The rate at which water passes into animals that live in water is equal to the rate at which it is removed. This results in no change in the mass of the animals.
Use the graphs to determine the concentration of sea water in which *Ventrosia ventrosa* normally lives. [1]

..... %

*(b)* Name the process which causes *Potamopyrgus antipodarum* to decrease in mass as the concentration of sea water increases. Explain how this process takes place. [4]

.....

.....

.....

.....

.....

*(c)* Snails that live in sea water can take certain salts into their bodies against a concentration gradient.

(i) Name the process responsible for taking in these salts. [1]

.....

(ii) Name **two** chemicals that are needed for this process. [2]

.....

.....

8

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**10.** In order to find out the effect of a weedkiller on dandelions, a sample of the weedkiller was sprayed on a $10m^2$ lawn. The number of plants was counted in a $1m^2$ quadrat.
Describe how you would use the quadrat to estimate the total number of living dandelions on the whole lawn before and after treatment with the weedkiller. [6 QWC]

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**THERE ARE NO MORE QUESTIONS IN THIS EXAMINATION.**

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# GCSE MARKING SCHEME

## SCIENCE - BIOLOGY

## SUMMER 2012

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## INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 examination in GCSE SCIENCE - BIOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

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**UNIT B2**

**FOUNDATION TIER**

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **1.** | (a) | (i) | 3(µm) | 1 |
| | | (ii) | Algal (cell.) | 1 |
| | (b) | | | 3 |

| Feature | Micro-organism |
|---|---|
| Reproduces by budding | Yeast |
| Reproduces by dividing in two | Bacteria/ Algal cell |
| Reproduces inside a host cell | virus |

| | | |
|---|---|---|
| (c) | Protein. | 1 |
| | **Question total** | **[6]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **2.** | (a) | Unambiguous line pointing at / in nucleus in cell A (must not touch chromosome) | 1 |
| | (b) | 4/ 2 pairs | 1 |
| | (c) | Both cells must have: 2 long, 2 short lines drawn inside the nucleus. | 1 |
| | | **Question total** | **[3]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **3.** | (a) | (i) | (Soil) warmer under the sheets/ protects from frost damage; so enzymes work faster/ better. | 2 |
| | | (ii) | I Increases **and** plateaus/ flattens | 1 |
| | | | II From graph - should be 208 | 1 |
| | | | III From graph - should be 100 | 1 |
| | | | IV From graph - should be 28 | 1 |
| | (b) | (i) | Red (plastic) | 1 |
| | | (ii) | Blue (plastic) | 1 |
| | | (iii) | Comparison idea / control/ to see what it would be like in the open. Reject reference to fair test | 1 |
| | (c) | | To average / smooth out variation in results (due to variable weather/ soil conditions); So more reliable/ increased strength of evidence/ increased confidence in evidence. NOT accuracy/ comparison/ reproducibility/ fair test | 2 |
| | (d) | | Any reasonable suggestion such as: Unsightly / litter / not recycled/ / not biodegradable/ wasteful of resources / harmful if eaten by animals / could trap animals/ is poisonous NOT pollution/ kill or harm unqualified | 1 |
| | | | **Question total** | **[12]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **4.** | (a) | | Carbon dioxide/ $CO_2$<br><br>Oxygen/ $O_2$ | 2 |
| | (b) | | Absorb/ take in/ capture (sun)light.<br><br>NOT catch/ trap/ uses | 1 |
| | (c) | (i) | Kill leaf / stop reactions/ breaks down cells or cell walls.<br>NOT denature/ kill enzyme | 1 |
| | | (ii) | Decolourise leaf / dissolves or removes chlorophyll/ take the green out. | 1 |
| | | (iii) | Soften leaf / make leaf permeable. | 1 |
| | | (iv) | | 1 |

| ***Colour of leaf*** | ***Tick (✓) correct box*** |
|---|---|
| *dark blue-black* | ✓ |
| *dark brown* | |
| *Pale yellow* | |

**Question total** **[7]**

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **5.** | (a) | (i) | A Rib Accept rib cage | 3 |
| | | | B Trachea/ windpipe | |
| | | | C Bronchus/ bronchi | |
| | | (ii) | Diaphragm/ intercostal muscle; (allow even if label arrow incorrect) | 2 |
| | | | Feature identified ( mark independently of label) | |
| | (b) | (i) | Diffusion. | 1 |
| | | (ii) | Any **two** from: | 3 |
| | | | Large surface area; | |
| | | | thin; | |
| | | | Moist / damp; NOT wet/ water | |
| | | | Close to / rich or good blood supply. | |
| | | | Accept no gap between alveolus and blood supply | |
| | | | **Question total** | **[8]** |

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**FOUNDATION / HIGHER TIER**

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **6/1** | (a) | | Respiration/ respire. NOT anaerobic respiration | 1 |
| | (b) | (i) | To kill or destroy bacteria / fungi / micro-organisms/ microbes/ to sterilise.<br>NOT get rid of bacteria/ denature | 1 |
| | | (ii) | Weak disinfectant didn't kill <u>all</u> bacteria / fungi/ micro-organisms;<br><br>Bacteria/ fungi/ micro-organisms grew/ reproduced/ multiplied;<br><br>Respired producing heat | 3 |
| | | | **Question total** | **[5]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **7/2** | (a) | A Oesophagus/ gullet<br>B Gall bladder | 1<br>1 |
| | (b) | **Indicative content:**<br>Food enters small intestine.<br>Mixes with bile from gall bladder/ liver.<br>Fat emulsified or description/ large globules to small globules (not molecules).<br>Lipase from pancreas<br>Lipase in small intestine.<br>Breaks down/ digests/ hydrolyses fats.<br>To fatty acids.<br>And glycerol. | 6 |

**5-6 marks**
The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

**3-4 marks**
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

**1-2 marks**
The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

**0 marks**
The candidate does not make any attempt or give a relevant answer worthy of credit

**Question total** **[8]**

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **8/3** | (a) | (i) | Breathing is <u>faster</u> so <u>more smoke</u> will be taken in (OWTTE); | 3 |
| | | | Lungs are smaller so easily/ quickly fill with smoke (OWTTE); | |
| | | | Lungs are still developing/ growing therefore easily damaged. | |
| | | | Accept Lungs are smaller and still developing = 1 | |
| | | | Accept Therefore they fill quickly with smoke or easily damaged =1 | |
| | | (ii) | Any **two** from: | 2 |
| | | | Some parents think that smoking in cars has no effect on children; | |
| | | | How smoking in cars (greatly) concentrates cigarette smoke (OWTTE); | |
| | | | Levels of smoke in cars can be 27 times greater than in the home. | |
| | (b) | | Any **two** from: | 2 |
| | | | (Particles or soot in smoke) it clog up the mucus (making harder to move); | |
| | | | (Heat from smoke)/ it dries up mucus (and cleaning mechanism fails) or it stops the airways being moist; | |
| | | | (Chemicals in smoke) it paralysing/ anaesthetises/ stops cilia/ hair like structures so they stop working. | |
| | | | **Question total** | **[7]** |

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| Question | | Marking details | Marks Available |
|---|---|---|---|
| **9/4** | (a) | When the predatory mite reaches 500/ 1 week after introduction/ at week 5/ between weeks 5 and 6 ;<br>It kills off/ causes a decline in the red spider mite. | 2 |
| | (b) | Biological control  accept biocontrol | 1 |
| | (c) | It may start eating other (harmless/ non pest species/) insects/ species/ non target species (not enough to say it may become a pest itself).<br>NOT start eating the fruit | 1 |
| | | **Question total** | **[4]** |
| | | **TOTAL FOUNDATION TIER** | **[60]** |

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**HIGHER TIER**

| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **5.** | (a) | | Diagram B (no mark)<br>Any **two** from:<br>Diaphragm has flattened/ contracted;<br>Rib cage has moved up/ out/ up and out OR sternum has moved up/ out/ up and out;<br>Thoracic volume (or description of ) increased/ chest cavity expands;<br>(Accept reverse argument.) | 2 |
| | (b) | (i) | Oxygen;<br>Diffusing into blood / capillary. NOT moving or going in | 2 |
| | | (ii) | Any **two** from:<br>Large surface area relating to increased gaseous exchange;<br>Moist lining relating to gases dissolving and diffusing in solution;.<br>Rich blood supply relating to more/ faster gaseous exchange/ speed at which $CO_2$ can be removed and/ or $O_2$ can be supplied;<br>Thin wall relating to ease at which gases can diffuse/ easier for gas exchange. NOT thin cell walls | 2 |
| | | | **Question total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **6.** | (a) | | Any **two** from:<br>No embryos used/ own stem cells;<br>No animal use in experiments/ only tested on humans/ no animal rights issues; Not cruel (neutral)<br>No Genetic Modification. | 2 |
| | (b) | | Mitosis. (Spelling must be correct) | 1 |
| | (c) | (i) | (Growing) TIP of stem / shoot/ root or meristem | 1 |
| | | (ii) | 20 | |
| | | | **Question total** | **[5]** |
| **7.** | (a) | (i) | Any number between 5 and 10 | 1 |
| | | (ii) | Any number between 15 and 20 | 1 |
| | (b) | | 30-33 minutes | 1 |
| | (c) | | More energy released/ More ATP produced (per glucose molecule) / Glucose <u>completely</u> used / oxidised. NOT more glucose is oxidised | 1 |
| | (d) | | Yeast produces ethanol / alcohol;<br>Yeast produces carbon dioxide<br>It = muscle | 2 |
| | | | **Question total** | **[6]** |

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| Question | | | Marking details | Marks Available |
|---|---|---|---|---|
| **8.** | (a) | | Bases. | 1 |
| | (b) | | Amino acids. | 1 |
| | (c) | | **7** | 2 |
| | (d) | | Double helix. | 1 |
| | (e) | | Enzymes / hormones | 1 |
| | | | **Question total** | **[5]** |
| **9.** | (a) | | 25% | 1 |
| | (b) | | Osmosis;<br>Water passes out;<br>from a high water concentration to low concentration outside /down a gradient / from a low solute concentration to a high solute concentration (must indicate correct direction of movement);<br>through SPM (selective / partial / semi). | 4 |
| | (c) | (i) | Active transport/ uptake. | 1 |
| | | (ii) | Oxygen;<br>Glucose | 2 |
| | | | **Question total** | **[8]** |

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| Question | Marking details | Marks Available |
|---|---|---|
| **10.** | **Indicative content** | |

A $1m^2$ quadrat is thrown randomly and the number of living dandelions in the quadrat is counted. This is repeated at least twice (until the number in the quadrat is constant/ not increasing or a stated number of times). An average is calculated of the numbers counted. The number is multiplied to calculate the total number in the whole lawn. This is done before treatment and 1 week/ stated time after treatment

**5-6 marks**
The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

**3-4 marks**
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

**1-2 marks**
The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

**0 marks**
The candidate does not make any attempt or give a relevant answer worthy of credit

| | |
|---|---|
| **Question total** | **[6]** |
| **TOTAL HIGHER TIER** | **60** |



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