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# GCSE (9–1) Combined Science B (Twenty First Century Science)

F

## J260/01 Biology (Foundation Tier)

Sample Question Paper

## Date – Morning/Afternoon

Version 2

Time allowed: 1 hour 45 minutes

**You may use:**
- a scientific or graphical calculator

| | |
|---|---|
| First name | |
| Last name | |
| Centre number | |
| Candidate number | |



**INSTRUCTIONS**
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**INFORMATION**
- The total mark for this paper is **95**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in the question marked with an asterisk (*).
- This document consists of **32** pages.

Answer **all** the questions.

**1** **(a)** Scientists use key terms to explain genetics.

Use words from the list to complete the sentences about genetics.

You may use each word, once, more than once or not at all.

**alleles** **chromosomes** **genes** **genome** **nucleotides**

The molecule which carries the genetic information is DNA.

DNA is a polymer made up of ……

Sections of DNA which code for a particular protein are called ……

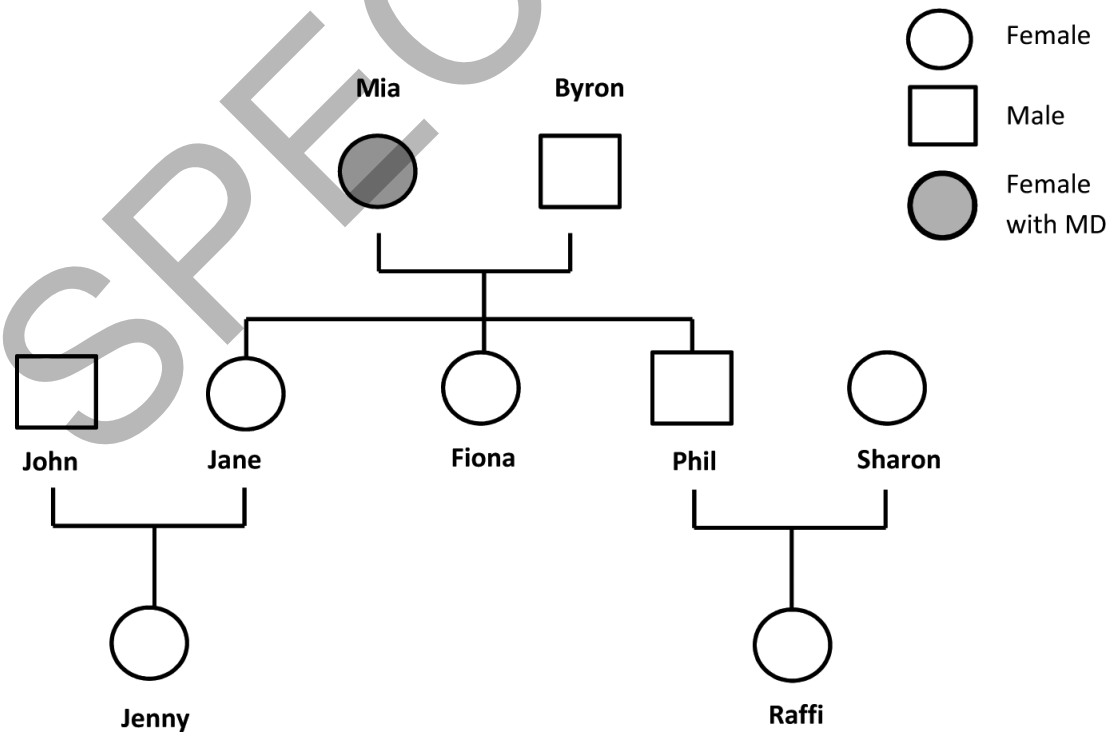
**[2]**

**(b)** Mitochondria are sub-cellular structures inside nearly every cell of the body. They have a small amount of their own DNA.

Mitochondria are inherited **only** from the mother. Mitochondria are inherited in the cytoplasm of the egg.

Some faulty mitochondria cause Mitochondrial Disease (MD). Symptoms can be brain damage, muscle wasting, heart failure and blindness.

Look at the family tree. Mia has Mitochondrial Disease (MD).



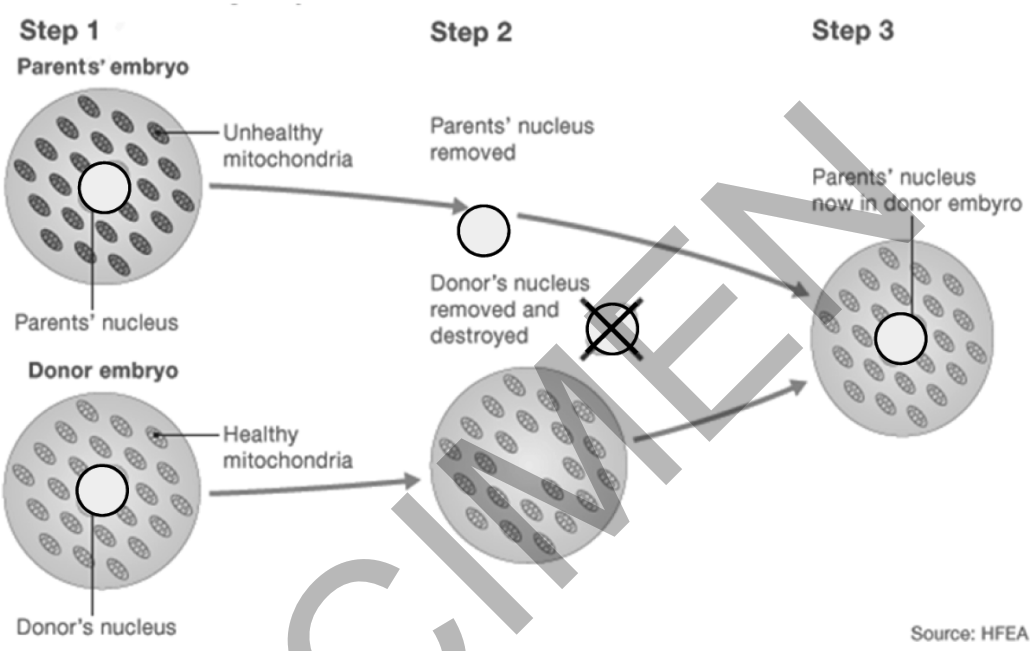

Name the **four other** people in Mia's family tree who will definitely have Mitochondrial Disease.

**1**..... **2**..... **3**..... **4**..... **[2]**

**(c) (i)** In February 2015 the UK became the first country in the world to approve laws to allow the creation of babies with genetic material from three people.

The new laws were passed to help develop treatments for Mitochondrial Disease.

The diagram shows one way in which passing on Mitochondrial Disease might be prevented.




Explain why the embryo at the end of the process can be described as having three parents.

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.....

..... **[2]**

**(ii)** State **two** possible benefits of this new technique.

Include practical and ethical considerations.

**1** .....

.....

**2** .....

..... **[2]**

**2** **(a)** Communicable diseases in plants and animals can be caused by microorganisms called pathogens.

Put a tick (✓) in the box next to the type of organism that does **not** cause infectious disease.

**Type of organism**

| | |
|---|---|
| Bacteria | ☐ |
| Fungi | ☐ |
| Insects | ☐ |
| Protists | ☐ |

**[1]**

**(b)** Our bodies have defences that make it difficult for pathogens to enter.

Use **lines** to link each **defence** to its correct **description**.

One line has been drawn for you.

| Defence | Description |
|---|---|
| Bacteria living in intestines | traps pathogens |
| Mucus | compete with pathogens |
| Skin | breaks down pathogens |
| Stomach acid | barrier to pathogens |

**[2]**

**(c)** In 2014, there was an outbreak of Ebola in Africa. It was estimated that just over 50% of individuals infected with Ebola died during this outbreak.

Read the article below about Ebola.


Ebola is a serious infectious disease of humans.

The early symptoms are fever, muscle pain, tiredness, headache and sore throat, then vomiting, diarrhoea and bleeding. Symptoms appear about 21 days after infection.

The Ebola pathogen has been found in the blood, vomit, faeces, urine and other bodily fluids of people with symptoms of the disease.

The Ebola pathogen is only found in these bodily fluids after the infected person has symptoms.

**(i)** Use information in the article to identify **three** signs that might show someone that they have Ebola.

**1** .....

**2** .....

**3** ..... **[1]**

**(ii)** Use the information in the article to describe how the Ebola pathogen spreads from person to person.

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.....

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..... **[3]**

**(iii)** Ebola is a rare infection.

Describe how a **common** human infection that you have studied is spread from person to person.

.....

.....

..... **[2]**

**(d)** Some infectious diseases can be prevented by a vaccination

Put a tick (✓) in the box next to the **correct** description of how vaccination does this.

A vaccination

... causes the production of antibodies before infection. ☐

... causes the production of antigens before infection. ☐

... stops the pathogen getting into the body. ☐

... stops the pathogen reproducing inside the body. ☐

**[1]**

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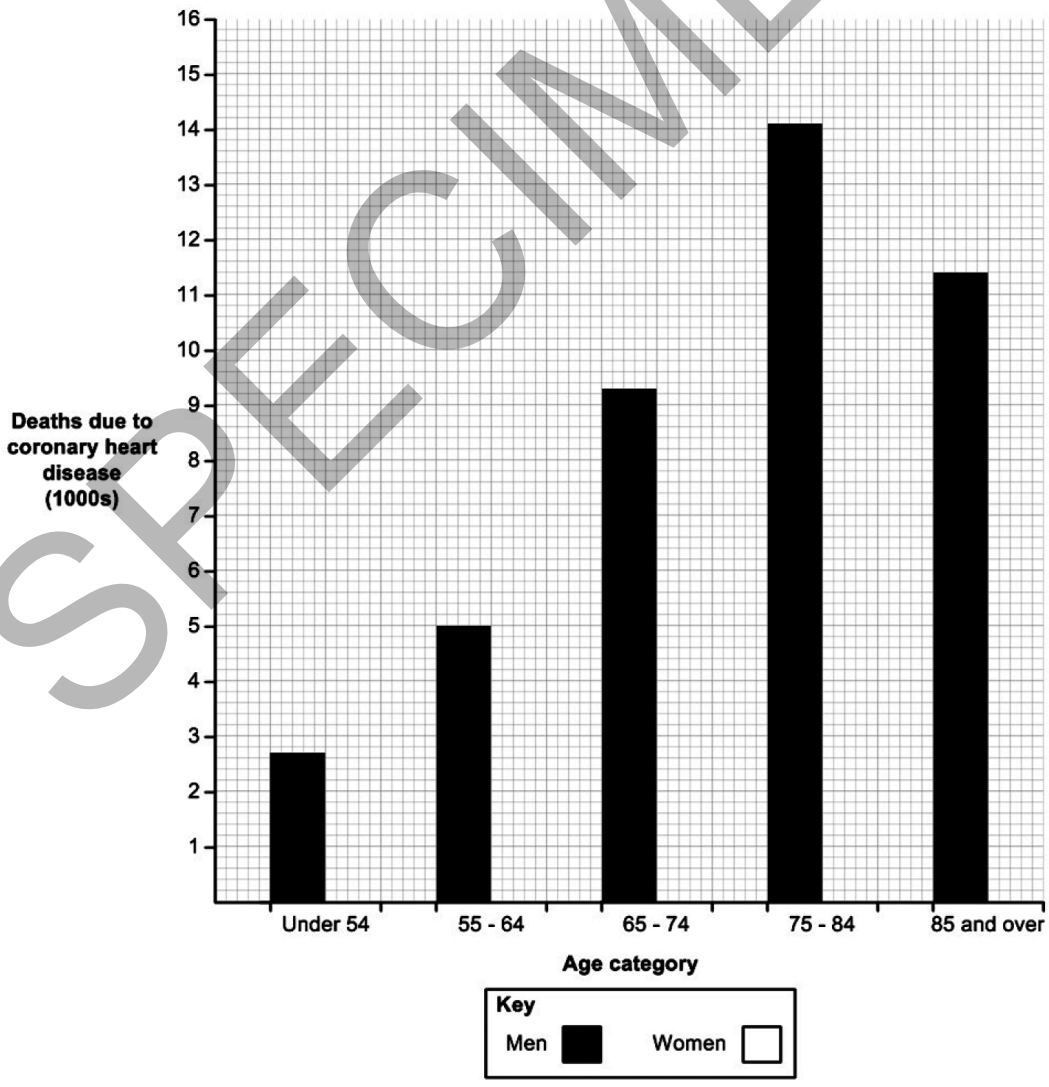
**TURN OVER FOR THE NEXT QUESTION**

**3** **(a)** Here are some data about deaths caused by coronary heart disease, a type of cardiovascular disease, collected by the British Heart Foundation in England.

The figures are rounded to the nearest hundred.

| Age category | Deaths in 2012 | |
|---|---|---|
| | Men | Women |
| Under 54 | 2 700 | 700 |
| 55 – 64 | 5 000 | 1 400 |
| 65 – 74 | 9 300 | 3 800 |
| 75 – 84 | 14 100 | 9 500 |
| 85 and over | 11 400 | 15 500 |

Complete the graph below by adding the data for women. **[3]**



**(b)** The risk of coronary heart disease and other types of cardiovascular condition, such as a heart attack, is also affected by factors other than age and gender.

Describe how **two** lifestyle factors can increase or decrease the risk of having a heart attack.

.....

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.....

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..... **[4]**

**(c)** The heart forms part of the circulatory system.

What role does the heart play in this system?

..... **[1]**

**(d)** Water moves through a plant in the xylem.
Which sentence best explains how the xylem is adapted to its function?

Put one tick (✓) in the correct box.

Cells are joined end to end and contain cytoplasm. ☐

Cells are joined end to end with no connecting cell walls. ☐

Companion cells containing mitochondria to produce energy. ☐

Perforated plates allow movement between cells. ☐ **[1]**

**(e)** The skin contains stem cells. Stem cells are unspecialised cells.

How does this make them useful to scientists?

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.....

..... **[2]**

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**TURN OVER FOR THE NEXT QUESTION**

**4** **(a)** Organisms that can photosynthesise are called producers.

Photosynthesis produces glucose.

Describe a test that can be used to show that a solution contains glucose.

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.....

.....

..... **[3]**

**(b)** Yeast, a single celled microorganism, can use glucose for respiration.

Yeast can respire in conditions with oxygen and without oxygen.Yeast can be grown in a container called a fermenter.

Two fermenters, **A** and **B**, are set up with a solution containing yeast.

- In fermenter, **A**, air containing oxygen is bubbled through the solution.
- In second fermenter, **B**, the lid is shut and no air can get in or out.

Samples are taken and yeast cells are counted.

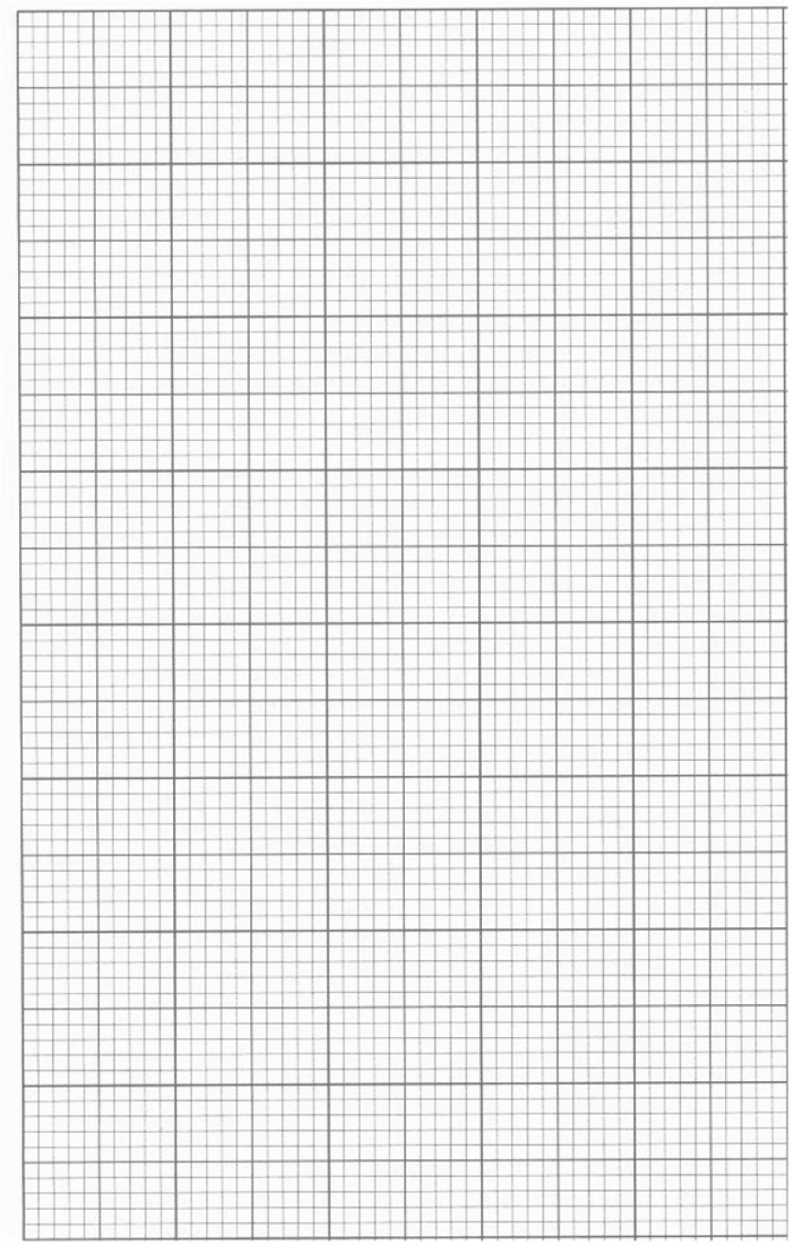
The results are shown in Table 4.1

| **Time when yeast samples were taken (hours)** | **Number of yeast cells (in 1 $mm^3$)** | |
|---|---|---|
| | **A** | **B** |
| 0 | 50 | 50 |
| 1 | 100 | 100 |
| 2 | 200 | 150 |
| 3 | 400 | 175 |
| 4 | 800 | 200 |

**Fig 4.1**

**(i)** Plot the data given in the table (Fig 4.1) on the grid below.

Use the points to draw a curve through all the plots for **each** fermenter (**A** and **B**) and label each line appropriately.



**[4]**

**(ii)** Describe the results shown in the table (Fig 4.1) and the graph.

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.....

..... **[2]**

**(c)** Describe **two** differences between anaerobic and aerobic respiration.

**1** .....

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**2** .....

..... **[2]**

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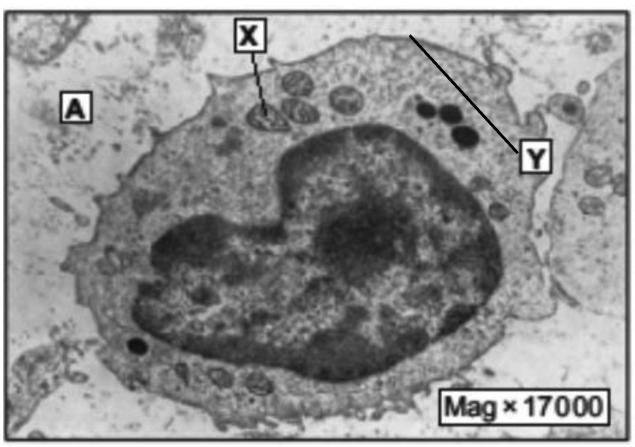
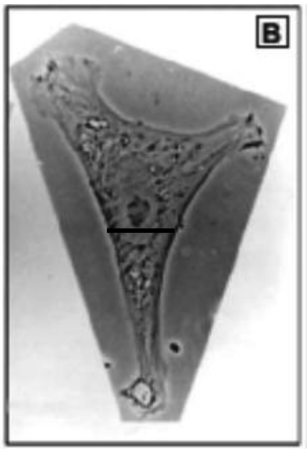
**TURN OVER FOR THE NEXT QUESTION**

**5** The photographs **A** and **B** both show a type of human white blood cell.

One was taken using a light microscope and one using an electron microscope.




**(a) (i)** A scientist measures the diameter of the white blood cell in photograph **B**.

The diameter is 8 mm.

The scientist knows that the actual diameter of the living cell is 0.01 mm.

Use this information and the equation below to calculate the magnification of photograph **B**.

$$\text{magnification} = \frac{\text{measured size}}{\text{actual size}}$$

Magnification = ..... **[1]**

**(ii)** Use your calculation of magnification in **(i)** and the information in the photographs to explain why photograph **A** is the one taken with an electron microscope.

.....

.....

..... **[2]**

**(b) (i)** Name the structure labelled **Y** in photograph **A**.

..... **[1]**

**(ii)** State the function of the structure labelled **X** in photograph **A**.

..... **[1]**

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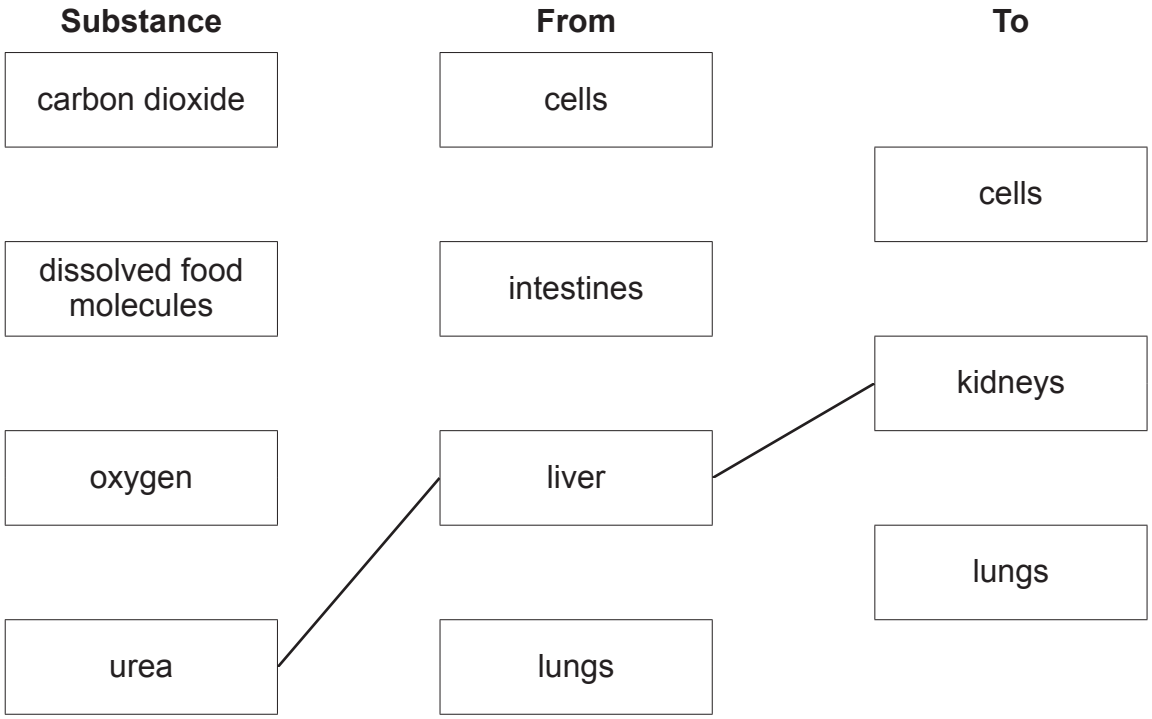
**TURN OVER FOR THE NEXT QUESTION**

**6** **(a)** The human circulatory system transports substances from place to place within the body.

Use lines to complete the diagram showing where the listed **substances** are moved **from** and **to** in the human body.

Some boxes may have more than one line drawn to them.

Two lines have been drawn for you.




**[3]**

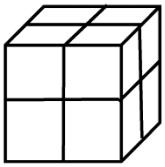
**(b)** A scientist knows that surface area is important at gas exchange surfaces.

She is modelling the shape of animals using 1 $cm^3$ blocks.

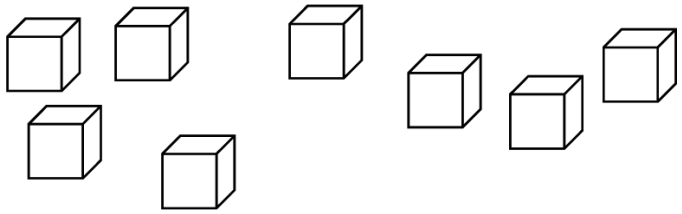
She makes two models. Each model contains eight 1 $cm^3$ blocks.

- **A** is a six sided cube.
- **B** has each block separate.

**A**



**B**



She works out the surface area of each model by counting the sides and starts to put the results in a table.

| Model | Surface area ($cm^2$) | Volume ($cm^3$) | Surface area : volume ratio |
|---|---|---|---|
| **A** | 24 | 8 | ..... : ..... |
| **B** | 48 | 8 | ..... : ..... |

Complete the table by calculating the surface area : volume ratios.

You can use the space below for working.

**[2]**

**(c)** As animals get bigger, they need special gas exchange surfaces like lungs.

Using the scientist's findings about the surface area : volume ratios and your own knowledge, explain why bigger animals need special gas exchange surfaces.

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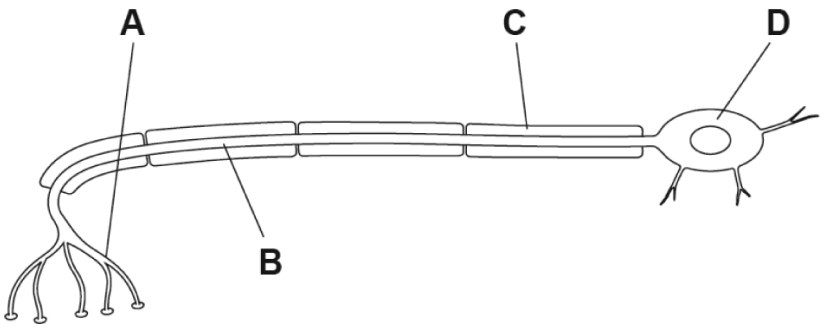
..... **[2]**

**7** **(a)** **(i)** The diagram below shows a motor neuron.




Which label, **A**, **B**, **C** or **D**, is pointing to the fatty sheath?

……. **[1]**

**(ii)** The nervous system consists of billions of neurons.

An electrical impulse can travel down a neuron at different speeds.

The table shows information about three neurons, **D**, **E** and **F**.

| Neuron | Length (m) | Time taken for impulse to travel (s) | Speed (m/s) |
|---|---|---|---|
| **D** | 1.3 | 0.027 | 48.15 |
| **E** | 1.3 | 0.014 | |
| **F** | 0.8 | 0.022 | |

Calculate the speed of the electrical impulse travelling down neuron **E** and neuron **F**.

Neuron **E** speed = …… m/s

Neuron **F** speed = …… m/s

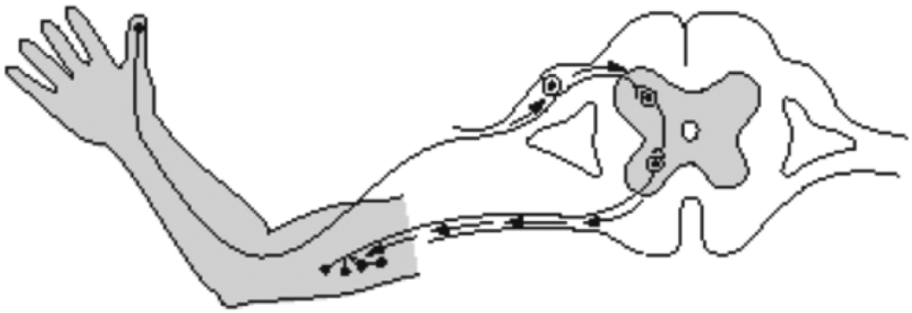
**[2]**

**(iii)** What is the role of the fatty sheath?

.....

..... **[1]**

**(b)** The diagram shows the reflex arc involved in pulling the hand away from a hot object.



**(i)** What is the main feature of a reflex action, such as pulling the hand away from a hot object?

..... **[1]**

**(ii)** Why are reflex actions important?

..... **[1]**

**8** **(a)** Charles Darwin suggested that evolution happened partly because of natural selection.

An example of natural selection today is the evolution of antibiotic resistance in bacteria.

A number of steps occur to produce resistant bacteria.

The steps are listed below but in the wrong order.

**A** Number of resistant bacteria increases.

**B** Where the antibiotic is used the new variant is more likely to survive.

**C** An enzyme made by the new variant breaks down the antibiotic.

**D** A mutation causes a new variant.

**E** The new variant reproduces passing on the mutation.

Put the steps in the correct order.

Write the letters **A**, **B**, **C**, **D** and **E** in the boxes.

| | | | | |
|---|---|---|---|---|
| | | | | |

**[3]**

**(b)** Humans have changed the characteristics of domesticated animals and crop plants by selective breeding.

Milk production per cow has increased since 1930. Some of this increase has been caused by selective breeding.

Explain how selective breeding has increased milk production per cow.

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..... **[4]**

**9** **(a)** Jack and Sarah have a daughter, Nina, who has just been diagnosed with Marfan syndrome. This is a genetic disease that affects the body's connective tissue. (Connective tissue holds organs in place.)

Nina's Dad also has Marfan syndrome.

Using the letters, **D** and **d** to represent the alleles for this disease, predict the probability that Jack and Sarah's next child will have Marfan syndrome.

Complete the Punnett square below.

| | | **Sarah** | |
|---|---|---|---|
| | | d | d |
| **Jack** | D | | |
| | d | | |

Probability = ..... **[2]**

**(b)** 1 in 5000 people in the UK has Marfan syndrome.

The population of the UK in 2014 was 64.1 million.

Calculate the number of people with Marfan syndrome in the UK in 2014.

Show your working.

Number of people = ..... **[2]**

**(c)** Lung cancer affects far more people in the UK than Marfan syndrome.

In 2011, there were 43463 new cases of lung cancer diagnosed.

Why is the incidence of lung cancer so high?

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.....

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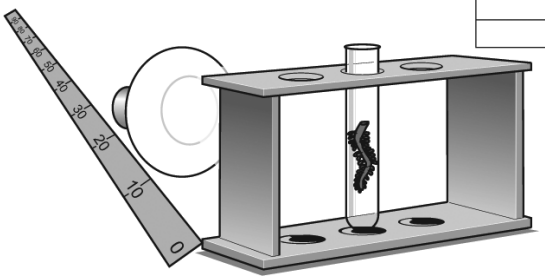
..... **[2]**

**10** Two scientists are investigating the effect of light intensity on the rate of photosynthesis.

The diagram shows how they set up their investigation, and their results.

| Distance between the pondweed and light source (cm) | Number of bubbles given off in 1 minute |
|---|---|
| 100.0 | 8 |
| 50.0 | 28 |
| 25.0 | 105 |
| 12.5 | 105 |




**(a)** The word equation for photosynthesis is:

$$\text{Water} + \text{carbon dioxide} \xrightarrow[\text{chlorophyll}]{\text{sunlight energy}} \text{oxygen} + \text{glucose}$$

In which sub-cellular structure in a plant cell does photosynthesis occur?

..... **[1]**

**(b)** Describe the pattern in the scientist's results.

.....

.....

..... **[2]**

**(c)** **(i)** One scientist thinks that the result of 105 bubbles at 12.5 cm may be an error.

Describe how she could be more certain that 105 is the **true** value.

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..... **[2]**

**(ii)** How could similar apparatus be used to allow the scientists to investigate the effect of temperature on the rate of photosynthesis?

Other laboratory equipment is also available.

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.....

..... **[2]**

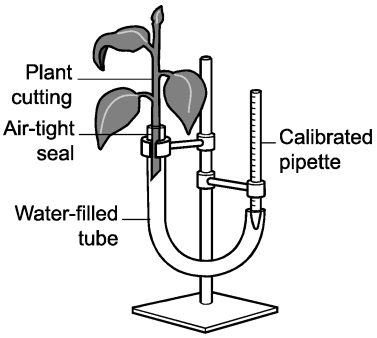
**(d)** The scientists also investigate the rate at which water is lost by leaves.

**(i)** What is the loss of water from leaves called?

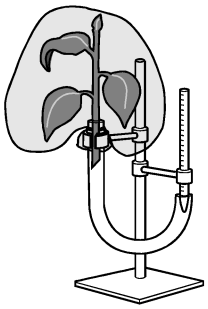
..... **[1]**

**(ii)** The scientists investigate the water uptake by a plant cutting using a potometer.

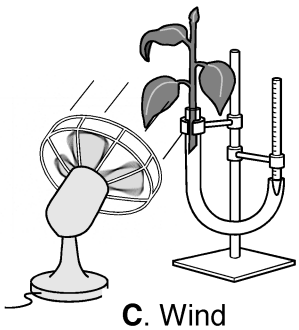
- They measure the water uptake in 30 minutes.
- They use four conditions: **A**, **B**, **C** and **D**, as shown below.



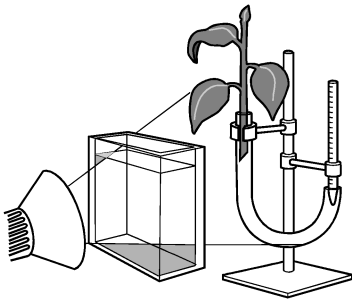

**A**. Normal room



**B**. Mist



**C**. Wind



**D**. Bright light

They take **three** readings for each condition and record their results in a table.

| Condition | Water uptake in 30 minutes ($cm^3$) | | | | Rate of water uptake ($cm^3$/min) |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | Mean | |
| **A** (Normal room) | 4.18 | 4.01 | 3.98 | 4.06 | 0.32 |
| **B** (Mist) | 2.06 | 1.85 | 2.25 | 2.05 | 0.07 |
| **C** (Wind) | 9.34 | 9.85 | 9.20 | ..... | ..... |
| **D** (Bright light) | 10.36 | 10.56 | 9.89 | 10.27 | 0.34 |

Complete the table by calculating the mean **and** the rate of water uptake for condition **C.** **[2]**

**(iii)** Condition D (bright light) causes plants to take up the most water.

Explain the results for **D**.

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..... **[2]**

**(iv)** The volume of water taken up by the plants in this experiment may **not** be an accurate measurement of water lost from the plant.

Suggest why.

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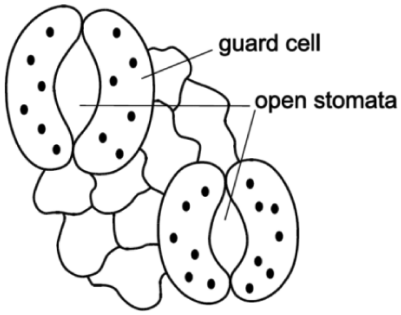
..... **[2]**

**(e)** Plants lose water from their leaves through tiny holes called stomata. These can be seen in the diagram below.




Plants can control water loss by closing their stomata.

Describe the consequences for photosynthesis for plants living in dry places if they need to close their stomata to save water.

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..... **[2]**

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**TURN OVER FOR THE NEXT QUESTION**

**11** **(a)*** Ling is doing some fieldwork in an area where trees are growing around the edge of a field.

Ling wants to find out if the **type** of plant growing under a tree changes as you move away from the tree towards the middle of the field. She thinks light might affect the type of plant growing.

Ling uses a tape measure, quadrat, identification key and light meter in her fieldwork.

Explain how she will use this apparatus **and** describe how she will process her results.

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..... **[6]**

**(b)** Alex carries out a similar investigation but is interested in biodiversity and how humans can affect it.

Field **X** has been planted with carrots and Field **Y** is a grass meadow.

Alex counts flowering plants within quadrats in the two fields and is able to estimate the number of flowering plants per $m^2$ in each field.

His results are shown in Table 11.1.

| Flowering plant | Number of plants in $1m^2$ | |
|---|---|---|
| | Field X | Field Y |
| Carrots | 16 | 0 |
| Daisy | 0 | 6 |
| Dandelion | 4 | 9 |
| Buttercup | 0 | 5 |
| Number of species | | |
| Total number of plants | | |
| Biodiversity index | | |

**Table 11.1**

Complete the last three rows in the table.

You will need to calculate the biodiversity index using the equation below:

$$\text{biodiversity index} = \frac{\text{number of species in the area}}{\text{total number of plants in the area}}$$

**[1]**

**(c)** It is important to try to maintain biodiversity.

Which of the following would help to prevent a decrease in biodiversity?

Put a tick (✓) in the box next to the correct answer.

Decreasing the genetic variation within species. ☐

Increasing the population of a common species. ☐

Storing seeds in seed banks. ☐

Using wood rather than oil for fuel. ☐ **[1]**

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OCR
Oxford Cambridge and RSA

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**…day June 20XX – Morning/Afternoon**

**GCSE (9–1) Combined Science B (Twenty First Century Science)**
**J260/01 Biology (Foundation tier)**

**SAMPLE MARK SCHEME**

**Duration:** 1 hour 45 minutes

**MAXIMUM MARK 95**

**This document consists of 24 pages**

# MARKING INSTRUCTIONS

## PREPARATION FOR MARKING

### SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

## MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Once the level is located, award the higher or lower mark:

**The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.
**The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

**In summary:**

**The skills and science content determines the level.**
**The communication statement determines the mark within a level.**

Level of response question on this paper is **11(a)**.

11. **Annotations**

| Annotation | Meaning |
|---|---|
| **DO NOT ALLOW** | Answers which are not worthy of credit |
| **IGNORE** | Statements which are irrelevant |
| **ALLOW** | Answers that can be accepted |
| ( ) | Words which are not essential to gain credit |
| __ | Underlined words must be present in answer to score a mark |
| **ECF** | Error carried forward |
| **AW** | Alternative wording |
| **ORA** | Or reverse argument |

12. **Subject-specific Marking Instructions**

**INTRODUCTION**

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Combined Science B:

| | Assessment Objective |
|---|---|
| **AO1** | **Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.** |
| **AO1.1** | Demonstrate knowledge and understanding of scientific ideas. |
| **AO1.2** | Demonstrate knowledge and understanding of scientific techniques and procedures. |
| **AO2** | **Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.** |
| **AO2.1** | Apply knowledge and understanding of scientific ideas. |
| **AO2.2** | Apply knowledge and understanding of scientific enquiry, techniques and procedures. |
| **AO3** | **Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.** |
| **AO3.1** | Analyse information and ideas to interpret and evaluate. |
| **AO3.1a** | Analyse information and ideas to interpret. |
| **AO3.1b** | Analyse information and ideas to evaluate. |
| **AO3.2** | Analyse information and ideas to make judgements and draw conclusions. |
| **AO3.2a** | Analyse information and ideas to make judgements. |
| **AO3.2b** | Analyse information and ideas to draw conclusions. |
| **AO3.3** | Analyse information and ideas to develop and improve experimental procedures. |
| **AO3.3a** | Analyse information and ideas to develop experimental procedures. |
| **AO3.3b** | Analyse information and ideas to improve experimental procedures. |

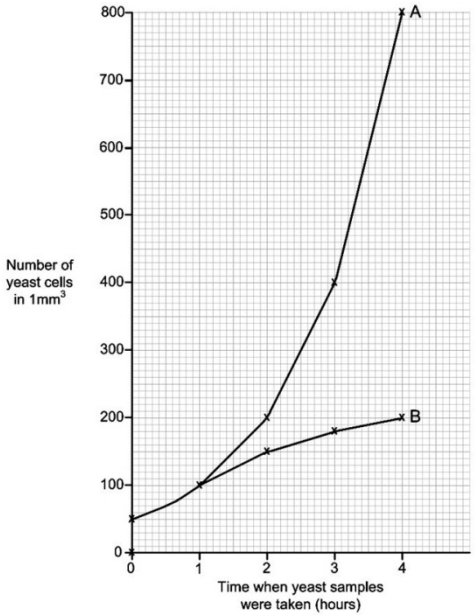
| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 1 | (a) | | Nucleotides ✓<br>Genes ✓ | 2 | 1.1 | |
| | (b) | | Jane, Fiona, Phil ✓<br>Jenny ✓ | 2 | 2.1 | **ALLOW** Jane, Fiona, and Phil in any order but all must be named for first marking point. |
| | (c) | (i) | "Parent's embryo" has DNA / chromosomes / genes from mother and father ✓<br>Mitochondria (contain DNA) from donor embryo ✓ | 2 | 3.2b | |
| | | (ii) | **Any two from**<br>*Benefits*<br>Child will not get mitochondrial disease ✓<br>Child cannot pass on mitochondrial disease ✓<br>Parents and family could not cope with a child with mitochondrial disease ✓<br>Cost benefits if don't have to treat affected child ✓ | 2 | 3.2a | . |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 2 | (a) | | **Type of organism**<br>Bacteria ☐<br>Fungi ☐<br>Insects ☑<br>Protists ☐ | 1 | 1.1 | If more than one box is ticked, do not award the mark even if the correct box is also ticked |
| | (b) | | **Defence** / **Description**<br>Bacteria living in intestines → Compete with pathogens<br>Mucus → Traps pathogens<br>Skin → Barriers to pathogens<br>Stomach acid → Breaks down pathogens | 2 | 1.1 | Three lines correct = 2 marks<br>Two lines correct = 1 mark<br>One line correct = no marks |
| | (c) | (i) | **Any three from**<br>Fever / muscle pain / tiredness / headache / sore throat / vomiting / diarrhoea / bleeding ✓ | 1 | 2.1 | Any order, three needed for one mark |
| | | (ii) | Ebola / virus / pathogen is in vomit / faeces / blood ✓<br>Contact with vomit / faeces / blood may spread disease / Ebola / virus / pathogen ✓<br>Idea that physical defences have to be bypassed e.g. cut / break in skin / touch infected bodily fluid then touch own eye ✓ | 3 | 2.1 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| **Question** | | | **Answer** | **Marks** | **AO element** | **Guidance** |
| | | **(iii)** | Correct human infection ✓<br>Correct infection route described ✓ | **2** | **1.1** | |
| | **(d)** | | ... causes the production of antibodies before infection. ✓<br>... causes the production of antigens before infection.<br>.... stops the pathogen getting into the body.<br>... stops the pathogen reproducing inside the body. | **1** | **1.1** | If more than one box is ticked, do not award the mark even if the correct box is also ticked |

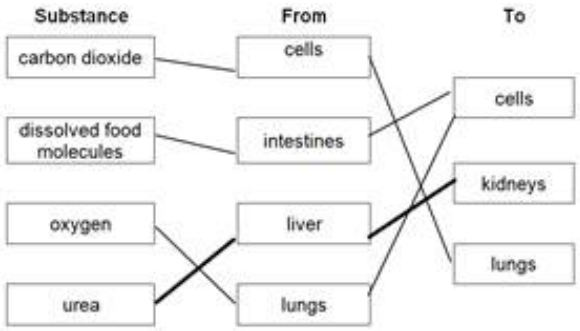
| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 3 | (a) | | All bars correctly plotted = 3 ✓<br>3 or 4 bars correctly plotted = 2 ✓<br>2 bars plotted correctly = 1 ✓ | 3 | 2.2 | **ALLOW** error of plus or minus ½ small square on the graph paper grid |
| | (b) | | **Two correct lifestyle factors and associated descriptions required for 4 marks**<br><br>Genetic / may have inherited genes ✓<br>**AND**<br>That makes heart attacks more or less of a risk ✓<br>**OR**<br>Exercise ✓<br>**AND**<br>Makes heart attacks less of a risk ✓<br>**OR**<br>High fat diet / obesity ✓<br>**AND**<br>Makes heart attacks more of a risk ✓<br>**OR**<br>Stress ✓<br>**AND**<br>Makes heart attacks more of a risk ✓<br>**OR**<br>Drinking too much alcohol ✓<br>**AND**<br>Makes heart attacks more of a risk ✓<br>**OR**<br>Smoking ✓ | 4 | 1.1 | One mark for each correctly identified lifestyle factor without description, up to a maximum of two |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | | **AND**<br>Makes heart attacks more of a risk ✓ | | | **ALLOW** increase in blood CO (due to smoking) |
| | **(c)** | | Acts as a pump ✓ | **1** | **1.1** | |
| | **(d)** | | ✓ Cells are joined end to end with no connecting walls | **1** | **1.1** | If more than one box is ticked, do not award the mark even if the correct box is also ticked |
| | **(e)** | | They can specialise into other cells ✓<br>Could be used to treat disease ✓ | **2** | **1.1**<br>**2.1** | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 4 | (a) | | Add (equal volume) of Benedict's solution ✓<br>Heat in a hot water bath ✓<br><br>Brick red precipitate is a positive test for glucose ✓ | 3 | 1.2 | **DO NOT ALLOW** heat over a Bunsen burner |
| | (b) | (i) | Plots correct +/- half a square ✓<br>Appropriate scale ✓<br>Axes correct and labelled ✓<br>Lines joined in curves and labelled ✓<br>  <br> | 4 | 2.2 | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | (ii) | **Any two from**<br>**A** / oxygen increases faster than **B** / no oxygen ✓<br>In **A**, numbers double every hour ✓<br>In **B**, numbers double every hour and then slow ✓<br>Both increase at the same rate in the first hour ✓<br>**A** increases to 800 ✓<br>**B** increases to 200 ✓ | **2** | **3.1a** | |
| | (c) | | **Any two from**<br>Aerobic uses oxygen and anaerobic does not use oxygen ✓<br>Anaerobic releases less energy / ATP than aerobic ✓<br>Anaerobic can release lactic acid / carbon dioxide ✓<br>Glucose breakdown is complete in aerobic but incomplete in anaerobic ✓ | **2** | **1.1** | **ALLOW** the reverse answer in each case |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 5 | (a) | (i) | 800 ✓ | 1 | 2.2 | |
| | | (ii) | *A has:*<br>Greater resolution / more detail ✓<br>Greater magnification ✓ | 2 | 2.2 | **ALLOW** organelles such as mitochondria are visible |
| | (b) | (i) | Y = cell membrane ✓ | 1 | 2.1 | |
| | | (ii) | Releases energy / ATP ✓ | 1 | 1.1 | |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td> 
</td><td>3</td><td>1.1</td><td>Cells to carbon dioxide to lungs<br><br>Intestines to dissolved to cells<br><br>Lungs to oxygen to cells<br><br>i.e. mark each substance separately</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table>
<tr><th>Model</th><th>Surface area ($cm^2$)</th><th>Volume ($cm^3$)</th><th>Surface area : volume ratio</th></tr>
<tr><td>A</td><td>24</td><td>8</td><td>3:1 ✓</td></tr>
<tr><td>B</td><td>48</td><td>8</td><td>6:1 ✓</td></tr>
</table></td><td>2</td><td>2.2</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>Any two from<br>As they get bigger, the surface area : volume ratio gets smaller ✓<br>So gases diffuse more slowly in / out ✓<br>Diffusion across outer body surface too slow ✓</td><td>2</td><td>2.1 x 1<br><br>1.1 x 1</td><td></td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 7 | (a) | (i) | C ✓ | 1 | 1.1 | |
| | | (ii) | **B:** 92.86 ✓<br>**C:** 39.36 ✓ | 2 | 2.2 | **DO NOT ALLOW** answers not given to 2d.p. |
| | | (iii) | Prevents impulse leaking out / insulates neuron ✓ | 1 | 1.1 | |
| | (b) | (i) | Fast ✓ | 1 | 1.1 | |
| | | (ii) | Prevent damage / safety ✓ | 1 | 1.1 | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 8 | (a) | | **D C B E A** all three marks<br>**D** first and **A** last ✓<br>**C** before **B** ✓<br>**B** before **E** ✓ | 3 | 1.1 | |
| | (b) | | **Any four from**<br>Choose a bull from a high milk yield herd / mother with high milk yield ✓<br>Choose a cow from a high milk yield herd / mother with high milk yield ✓<br>Breed together ✓<br>From the next generation choose high yield cow ✓<br>Repeat over many generations ✓ | 4 | 2.1 | **ALLOW** genes for high milk yield increase / genes for low milk yield lost from population. |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 9 | (a) | | **Sarah**<br>**Jack**<br>d d<br>D Dd Dd ✓<br>d dd dd<br>Probability ½ / 50% / 1 in 2 ✓ | 2 | 2.2 | |
| | (b) | | **FIRST CHECK THE ANSWER ON THE ANSWER LINE IF** answer = 12 820 award 2 marks<br><br>64 100 000 / 5 000 ✓<br>12 820 ✓ | 2 | 2.2 | |
| | (c) | | Linked to smoking ✓<br>Linked to work related exposure to pollutants ✓ | 2 | 1.1 | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 10 | (a) | | Chloroplast ✓ | 1 | 1.1 | |
| | (b) | | The closer the light the faster photosynthesis / more bubbles produced ✓<br>No further increase on photosynthesis / number of bubbles from 25 to 12.5 cm ✓ | 2 | 3.1a | **ALLOW** more oxygen produced |
| | (c) | (i) | Repeat the reading for 12.5 cm ✓<br>If the number of bubbles is close to 105 then she can be more certain it is the true value ✓ | 2 | 3.3b | **ALLOW** repeat for all distanced and calculate a mean |
| | | (ii) | **Any two from**<br>Use a heat source to vary the temperature e.g. a water bath ✓<br>Use a thermometer to measure the temperature ✓<br>Count the number of bubbles (of oxygen) given off (at each temperature) ✓ | 2 | 3.3a | |
| | (d) | (i) | Transpiration ✓ | 1 | 1.1 | |
| | | (ii) | **C:** mean 9.46 ✓<br>**C:** rate of water uptake 0.32 ✓ | 2 | 1.2 | |
| | | (iii) | Stomata let in gas / carbon dioxide needed for photosynthesis ✓<br><br>Stomata open when it is light / during the day ✓ | 2 | 1.1 | **ALLOW** idea that more stomata are open for one mark |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | (iv) | **Any two from**<br>**1.** Water may be lost from parts of the apparatus that are not sealed ✓<br>**2.** Some water is used for photosynthesis ✓<br><br>**3.** If the plant is wilting, the plant will use water to restore turgidity ✓ | **2** | **1.2**<br><br>**1.1** | MP2 **DO NOT ALLOW** incorrect use of water e.g. respiration |
| | **(e)** | | Will be unable to exchange gases / take in carbon dioxide ✓<br>So rate of photosynthesis will decrease / go down ✓ | **2** | **2.1** | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 11 | (a)* | | Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.<br><br>**Level 3 (5–6 marks)**<br>Correctly explains in detail how to use all four pieces of apparatus to carry out a transect from the tree to the middle of the field.<br>**AND**<br>Provides a complete description as to how results will be processed.<br><br>*There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*<br><br>**Level 2 (3–4 marks)**<br>Correctly explains in detail how to use two or three pieces of apparatus to carry out a transect from the tree to the middle of the field.<br>**AND**<br>Provides a partial description as to how results will be processed.<br><br>*There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*<br><br>**Level 1 (1–2 marks)**<br>Correctly explains how to use one piece of apparatus to carry out a transect from the tree to the middle of the field.<br>**AND**<br>Provides a simple description as to how results will be processed. | **6** | **2.1 ×4**<br><br>**3.1a ×2** | **AO2.1 Application of knowledge of apparatus to carry out sampling to this example**<br>Tape measure:<br>• Spread tape measure out from tree to middle of field<br>• Mark regular intervals to place quadrat e.g. every other metre<br>• Take regular readings along the transect<br>Quadrat<br>• A quadrat is a square frame<br>• Place quadrat on the ground<br>• At the intervals indicated by the tape measure being used to mark out the transect<br>• Estimate percentage cover of plants.<br>Identification key:<br>• Compare plants observed to images / descriptions<br>• Use to find names / species of plants<br>• In each quadrat<br>• Dichotomous choices within the key.<br>Light meter:<br>• Measure light levels / light intensities<br>• Hold equipment at ground level<br>• Equipment should be held at the same angle each time |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td></td><td></td><td></td><td>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.<br><br>0 marks<br>No response or no response worthy of credit.</td><td></td><td></td><td>• Take a reading for each quadrat along the transect<br>AO3.1a Description of the processing of results<br>• Consider the types of plants in relation to the light readings<br>• Compare the light levels along the transect<br>• Compare plant types / species / percentage cover along the transect<br>• Draw a table to show percentage cover in each quadrat along the quadrat<br>• Possible graphical representation of results e.g. bar chart / kite diagram.</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><td>Number of species</td><td>2</td><td>3</td></tr><tr><td>Total number of plants</td><td>20</td><td>20</td></tr><tr><td>Biodiversity index</td><td>0.1</td><td>0.15</td></tr></table></td><td>1</td><td>2.2</td><td>All values need to be correct to award the mark</td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | (c) | | | 1 | 1.1 | |

Decreasing the genetic variation within species. ☐

Increasing the population of a common species. ☐

Storing seeds in seed banks. ✓

Using wood rather than oil for fuel. ☐

## Summary of updates

| Date | Version | Change |
|---|---|---|
| May 2018 | 2 | We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information please see our assessment principles in our "Exploring our question papers" brochures on our website |

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