OCR
Oxford Cambridge and RSA

Accredited

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

H

J260/05 Biology (Higher Tier)

Sample Question Paper

Date – Morning/Afternoon

Version 2.2

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.

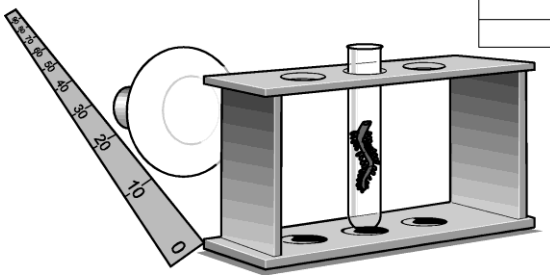
INFORMATION
- The total mark for this paper is **95**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **32** pages.

Answer **all** the questions.

1 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.

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..... **[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]**

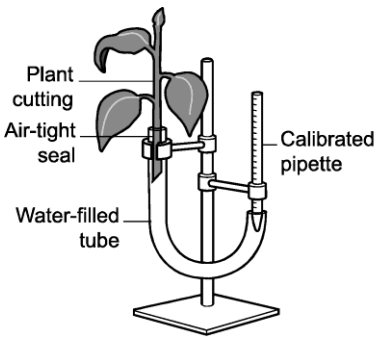
(d) The scientists also investigate the rate at which water is lost by leaves.

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

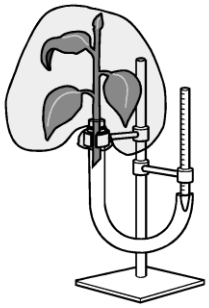
..... **[1]**

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

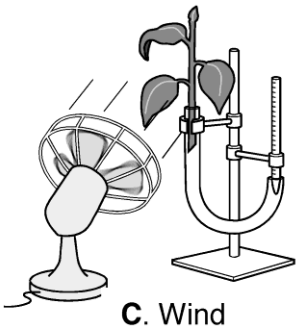
- They measure the water uptake in 30 minutes.
- They use four conditions: **A**, **B**, **C** and **D**, as shown below.



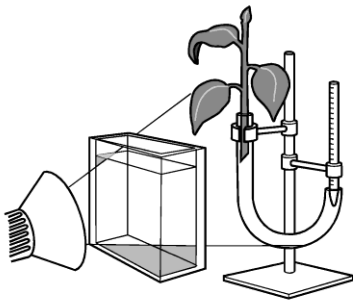
A. Normal room



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]**

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

Explain the results for **D**.

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

(v) 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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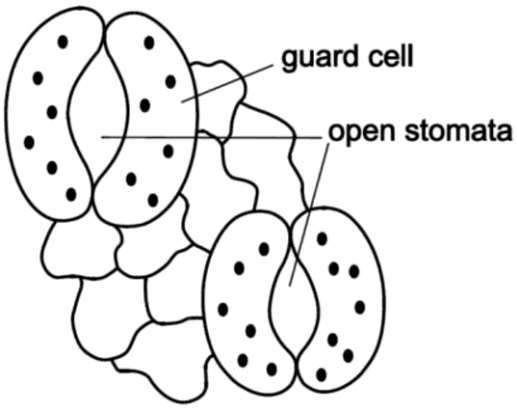
..... **[2]**

(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]**

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

Jane 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.

Jane 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 2.1.

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 2.1

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]**

3 Scientists use key words to explain inheritance.

(a) Complete the sentences about genetics.

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 ……

An organisms' entire genetic material is called its …… **[3]**

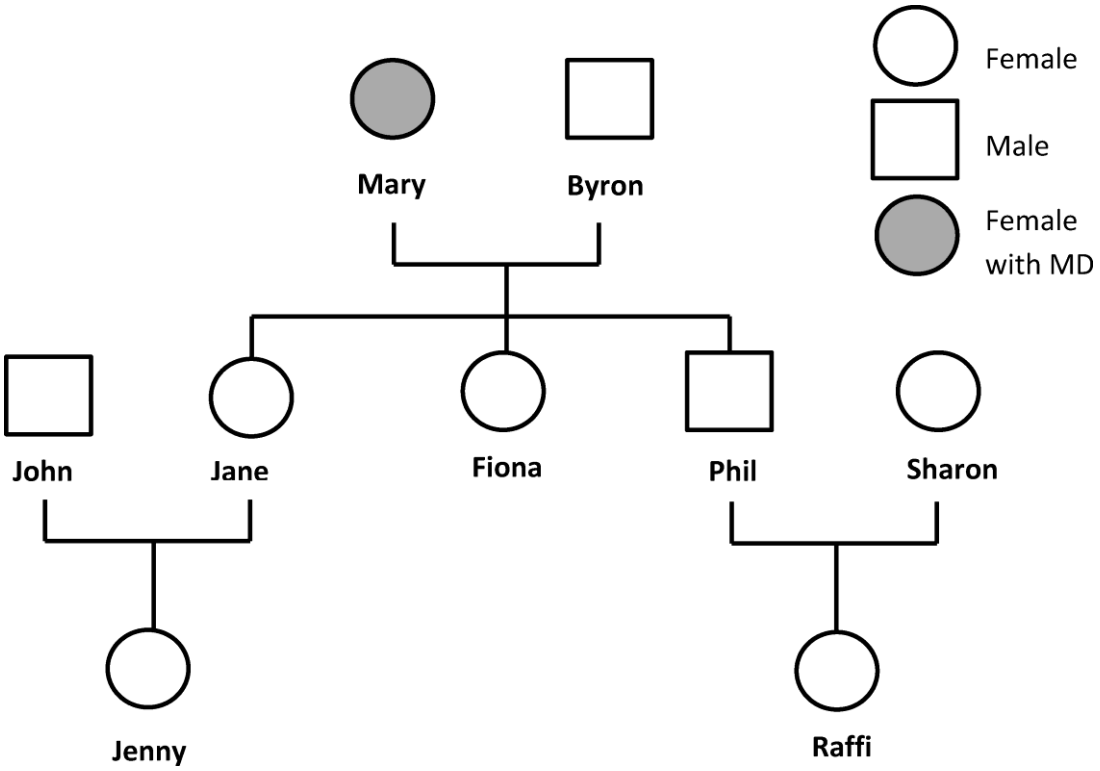
(b) Mitochondria are sub-cellular structures inside nearly every cell of the body.

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 cell.

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

Look at the family tree. Mary has mitochondrial disease (MD).



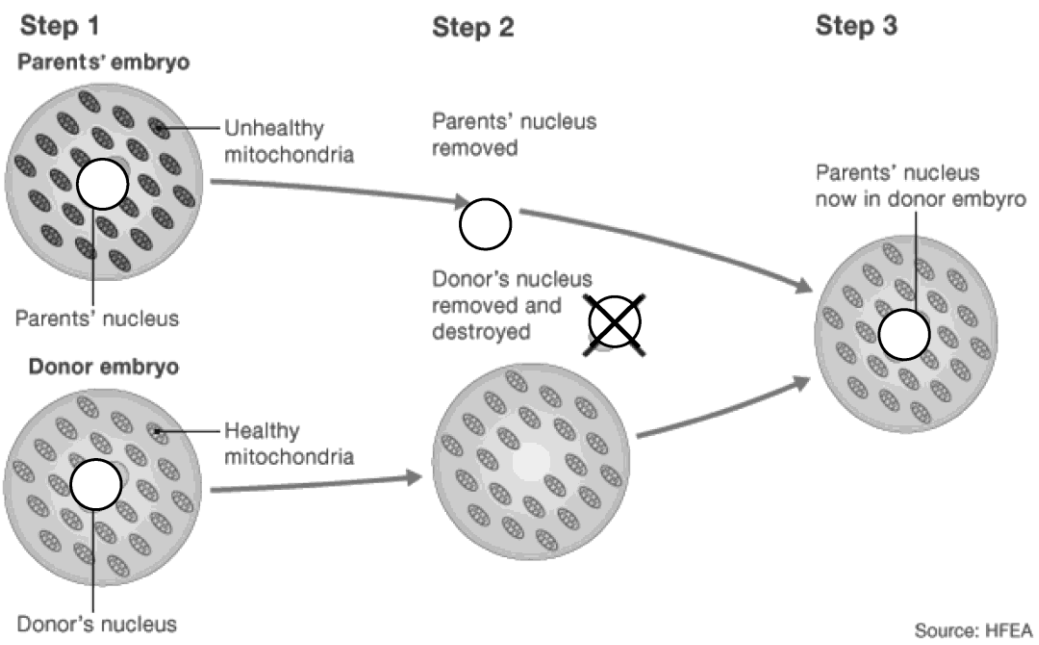
Name the **four other** people in Mary's family tree who will definitely have Mitochondrial Disease.

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

(c) 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.



Describe some of the possible benefits of using this gene technology.

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

(d) (i) Enviropig is a genetically engineered type of pig.
It has been engineered to make the enzyme phytase in its salivary glands.

Phytase is naturally present in many plants.
It enables Enviropig to digest plant phosphorus-containing compounds more efficiently.

Describe the main steps used to produce the genetically engineered Enviropig.

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

(ii) Explain why the enzymes naturally present in pig saliva cannot digest plant phosphorus-containing compounds.

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

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TURN OVER FOR THE NEXT QUESTION

4 Infectious diseases in plants and animals can be caused by some types of microorganisms, called pathogens.

(a) Our bodies have defences that make it difficult for pathogens to enter our bodies.

Use **lines** to link each **defence** to its correct **description.**
One of the descriptions is incorrect.

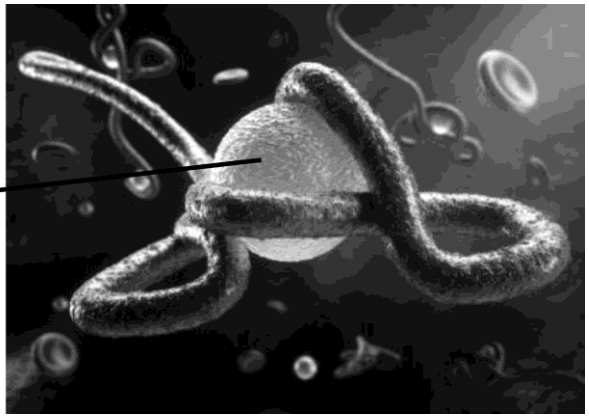
Defence	Description
	traps pathogens
Bacteria living in intestines	
	competes with pathogens
Mucus	
	breaks down pathogens
Skin	
	barrier to pathogens
Stomach acid	
	contains an enzyme that kills pathogens
Tears	
	recognises pathogen

[3]

(b) 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 information about Ebola.

Ebola pathogen (a virus)



Ebola is a serious communicable 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) Describe **one** way that the spread of Ebola from individuals with symptoms could be reduced.

Use the information above in your explanation.

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

(ii) If an individual survives Ebola, they are unlikely to ever suffer from it again.
They are immune.

Explain how individuals become immune to Ebola.

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

(c) New medicines, including vaccinations, are tested before they are made widely available.

Preclinical and clinical tests are used to assess the safety and effectiveness of new medicines.

Complete the tables below by putting a tick (✓), in **one** box next to the test to show if it assesses **safety**, **effectiveness** or **both**.

For each test, one example has been done for you.

Preclinical tests	Safety	Effectiveness	Both
Cultured human cells			✓
Whole animals			

Clinical tests	Safety	Effectiveness	Both
Healthy volunteers			
Humans with the disease			✓

[2]

(d) It usually takes years of preclinical testing before a new medicine or vaccine is tested on humans.

In 2014, a new vaccine for Ebola was tested only a few months after it was first made.

Use the information in the question about Ebola and ideas about risk to suggest why the 2014 Ebola vaccine was tested so quickly on humans.

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

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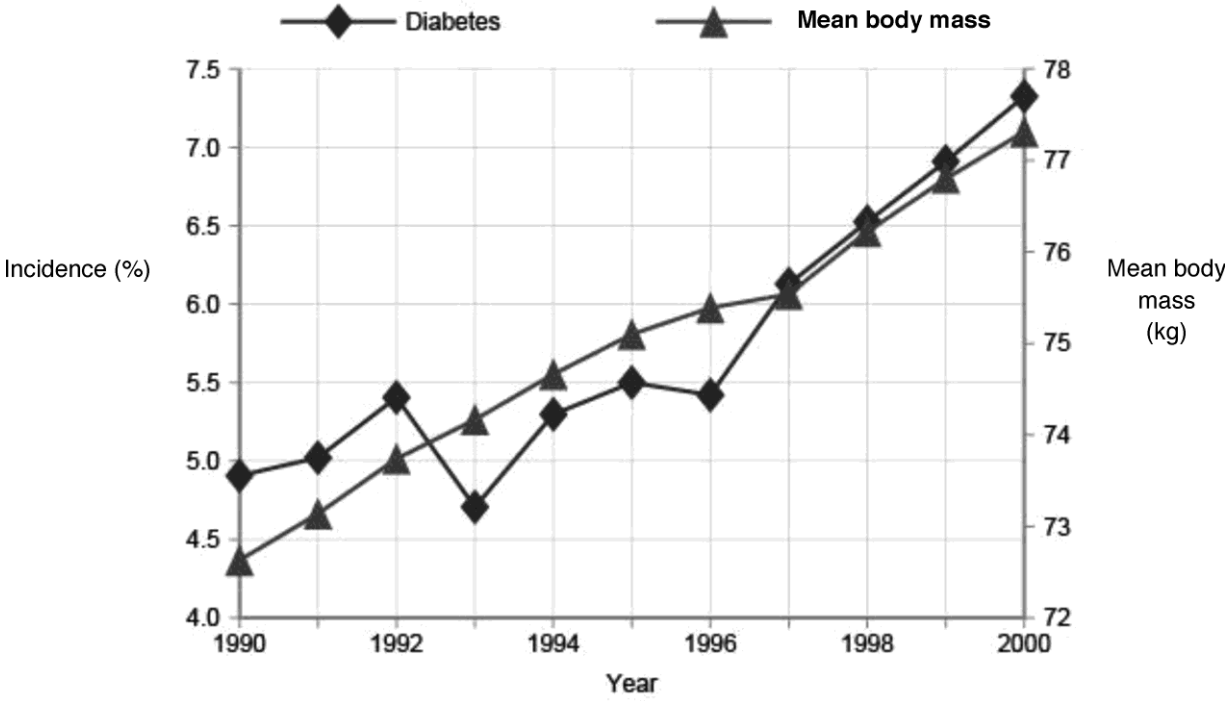
TURN OVER FOR THE NEXT QUESTION

5 The graph shows the changes in mean body mass and incidence of type 2 diabetes from 1990 to 2000.



(a) Use the graph to decide which of these statements is correct.

Put a tick (✓) in the boxes next to the **three** correct statements.

Statement

The biggest annual increase in diabetes was from 1996–1997. ☐

The incidence of diabetes increased in every year. ☐

The mean body mass increased by less than 6 kg per person from 1990 to 2000. ☐

The mean body mass increased in every year. ☐

The percentage incidence of diabetes increased by more than 2.5% from 1990 to 2000. ☐

[3]

(b) The data in the graph suggests that the incidence of diabetes increases as body mass increases.

What extra information is needed to show if this is a causal relationship?

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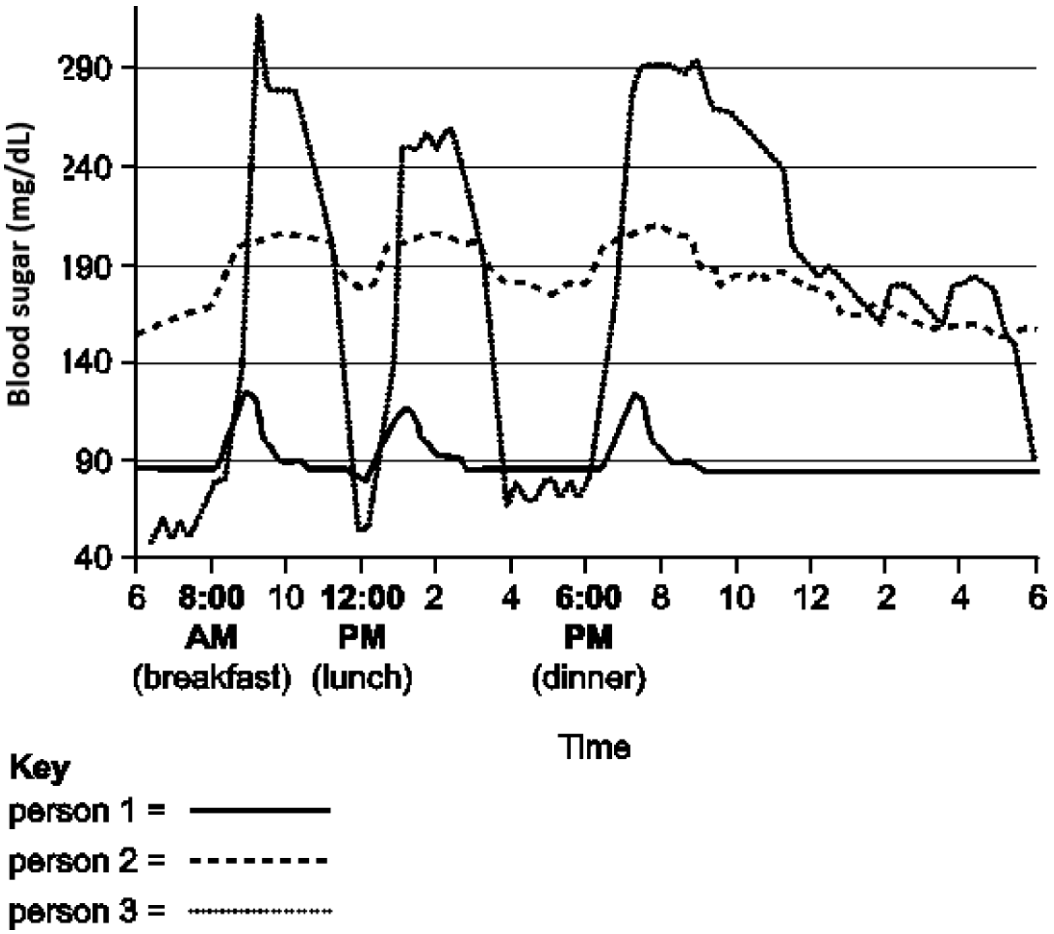
..... **[1]**

(c) In 2013 in the UK, 3.2 million people had been diagnosed with diabetes.

320 000 of these had type 1 diabetes.

Show that 90% of people with diabetes in 2013 had type 2 diabetes. **[2]**

(d) The graph shows how the blood sugar level of three people varies over a day.



One person has **type 1** diabetes, one has **type 2** diabetes and the third **doesn't have diabetes**.

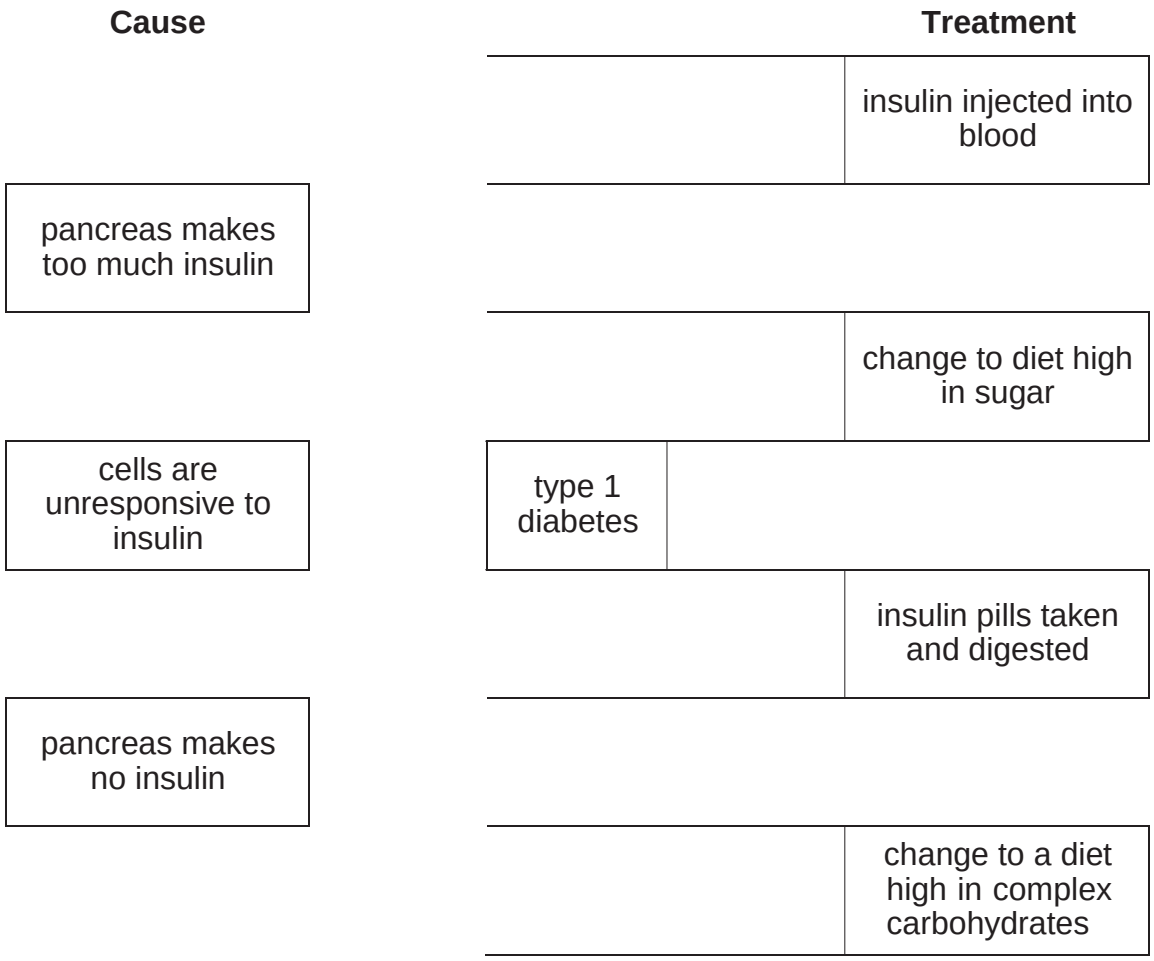
Use the information from the graph to identify each person and complete the table.

Person	Condition identified
1	
2	
3	

[2]

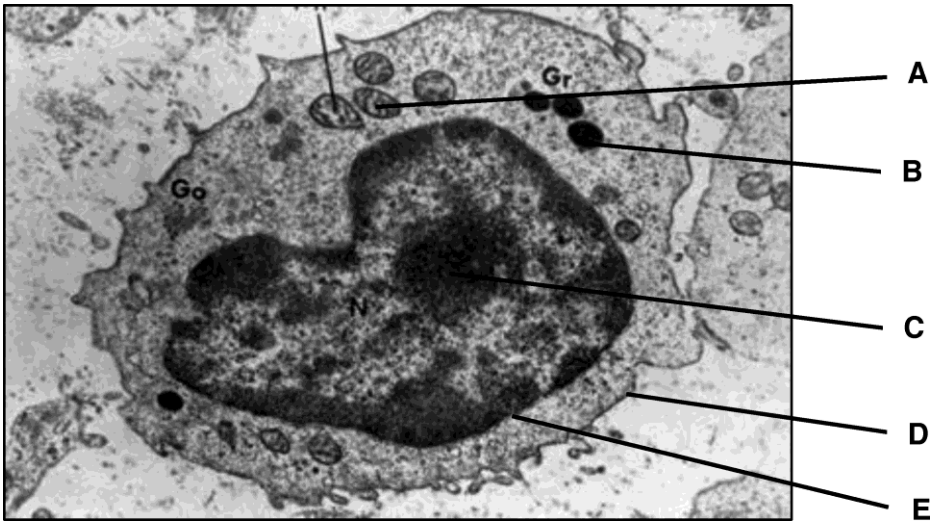
(e) **Type 1** and **type 2** diabetes have different causes and different treatments.

Use **two lines** to complete the diagram to show the correct **cause** and **treatment** for **type 1 diabetes**.



[2]

6 **(a)** **(i)** The picture is a micrograph of a type of human cell.



Write down the letter **A**, **B**, **C**, **D** or **E** which indicates a mitochondrion.

…… **[1]**

(ii) A scientist is trying to identify the cell in the micrograph. He knows his micrograph has a magnification of 8 000.

On his micrograph, a scientist measures the diameter of the cell to be = 100 mm.

Calculate the actual diameter of the cell.

Show your working.

Diameter ……mm **[2]**

(b) The scientist observes another cell using an electron microscope. It is found to be much smaller than the first cell and also has no mitochondria.

Put a tick (✓) in the box next to the possible second cell type.

Cell type

Bacterial cell ☐

Leaf palisade cell ☐

Liver cell ☐

Neurone ☐ **[1]**

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TURN OVER FOR THE NEXT QUESTION

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

Cells need to be constantly supplied with inputs for cellular respiration and the waste outputs need to be removed from cells.

Write down the waste outputs of aerobic and anaerobic cellular respiration in humans.

Aerobic waste outputs .....

Anaerobic waste outputs .....**[2]**

(b) The image shows a type of animal called a flatworm.

(Image removed due to third party copyright restrictions.)

Flatworms can grow quite large. However, flatworms do not have a circulatory system.

Explain why even large flatworms can exchange gases efficiently and do not need a transport system.

Use ideas about surface area, volume and diffusion in your explanation.

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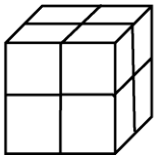
..... **[3]**

(c) Earthworms have a circulatory system but have no specialised gas exchange surface. Gases diffuse in and out of the earthworm across its moist skin.

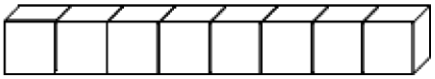
A scientist makes two models **A** and **B** using 1 cm^3 blocks.

- **A** is a 2 cm × 2 cm × 2 cm cube.
- **B** is eight 1 cm^3 blocks in a line to represent an earthworm.

A



B (earthworm)

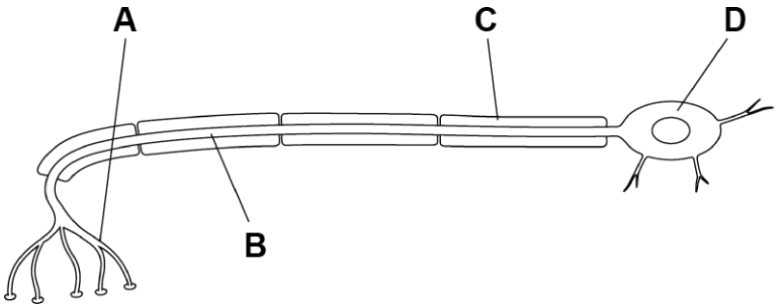


Calculate the values below to complete the scientist's results table.

Model	Surface area (cm^2)	Volume (cm^3)	Surface area : volume ratio
A			
B			

[2]

8 **(a)** The diagram below shows a motor neuron.



Describe the effect on the function of the motor neuron if part **C** is damaged.

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

(b) Ling picks up a hot plate and quickly drops it. This is a reflex action.

Describe the sequence of events that happens in Ling's nervous system during this reflex action.

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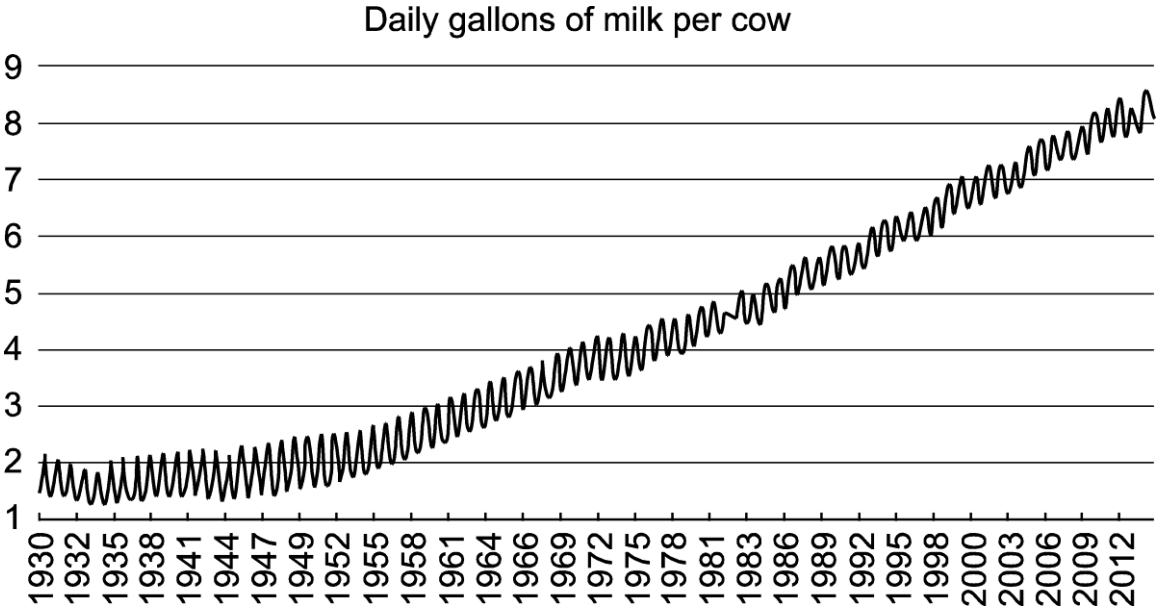
9 **(a)** Humans have changed the characteristics of domesticated animals and crop plants by selective breeding.

Look at the graph below.



The graph shows how 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]**

(b) Other ways of improving milk production in cows have been developed over this time period.

State another way of improving milk production that is used by farmers.

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

10 **(a)** The human menstrual cycle is controlled by hormones.

Draw a line from each hormone to describe the **role** of the hormone in the menstrual cycle.

Hormone	Interaction
Oestrogen	Causes the ovaries to develop a follicle containing an egg, which will then produce oestrogen
FSH	Causes the uterus lining to thicken
Progesterone	Causes the follicle to release an egg, the remaining corpus luteum produces progesterone
LH	Maintains the lining of the uterus

[3]

(b) (i) Some data was collected from an IVF clinic.

The table below shows the percentage of IVF treatments that resulted in live births in 2010.

Age of female receiving treatment	Percentage of live births
Under 35	32.2
35 – 37	27.7
38 – 39	20.8
40 – 42	13.6
43 – 44	5

Current guidelines in the UK recommend that women aged 40 and under should be offered three rounds of free IVF treatment. Women aged 40 to 42 should be offered only one round.

Evaluate the data in the table to suggest why these decisions are made.

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

(ii) In one year, the fertility clinic treated 387 females.

90 of these females were successful and gave birth to live babies.

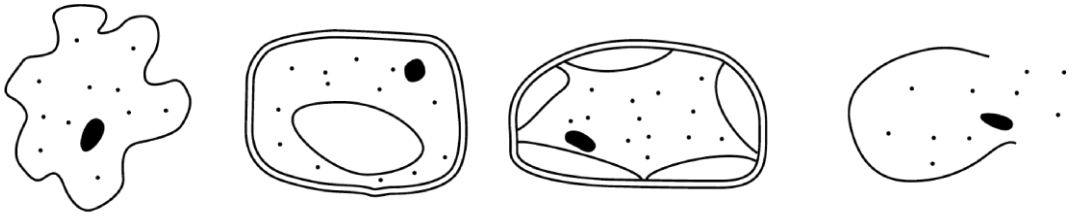
Calculate the percentage of live births.

Show your working.

Percentage of live births .....% **[1]**

11 **(a)** James carried out an experiment by putting various animal and plant cells in different solutions.

The diagrams below show the appearance of the four cells down a microscope after one hour.



A **B** **C** **D**

In the table below, write the letter **A**, **B**, **C** or **D** next to the description that best matches the diagram. One has been done for you.

Description	Letter
A plant cell that has been placed in distilled water.	**B**
A plant cell that has been placed in a concentrated sugar solution.	
An animal cell that has been placed in distilled water.	
An animal cell that has been placed in a concentrated sugar solution.	

[3]

(b) Explain, in terms of osmosis, what has happened to cell **B**.

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

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TURN OVER FOR THE NEXT QUESTION

12 A student viewed a large number of cells from an onion root tip under a microscope.

She recorded the number of cells that were in each stage of the cell cycle of mitosis.

The results are shown in the table below.

Stage of mitosis	Number of cells in stage	Cells in stage as percentage of total (%)
Interphase	176	79.7
First stage of division of nucleus	20	9.1
Second stage of division of nucleus	12	5.4
Third stage of division of nucleus	6	2.7
Fourth stage of division of nucleus	7	

(a) Calculate the percentage of cells that were observed in the fourth stage of division of the nucleus.

Show your working.

Percentage of cells ……% **[2]**

(b) Before the division of the nucleus of a cell by mitosis, the genetic material must replicate.

Explain why this is essential.

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…… **[2]**

(c) The nucleus of a gamete such as a sperm cell is produced by **meiosis**.

During meiosis a cell undergoes two divisions.

Suggest how cells produced by meiosis may differ from those produced by mitosis.

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

END OF QUESTION PAPER

Summary of updates

Date	Version	Change
February 2021	2.1	Image of a flatworm removed from Question 7b due to third party copyright restrictions.
December 2021	2.2	Updated copyright acknowledgements.

OCR
Oxford Cambridge and RSA

H

…day June 20XX – Morning/Afternoon

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

J260/05 Biology (Higher 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 **2(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)		Chloroplast ✓	1	1.1	
	(b)		The closer the light the faster photosynthesis / more bubbles produced ✓ No further increase in 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 ✓ 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** Use a heat source to vary the temperature e.g. a water bath ✓ Use a thermometer to measure the temperature ✓ Count the number of bubbles (of oxygen) given off (at each temperature) ✓	2	3.3a	

Question			Answer	Marks	AO element	Guidance
	(d)	(i)	Transpiration ✓	1	1.1	
		(ii)	**C:** mean 9.46 ✓ **C:** rate of water uptake 0.32 ✓	2	1.2	
		(iii)	Stomata let in gas / carbon dioxide needed for photosynthesis ✓ Stomata open when it is light / during the day ✓	2	1.1	**ALLOW** idea that more stomata are open for one mark
		(iv)	**Any two from** **1.** Water may be lost from parts of the apparatus that are not sealed ✓ **2.** Some water is used for photosynthesis ✓ **3.** If the plant is wilting, the plant will use water to restore turgidity ✓	2	1.2 1.1	MP2 **DO NOT ALLOW** incorrect use of water e.g. respiration
	(e)		Will be unable to exchange gases / take in carbon dioxide ✓ So rate of photosynthesis will decrease / go down ✓	2	2.1	

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

0 marks
No response or no response worthy of credit.</td><td></td><td></td><td>• Take a reading for each quadrat along the transect

AO3.1a Description of the processing of results
• Consider the types of plants in relation to the light readings
• Compare the light levels along the transect
• Compare plant types / species / percentage cover along the transect
• Draw a table to show percentage cover in each quadrat along the quadrat
• 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>20</td><td>20</td></tr><tr><td>Total number of plants</td><td>2</td><td>3</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	

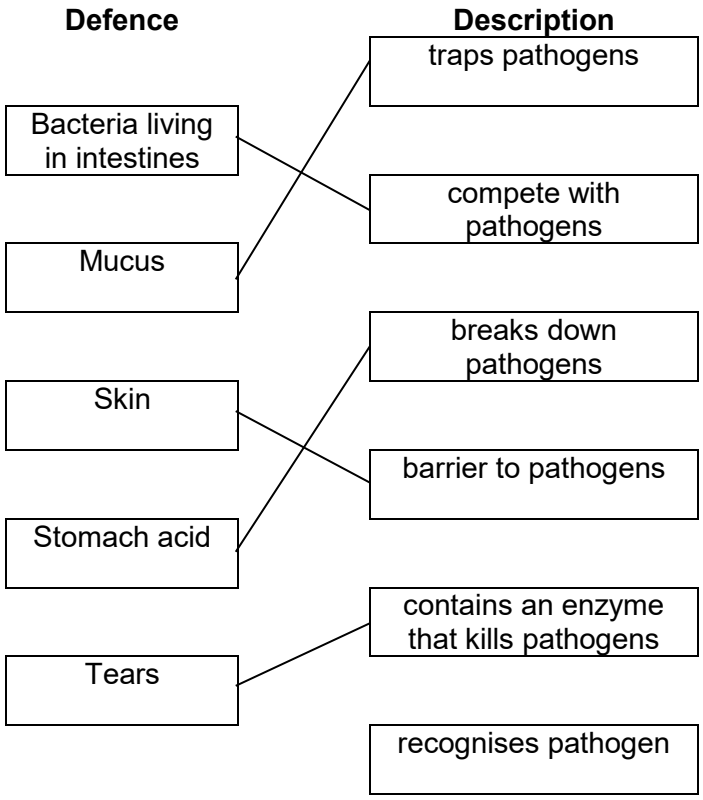
Decreasing the genetic variation within species. ☐

Increasing the population of a common species. ☐

Storing seeds in seed banks. ✓

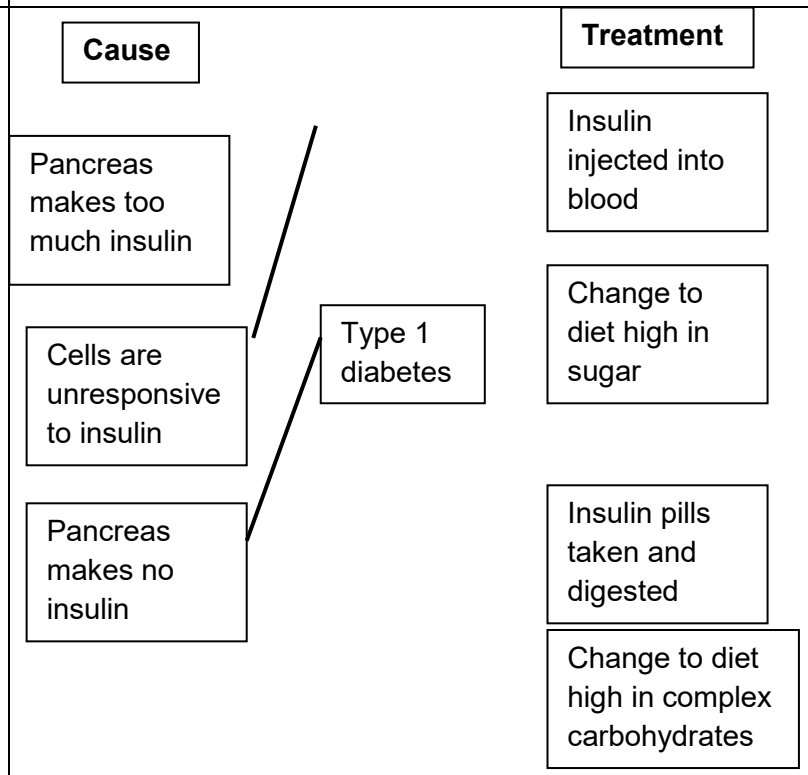
Using wood rather than oil for fuel. ☐

Question			Answer	Marks	AO element	Guidance
3	(a)		Nucleotides / nitrogenous bases ✓ Genes / codons / base triplets ✓ Genomes ✓	3	1.1	
	(b)		Jane, Fiona, Phil ✓ Jenny ✓	2	2.1	**ALLOW** Jane, Fiona, and Phil in any order but all must be named for first marking point
	(c)		**Any 2 from** *Benefits* Child will not have mitochondrial disease ✓ In the future child cannot pass on mitochondrial disease ✓ Parents and family could not cope with a child with mitochondrial disease ✓ Cost benefits if don't have to treat affected child ✓	2	3.2b	
	(d)	(i)	Isolate gene for phytase from a plant genome ✓ Vector inserts (phytase) gene to pig genome ✓ Use a vector e.g. a virus or plasmid to transfer the gene ✓	3	2.1 ×2 1.1	
		(ii)	Enzymes present in pig saliva are a different shape (from those in plants) ✓ Plant phosphorus will not fit into the <u>active site</u> ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
4	(a)			3	1.1	All 5 lines correct with no additional line(s) = 3 marks Subtract a mark off for each incorrect line
	(b)	(i)	**Any one from** Isolation of infected individuals ✓ No contact with vomit / faeces / blood from infected individuals ✓ People treating Ebola patients to wear protective clothing ✓ Protective clothing sterilised / incinerated ✓	1	2.1	

<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>(ii)</td><td>Any four from
Receptors / membrane bound antibody on a white blood cell attaches to Ebola antigen ✓
White blood cells clone / multiply / most produce antibody to Ebola antigen ✓
Some of the white blood cell clones become memory cells ✓
A second infection by Ebola triggers antibody production ✓
Ebola destroyed before infected individual becomes ill ✓
Massive number of antibodies produced in a short time ✓</td><td>4</td><td>2.1</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th>Preclinical tests</th><th>Safety</th><th>Effectiveness</th><th>Both</th></tr>
<tr><td>Cultured human cells</td><td></td><td></td><td>✓</td></tr>
<tr><td>Whole animals</td><td></td><td></td><td>✓</td></tr>
</table>
<table>
<tr><th>Clinical tests</th><th>Safety</th><th>Effectiveness</th><th>Both</th></tr>
<tr><td>Healthy volunteers</td><td>✓</td><td></td><td></td></tr>
<tr><td>Humans with the disease</td><td></td><td></td><td>✓</td></tr>
</table>
</td><td>2</td><td>1.1</td><td>Tick in correct box for mark.
If more than one box is ticked in each empty row, do not award the mark even if the correct box is also ticked</td></tr>
<tr><td></td><td>(d)</td><td></td><td>Any one from
Ebola infection carries a very high risk ✓
Worth taking the risk of (even serious) side effects ✓</td><td>1</td><td>3.1a</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
5	(a)		**Statement** The biggest annual increase in diabetes was from 1996-1997. ✓ The incidence of diabetes increased in every year. ☐ The mean body mass increased by less than 6 Kg per person from 1990 to 2000. ✓ The mean body mass increased in every year. ✓ The percentage incidence of diabetes increased by more than 2.5% from 1990 to 2000. ☐	3	2.2	
	(b)		Mechanism / knowledge of how increasing body mass could affect cause diabetes ✓	1	2.1	
	(c)		**EITHER** 3 200 000 – 320 000 = 2 880 000 ✓ 2 880 000 x 100/3 200 000 = 90% ✓ **OR** 320 000 x 100/3 200 000 = 10% ✓ 100 – 10 = 90% ✓	2	2.2	

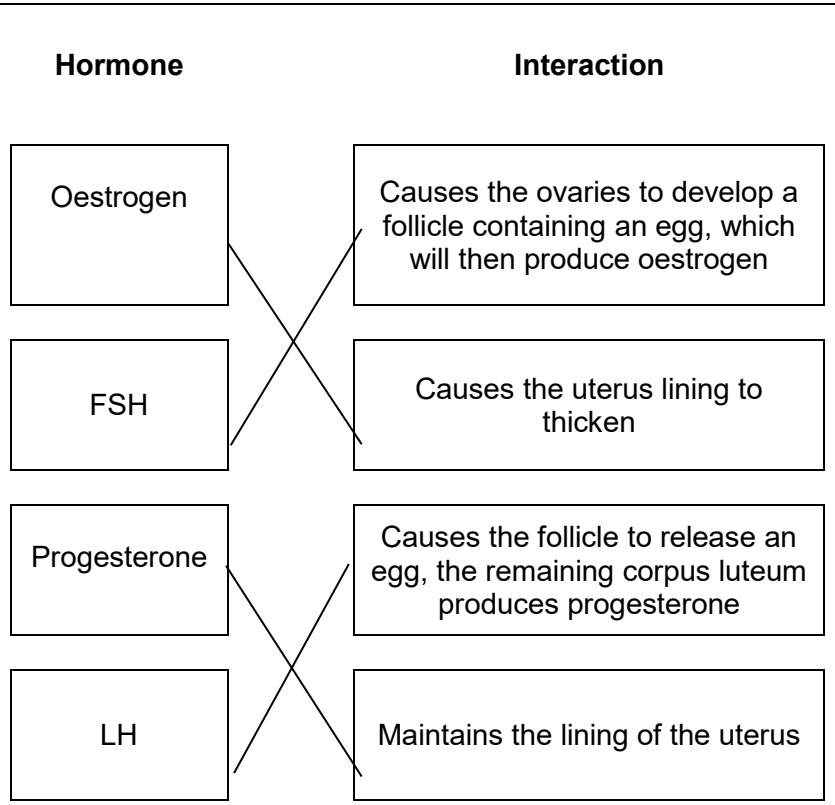
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td></td><td>(d)</td><td></td><td><table><tr><th>Person</th><th>Diagnosis</th></tr><tr><td>1</td><td>no diabetes</td></tr><tr><td>2</td><td>type 1 diabetes</td></tr><tr><td>3</td><td>type 2 diabetes</td></tr></table></td><td>2</td><td>3.2a</td><td>All three correct = 2 marks
One or two correct = 1 mark</td></tr>
<tr><td></td><td>(e)</td><td></td><td> 
</td><td>2</td><td>1.1</td><td>One mark for correct cause and one mark for correct treatment</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	A ✓	1	2.2	
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **IF** answer = 0.0125 mm award 2 marks 100 / 8 000 ✓ Answer = 0.0125 ✓	2	2.2	**ALLOW** 12.5µm
	(b)		✓ Bacterial cell	1	2.1	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>Aerobic waste = carbon dioxide ✓
Anaerobic waste = lactic acid ✓</td><td>2</td><td>1.1</td><td>ALLOW water for aerobic waste</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Any three from
Flatworms have a very big surface area to volume ratio ✓
Idea that gas exchange is therefore rapid ✓
(Because of shape) no cell is far from the surface ✓
So diffusion is rapid enough to deliver oxygen and remove carbon dioxide ✓</td><td>3</td><td>2.1</td><td>Large surface area not enough for one mark</td></tr>
<tr><td></td><td>(c)</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>34</td><td>8</td><td>17:4</td></tr></table>First two columns correct ✓
Ratios correct ✓</td><td>2</td><td>2.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
8	(a)		(Damage to fatty sheath) results in a decrease in speed of the nerve impulse ✓	1	1.1	**ALLOW** signal / information
	(b)		Detected by receptors in the skin ✓ Impulse is sent along the sensory neuron ✓ To spinal cord / CNS ✓ Impulse is sent along the motor neuron ✓ To (hand / arm) muscles / effectors ✓	5	1.1	**DO NOT ALLOW** brain

Question			Answer	Marks	AO element	Guidance
9	(a)		**Any four from:** Choose a bull from a high milk yield herd / mother with high milk yield ✓ Choose a cow from a high milk yield herd / mother with high milk yield ✓ Breed together ✓ From the next generation choose high yield cow ✓ Repeat over many generations ✓	4	2.1	**ALLOW** genes for high milk yield increase / genes for low milk yield lost from population.
	(b)		**Any one from** Better nutrition ✓ Use of antibiotics ✓ Use of pesticides ✓ Use of hormones ✓ Use of vaccinations ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
10	(a)			3	1.1	4 correct answers = 3 marks 3 correct answers = 2 marks 2 correct answers = 1 mark Mark each hormone separately
	(b)	(i)	**Any one from** After the age of 39 the likelihood of the IVF working decreases dramatically so it is not thought not to be worthwhile ✓ Eggs are poorer quality so less likely to work ✓	1	3.1b	
		(ii)	90 / 387 = 23% ✓	1	1.2	**ALLOW** 23.3% / 23.26%

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>11</td><td>(a)</td><td></td><td>
<table>
<tr><th>Description</th><th>Letter</th></tr>
<tr><td>A plant cell that has been placed in distilled water.</td><td>B</td></tr>
<tr><td>A plant cell that has been placed in a concentrated sugar solution.</td><td>C ✓</td></tr>
<tr><td>An animal cell that has been placed in distilled water.</td><td>D ✓</td></tr>
<tr><td>An animal cell that has been placed in a concentrated sugar solution.</td><td>A ✓</td></tr>
</table>
</td><td>3</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>Any two from
Water moves into the cell ✓
By osmosis ✓
Down a concentration gradient / from where there is more water to where there is less ✓
Cell does not burst because of the cell wall ✓</td><td>2</td><td>2.1</td><td>DO NOT ALLOW along a concentration gradient</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
12	(a)		**FIRST CHECK THE ANSWER ON THE ANSWER LINE** If the answer = 3.17 award 2 marks (7 ÷ 221) × 100 ✓ 3.17 ✓	**2**	**1.2**	
	(b)		Cells are genetically identical / have the same DNA ✓ So both (daughter) cells receive all of the genetic information / a full copy of the genetic material ✓	**2**	**1.1**	**ALLOW** in context of identical to each other or identical to parent **ALLOW** same genetic information / material **ALLOW** same / correct amount of DNA **IGNORE** 'new cells need genetic material' without ref to full amount
	(c)		**Any two from** Half the genetic information ✓ Genetic information not identical / produces genetically different cells ✓ 4 cells produced ✓	**2**	**1.1**	**DO NOT ALLOW** identical / not identical without genetic **DO NOT ALLOW** smaller cells

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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