OCR
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GCSE (9–1) Biology A (Gateway Science) **F**
J247/02 Paper 2 (Foundation Tier)
Sample Question Paper

Date – Morning/Afternoon
Time allowed: 1 hour 45 minutes

Version 2.2

You may use:
• a scientific or graphical calculator
• a ruler

First name	
Last name	

Centre number						Candidate number				

INSTRUCTIONS
• Use black ink. You may use an HB pencil for graphs and diagrams.
• 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 **90**.
• The marks for each question are shown in brackets **[ ]**.
• Quality of extended response will be assessed in questions marked with an asterisk (*).
• This document consists of **32** pages.

SECTION A

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

1   Which statement is an example of sustainability?

    A   Harvesting selected trees from a forest and replanting.

    B   Replacing forests with food crops.

    C   Taking fish from the sea faster than they can reproduce.

    D   Using crude oil to make plastics.

Your answer [＿＿]   **[1]**

2   Many habitats are being destroyed.

It is important to stop habitat destruction to maintain:

    A   Active transport

    B   Biodiversity

    C   Differentiation

    D   Homeostasis

Your answer [＿＿]   **[1]**

3 The diagram shows a food web.
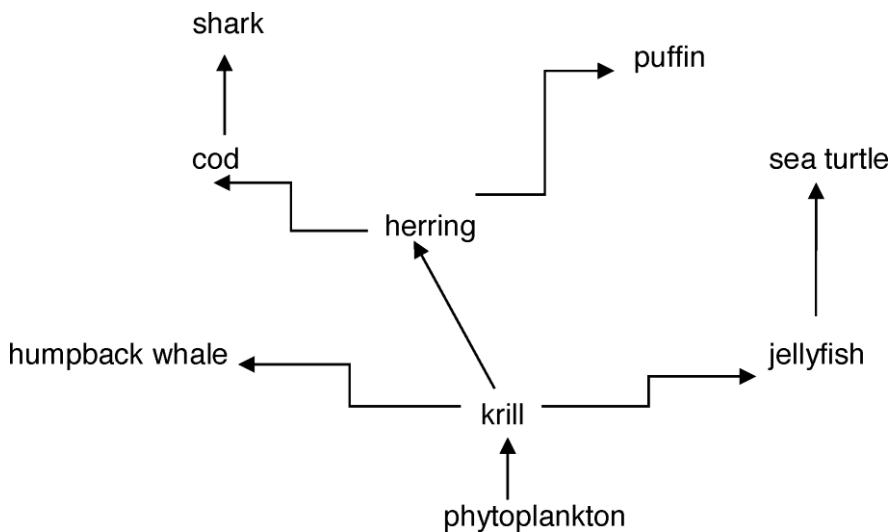
What is the most likely effect on the food web, if the number of cod decreases?

A An increase in the number of herrings

B An increase in the number of krill

C An increase in the number of sharks

D No effect on the population of puffins

Your answer [ ] **[1]**

4 Look at the pyramid of biomass.
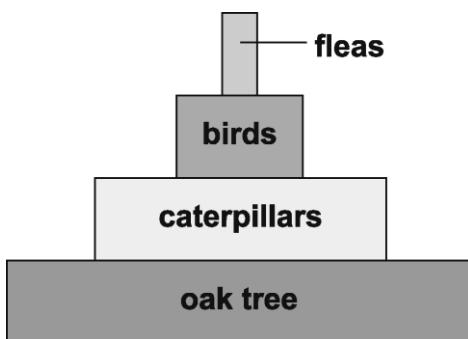
What can you tell from this pyramid of biomass?

A All four trophic levels contain consumers.

B Fleas are producers.

C The trophic level with oak trees has the lowest biomass.

D There are fewer birds than caterpillars.

Your answer [ ]   **[1]**

5 Organisms in an ecosystem are affected by **biotic** factors.

Which term is a biotic factor?

A Disease

B Light intensity

C Rainfall

D Wind speed

Your answer [ ]   **[1]**

6 What are the names of the two scientists who first suggested the theory of natural selection?

   A Darwin and Mendel

   B Mendel and Wallace

   C Wallace and Darwin

   D Watson and Crick

Your answer [   ] **[1]**

7 A sperm cell of a mouse has 20 chromosomes.

Which row in the table shows the correct number of chromosomes in each cell?

	Number of chromosomes in	
	a mouse egg cell	a mouse eye cell
A	20	20
B	20	40
C	40	20
D	40	40

Your answer [   ] **[1]**

8 The DNA of an unborn baby can be found in the blood sample of the mother.

This DNA is tested to see which chromosomes are present.

Which conclusion is correct for the unborn baby?

   A It must be a boy if an X chromosome is present.

   B It must be a boy if a Y chromosome is present.

   C It must be a girl if an X chromosome is present.

   D It must be a girl if a Y chromosome is present.

Your answer [   ] **[1]**

9 Different diseases are caused by different pathogens.

Which type of pathogen causes tobacco mosaic disease?

A A bacterium

B A fungus

C A protist

D A virus

Your answer ☐ **[1]**

10 What may a vaccine contain?

A Antibiotics specific to the microbe

B Dead microbes

C Memory cells

D Small numbers of live harmful microbes

Your answer ☐ **[1]**

11 Scientists want to make human stem cells from body cells rather than getting stem cells from embryos.

Why is this?

A Human embryos are single-celled.

B Some people object to destroying human embryos.

C Stem cells cannot be found in human embryos.

D The cells in human embryos are all differentiated.

Your answer ☐ **[1]**

12 New drugs are tested on humans, animals and tissues.

Which order is used when tested?

A Animals – tissues – humans

B Humans – animals – tissues

C Tissues – animals – humans

D Tissues – humans – animals

Your answer ☐ **[1]**

13 Why is it difficult to kill cancer cells in the body?

A They are body cells and so the body's defence system does not attack them.

B They are foreign cells that are not destroyed by antibiotics.

C They divide very slowly.

D They hide inside other body cells, away from the body's defence system.

Your answer ☐ **[1]**

14 Heart disease affects a large number of people.

Which factor contributes to heart disease?

A Being a non-smoker

B Lack of exercise

C Low fat diet

D Not drinking alcohol

Your answer ☐ **[1]**

15   Look at the table.

It shows the death rates from coronary heart disease (CHD) in the UK in 2008.

Death rates from CHD per 100,000 population			
Age 55–64		Age 65–74	
Men	**Women**	**Men**	**Women**
175	47	443	179

In 2008 the total number of deaths per 100,000 in both age ranges was 844.

What percentage of these deaths were women?

A   5.6%

B   21.2%

C   22.6%

D   26.8%

Your answer   **[1]**

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TURN OVER FOR THE NEXT QUESTION

SECTION B

Answer **all** the questions.

16 Different parts of the body have natural defence mechanisms to stop pathogens infecting the body.

These defences include:

• skin

• tears

• secretions from the stomach.

(a) Describe how each defence stops pathogens infecting the body.

....

....

....

....

....

....

.... **[4]**

(b) Sometimes the defence mechanisms do **not** work and pathogens enter the body. The pathogens may then be treated with antibiotics.

What is an antibiotic?

....

....

.... **[2]**

(c) A student is ill and is having tests in hospital.
His doctors monitor his body temperature frequently.

Explain why it is important to monitor his body temperature frequently.

....

.... **[2]**

(d) The doctors took a sample of blood from the student.
They looked at the specimen under a light microscope.

This is a picture of what they saw.
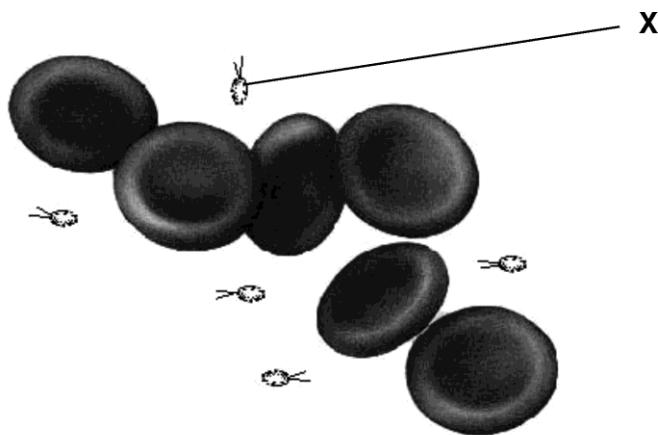
From this picture, the doctors decide that the student's illness is caused
by bacteria (labelled **X**).

(i) Why do the doctors **not** think that the structures labelled **X** are viruses?

.... **[1]**

(ii) What equipment could the doctors use to get a clearer image to confirm
their ideas?

.... **[1]**

(e) The student's doctors want to check that the bacteria causing his illness are not resistant to the antibiotic erythromycin.

This is the method they use:

1. A petri dish is made that has the bacteria growing evenly over the surface of agar.

2. A disc of filter paper is soaked in erythromycin.

3. The disc is placed on the agar in the centre of the petri dish.

4. The lid of the dish is fixed on with a piece of tape.

5. The dish is then incubated.

(i) Why did the doctors tape the lid on the petri dish?

.... **[1]**

(ii) The diagram shows the doctor's results.
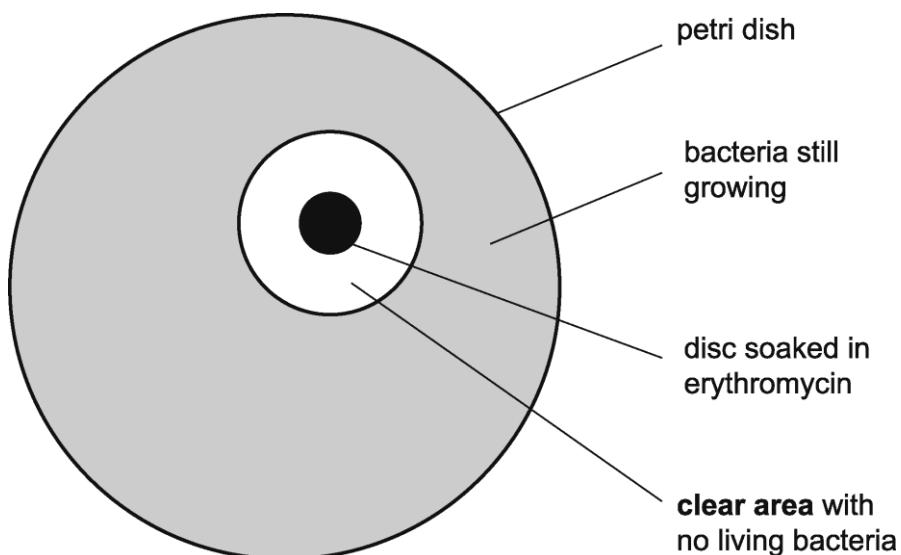
Use a ruler to measure the diameter of the **clear area** in mm.

Using this diameter, calculate the area of the circle where there are no living bacteria.

- The area of a circle = πr^2 and $\pi = 3.14$

Answer = ... mm^2 **[3]**

(iii) This table is used to analyse the results of the experiment.

Area clear of bacteria including the area of the disc (mm²)	Level of resistance
less than 133	resistant
133 to 416	intermediate resistance
more than 416	not resistant

Use your result from part **(ii)** to judge the level of resistance in the microbe.

.... **[1]**

Turn over

17 Rheumatic fever is a rare disease in the UK.

Look at this information.

Rheumatic fever information leaflet
Bacteria can enter the mouth and cause a sore throat.
This may develop into rheumatic fever.
Rheumatic fever is much more likely if a person does not get enough food or lives in overcrowded conditions.
White blood cells in the body make protein molecules to kill the bacteria causing rheumatic fever.
However, sometimes these molecules attack heart valves, making them leaky.

(a) (i) Put ticks (✓) in the **two** boxes that best describe rheumatic fever.

|	
a communicable disease	
a disease that is affected by lifestyle	
a disease that is caused by defective alleles	
a non-communicable disease	

[1]

(ii) White blood cells make protein molecules that can kill the bacteria.

What is the name of these protein molecules?

.... **[1]**

(iii) The diagram shows one of the valves that can be made leaky.
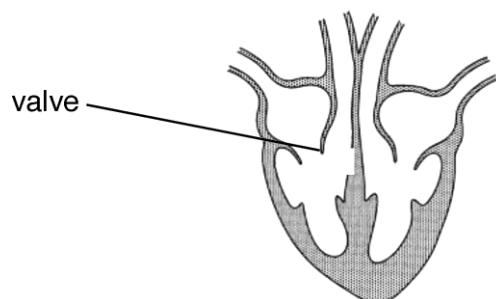
valve

People who have this leaky valve often have these symptoms:

- they get out of breath easily

- they do not seem to have much energy and feel tired.

Write about the job of this valve and how damage to the valve may cause these symptoms.

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.. **[4]**

(b) **Look at the graph.**

- It gives data about people of different ages.

- It shows the number of cases of rheumatic fever.

- It also shows the number of new cases of heart problems caused by rheumatic fever.

Number of cases of rheumatic fever ■

Number of new cases of heart problems caused with rheumatic fever ○

Age of people in years
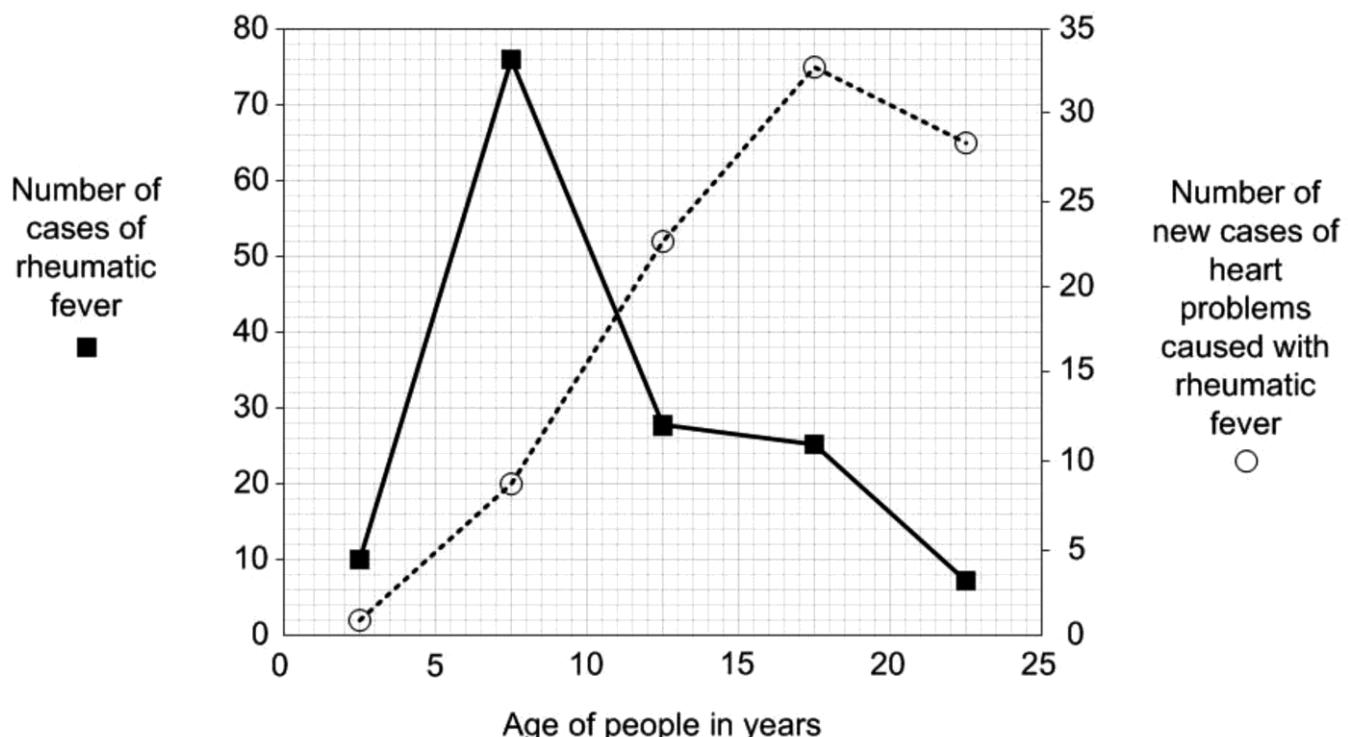
(i) What is the age of people that most commonly have rheumatic fever?

Answer = ... years **[1]**

(ii) How many years after getting rheumatic fever is it most common to get heart problems?

How can you tell this from the graph?

....

....

....

.... **[2]**

(c) One treatment for the heart valve problem is to lower the patient's blood pressure.

Blood pressure can be lowered by taking a drug to **increase** the amount of water excreted by the body.

Which organ would be targeted by the drug and what would be the effect on urine?

Organ targeted ....

effect on urine ....

.... **[2]**

18 Wolfram's syndrome is a genetic disorder.

- It is caused by a recessive allele (n).

- In people with Wolfram's syndrome, a protein does not function correctly.

The diagram shows a pair of chromosomes from a person called Kai.

Allele for non-Wolfram's syndrome allele (N)

Allele for Wolfram's syndrome (n)
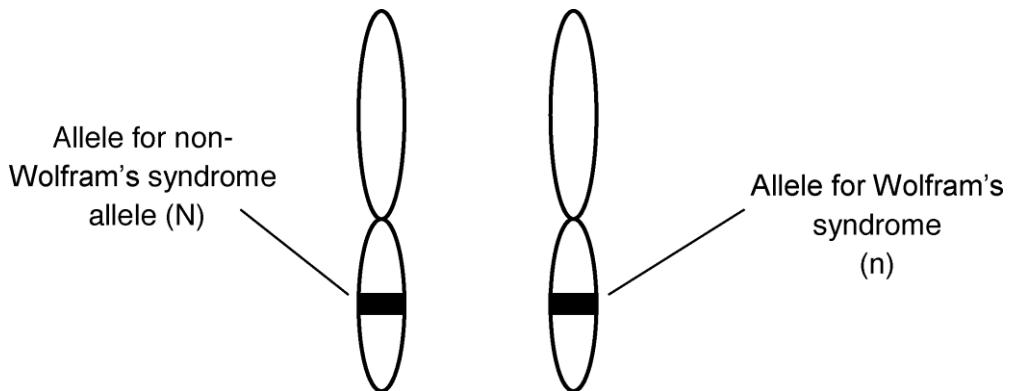
(a) Complete these sentences.

Kai does **not** have Wolfram's syndrome.

This is because his genotype is ....

This means that the probability of any one of his sperm having the Wolfram's

allele is..**[2]**

(b) (i) Layla is expecting a baby.

Kai is the father.

Complete this genetic diagram.

		Kai	
Layla	N		
	n		

[2]

(ii) Wolfram's syndrome can affect the production of hormones from the pancreas.

Layla and Kai's doctor tells them that there is a chance that their baby will have problems controlling its blood glucose level.

Explain why the doctor thinks this.

Use information from part **(b)(i)** and your biological knowledge.

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.... **[4]**

19 In many countries, people rely on bananas for food.

Black sigatoka is a disease of banana plants.

The disease is caused by a fungus.

(a) Banana plants grown by farmers are usually produced asexually.

This process uses mitosis.

This means that, if one banana plant dies of black sigatoka, all the bananas can die.

Explain why.

....

.... **[1]**

(b) The food security of bananas could be improved using different methods.

Draw a straight line to join each **method** to a step that it **involves**.

method	involves
biological control	putting a gene for resistance into banana plants
	growing bananas in a greenhouse
genetic engineering	choosing resistant banana plants to use for reproduction
	using hydroponics
selective breeding	introducing a virus that kills black sigatoka fungus

[3]

(c) A type of pesticide called a fungicide can be used to kill the fungus.

Scientists are investigating how well a fungicide works.
They also want to see if the fungicide works better if they add a chemical called a sticking agent. This helps the fungicide stick to the banana leaves.

The scientists grow banana plants in four blocks.

The table shows the treatments each block is given.

Block	Treatment	
	Fungicide	**Sticking agent**
A	✓	✓
B	✓	X
C	X	✓
D	X	X

(i) Why did the scientists include the treatments given to block **C** and block **D**?

Block **C** ....

....

Block **D** ....

.... **[2]**

(ii) After a few months the scientists gave the plants in each area a disease rating.
The higher the disease rating the more disease present.

Block	Disease rating
A	20
B	35
C	45
D	60

What conclusions could the scientists make from this study?

....

....

....

.... **[3]**

20 The rock pocket mouse is a small grey coloured mouse that lives in Mexico.

- These mice are the main food for owls.

- Rattlesnakes also feed on these mice.

- The mice get most of their food from grass plants.

(a) Complete the sentences about this food web.

The grass plants are producers in the food web.

Mice are primary .... in this food web.

The group of mice living in this habitat is called a population.

All the organisms living in this habitat is called the .... **[2]**

(b) Scientists want to construct a pyramid of biomass for this food web.

They first need to estimate how many organisms there are in the area.
They decide to do this using sampling.

(i) Describe how the scientists would sample an area and ensure that the sample was **not** biased.

....

....

.... **[2]**

(ii)* To estimate grass cover and the number of animals, the scientists use a quadrat.

- Why do scientists use sampling when studying the organisms living in a habitat?

- Identify the limitations of this method and potential improvements that could be made to ensure that the estimated population size of plants and animals closely matches the actual value.

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.... **[6]**

(c) In most areas of Mexico the ground is covered in grey rocks.

In one area the ground is covered with black rocks.
The black rocks were formed about 1000 years ago when a volcano erupted.

The scientists make two observations:

1. Very occasionally a black mouse is born to grey parents due to a mutation.

2. Black mice are well camouflaged.

    Using these two observations, explain why most of the mice in this area are black and **not** the usual grey.

    ....

    ....

    ....

    ....

    ....

    .... **[4]**

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TURN OVER FOR THE NEXT QUESTION

21 Some students are investigating lichens.
Lichens are often studied because they are sensitive to pollution.

(a) Lichens are made up of two different organisms: fungus and algae.

Fungi and algae gain from living together.

What biological name is given to a relationship where both organisms gain?

.... **[1]**

(b) The students find a diagram of a lichen.

hyphae of the fungus makes a waterproof barrier

algae cells which contain chloroplasts
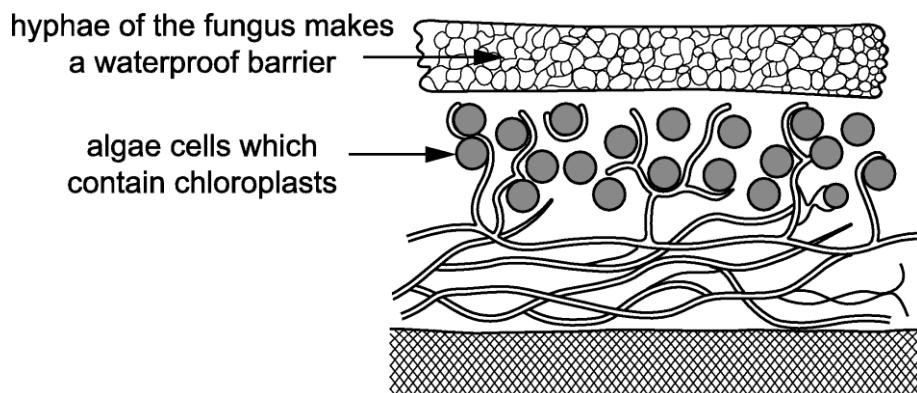
Using the diagram, suggest what the algae and fungus each gain from their relationship.

Algae ....

....

Fungus ....

.... **[2]**

(c) Lichens are sensitive to pollution because they take up chemicals from the air.

The diagram shows a 'bushy' species of lichen and a 'crusty' species of lichen.
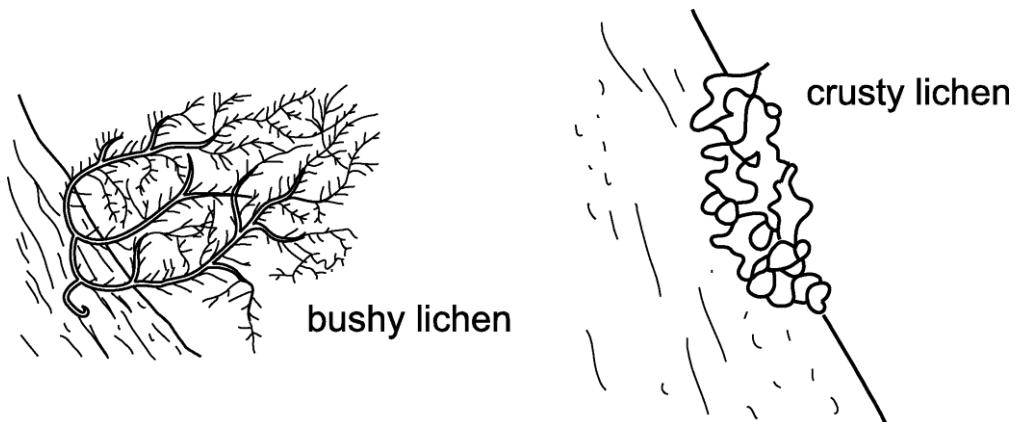
Bushy lichens are usually more sensitive to pollution than crusty lichens.

Use the diagrams to suggest why.

....

.... **[1]**

(d) The students decide to use lichens to try and work out how polluted their school grounds are.

They read about a scale called the Lichen Diversity Value (LDV).

LDV is worked out in this way.

Step 1 Choose four trees in the area.

Step 2 Hold a quadrat on the north side of the trunk of one tree.

Step 3 Count the total number of all the lichens in the quadrat.

Step 4 Repeat **steps 1–3** on the east, south and west side of the tree.

Step 5 repeat **steps 1–4** for each tree.

(i) Suggest how the students could choose the four trees in **step 1**.

....

.... **[1]**

(ii) The students record their results in a table.

	Total number of lichens found in each quadrat			
Tree number	North	East	South	West
1	3	11	18	7
2	4	12	17	8
3	5	10	15	12
4	4	15	12	9
mean	4.0	12.0	15.5	....

The LDV is found by adding together the four mean values.

The students calculate the mean number of lichens on the north, east and south sides of the trees.

- Calculate the mean value for the west side and add it to the table.

- Calculate the LDV.

LDV = ...**[2]**

(iii) This scale shows the type of diversity shown by the LDV.

```
120 ┌─────────────┐
    │             │
100 │  Very high  │
    │             │
 80 ├─────────────┤
    │    High     │
 60 ├─────────────┤
    │  Moderate   │
 40 ├─────────────┤
    │    Low      │
 20 ├─────────────┤
    │  Very low   │
  0 └─────────────┘
```

LDV
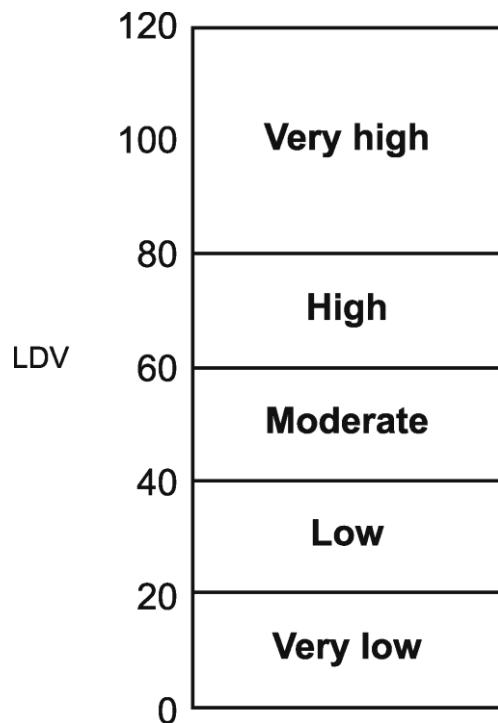
What does the LDV show about the amount of diversity in the school grounds?

....

.... **[2]**

(iv) LDV is calculated by counting all the lichens present.

The students want to make a better assessment of pollution.

What else about the lichens could the students look for?

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.... **[3]**

22 Some students measure the temperature inside a compost heap.
They also measure the external temperature.

On five occasions they mixed up the compost heap with garden forks.

The graph shows their results.
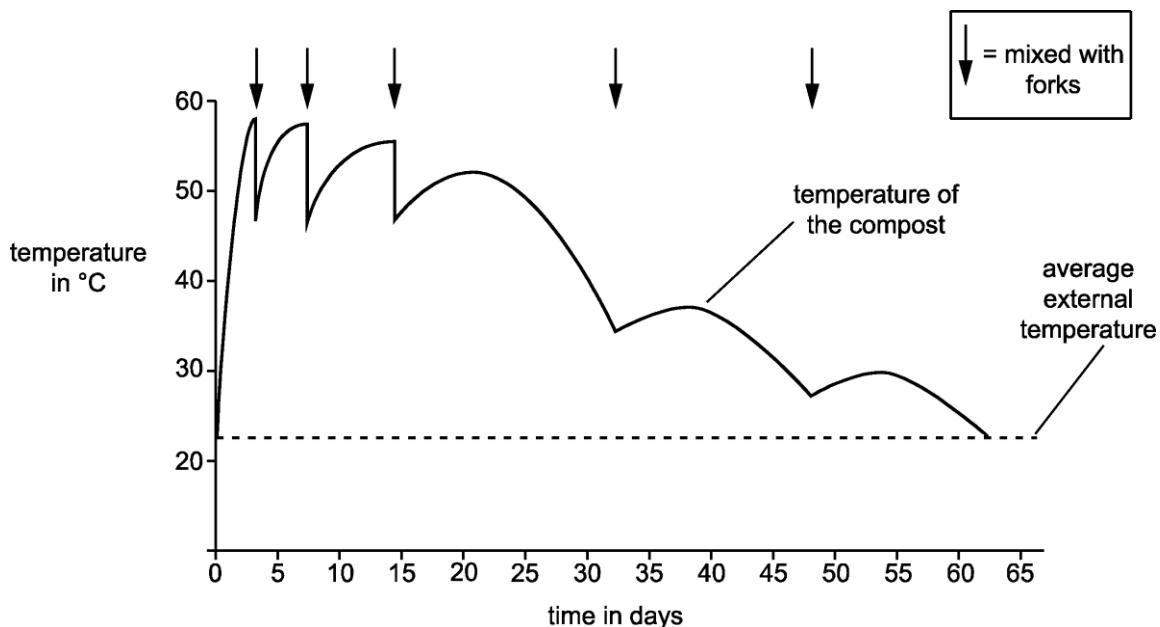
(a) (i) The compost took 63 days to completely decompose.

Explain how the students could tell this from their graph.

....

....

.... **[1]**

(ii) The rate of temperature increase is greatest before the compost is mixed for the first time.

Explain how the rate of temperature change can be calculated.

....

....

.... **[1]**

(b) Compost decomposes more slowly below 30°C or above 60°C.

Use ideas about enzymes and decomposition to explain why.

....

....

.... **[2]**

(c) Use the graph to describe how mixing with a fork helps to provide the best temperature for decomposition.

....

....

.... **[2]**

END OF QUESTION PAPER

Summary of updates

Date	Version	Details
October 2021	2.2	Updated copyright acknowledgements.

OCR
Oxford Cambridge and RSA

…day June 20XX – Morning/Afternoon

GCSE (9–1) Biology A (Gateway Science)
J247/02 Paper 2 (Foundation Tier)

SAMPLE MARK SCHEME

Duration: 1 hour 45 minutes

MAXIMUM MARK   90

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.   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.

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 Biology A:

	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.

SECTION A

Question	Answer	Marks	AO element	Guidance
1	A	1	1.1	
2	B	1	1.1	
3	A	1	2.1	
4	D	1	2.1	
5	A	1	1.1	
6	C	1	1.1	
7	B	1	2.1	
8	B	1	2.1	
9	D	1	1.1	
10	B	1	1.1	
11	B	1	2.1	
12	C	1	1.1	
13	A	1	2.1	
14	B	1	1.1	
15	D	1	2.1	

Question			Answer	Marks	AO element	Guidance
16	(a)		skin forms a barrier (1)	1	1.1	
			enzymes in tears (1)	1	1.1	
			acid in the stomach (1)	1	1.1	
			acid / enzymes break down microbes (1)	1	1.1	
	(b)		**two from:**	1	1.1	
			a chemical (usually) made by fungi / microbes (1)	1	1.1	
			that kills (other) microbes / kills bacteria (1)			
			does not destroy viruses (1)			
	(c)		idea that it is a sign of the extent of the disease (1)	1	2.1	
			temperatures far away from normal can be dangerous (1)	1	1.1	
	(d)	(i)	structure X is too big to be a virus	1	2.1	**ALLOW** viruses cannot be seen with a light microscope
		(ii)	use an electron microscope (1)	1	1.2	
	(e)	(i)	to prevent other people taking in the microbe (1)	1	1.2	**allow** to prevent other microbes starting to grow/contamination **allow** to prevent release of the bacteria if the dish is dropped/knocked
		(ii)	correct area = 452(mm^2) (3) or correct measurement of diameter to calculate radius (1) correct calculation using calculated radius (2)	3	1.2 2 x 2.2	**allow** 452.2
		(iii)	not resistant (1)	1	3.1b	**allow** ECF from (ii)

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	<table><tr><td>a communicable disease</td><td>✓</td></tr><tr><td>a disease that is affected by</td><td>✓</td></tr><tr><td>lifestyle a disease that is caused by defective alleles</td><td></td></tr><tr><td>a non-communicable disease</td><td></td></tr></table>	1	2.1	Both correct answers are required for the mark
		(ii)	antibodies (1)	1	1.1	
		(iii)	idea that it stops blood flowing backwards (1)	1	1.1	
			inefficient circulation to lungs/ less blood would go to the lungs (1)	1	2.1	
			Increased ventilation required for gaseous exchange (1)	1	2.1	
			idea of less oxygen available to the tissues/fatigue/oxygen debt (1)	1	1.1	
	(b)	(i)	7.5 (years) (1)	1	2.1	
		(ii)	10 years (1)	1	2.1	
			idea of time between two peaks (1)	1	3.2a	
	(c)		kidney (1)	1	1.1	
			higher volume / less concentrated (1)	1	1.1	
18	(a)		Nn / heterozygous (1)	1	2.1	
			0.5 (1)	1	2.2	**allow** 50% / ½ / 1 in 2 / 50:50
	(b)	(i)	Layla's and Kai's genotypes Nn (1)	1	2.2	

Question			Answer	Marks	AO element	Guidance
			correct genotypes of offspring (NN, Nn, Nn, nn)	1	2.2	
		(ii)	baby may be nn (1)	1	2.1	
			one in four chance of baby being affected (1)	1	3.1b	
			pancreas produces insulin (1)	1	1.1	
			insulin controls blood glucose level (1)	1	1.1	
19	(a)		all genetically identical / all have the same genes (1)	1	2.1	all clones (1)
	(b)		biological control — introducing a virus that kills black sigatoka fungus genetic engineering — putting a gene for resistance into banana plants selective breeding — choosing resistant banana plants to use for reproduction (other boxes: growing bananas in a greenhouse; using hydroponics)	3	3 x 2.1	
	(c)	(i)	Block C was used so the scientists could see if the sticking agent alone killed the fungus (1)	1	3.1a	
			Block D was used so the scientists could compare the action of the other treatments with no treatment / as a control (1)	1	3.1a	

Question			Answer	Marks	AO element	Guidance
		(ii)	fungicide and sticking agent were the best at killing fungus (1)	1	3.2b	
			fungicide on its own still killed the fungus (but less than with sticking agent (1)	1	3.2b	
			sticking agent does kill the fungus (but less than fungicide) (1)	1	3.2b	
20	(a)		consumers (1)	1	1.1	
			community (1)	1	1.1	
	(b)	(i)	Set out a grid/sample area (1)	1	1.2	
			use random sampling within that area (1)	1	1.2	

Question			Answer	Marks	AO element	Guidance
		(ii)*	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)** **Explains improved animal sampling techniques** *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)** **Explains advantages of plants being sedentary along with the limitations of animal sampling using a quadrat** *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)** **Provides a basic description of why sampling has to be used and use of or the limitations of the quadrat** *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*	6	3 x 1.2 3 x 3.3b	**AO3.3b: Analyse the information to develop the techniques to improve the sampling techniques** • use of capture / recapture • use of pitfall traps • use of pooters • plants are sedentary so will not move and as such are easy to count • animals can move away/frightened away • risk of counting animal more than once • missing some animals e.g. burrowing **and** • further limitations of these methods **AO1.2: Demonstrate knowledge of sampling techniques and why sampling is carried out** • a basic description of use of capture/recapture pitfall traps and pooters • gives a basic description as to why sampling techniques are used • the habitat is often too large to count everything • saves time / would take too long otherwise
	(c)		process involves natural selection (1)	1	2.1	
			mice fed on by snakes / owls (1)	1	2.1	
			black mice less likely to get eaten by snakes / owls (1) can pass on the gene for black colour (1)	1	2.1	

Question			Answer	Marks	AO element	Guidance
				1	2.1	
21	(a)		mutualism (1)	1	1.1	
	(b)		algae gain protection (1)	1	2.1	**allow** idea about prevention of drying out / absorbing water / minerals
			fungi gain sugars (1)	1	2.1	
	(c)		larger surface area (to take up pollutants) (1)	1	2.1	**allow** sticks out more from bark
	(d)	(i)	use of random numbers (1)	1	1.2	**allow** randomly
		(ii)	40.4 (2)	2	2 x 2.2	**allow** correct mean ie 9.0 (1)
		(iii)	moderate pollution (1) only just above low / closer to low than high (1)	1 1	3.1a 3.2a	**allow** ECF from (d) (ii)
		(iv)	identify the species of lichens present in their sample (1)	1	3.3b	**allow** reference to bushy / crusty
			find out how sensitive to pollution these lichens are (1)	1	3.3b	
			if the lichens are mostly pollution sensitive species = low pollution levels (1)	1	3.3b	**allow** ora
22	(a)	(i)	the temperature of the heap was the same as the external temperature (1)	1	2.2	
		(ii)	Change in temperature ÷ time **OR** Tangent drawn from line and used to calculate rate	1	2.2	

Question			Answer	Marks	AO element	Guidance
	(b)		above 60° C the enzymes in the decomposers had denatured (1)	**1**	**1.2**	
			below 30° C the enzymes in the decomposers were working too slowly (1)	**1**	**1.2**	
	(c)		initially / for the first three times forking reduces the temperature / stops it getting too hot (1)	**1**	**3.1a**	
			towards the end forking helps to increase the temperature (1)	**1**	**3.1a**	

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.
October 2019	2.1	Question 17(b) - There has been a change to the answer of this question. Question 20(a) - There has been a change to the answer of this question.