

## Tuesday 16 May 2023 – Morning

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

#### J257/01 Breadth in biology (Foundation Tier)

Time allowed: 1 hour 45 minutes



**You must have:**

- a ruler (cm/mm)

**You can use:**

- an HB pencil
- a scientific or graphical calculator



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

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Last name

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#### INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

#### INFORMATION

- The total mark for this paper is **90**.
- The marks for each question are shown in brackets [ ].
- This document has **24** pages.

#### ADVICE

- Read each question carefully before you start your answer.

2  
BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

1 (a) Write these structures in order of size.

<b>Cell</b>	<b>Chromosome</b>	<b>Gene</b>	<b>Nucleotide</b>	<b>Nucleus</b>
<b>Smallest</b>	.....			
↓	.....			
	.....			
	.....			
	.....			
<b>Largest</b>	.....			

[4]

(b) The table shows the number of chromosomes that different animals have in each body cell.

Animal	Number of chromosomes in each body cell
Earthworm	36
Giant panda	42
Gorilla	48
Fly	8
Cat	38
Polar bear	74
Rat	42
Snail	24
Tiger	38

A student looks at the data and writes this conclusion:

*"The larger the animal, the more chromosomes it has in each body cell."*

Explain why the student is **not** correct.

Use **two** pieces of evidence from the table to support your answer.

.....

.....

.....

..... [2]

- 2 Cocker spaniels are a breed of dog.  
The colour of their fur is affected by the alleles of one of their genes.

The black fur allele (**B**) is dominant. The brown fur allele (**b**) is recessive.

(a) Two cocker spaniels have a puppy.

- One of the parents has black fur and the alleles **Bb**.
- The other parent has brown fur and the alleles **bb**.

Calculate the probability that the puppy has black fur, using the Punnett square.


Probability = ..... [4]

- (b) Complete the sentence to explain why many other fur colours and patterns are seen in cocker spaniels.

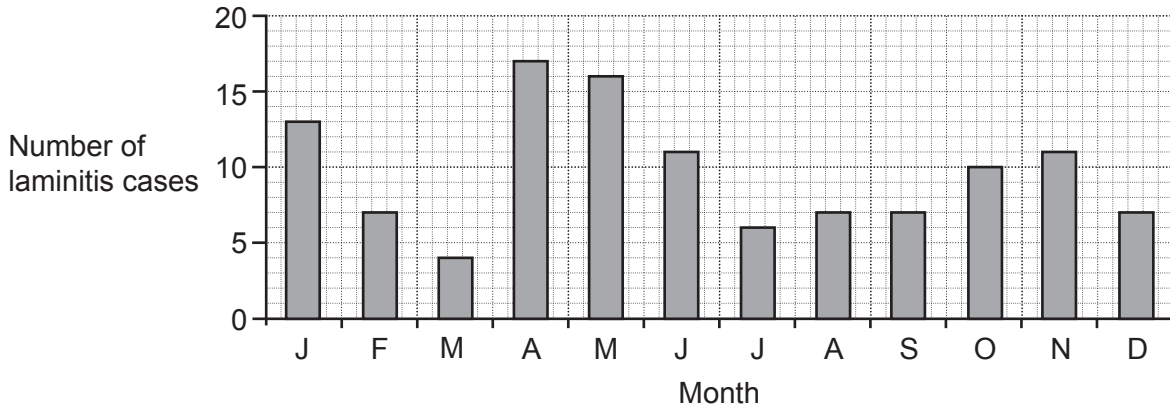
Put a ring around the correct option.

Many different fur colours and patterns are seen in cocker spaniels because most features are the result of **no genes / one gene / many genes**.

[1]

3 Horses can develop a condition called laminitis.

The graph shows the number of laminitis cases in one area in one year.



(a) Complete the sentence.

A horse is **most** likely to develop laminitis in the month of .....

[1]

(b) How many cases of laminitis were there in February?

Number of cases = .....

[1]

(c) Plants can defend themselves against disease.

Which **two** describe plant defences against disease?

Tick (✓) **two** boxes.

- Antibodies
- Cell walls
- Platelets
- Waxy leaf cuticle
- White blood cells

[2]

(d) Ash dieback is a plant disease caused by a pathogen found in soil. It is easily spread from one tree to another.

(i) A boy goes cycling in a woodland where there is ash dieback.

Suggest **one** way in which the boy could prevent spreading the disease to another woodland.

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

(ii) Which type of pathogen causes ash dieback?

Tick (✓) **one** box.

Bacterium   
 Fungus   
 Virus

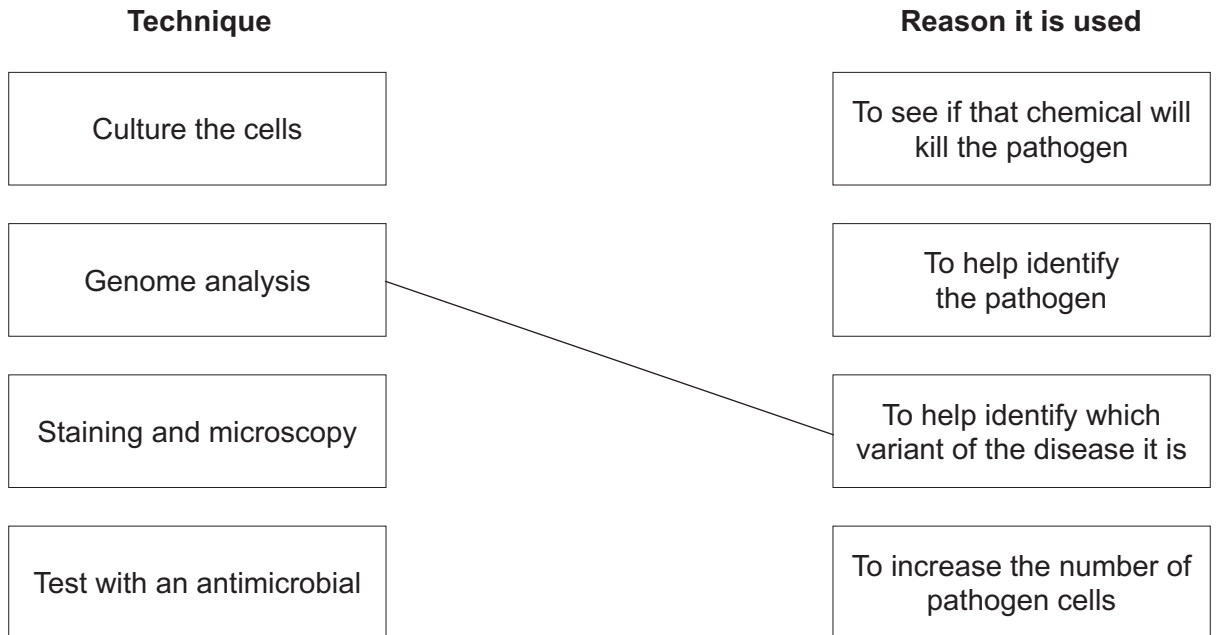
[1]

(e) A scientist collects a sample of pathogen cells from a plant with a disease.

The scientist uses different techniques to try to work out how the disease can be treated.

Draw one line from each **technique** to the correct **reason it is used**.

One has been done for you.



[2]

- 4 (a) Complete the sentences to describe the process of photosynthesis.

Use words from the list.

<b>carbon dioxide</b>	<b>chloroplast</b>	<b>glucose</b>
<b>hydrogen</b>	<b>oxygen</b>	<b>water</b>

In the first stage of photosynthesis light and chlorophyll are needed to split

..... molecules into hydrogen and oxygen.

The ..... is released to the atmosphere as a waste product.

The ..... is transferred to the second stage where it combines with

..... to form glucose.

[4]

- (b) The glucose produced by plants can be stored as a large carbohydrate.

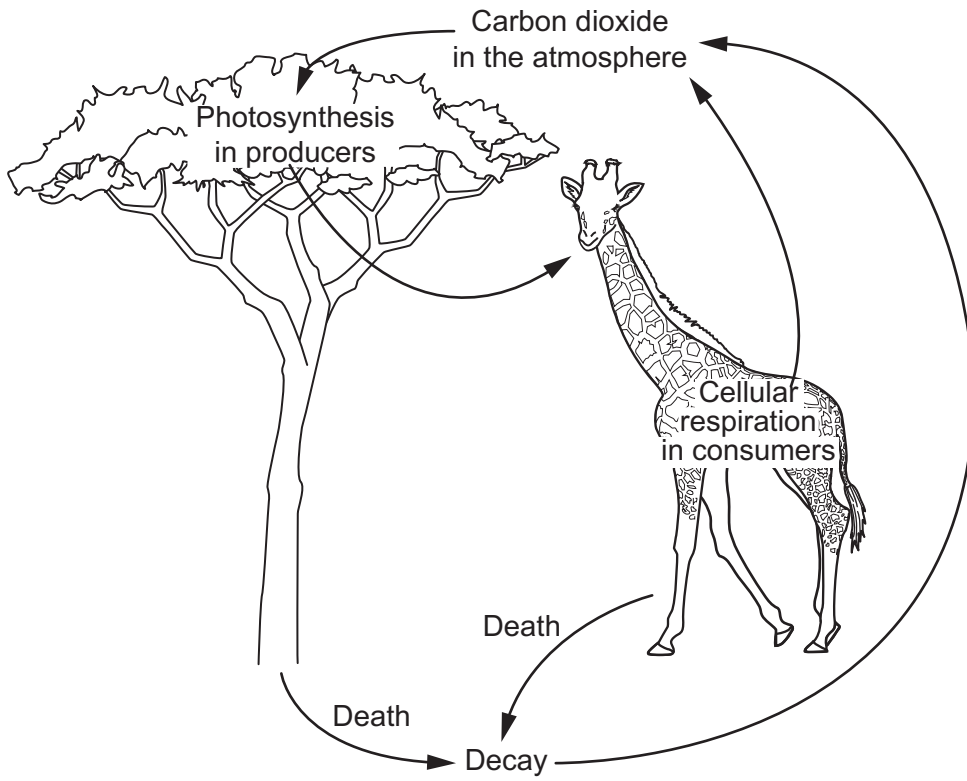
What is the name of this carbohydrate?

Tick (✓) **one** box.

- Fat
- Glycerol
- Protein
- Starch

[1]

5 The diagram shows how carbon moves through parts of the carbon cycle.



(a) (i) Explain why photosynthesis in producers is important for **consumers**.

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

(ii) Explain why cellular respiration in consumers is important for **producers**.

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



- (b) Some trees lose their leaves in autumn. These leaves fall to the ground and decay.

A student investigates the rate of decay of leaves. The table shows the results.

Initial mass of leaves (g)	Final mass of leaves (g)	Change in mass over 10 days (g)
20	9	11

Calculate the rate of decay.

$$\text{Rate of decay (g/day)} = \frac{\text{change in mass (g)}}{\text{number of days}}$$

Rate of decay = ..... g/day [2]

- 6 When a person swims in the sea and their body is surrounded by water, they are at risk of hypothermia.

Hypothermia is where body temperature falls below 35 °C.

- (a) A student investigates the effect of different water temperatures on the temperature of the body.

The student uses a test tube of red liquid at 37 °C to represent the human body.

- (i) Describe a method the student could use to investigate the effect that the surrounding water temperature has on the temperature of the red liquid in the test tube.

In your method describe:

- what the student should change
- what the student should measure.

.....

.....

.....

.....

.....

.....

..... [3]

- (ii) Describe **one** thing the student should control in the method described in (a)(i).

.....

..... [1]

- (b) Why is a test tube of liquid **not** a good model of the human body?

.....

..... [1]

7 The amount of water in the body should be kept constant.

(a) The table shows the amounts of water gained and lost from one person in one day.

Volume of water gained (ml)		Volume of water lost (ml)	
From drinks	1200	From lungs and skin	900
From food	900	In faeces	100
Product of respiration	300	In urine	

Calculate the volume of water needed to be lost in urine to maintain the water balance of the person's body.

Volume = ..... ml [3]

(b) Complete the sentences to explain why it is important to control the amount of water in the blood.

Use words from the list.

<b>active transport</b>	<b>burst</b>	<b>diffusion</b>	<b>fully</b>
<b>osmosis</b>	<b>partially</b>	<b>shrink</b>	

The cell membranes of human body cells are ..... permeable.

If there is too much water in the blood, water will enter the cells by .....

This may cause the cells to .....

[3]

(c) Humans sweat when they are hot. Sweat contains water.

Some people have a condition that makes them produce too much sweat. A chemical called Botox can be used to treat this condition.

Botox stops the functioning of neurons that usually send nerve impulses to glands and muscles.

(i) Which type of neuron is affected by Botox?

Tick (✓) **one** box.

- Motor
- Receptor
- Relay
- Sensory

[1]

(ii) Suggest why some people may be concerned about using Botox to treat their condition.

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

(iii) Botox is a protein.

Describe a test you could use to show that Botox is a protein.

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

- 8 The table shows the length of the menstrual cycle for seven different females.

Female	Menstrual cycle length (days)
1	28
2	26
3	29
4	22
5	27
6	30
7	28

- (a) (i) Calculate the **mean** menstrual cycle length.

Give your answer to the nearest **whole** number.

Mean menstrual cycle length ..... days [3]

- (ii) Calculate the **median** menstrual cycle length.

Median menstrual cycle length ..... days [1]

- (iii) Sometimes ovulation does not occur and the menstrual cycle finishes early.

Which female in the table may not have ovulated?

Explain your answer.

Female .....

Explanation .....

..... [2]

(b) What is the role of hormones in sexual reproduction in humans?

.....

.....

.....

..... [2]

(c) Complete the table to describe different types of contraception.

Tick (✓) the correct boxes in each row.

Type of contraception	Prevents ovulation	Reduces the chance of pregnancy	Reduces risk of transmission of STIs
Condom			
Oral pill			

[3]

9 Complete the sentences about meiosis.

Use words from the list.

<b>double</b>	<b>gametes</b>	<b>growth</b>	<b>half</b>
<b>interphase</b>	<b>one</b>	<b>three</b>	<b>two</b>

Meiosis is a type of cell division that produces .....

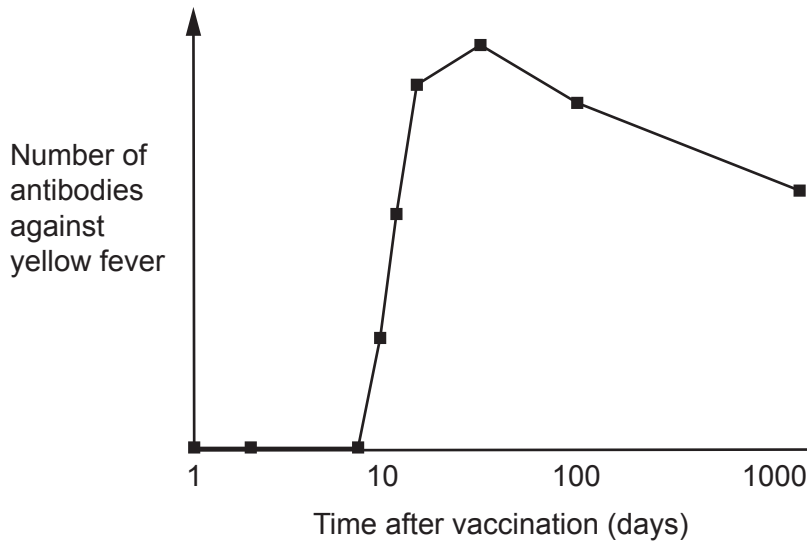
During meiosis the chromosomes are copied in a stage called .....

This stage is followed by ..... cell divisions which results in genetically different cells with ..... the number of chromosomes.

**[4]**

10 Yellow fever is a disease caused by a virus.

(a) A person is vaccinated against yellow fever. The graph shows the results of tests from this person.



(i) Explain how the vaccination caused this person's body to make antibodies against yellow fever.

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

(ii) Suggest why the number of antibodies has not returned to zero, 1000 days after vaccination.

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

(iii) What is the **minimum** number of days after vaccination that somebody should wait before travelling to an area where yellow fever is common?

Explain your answer.

Number of days .....

Explanation .....

[2]



(iv) The yellow fever virus is carried by mosquitoes.

Suggest **two** ways, other than vaccination, to prevent the spread of yellow fever.

1 .....

2 .....

[2]

(b) Why do we need to vaccinate a large proportion of the population to stop the spread of a disease?

.....

..... [1]

(c) Cancer is a different type of disease.

Which statements about cancer are **true**, and which are **false**?

Tick (✓) **one** box in each row.

	True	False
Cancer is a communicable disease.	<input type="checkbox"/>	<input type="checkbox"/>
Cancer can be caused by our environment and lifestyle.	<input type="checkbox"/>	<input type="checkbox"/>
Cancer is a result of changes in a cell's DNA.	<input type="checkbox"/>	<input type="checkbox"/>
Cancer is a result of cells dividing uncontrollably by meiosis.	<input type="checkbox"/>	<input type="checkbox"/>

[3]

11 (a) (i) Complete the table to compare cellular aerobic and anaerobic respiration in humans.

Tick (✓) the correct boxes in each row.

Process	It requires glucose	It requires oxygen	It produces carbon dioxide	It produces water	It produces lactic acid
Aerobic respiration					
Anaerobic respiration					

[3]

(ii) Which statement about respiration is correct?

Tick (✓) **one** box.

Aerobic respiration produces more ATP than anaerobic respiration.

Anaerobic respiration produces more ATP than aerobic respiration.

Both aerobic and anaerobic respiration produce the same amount of ATP.

Neither aerobic or anaerobic respiration produces ATP.

[1]

(b) Heart muscle contains approximately 5000 mitochondria in every cell.

(i) Suggest why heart muscle cells need so many mitochondria.

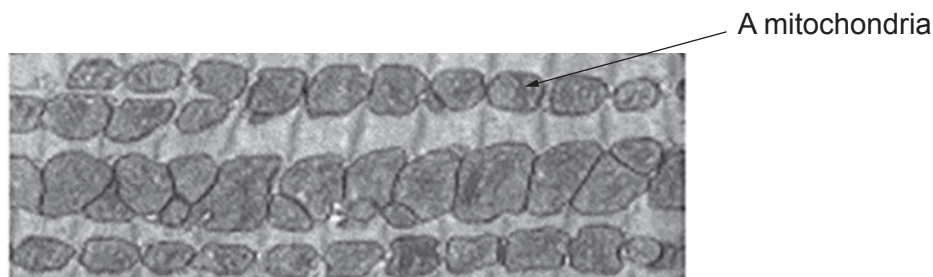
.....

.....

..... [2]

(ii) The image shows the mitochondria in a section of heart muscle. The mitochondria are different sizes.

One of the mitochondria is labelled.



Estimate the number of mitochondria in this image.

Number of mitochondria = ..... [1]

12 The table shows the percentage of land covered in rainforest in a country.

Year	Percentage of land covered in rainforest (%)
1940	75
1950	72
1961	53
1977	31
1983	26
1987	21
1997	42
2000	45
2005	50

(a) (i) Describe the trend in the data.

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

(ii) The government of the country started to protect areas of the rainforest and even paid people to regrow it.

Suggest when the government started to do this.

..... [1]

(iii) Predict when the rainforest will reach the percentage land coverage seen in 1940, if it increases by the same rate as shown from 1997 to 2005.

Predicted year = ..... [1]

(b) A rainforest is one of the most biodiverse areas of the Earth.

(i) Suggest why the government wants to continue to regrow the rainforest.

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

(ii) Suggest **two** challenges of regrowing the rainforest.

1. ....  
.....  
2. ....  
..... [2]

(c) Some plants in the rainforest reproduce sexually, but others reproduce asexually.

Which statements describe sexual reproduction, and which describe asexual reproduction?

Tick (✓) **one** box in each row.

	Sexual reproduction	Asexual reproduction
Occurs at a slower rate		
Offspring are all susceptible to the same diseases		
Only one parent is needed		
Provides offspring with genetic variation		

[3]

**END OF QUESTION PAPER**

**ADDITIONAL ANSWER SPACE**

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

A large area of lined paper for writing. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.





A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the page.

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