OCR
Oxford Cambridge and RSA

F

Tuesday 17 May 2022 – Morning

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

J257/01 Breadth in biology (Foundation Tier)

Time allowed: 1 hour 45 minutes

8997417655

You must have:
- a ruler (cm/mm)

You can use:
- an HB pencil
- a scientific or graphical calculator

J257701

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

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

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.

Answer **all** the questions.

1 Complete the sentences about DNA and the production of proteins in cells.

Put a (ring) around each correct answer.

The shape of DNA is called a **double helix / nucleotide / nucleus**.

Sections of DNA called **genes / nucleotides / sugars** tell the cell how to make proteins.

A protein is a polymer made of **amino acids / fatty acids / sugars** joined together in a particular order.

Carbohydrates / enzymes / fats are examples of proteins found in cells. **[4]**

2 Hormones in the human body are produced by the endocrine system.

(a) Draw **three** lines to identify the **features** of hormones.

	Features
	Are transported in the blood
	Are transported as an electrical impulse
Hormones	Are secreted by a gland
	Are made of nerve cells
	Have effects that can last a long time

[3]

(b) Insulin is an example of a hormone produced by the human body.

Which disease can insulin be used to treat?

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

3 This question is about cellular respiration.

(a) Which statement describes the process of cellular respiration?

Tick (✓) **one** box.

It is a photosynthetic reaction. ☐

It is an endothermic reaction. ☐

It is an exothermic reaction. ☐

It is an immune response. ☐

[1]

(b) Which type of cellular respiration produces ethanol?

Tick (✓) **one** box.

Aerobic respiration in animal cells ☐

Aerobic respiration in plant cells ☐

Anaerobic respiration in animal cells ☐

Anaerobic respiration in microorganisms ☐

[1]

(c) ATP is a product of cellular respiration.

Complete the table about ATP.

Tick (✓) **one** box in each column.

	Active transport	**Diffusion**	**Muscle contraction**
Does **not** use ATP			
Uses ATP			

[2]

ATP is produced in mitochondria.

A light microscope **cannot** be used to see the detailed structure of mitochondria.

(d) State **one** reason why an electron microscope **can** be used to see the detailed structure of mitochondria.

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

4 Complete each sentence about structures in the human body.

Use words from the list.

artery	**brain stem**	**cerebellum**	**heart**	**kidney**	**lens**
motor	**pancreas**	**retina**	**sensory**	**vein**	

(a) A neuron that connects a receptor to the central nervous system. ..... **[1]**

(b) The organ that secretes insulin. ..... **[1]**

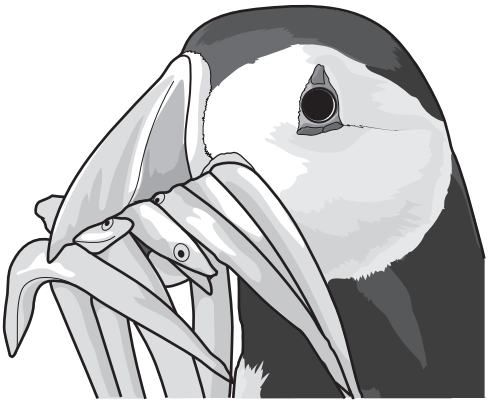
(c) A blood vessel that contains valves and returns blood to the heart. ..... **[1]**

(d) An organ that removes water and urea from the blood. ..... **[1]**

(e) The part of the eye where an image forms. ..... **[1]**

(f) The part of the brain that regulates heart rate. ..... **[1]**

5 Puffins are a species of bird.



Puffins nest on the Farne Islands off the coast of North East England.

Every 5 years the number of breeding pairs of puffins is counted. The data are shown in the table.

Year	Number of puffin breeding pairs
2003	55 674
2008	36 835
2013	39 962

(a) Describe the overall trend in the data from 2003 to 2013.

.....

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

(b) Which of the following could be a reason for the change in breeding pair numbers?

Tick (✓) **one** box.

There are no predators. ☐

There is a more favourable climate. ☐

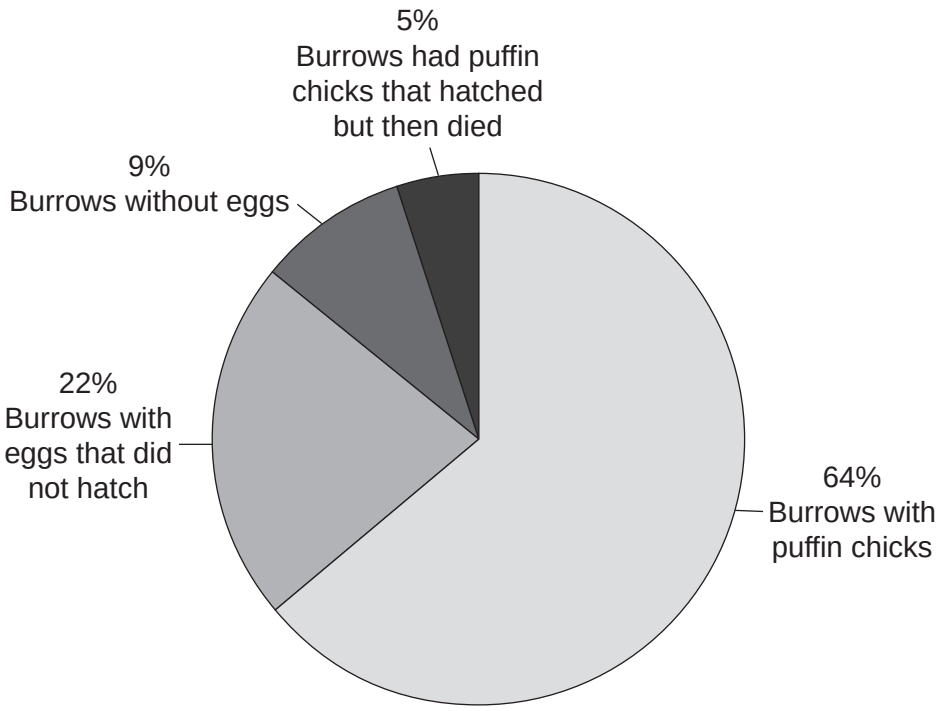
There is less competition in the ecosystem. ☐

There is not enough food. ☐

[1]

(c) Puffins lay their eggs in burrows. They lay 1 egg each year.

The pie chart shows data about puffin burrows.



(i) What percentage of burrows had puffin chicks that hatched?

Percentage = ... % **[2]**

(ii) Use the data in the pie chart to calculate how many chicks would survive if there were 40 000 breeding pairs of puffins.

Put a (ring) around the correct answer.

25 600 **27 600** **36 400** **34 400**

[1]

(d) Puffins eat a diet high in protein.

Draw **one** line to connect the **reagent used to test for protein** and the **colour of a positive** test.

Reagent used to test for protein	**Colour of positive test result**
Benedict's	Black
Biuret	Purple
Iodine	Red

[2]

6 Elephants must maintain their body temperature within a set range.

(a) Which word describes the maintenance of a constant internal environment?

Put a (ring) around the correct answer.

active transport **homeostasis** **osmosis** **respiration**

[1]

(b) Some elephants are kept in zoos.

A zookeeper measures the body temperature of five healthy elephants. The results are shown in the table.

Elephant	Body temperature (°C)
1	36.0
2	36.2
3	37.0
4	36.8
5	36.4

(i) Use the data in the table to work out the normal body temperature range of these elephants.

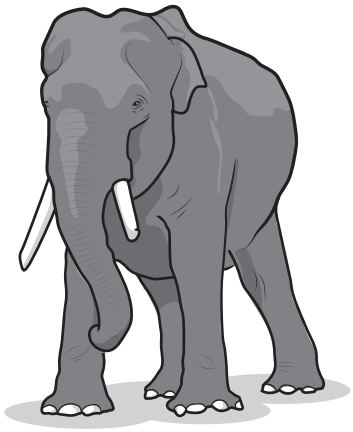
Normal body temperature range = ... to ..... °C **[1]**

(ii) Calculate the mean body temperature of the five elephants.

Give your answer to **one** decimal place.

Mean body temperature = ... °C **[2]**

(c) An elephant is shown in the diagram.



(i) Elephants live in hot climates and have very few sweat glands. They find it difficult to lose heat.

Which statement explains why elephants find it difficult to lose heat?

Tick (✓) **one** box.

Elephants have a large surface area. ☐

Elephants have a small surface area : volume ratio. ☐

Elephants have a small volume. ☐

Elephants sweat a lot. ☐

[1]

(ii) Suggest **one** way elephants can reduce their body temperature.

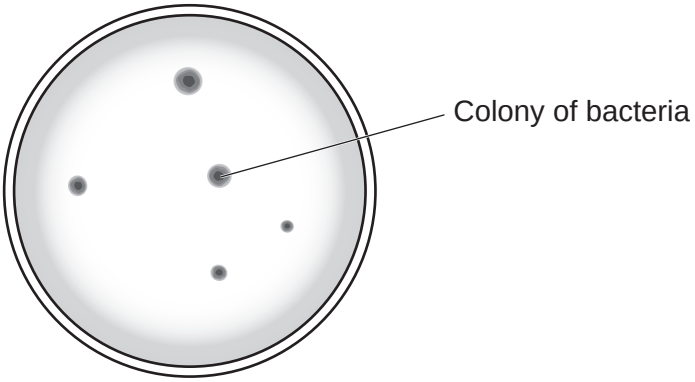
.....

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

7 Anika is investigating the growth of bacteria.

She takes a sample from a yoghurt drink that contains live bacteria and spreads it on an agar plate.

Anika incubates the agar plate for 3 days. After three days bacterial colonies have grown, as shown in the diagram.



Anika uses a light microscope to look at the bacterial colonies.

(a) The image Anika can see under the microscope is blurry.

Describe how she should change the microscope to get a better image.

.....

.....

.....

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

(b) **(i)** There can be millions of bacteria in one colony.

Assume each colony on the agar plate has 2 million bacteria.

Use the diagram to estimate the total number of bacteria on the agar plate.

Estimated number of bacteria on the agar plate = ... **[1]**

(ii) Explain why this estimated number is **not** accurate.

.....

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

(c) Where is the genetic material in a bacterial cell found?

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

8 **Fig. 8.1** shows a coral reef. Coral reefs are underwater ecosystems that support many different species.

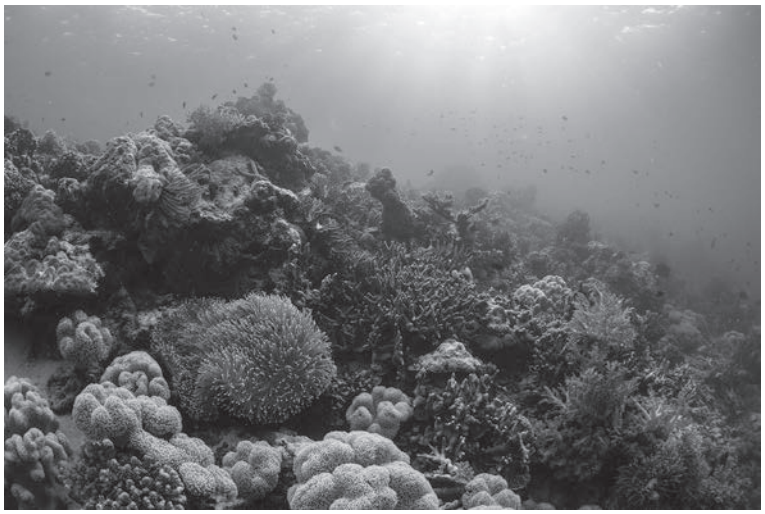


Fig. 8.1

(a) **Fig. 8.2** shows the amount of one species of coral present in a coral reef over time.

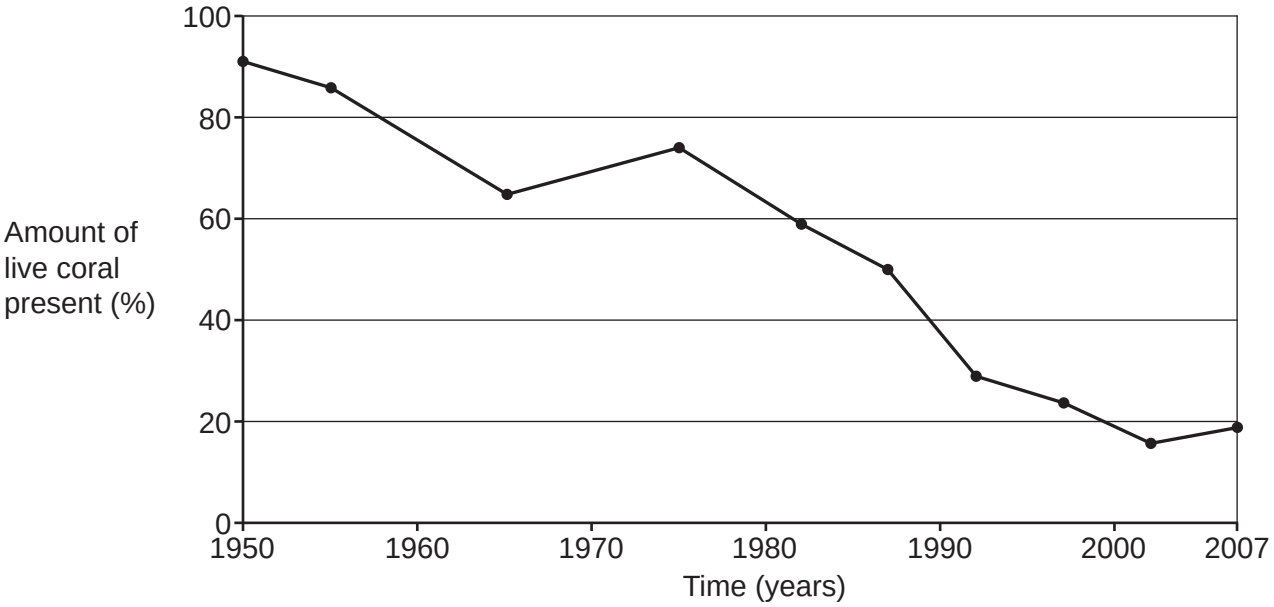


Fig. 8.2

(i) Describe the trend shown by the data in **Fig. 8.2**.

.....

.....

.....

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

(ii) Coral reef is a habitat for many populations of fish.

Suggest how a population of fish may be affected by the trend shown in the graph.
Give a reason for your suggestion.

.....

.....

.....

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

(iii) The loss of live coral can be a result of an increase in water temperature.

Predict what will happen to this coral reef in the future.
Give a reason for your answer.

Prediction .....

Reason .....
[2]

(b) Coral are animals. They benefit from having photosynthesising algae living inside them.

Suggest **one** substance the algae provide the coral with.

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

(c) Many marine ecosystems are threatened by human activity, such as overfishing.

Suggest **two** ways in which humans can have a positive effect on these ecosystems.

1 .....

.....

2 .....

.....
[2]

9 This question is about genetics.

(a) Draw lines to connect each **genetic term** to its **definition**.

Genetic term	Definition
Alleles	A different version of a gene
Chromosome	The two copies of a gene in a pair of chromosomes
Genetic variant	The characteristic that results from a gene and interaction with the environment
Phenotype	A long thin structure made from DNA

[4]

(b) Sickle cell anaemia is an inherited disease. The disease is caused by a recessive allele.

The recessive allele is represented with an **a**, and the dominant allele is represented with an **A**.

Complete the table to show whether the person with each genotype will have sickle cell anaemia.

Tick (✓) **one** box in each row.

Person's genotype	The person **will** have sickle cell anaemia	The person **may or may not** have sickle cell anaemia	The person will **not** have sickle cell anaemia
AA			
Aa			
aa			

[3]

(c) Amaya and Jack do **not** have sickle cell anaemia.

They want to have a baby. They decide to both have a genetic test.

Explain why Amaya and Jack decide to have a genetic test.

.....

.....

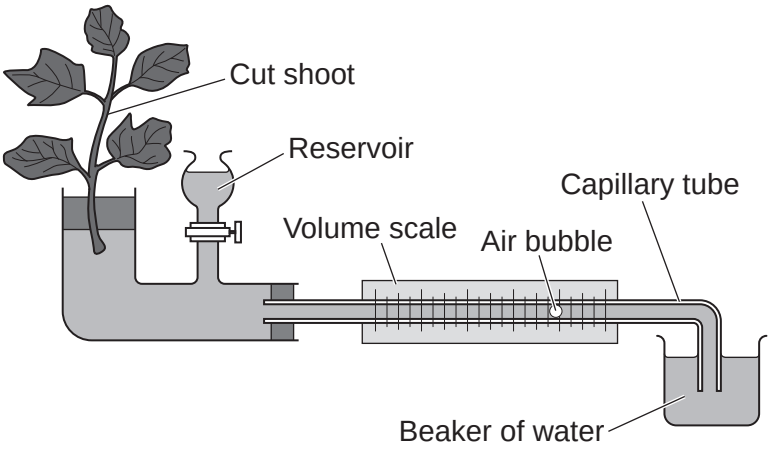
.....

.....

.....

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

10 Kai is investigating transpiration in plants. The diagram shows a potometer.



(a) Put sentences **A** to **E** in the correct order to describe how Kai can use the equipment in the diagram to measure transpiration rate.

One has been done for you.

A Cut a shoot and place it in the potometer.

B Seal gaps with petroleum jelly.

C Fill the potometer with water.

D Leave for a set amount of time and record the new position of the air bubble.

E Note the position of the air bubble.

C				

[3]

(b) Kai thinks temperature affects the rate of transpiration.

Describe how Kai could use the equipment in the diagram to investigate the effect of temperature on the rate of transpiration.

.....

.....

.....

.....

.....

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

(c) Name the vessel that transports sugars in plants.

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

11 Sepsis is an illness. It happens when an infection changes the body's normal immune response to infection.

Sepsis causes the immune system to damage the body's organs and tissues.

(a) Which type of cell in the blood is responsible for the damage to the tissues and organs?

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

(b) Sepsis can cause blood clots to form.

Name the part of the blood that starts the clotting process.

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

(c) Sepsis can be prevented by stopping the spread of microorganisms between people.

Suggest **one** way members of a community could help prevent the spread of microorganisms within the community.

.....

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

(d) **(i)** Sepsis affects 30 million people worldwide each year.

Put a (ring) around the number that shows 30 million in standard form.

3.0×10^7 **30×10^6** **30×10^7** **$30\,000\,00 \times 10$**

[1]

(ii) Of the 30 million people affected by sepsis each year, 1.2 million are children.

Calculate the percentage of people affected by sepsis each year who are children.

Percentage affected who are children = ... % **[2]**

Doctors in the USA tried a new treatment for sepsis.

47 patients were given the new treatment. 43 of these patients made a full recovery.

(e) Should this treatment be used on all patients with sepsis?

Give **one** reason why the treatment should be used and **two** reasons why it should not.

Reason to use the treatment .....

.....

Reasons **not** to use the treatment.

1 .....

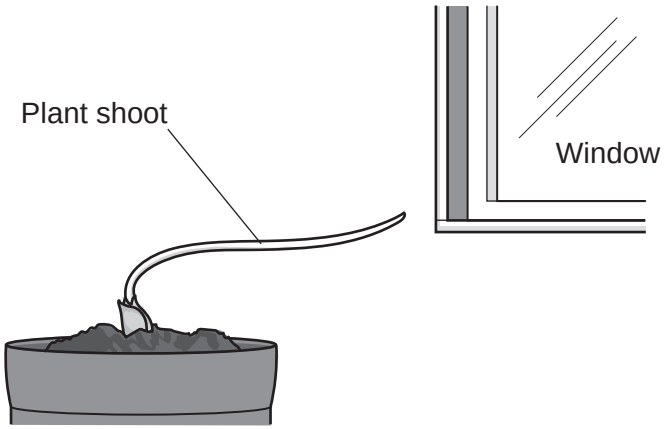
.....

2 .....

.....

[3]

12 Plants respond to their environment.
One example is their response to light, as shown in the diagram.



(a) Complete each sentence to explain how the plant shoot responds to light.
Use words from the list.

auxins	**dark**	**insulin**	**less**
light	**more**	**progesterone**	**shade**

The response to light is controlled by plant hormones called ..... .

When the plant is placed in an environment where the light is coming from one direction, there is an uneven distribution of the hormone in the shoot.

..... hormone collects on the side of the shoot that is in the shade.

This causes more cell elongation on the side of the shoot that is in the

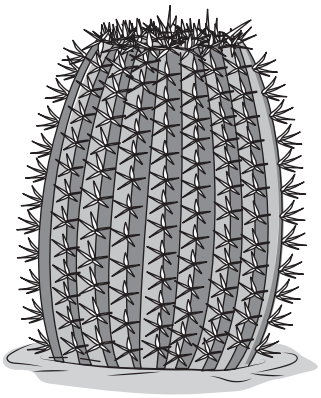
..... so the shoot grows towards the light.

[3]

(b) What word is used to describe a plant root's response to gravity?

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

13 The diagram shows a cactus. It reproduces sexually by producing flowers.



(a) There are 22 chromosomes in all of the cells in this cactus apart from the gamete cells.

Complete the table to identify how many chromosomes are present during the events that take place in the life cycle of a cactus.

Tick (✓) **one** box in each row.

Event in the cactus life cycle	**Number of chromosomes**		
	11	**22**	**44**
At the end of interphase during meiosis			
At the end of interphase during mitosis			
In the cells produced by mitosis as the cactus grows			
In the pollen produced by meiosis			

[4]

A cactus must get water from the soil.

(b) Which process reacts water with carbon dioxide in plant cells?

Tick (✓) **one** box.

Active transport ☐

Cellular respiration ☐

Photosynthesis ☐

Transpiration ☐

[1]

(c) Name the vessel in a plant that transports water up the stem.

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

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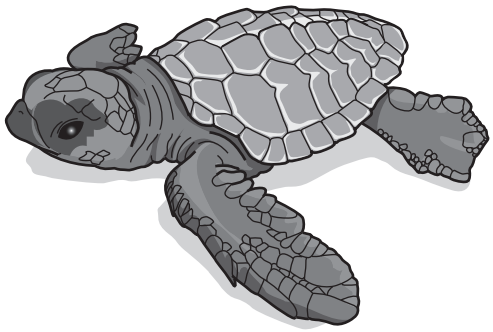
14 The diagram shows a Pacific sea turtle. The sex of Pacific sea turtles' offspring is determined by the temperature at which their eggs incubate.



(a) Explain how sex determination in **humans** is different to sex determination in turtles.

.....

.....

.....

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

(b) The effect of temperature on the sex of the offspring is shown in the table.

Egg incubation temperature (°C)	**Sex of offspring**
Below 27.7	male
Between 27.7 and 31.0	mix of male and female
Over 31.0	female

(i) In some locations in 2020 the female turtles outnumbered male turtles in a ratio of 116 : 1.

Calculate the number of female turtles in a sample of 18 000 turtles.

Give your answer to the nearest whole number.

Number of female turtles = ... **[3]**

(ii) In the 1970s the ratio of female to male turtles was 6 : 1.

What effect could the change in the ratios from 1970 to 2020 have on the population of sea turtles?

Explain your answer.

.....

.....

.....

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

(iii) Suggest how scientists could help return the sex ratio in the next generation of turtles to that seen in the 1970s.

.....

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

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).

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