Surname		Centre Number	Candidate Number
First name(s)			0

GCSE

wjec cbac

3400U20-1

S24-3400U20-1

FRIDAY, 10 MAY 2024 – MORNING

BIOLOGY – Unit 2:
Variation, Homeostasis and Micro-organisms
FOUNDATION TIER

1 hour 45 minutes

3400U201 01

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	5	
2.	4	
3.	13	
4.	17	
5.	15	
6.	6	
7.	10	
8.	10	
Total	80	

ADDITIONAL MATERIALS

A calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.
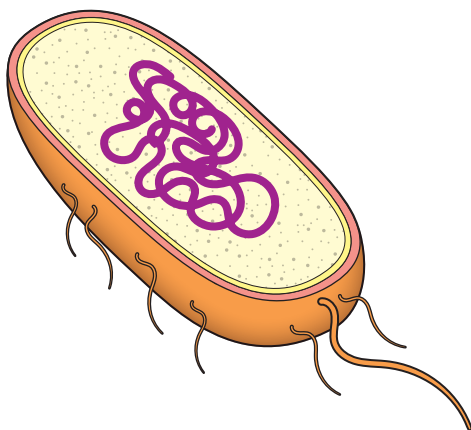
Question **6** is a quality of extended response (QER) question where your writing skills will be assessed.

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Answer **all** questions

1. **Images 1.1A** and **1.1B** show two types of micro-organism.

    Image 1.1A   **Image 1.1B**
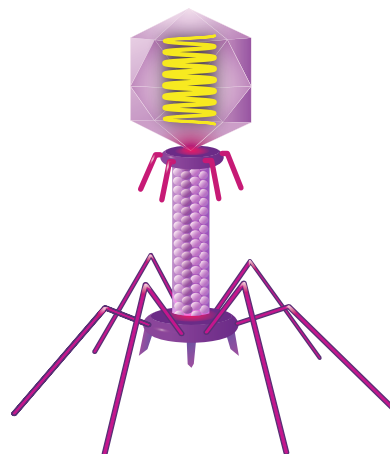
    Complete **Table 1.2** by placing a tick (✓) in the correct column for each statement.   [5]

    Table 1.2

	Type of micro-organism	
Statement	bacterium	virus
Type of micro-organism in **Image 1.1A**		
Type of micro-organism in **Image 1.1B**		
Type of micro-organism that causes chlamydia		
Type of organism that contains genes surrounded by a protein coat		
Type of organism that may be killed by antibiotics		
Type of micro-organism that causes AIDS		

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2. **Image 2** shows two different sources of stem cells.

Image 2
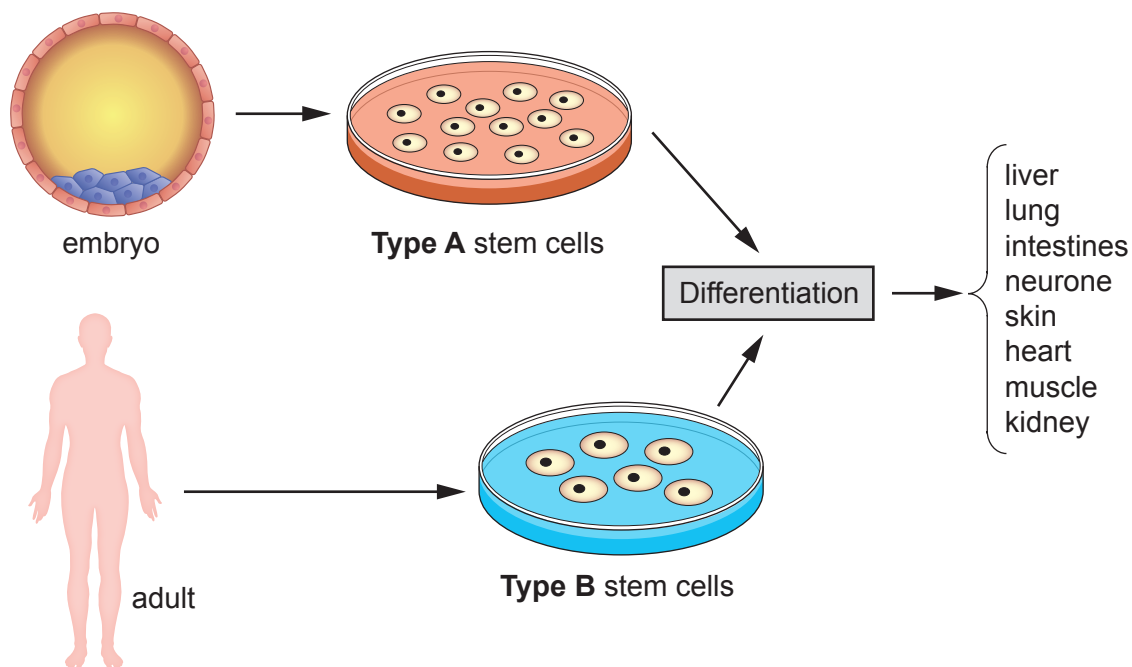
(a) Underline which **one** of the following statements is the correct definition of a stem cell. [1]

A stem cell is a differentiated cell that can become specialised.

A stem cell is a specialised cell that can become undifferentiated.

A stem cell is an undifferentiated cell that can become specialised.

(b) Name the **two** types of stem cell shown in **Image 2**. [2]

Type A ....

Type B ....

(c) State **one** reason why some people disagree with the use of embryos as a source of stem cells. [1]

....

....

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3. (a) **Table 3.1** shows the classification of **three** species of badger.

Table 3.1

Classification	Species of badger		
	European	Honey	Asian
Kingdom	Animal	Animal	Animal
Phylum	Vertebrate	Vertebrate	Vertebrate
Class	Mammal	Mammal	Mammal
Order	Carnivore	Carnivore	Carnivore
Family	Mustelidae	Mustelidae	Mustelidae
Genus	Meles	Mellivora	Meles
Species	meles	capensis	leucurus

(i) State the **two** species of badger that are most closely related. Explain your answer. [2]

....

....

....

....

(ii) Use **Table 3.1** to state the scientific name of the honey badger. [1]

....

(iii) State **one** reason why scientists use scientific names instead of common names for organisms. [1]

....

....

(iv) The honey badger is a vertebrate. State what is meant by the term vertebrate. [1]

....

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(b)   **Image 3.2** is a fact file about the honey badger.

Image 3.2

Common names: honey badger, ratel, honey ratel

Body length: approximately 70 cm (males bigger than females)
Habitat: varies from desert to rainforest
Diet includes: insect larvae, scorpions, lizards, rodents, birds, snakes, foxes and wild cats
Predators include: lion, leopard, humans

Other facts:

• Their skin is very tough. This makes it hard for snakes to bite.
• They live on their own most of the time. This reduces intraspecific competition.
• They hunt for their own food but they will also steal prey from other carnivores.
• Their sharp teeth and long claws allow them to easily rip meat from bone.

Use the information in **Image 3.2** to describe **two** adaptations of the honey badger. Explain how each helps them survive.   [2]

Adaptation	How it helps them to survive
....	....
....	....
....	....
....	....

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(c) Suggest what would happen to the number of honey badgers if the number of lions increased. Explain your answer. [2]

....

....

....

....

(d) (i) State what is meant by **intraspecific competition**. [1]

....

....

(ii) List **three** resources for which **all** animals compete. [3]

1. ....

2. ....

3. ....

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4. (a) In Type 2 diabetes the body tissues do not respond to insulin.

- The main risk factors are obesity, lack of regular exercise, family history and age.
- The condition can be diagnosed by blood tests to measure glucose levels or by testing urine for glucose.
- There are no drugs that can cure Type 2 diabetes.
- However, a drug called metformin improves the response of the body tissues to insulin.

(i) Choose words from the list below to fill in the gaps in the sentences. [4]

liver   pancreas   stomach   glycogen   hormone   starch

Insulin is a .... that is produced in the .... It travels in

the blood to the .... and causes glucose to be converted to

....

(ii) Use the information provided to complete **Table 4.1** by writing **true** or **false** next to each of the statements. [4]

Table 4.1

Statement	True/False
Type 2 diabetes is caused by too much insulin being produced.	
Metformin works by reducing the response of the body tissues to insulin.	
Being overweight is a risk factor for Type 2 diabetes.	
Type 2 diabetes can be cured with medication.	
Only lifestyle choices affect the risk of developing Type 2 diabetes.	

(iii) Doctors may prescribe metformin tablets to help treat Type 2 diabetes. Suggest **two lifestyle changes** the doctor may also advise. [2]
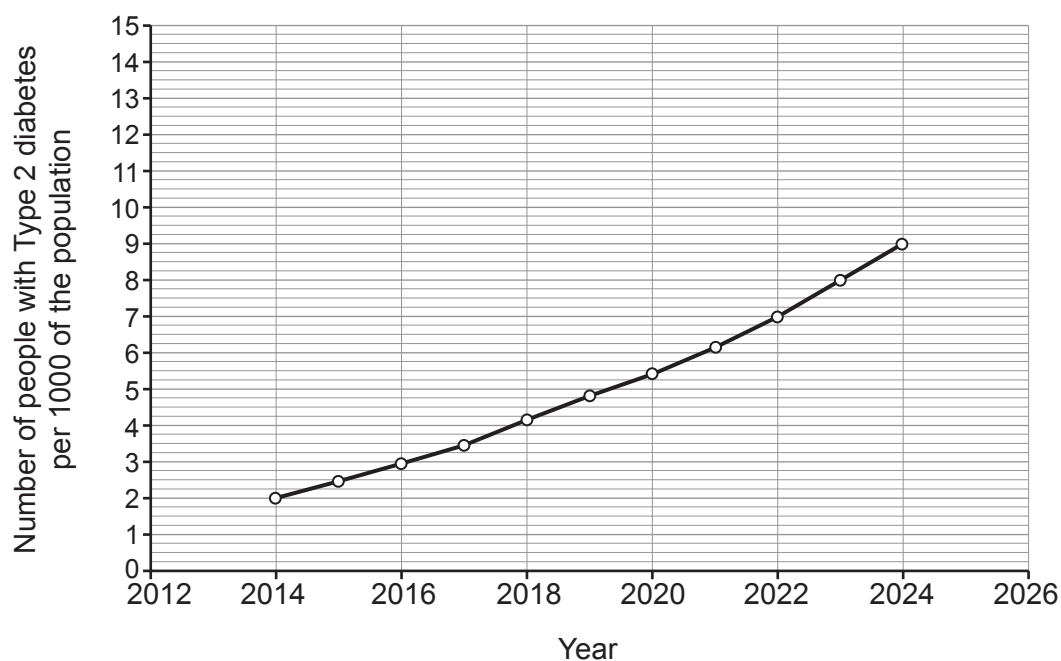
1. ....

2. ....

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Turn over.

(b) **Graph 4.2** shows the number of people with Type 2 diabetes per 1000 of the population between 2014 and 2024.

Graph 4.2

(i) Describe the trend shown in **Graph 4.2** between 2014 and 2024. [1]

....

....

(ii) Use the information in **Graph 4.2** to calculate the difference in the number of people with Type 2 diabetes per 1000 of the population between **2014** and **2024**. [1]

Difference per 1000 of the population between 2014 and 2024 = ...

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(iii) Use your answer to part (b)(ii) and the following equation to calculate the percentage change in the number of people that have Type 2 diabetes per 1000 of the population between 2014 and 2024. [2]

$$\text{Percentage change} = \frac{\text{(Difference in the number of people with Type 2 diabetes in 2024 and 2014)}}{\text{(Number of people with Type 2 diabetes in 2014)}} \times 100$$

Space for working

Percentage change = ...

(iv) Use **Graph 4.2** to estimate the number of people per 1000 of the population that will have Type 2 diabetes in **2026** if the current trend continues. Show on **Graph 4.2** how you arrived at your answer. [1]

Number of people per 1000 of the population that will have Type 2 diabetes

in 2026 = ...

(c) (i) <u>Underline</u> the chemical solution that can be used to test for glucose in urine. [1]

Biuret reagent   **Benedict's reagent**   **Iodine**

(ii) State what colour the solution would turn if the person had diabetes. [1]

....

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5. The rock pocket mouse lives in a sandy desert in the United States. The mouse may be either light or dark in colour. A volcano erupted 1.7 million years ago and turned large parts of the desert into dark coloured rock. **Image 5.1** shows how two locations (**A** and **B**) in the desert could have looked before the volcano erupted.

Image 5.1
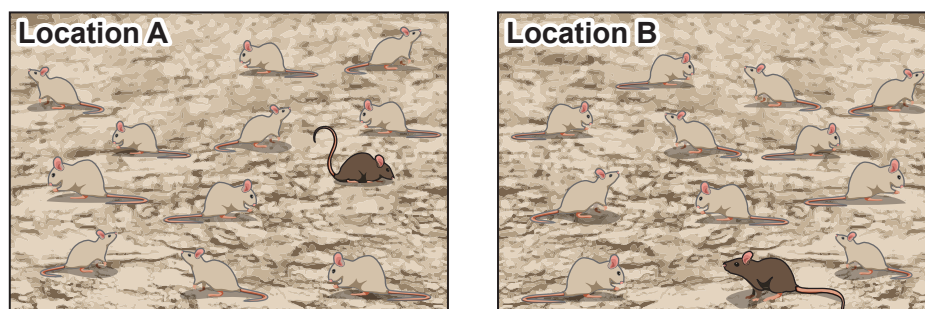
Image 5.2 shows how the mouse population might have changed over time after the volcano erupted.

Image 5.2

| 1.7 million years ago | 1.6 million years ago | 1.5 million years ago |
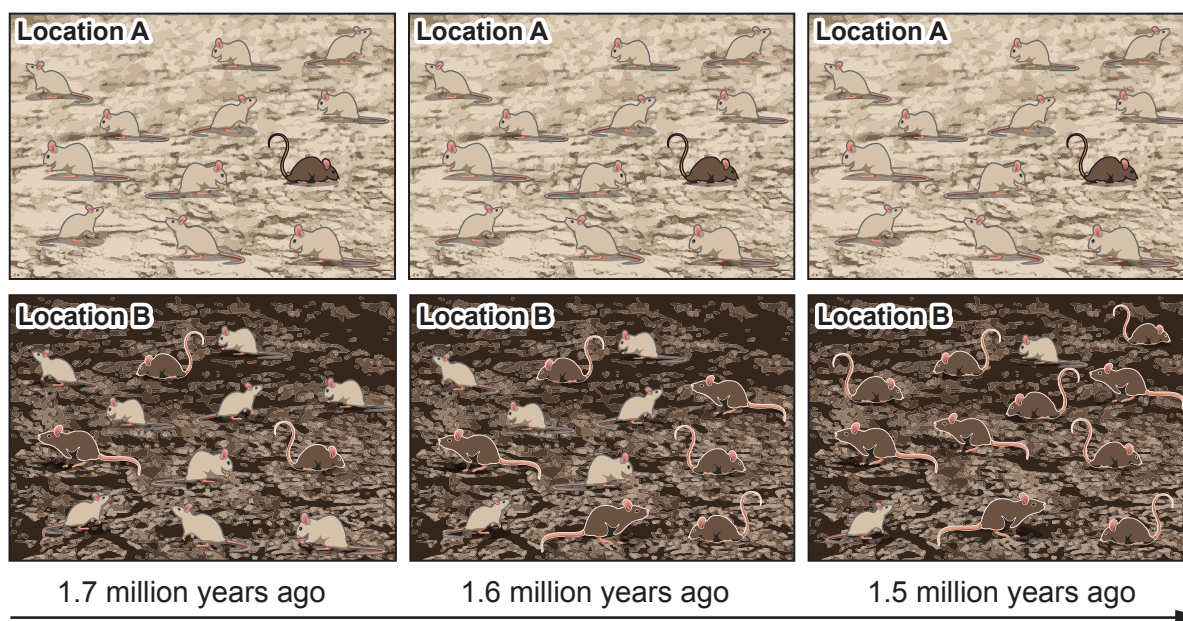
(a) ⟨Circle⟩ the cause of the changed rock colour in location **B** from the list below. [1]

flooding   volcanic eruptions   human activities   forest fires

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(b) **Tables 5.3** and **5.4** show the number of light and dark coloured mice over time.

Table 5.3 – Location **A**

	Number of mice in Location **A**		
Time period (million years ago)	light coloured	dark coloured	Total
1.7	11	1	12
1.6	11	1	12
1.5	11	1	12

Table 5.4 – Location **B**

	Number of mice in Location **B**		
Time period (million years ago)	light coloured	dark coloured	Total
1.7	9	3	....
1.6	....	6	12
1.5	2	....	12

(i) Use **Image 5.2** to complete **Table 5.4**.   [2]
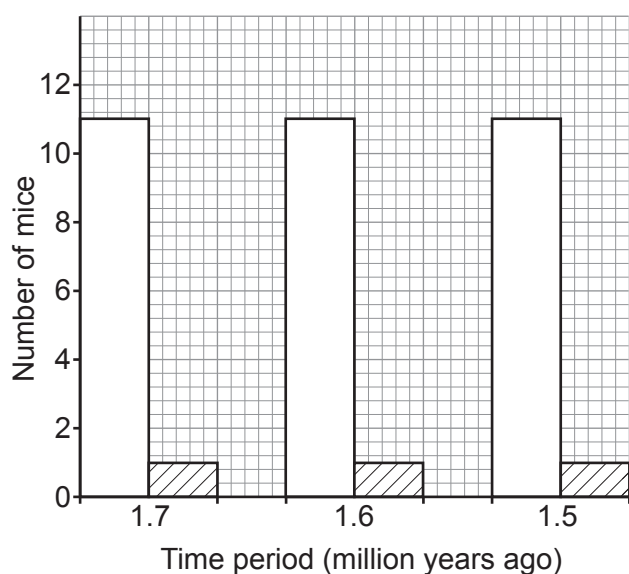
(ii)   Use the information in **Table 5.4** to complete **Graph 5.6** for Location **B** by

    I.   adding the axes labels;   [1]

    II.   adding a scale to both axes;   [1]

    III.   drawing bars for each of the results.   [2]

Location **A** has been done for you on **Graph 5.5**.

Graph 5.5 – Location **A**   **Graph 5.6** – Location **B**

Number of mice (y-axis); Time period (million years ago) (x-axis), values 1.7, 1.6, 1.5
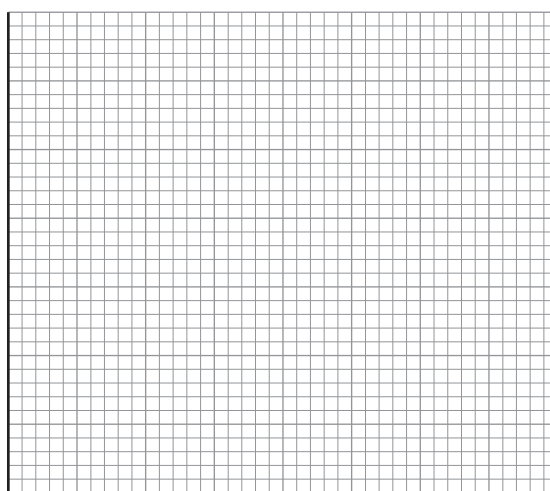
Key:
☐ light coloured mice   ▨ dark coloured mice

(iii)   State what happened over time to the number of **light coloured** mice at

    I   location **A**;   [1]

    ....

    II   location **B**.   [1]

    ....

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(c)　(i)　A mutation caused the dark-coloured mice to appear in a population of light coloured mice.
Define the term **mutation**. [1]

....

....

(ii)　Suggest and explain why the dark coloured mice had an advantage in Location **B**. [2]

....

....

....

(iii)　Suggest what will happen to the number of light coloured mice in Location **B** in the future. [1]

....

....

(iv)　The change in colour over time is an example of natural selection or survival of the fittest.
Tick (✓) the boxes next to the **two** scientists who developed the theory of natural selection. [2]

Gregor Mendel　　☐

Charles Darwin　　☐

Carl Linnaeus　　☐

Alfred Wallace　　☐

Alexander Fleming　　☐

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6. **Image 6** shows the stages of genetically modifying a soya bean crop plant to become herbicide resistant.

    Image 6

Stage 1	herbicide resistant plant → cell
Stage 2	cell → extracted DNA
Stage 3	extracted DNA ✂ → herbicide resistant gene
Stage 4	soya bean plant cell → DNA from soya bean plant
Stage 5	herbicide resistant gene → ← DNA from soya bean plant
Stage 6	→ genetically modified soya bean plant cell
Stage 7	cell division → genetically modified soya bean plant

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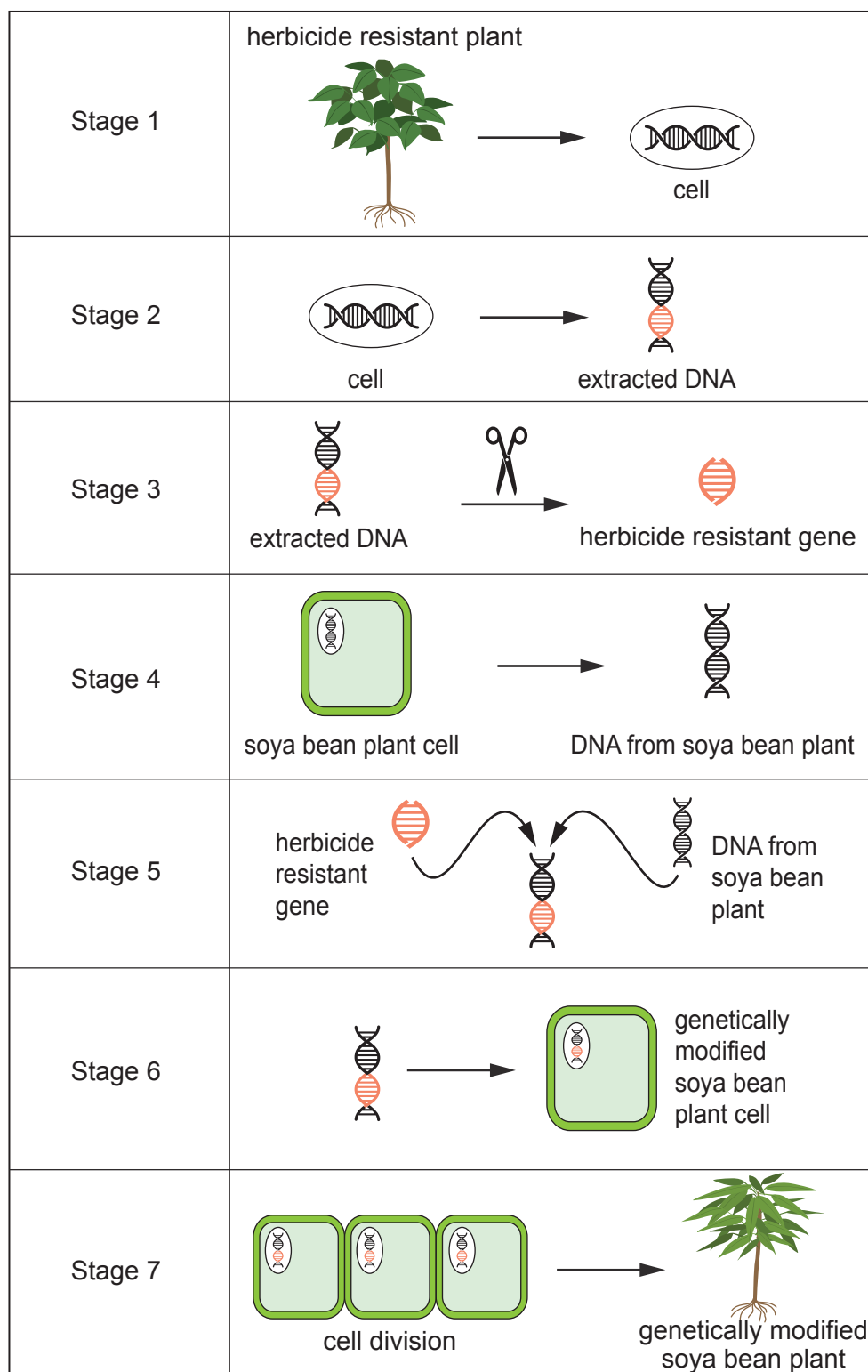
Use **Image 6** to describe what is happening in each of the stages **1–7** during the process of genetic modification.
Include **one** advantage and **one** disadvantage of genetically modified (GM) crops in your answer. [6 QER]

6

(3400U20-1) **Turn over.**

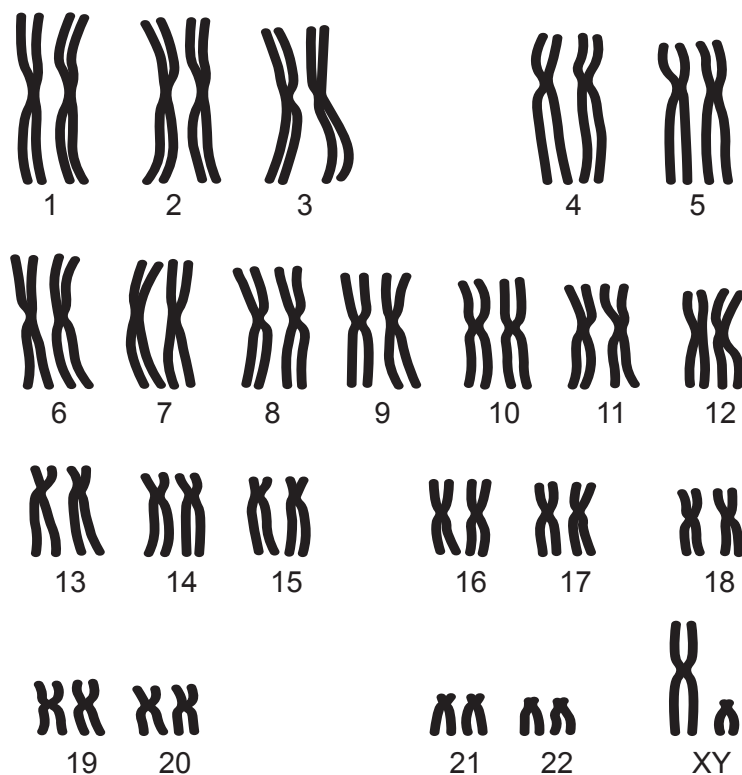**7.** **Image 7.1** shows a set of chromosomes from a human male body cell.

Image 7.1

(a) (i) State the number of chromosomes in a human body cell. [1]

....

(ii) Draw a (circle) around the sex chromosomes in **Image 7.1**. [1]

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(b) **Images 7.2A** and **7.2B** show male and female lions.

Image 7.2A

Male

Image 7.2B

Female

(i) Complete the Punnett square below to show possible offspring when the male lion (XY) and the female lion (XX) mate. [2]

(ii) State the expected ratio of male:female lions in the offspring. [1]

.... : ....

(iii) State whether it is the male or female lion that determines the sex of the offspring. Explain your answer. [2]

....

....

....

....

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(c) Lions have 38 chromosomes in their body cells.

(i) State how many chromosomes there are in a **sex cell** of a lion. [1]

....

(ii) State the scientific name for sex cells. [1]

....

(iii) Name the type of cell division that produces sex cells. [1]

....

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8. A class of year 11 boys were investigating reaction time. The students suggested the following hypothesis:

"Year 11 students have faster reaction times than teachers"

A computer program was used to record the reaction time. Each individual had to press a button on the keyboard when the screen turned green (**Image 8.1**). Each individual had three attempts and the mean value was recorded.

Image 8.1

(a) (i) State the stimulus and the receptor involved in this investigation. [2]

Stimulus: ....

Receptor: ....

(ii) Describe how the information travels from the **receptor** to the **central nervous system**. [2]

....

....

....

....

(3400U20-1)   **Turn over.**

(b)   The results for the students are shown in **Table 8.2** and the teachers in **Table 8.3**.

Table 8.2

Name	Age	Reaction time (ms)
Rhidian	15	382
Iestyn	15	412
Reuben	15	375
James	15	399
Harvey	15	401
		Mean reaction time $=$ 394

Table 8.3

Name	Age	Reaction time (ms)
Miss Williams	42	479
Mr Davies	32	391
Mrs Wilcox	37	415
Mr Jones	55	475
Mrs Evans	48	431
		Mean reaction time = ...

(i)   Complete **Table 8.3** by calculating the mean reaction time for the teachers **to the nearest whole number**.   [2]
Space for working.

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(ii) Evaluate the extent to which the results in **Tables 8.2** and **8.3** support the students' hypothesis. [2]

You should do this by giving:
- **one** piece of evidence that supports the hypothesis
- **one** piece of evidence that does not support the hypothesis

Evidence that supports hypothesis

....

....

Evidence that does not support the hypothesis

....

....

(iii) State **one** variable that should have been controlled in this investigation. [1]

....

(iv) State **one** way that the students could have increased their confidence in their results. [1]

....

....

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END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.	Examiner only

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