

Write your name here

Surname

Other names

Centre Number

Candidate Number

Edexcel GCE

Biology

Advanced Subsidiary

Unit 2: Development, Plants and the Environment

Monday 3 June 2013 – Morning

Time: 1 hour 30 minutes

Paper Reference

6BI02/01

You do not need any other materials.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
– *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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PEARSON

Answer ALL questions.

Some questions must be answered with a cross . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

1 A student studied three different cells: an animal cell, a bacterial cell and a plant cell.

For each of the statements below, put a cross in the box that corresponds to the correct statement.

(a) DNA is located in the nucleus in

(1)

- A** the animal cell only
- B** the bacterial cell only
- C** two of the cells only
- D** all three cells

(b) A cell wall is present in

(1)

- A** the animal cell only
- B** the bacterial cell only
- C** the plant cell only
- D** two of the cells only

(c) Centrioles are present in

(1)

- A** the animal cell only
- B** the plant cell only
- C** two of the cells only
- D** all three cells

(d) A cell surface membrane is found in

(1)

- A** the bacterial cell only
- B** the plant cell only
- C** two of the cells only
- D** all three cells



(e) Mitochondria are found in

(1)

- A the bacterial cell only
- B the plant cell only
- C two of the cells only
- D all three cells

(f) Ribosomes are found in

(1)

- A the animal cell only
- B the bacterial cell only
- C two of the cells only
- D all three cells

(g) Smooth endoplasmic reticulum (SER) is present in

(1)

- A the animal cell only
- B the bacterial cell only
- C the plant cell only
- D two of the cells only

(h) Amyloplasts may be present in

(1)

- A the animal cell only
- B the bacterial cell only
- C the plant cell only
- D all three cells

(Total for Question 1 = 8 marks)



2 Several processes lead up to fertilisation in animals and plants.

* (a) Describe and explain how, in mammals, events following the acrosome reaction prevent more than one sperm fertilising an egg.

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(b) Animals produce haploid gametes by meiosis.

Explain how meiosis gives rise to genetic variation in gametes.

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- (c) In flowering plants, the growth of pollen tubes is affected by many factors. An investigation was carried out to study the effect of the concentration of a chemical called methylpurine on pollen tube growth.

Pollen grains from lily flowers were exposed to 0.01 mol dm^{-3} methylpurine at pollination.



Lily flowers
Magnification $\times 0.2$

After 48 hours, the lengths of the pollen tubes formed were measured and the mean length calculated.

This was repeated with two other concentrations of methylpurine and a control with no methylpurine.

The results are shown in the table below.

Concentration of methylpurine / mol dm^{-3}	Mean length of pollen tube after 48 hours / mm
0.0000	94
0.0001	95
0.0010	90
0.0100	28

- (i) The investigation was carried out at a constant temperature of $22.5 \text{ }^\circ\text{C}$.

Suggest why the temperature was kept constant.

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(ii) Using the information in the table, describe the effect of methylpurine concentration on the mean length of pollen tubes from lily flowers.

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(iii) Methylpurine can inhibit messenger RNA (mRNA) synthesis.

Suggest how this can cause the change in mean pollen tube length.

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(Total for Question 2 = 13 marks)



- 3 (a) William Withering tested the use of digitalis to treat a heart condition. The table below describes some of the stages he could have used.

Place a tick (✓) in the box if he used this stage in his test and place a cross (✗) in the box if he did not.

(3)

Description of stage	Tick / cross
He tried to isolate digitalis from foxglove plants.	
He tested digitalis on healthy humans.	
He used a placebo to make sure digitalis worked.	

- (b) (i) Explain why placebos are used to test the efficiency of new drug treatments.

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- (ii) Explain what is meant by a **double blind trial**.

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(Total for Question 3 = 7 marks)



4 Recently, scientists have shown an interest in using plant tissue culture techniques to produce large numbers of genetically identical cotton plants. Cotton plants provide fibres used for clothing.

Plant tissue culture techniques depend on the totipotent properties of the cells used.

(a) Describe how you could use a plant tissue culture technique to show totipotency in cotton plant seedlings.

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(b) Scientists used similar plant tissue culture techniques to investigate the effect of the age of the seedlings on totipotency. Seedlings were divided into four groups, each consisting of 25 seedlings. One group was grown for 7 days before the plant tissue culture technique was carried out. The number of seedlings that showed totipotency was recorded as a percentage.

This procedure was repeated for the other three groups of seedlings, which were grown for 14, 21 and 28 days respectively before the plant tissue culture technique was carried out.

The results are shown in the table below.

Age of seedlings before plant tissue culture technique carried out / days	Percentage of seedlings showing totipotency (%)
7	76
14	56
21	40
28	60

(i) Describe the effect of age on the percentage of seedlings showing totipotency.

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(ii) The scientists were concerned about the reliability of the data.

Suggest how the data could have been made more reliable.

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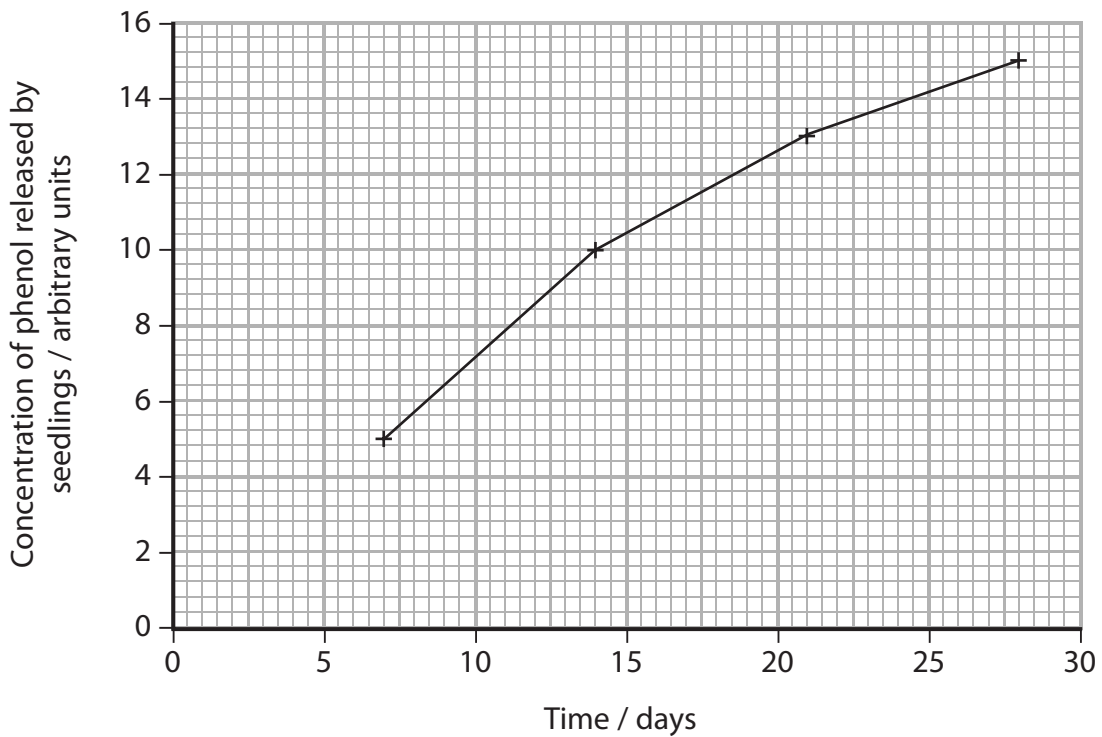
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(c) As cotton plants grow, they release a substance called phenol.

In another investigation, the scientists measured the concentration of phenol released by seedlings.

The results are shown in the graph below.



(i) Using the information in the table in part (b) and the graph, give evidence to support the hypothesis that phenol reduces totipotency.

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(ii) Using the information in the table in part (b) and the graph, give evidence that does **not** support the hypothesis that phenol reduces totipotency.

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(d) Human stem cell research involves the use of both totipotent and pluripotent stem cells.

Describe the differences between a totipotent stem cell and a pluripotent stem cell.

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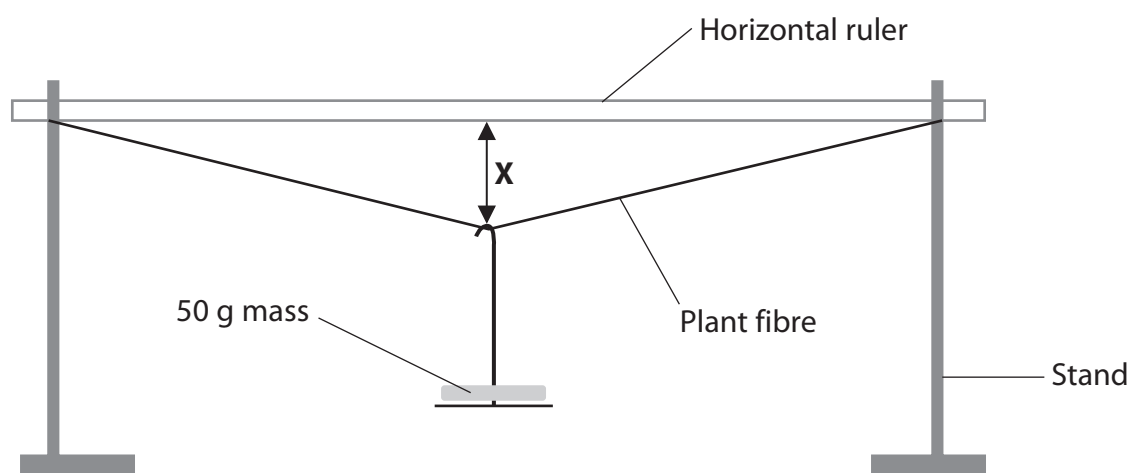
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(Total for Question 4 = 12 marks)



- 5 (a) A student used the apparatus shown in the diagram below to investigate the tensile strength of plant fibres.



She added a 50 g mass to the middle of the fibre and measured distance **X**. She repeated this by adding additional 50 g masses.

The results are shown in the table below.

Mass / g	Distance X / cm
0	0
50	2
100	4
150	5
200	5
250	Fibre broke

- (i) Describe the effect on distance **X** of increasing the mass.

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(ii) Another student thought that the data did not show the mass needed to break the fibre. He suggested that it could be anywhere between 200 g and 250 g.

Suggest how a more accurate result could be determined.

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(b) Suggest how you would use this apparatus to enable a valid comparison of the tensile strength of fibres from two different plants.

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(Total for Question 5 = 9 marks)



6 Carl Woese suggested that living organisms could be grouped into three domains.

(a) The Eukarya domain includes the plant kingdom.
Plants are different from other groups of organisms in the Eukarya domain as they have cellulose cell walls. The cellulose molecules in the cell wall are arranged in microfibrils.

The table below gives four features of a cellulose molecule and a cellulose microfibril.

If the feature is present place a tick (✓) in the box and if it is absent, place a cross (✗) in the box.

(4)

Feature	Cellulose molecule	Cellulose microfibril
Alpha (α) glucose		
1,4-glycosidic bonds		
1,6-glycosidic bonds		
Hydrogen bonds		

(b) Eukarya is one of the three domains.

Name the other **two** domains.

(2)

1.

2.

(c) Scientists classify organisms into taxonomic groups, such as the three domains.

Explain how organisms can be classified into taxonomic groups.

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(d) When Carl Woese first suggested that all organisms could be classified into one of the three domains, his ideas were not accepted.

Suggest how Woese's idea was critically evaluated.

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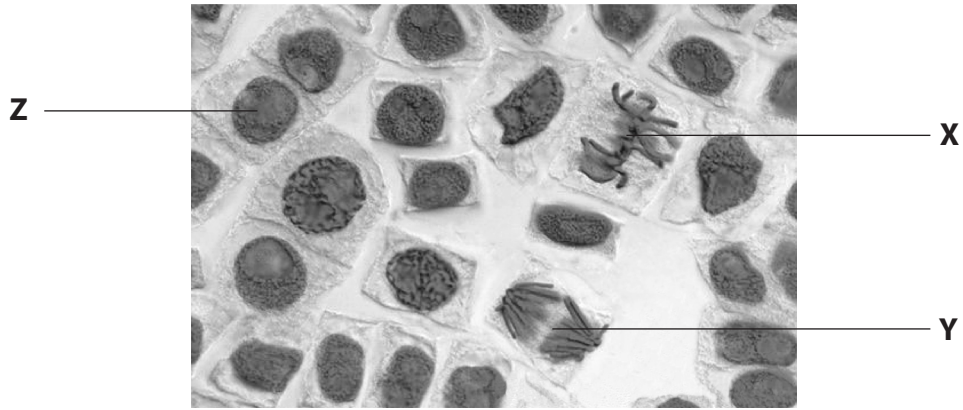
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(Total for Question 6 = 11 marks)



7 The photograph below shows plant cells at different stages in the cell cycle.



Magnification $\times 600$
Herve Conge,ISM / Science Photo library

(a) Name the stage of mitosis shown by each of the cells labelled **X** and **Y**.

(2)

X

Y

(b) Describe what occurs during prophase.

(4)

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(c) Cell **Z** is not undergoing mitosis.

Suggest which stage of the cell cycle it is undergoing.
Give a reason for your answer.

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(Total for Question 7 = 8 marks)



8 The black-footed ferret, shown in the photograph below, is one of North America's most endangered species. In 1986, only 18 individuals were living in the wild. These were used to start a captive breeding programme. Six zoos are now involved in this programme.



Black-footed ferret

Magnification $\times 0.1$

*(a) Suggest how this captive breeding programme in the six zoos ensures that genetic diversity is maintained in this species.

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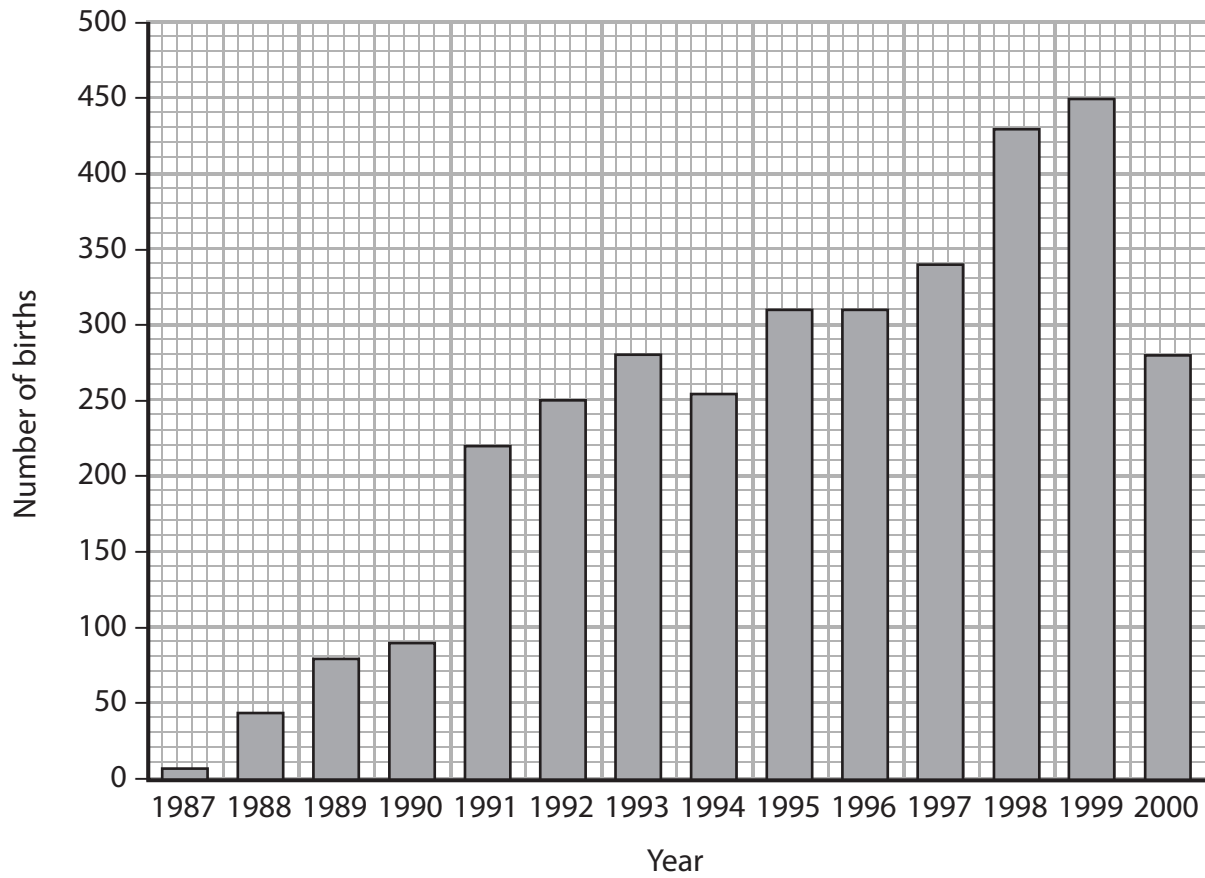
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(b) The graph below shows the number of black-footed ferrets in captivity born each year from 1987 to 2000.



(i) Each year since 1991, 200 black-footed ferrets have been released into the wild.
Suggest why no black-footed ferrets were released into the wild before 1991.

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(ii) Using the information in the graph, suggest how effective the captive breeding programme was between 1991 and 2000.

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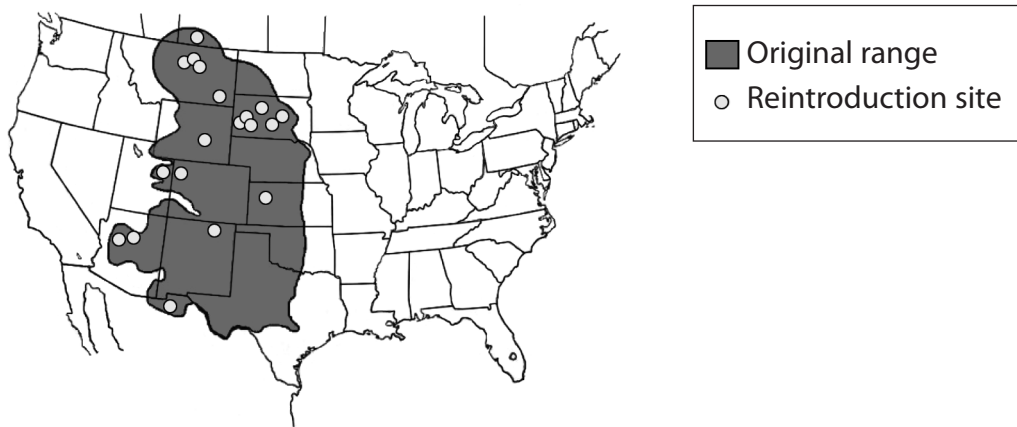
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(c) The map of the USA below shows the original range of the black-footed ferrets and the sites where they have been reintroduced. Their natural habitat is prairie, which is a type of grassland.

Only 1% of the prairie remains undisturbed by human activity.

Black-footed ferrets mainly prey on prairie dogs. Prairie dogs are treated as pests by farmers who may use poison to kill them.



Suggest **three** factors that could affect the survival chances of black-footed ferrets when they are reintroduced to the sites shown on the map.

(3)

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(Total for Question 8 = 12 marks)

TOTAL FOR PAPER = 80 MARKS





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