Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Biology

Advanced Subsidiary
Unit 2: Development, Plants and the Environment

Friday 15 January 2016 – Morning
Time: 1 hour 30 minutes

Paper Reference
WBI02/01

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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P 4 6 9 3 2 A 0 1 2 4

PEARSON

Answer ALL questions.

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

1 Organisms are made of cells. There are differences in the ultrastructure of prokaryotic and eukaryotic cells. There are also differences between plant and animal cells.

(a) Place a cross (☒) in the box next to the correct words to complete each of the following statements.

(i) Ribosomes are found in

(1)

☒ **A** animal cells only

☒ **B** eukaryotic cells only

☒ **C** prokaryotic cells only

☒ **D** eukaryotic and prokaryotic cells

(ii) Amyloplasts are found in

(1)

☒ **A** animal cells only

☒ **B** plant cells only

☒ **C** prokaryotic cells only

☒ **D** eukaryotic and prokaryotic cells

(iii) Mitochondria are found in

(1)

☒ **A** animal cells only

☒ **B** eukaryotic cells only

☒ **C** prokaryotic cells only

☒ **D** eukaryotic and prokaryotic cells

(iv) Centrioles are found in

(1)

☒ **A** animal cells only

☒ **B** all eukaryotic cells

☒ **C** prokaryotic cells only

☒ **D** eukaryotic and prokaryotic cells

(b) Eukaryotic cells contain membrane bound organelles. The diagram below shows one of these organelles.

(i) Place a cross (☒) in the box next to the name of this organelle.

(1)

☒ **A** centrioles

☒ **B** Golgi apparatus

☒ **C** mitochondrion

☒ **D** rough endoplasmic reticulum

(ii) Describe the function of this organelle.

(3)

(Total for Question 1 = 8 marks)

2 In multicellular organisms, cells can be organised into tissues, tissues into organs and organs into organ systems.

(a) Give **one** difference between the structure of a tissue and that of an organ.

(1)

(b) During the cell cycle, cells divide and then develop into tissues.

Explain the role of the cell cycle in the production of tissues.

(3)

(c) One of the stages of the cell cycle is mitosis.

Place a cross (☒) in the box next to the correct words to complete each of the following statements.

(i) The stages of mitosis take place in the following order

(1)

☒ **A** anaphase, telophase, metaphase, prophase

☒ **B** metaphase, anaphase, prophase, telophase

☒ **C** prophase, metaphase, anaphase, telophase

☒ **D** telophase, anaphase, metaphase, prophase

(ii) By the end of prophase

(1)

☒ **A** the chromatids move to the poles of the cell

☒ **B** the nuclear envelope breaks down and the spindle is formed

☒ **C** the nuclear envelope reforms and the spindle breaks down

☒ **D** the spindle fibres contract and the chromatids are separated

(Total for Question 2 = 6 marks)

3 Plant cell walls are formed as cells divide and develop.

(a) Read through the following passage about plant cell walls.
Write on the dotted lines the most appropriate word or words to complete the passage.

(4)

Plant cell walls contain cellulose, a polymer consisting of ..... monomers.

The monomers of this polymer are held together by ..... bonds.

Groups of cellulose molecules are held together by ..... bonds to form ..... that become part of the cell wall.

(b) The table below shows the chemical composition of fibres from five different plant sources.

Source of fibre	Chemical composition of fibres / arbitrary units		
	Cellulose	**Lignin**	**Pectin**
Flax	75	4	7
Jute	70	12	1
Cotton	95	0	4
Wheat	43	18	4
Wood	42	25	0

Using the information in the table and your own knowledge, suggest which source produces the weakest fibres. Give a reason for your answer.

(2)

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(c) The photograph below shows a wheat plant.

Magnification ×0.1

Calcium ion deficiency in wheat plants can affect the development of the cell wall. This results in slower growth of wheat plants and reduces the final mass of grain produced (crop yield).

(i) Explain the role of calcium ions in the structure of cell walls in plants.

(2)

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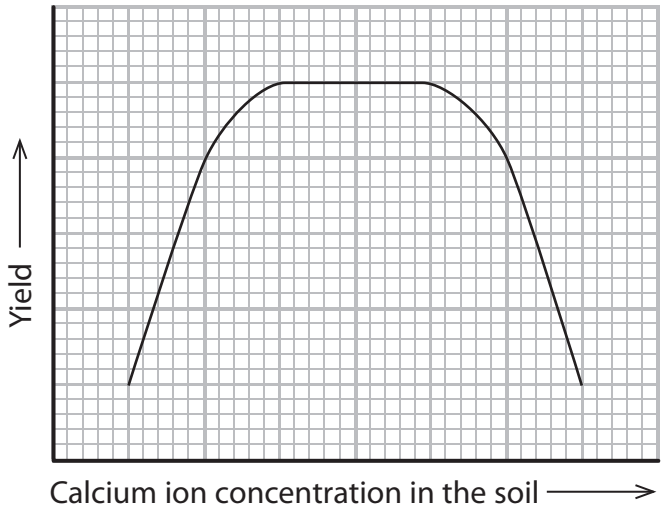
*(ii) The yield of crop plants, such as wheat, is affected by the calcium ion concentration in the soil. This is shown in the graph below.



Describe how to carry out an investigation to determine the concentration of calcium ions needed for the maximum yield of grain from wheat plants.

(5)

(Total for Question 3 = 13 marks)

4 Severe headaches are a symptom of migraine.

Sumatriptan is a drug that can reduce the symptoms of migraine.

Adults with migraine took part in a double blind trial to investigate the effects of sumatriptan.

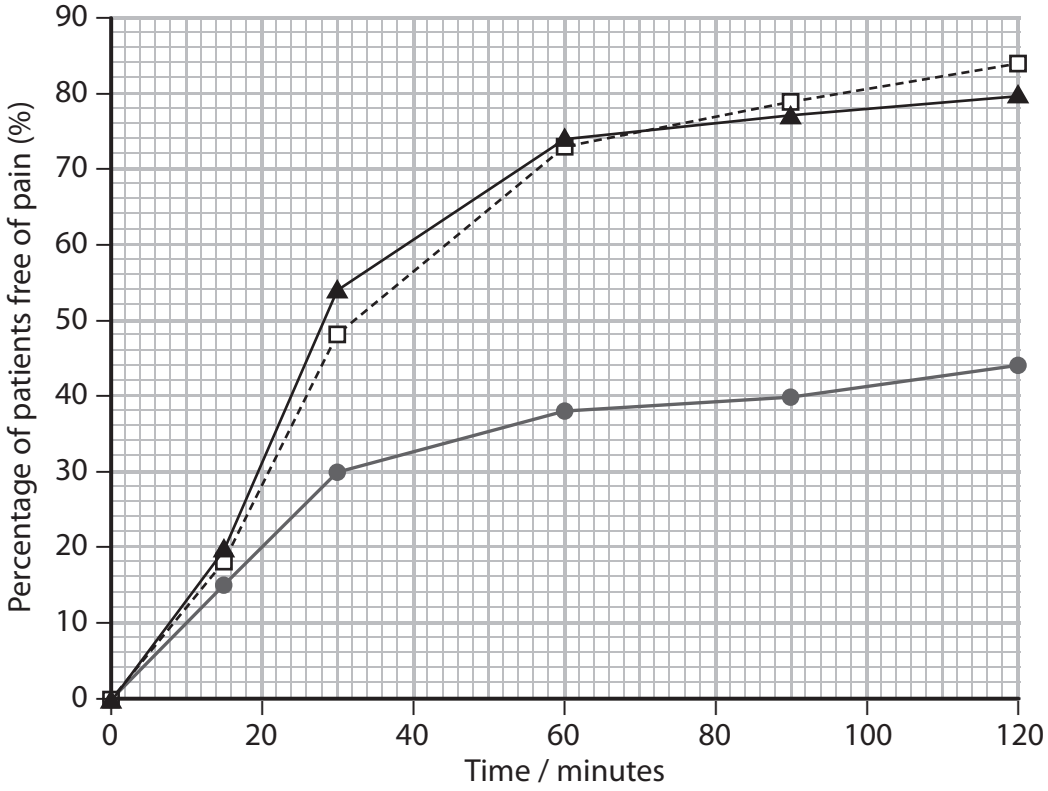
(a) Suggest how the **double blind trial** for this drug was carried out.

(4)

(b) Patients with a migraine attack were given either 10 mg sumatriptan, 20 mg sumatriptan or a placebo to treat the pain.

Patients recorded how long it took for them to be free of pain.

The results of this drug trial are shown in the graph below.



(i) Place a cross (☒) in the box to complete the following statement.

After 90 minutes, the difference in the percentage of patients free of pain between those taking a placebo and those taking 20 mg sumatriptan is

(1)

☒ **A** 37%

☒ **B** 40%

☒ **C** 77%

☒ **D** 79%

(ii) Using the information in the graph, describe the effects of sumatriptan on the treatment of the symptoms of migraine.

(3)

(iii) Using the information in the graph, suggest what conclusions can be drawn from this drug trial.

(3)

(Total for Question 4 = 11 marks)

5 The wild nutmeg tree, *Virola surinamensis*, is found in tropical forests in Brazil. The leaves and fruits are used in local medicines.

The wild nutmeg tree, shown in the photograph below, is an endangered species due to habitat loss.

© Smithsonian Tropical Research Institute

Magnification ×0.1

Habitat loss is reducing the biodiversity of tropical forests in Brazil.

(a) Suggest how the effects of habitat loss on the biodiversity of a tropical forest could be measured.

(2)

(b) Seeds of the wild nutmeg tree have been collected for storage in seed banks. It is important to collect seeds that allow the conservation of genetic diversity.

Explain how seed banks can help to conserve the genetic diversity of plant species.

(2)

(c) The germination of dried seeds from wild nutmeg trees was investigated. Seeds were dried at 50 °C for different lengths of time. After this treatment, some of the seeds were tested for moisture content and percentage germination.

The rest of the seeds were stored for four months. After storage, the moisture content and percentage germination were measured.

The results of this investigation are shown in the table below.

Drying time at 50 °C / minutes	Without storage		After storage	
	Percentage germination (%)	Moisture content (%)	Percentage germination (%)	Moisture content (%)
0	41	25.4	65	23.2
15	19	23.0	61	22.0
60	69	20.0	48	22.2
90	45	18.8	4	25.2
120	27	18.1	5	21.0
300	0	14.8	0	16.7

(i) Using the information in the table, describe the effects of drying time on the percentage germination of the seeds.

(3)

(ii) In this investigation, the seeds were stored at 22 °C and 53% humidity.

These stored seeds were observed to have fungi (mould) growing on their surfaces.

Suggest how these storage conditions could be changed to increase the percentage germination of these seeds after storage. Give an explanation for your answer.

(3)

(Total for Question 5 = 10 marks)

6 In Japan, scientists have used stem cells from the skin of mice to produce gametes.

The stem cells were stimulated to give rise to cells that can produce gametes. These cells were implanted into sterile female mice that had been unable to produce egg cells. These female mice were then able to produce egg cells.

The photograph below shows one of these female mice with her offspring.

Magnification ×1

(a) State the property of the stem cells which allowed them to give rise to cells that can produce gametes.

(1)

.....

(b) The allele for white fur is recessive. The scientists took a skin cell from a brown mouse and used it to grow egg cells in a sterile white mouse. These egg cells were fertilised with sperm from another white mouse.

All the offspring had brown fur.

Suggest what conclusion can be made from this observation.

(2)

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(c) Explain how the structure of an egg cell is related to its function as a gamete.

(4)

(d) When the undifferentiated cells were implanted into the sterile female mice they gave rise to egg cells. These egg cells were genetically varied.

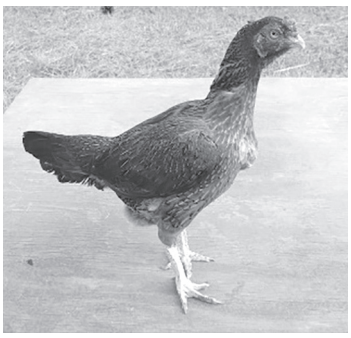
Suggest how these undifferentiated cells gave rise to genetically varied egg cells.

(4)

(Total for Question 6 = 11 marks)

7 Hens lay a variety of sizes of eggs. Certain breeds lay larger eggs than other breeds.

In India, two native breeds of hen were evaluated for egg production. The breeds were Aseel and Kadaknath.



Aseel hen
Magnification ×0.05

Kadaknath hen
Magnification ×0.1

(a) Egg size is affected by polygenic inheritance.

(i) Explain what is meant by **polygenic inheritance**.

(2)

(ii) State the type of variation expected in the size of eggs produced by one breed as a result of polygenic inheritance.

(1)

(iii) Young hens lay smaller eggs than older hens.

Environmental factors may also affect the size of eggs produced.

Suggest **one** environmental factor that may affect the size of eggs produced by hens.

(1)

(b) A group of 162 Aseel hens and a group of 178 Kadaknath hens were raised for a period of 56 weeks. Each week, the mean mass of the eggs produced was measured.

The hens were kept in the same environmental conditions.

The results are shown in the table below.

Time / weeks	Aseel hens		Kadaknath hens	
	Mean egg mass / g	Standard deviation	Mean egg mass / g	Standard deviation
28	42.57	0.30	36.02	0.33
32	44.65	0.29	37.14	0.29
36	45.84	0.27	40.09	0.38
40	47.57	0.34	41.56	0.19
56	51.61	0.61	44.06	0.34

(i) Using the information in the table, calculate the percentage increase in mean egg mass from 28 to 56 weeks for the Aseel hens.

Show your working.

(3)

..... %

(ii) Using the information in the table, explain why the statement that Aseel hens produce larger eggs than Kadaknath hens is a valid conclusion.

(2)

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(iii) The scientists also calculated the percentage of hens of different ages that were laying eggs.

The results are shown in the graph below.

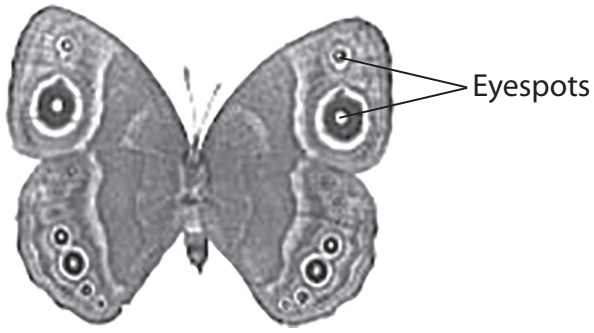
Using the information in the graph, compare the effect of the age of the hens on egg laying in these two breeds.

(3)

(Total for Question 7 = 12 marks)

8 Natural selection can lead to adaptation and evolution.

The photograph below shows the bush brown butterfly, *Bicyclus anynana*. It is found in eastern Africa.



Magnification ×1.0

(a) These butterflies are adapted to their environment.

(i) State **two** types of adaptation that could be shown by these butterflies.

(2)

1 .....

2 .....

*(ii) Suggest how natural selection could have given rise to adaptations of the bush brown butterfly.

(5)

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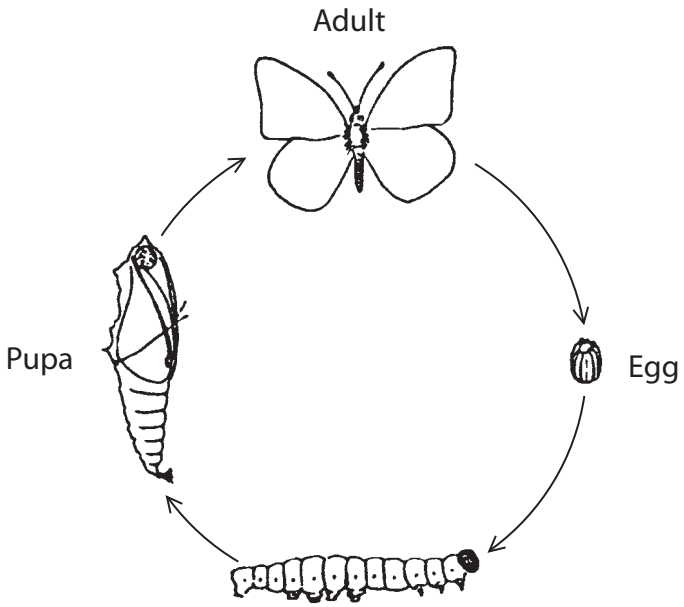
(b) The life cycle of a butterfly is shown in the diagram below.



Scientists carried out an experiment in which the caterpillars of the bush brown butterfly were kept in either cold or warm conditions. The types of butterfly that developed were recorded.

The results are shown in the table below.

Caterpillars kept in	Form of adult bush brown butterfly
Cold conditions	Wings with many, large eyespots
Warm conditions	Wings with few, small eyespots

Suggest why the scientists may have found it difficult to interpret the factors affecting the phenotype of these butterflies.

(2)

(Total for Question 8 = 9 marks)

TOTAL FOR PAPER = 80 MARKS

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