Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number	Candidate Number

Biology A (Salters Nuffield)

Advanced Subsidiary
Paper 2: Development, Plants and the Environment

Specimen Paper for first teaching September 2015
Time: 1 hour 30 minutes

Paper Reference
8BN0/02

You may need a ruler, a pencil and a calculator.

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.
- Show your working in any calculation questions and include units in your answer where appropriate.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You may use a scientific calculator.
- In questions marked with an **asterisk (*)**, marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

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.*

Advice

- Read each question carefully before you start to answer it.
- 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.

Write your answers in the spaces provided.

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 ☒.

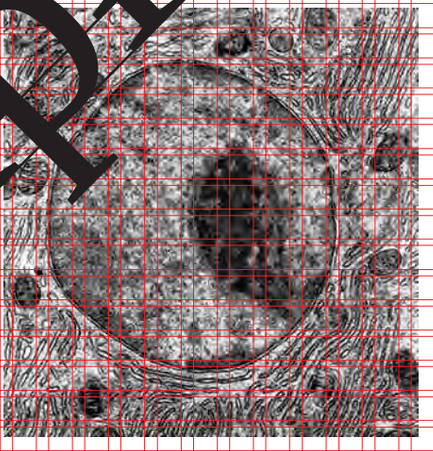
1 Living organisms are made of cells. The structure of a cell is different in bacteria, animals and plants.

(a) Which row shows the correct names of the organelles that could be found in the three different types of cell?

(1)

		Bacterial cell	Animal cell	Plant cell
☒	**A**	Plasmids	Golgi apparatus	Centrioles
☒	**B**	Ribosomes	Centrioles	Amyloplasts
☒	**C**	Centrioles	Ribosomes	Golgi apparatus
☒	**D**	Amyloplasts	Centrioles	Ribosomes

(b) The photograph shows a nucleus found in an animal cell.



Magnification: x 6 000

(i) Calculate the diameter of this nucleus in μm.

(2)

Answer ..... μm

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(ii) Describe the features shown in the photograph that allow this structure to be identified as a nucleus.

(3)

(Total for Question 1 = 6 marks)

Partial

2 Colour blindness in humans is an example of a sex-linked condition.

(a) (i) Which of the following is another example of a sex-linked condition in humans?

(1)

- ☒ **A** atherosclerosis
- ☒ **B** cystic fibrosis
- ☒ **C** haemophilia
- ☒ **D** lung cancer

(ii) In Australia, 8% of males are colour blind compared with 0.4% of females.

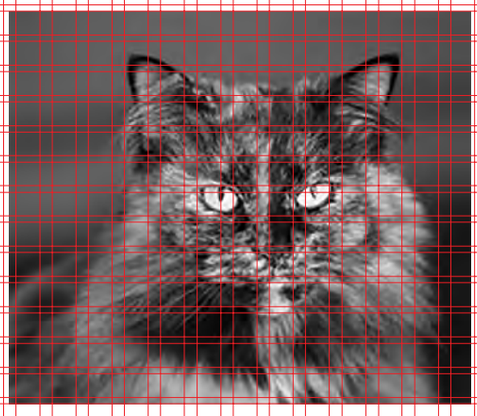
Explain why colour blindness is more common in males than in females.

(2)

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(b) Domestic cats have a gene for fur colour that is found only on the X chromosome. This gene has two alleles, one producing orange fur and the other producing black fur.

Tortoiseshell cats have patches of orange fur and patches of black fur. This pattern of fur colouration is usually found only in female cats.



With the help of a genetic diagram to explain why the tortoiseshell cat in the photograph is unlikely to be male.

(3)

Repeat

(Total for Question 2 = 6 marks)

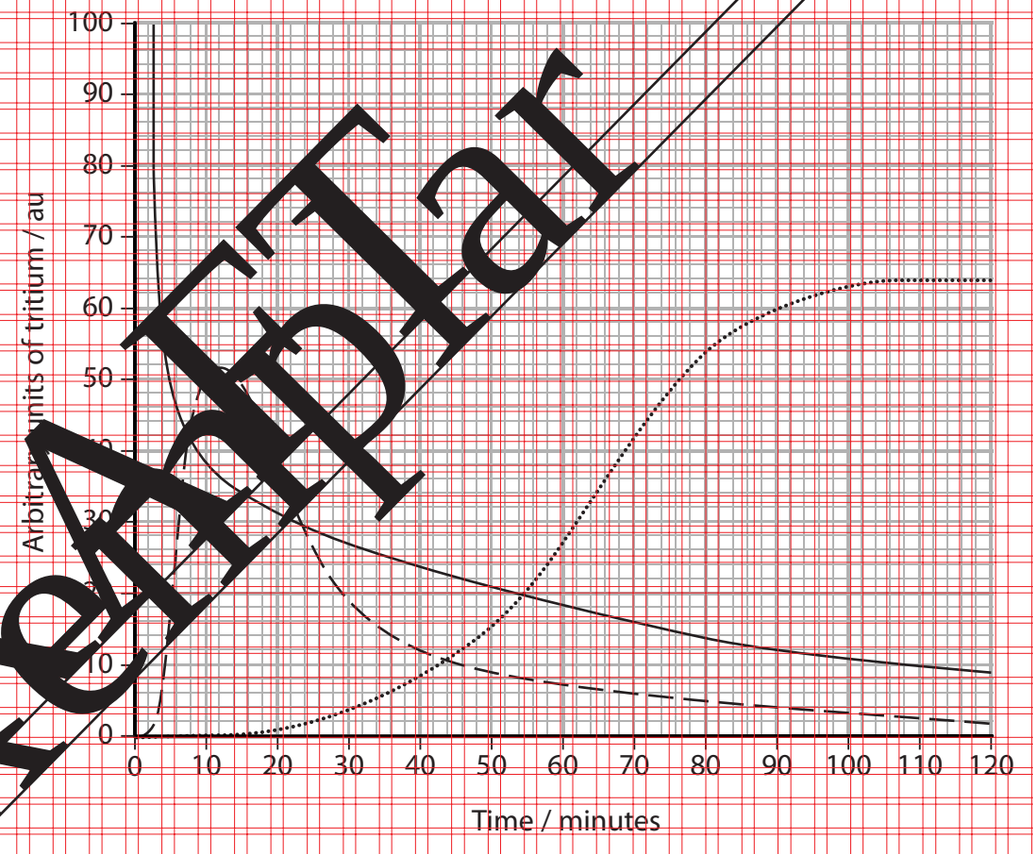
3 The pancreas is an organ in mammals that secretes enzymes and hormones.

(a) State what is meant by the term **organ**.

(1)

(b) In an experiment, cells of the pancreas were provided with amino acids labelled with a radioactive element called tritium.

The graph below shows the distribution of tritium within different organelles in the cells over a period of 120 minutes.



Exemplar

(i) Calculate the rate at which tritium moved out of the Golgi apparatus between 12 and 25 minutes.

(2)

Answer .....

(ii) Analyse the graph to explain the route taken by these amino acids within the pancreatic cells.

(4)

(Total for Question 3 = 7 marks)

Rapidar

4 Plants of the Solanaceae family, such as tomato and tobacco, have adaptations that defend them against pests such as caterpillars.

(a) The leaves may be covered in sticky hairs and parts of the plant may contain toxins.

(i) The two types of adaptation shown by plants of the Solanaceae family are

(1)

☒ **A** anatomical and behavioural

☒ **B** anatomical and physiological

☒ **C** behavioural and physical

☒ **D** behavioural and physiological

(ii) The drug atropine is extracted from the plant *Atropa belladonna*, a member of the Solanaceae family.

Atropine can be used to treat individuals with an extremely low heart rate. It can be fatal in high concentrations.

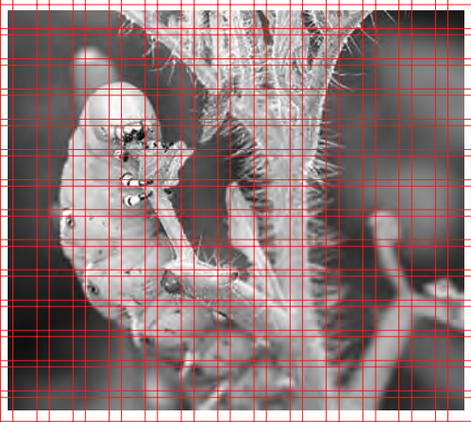
Describe how contemporary drug testing protocol enabled a safe dose for atropine to be determined.

(2)

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(b) Caterpillars of the hawk moth, *Manduca quinquemaculata,* are known as tomato hornworms.

Tomato hornworms mainly feed on the leaves of tomato plants.



Manduca sexta is a closely related species. Its caterpillars are called tobacco hornworms and they mainly feed on tobacco leaves.

The caterpillars of each species may be found feeding on either tobacco or tomato plants.

(i) These caterpillars are closely related species because

(1)

☒ **A** they are both called hornworms

☒ **B** they are both hawk moth caterpillars

☒ **C** they belong to the same genus

☒ **D** they feed on plants belonging to the same family

Reprint

(ii) Scientists investigated how damage to plants can affect gene expression.

When the tomato hornworms bite the leaves of tomato plants, proteins are produced inside the leaf cells. Some of these proteins are enzyme inhibitors that prevent the tomato hornworms from digesting the leaves.

Deduce how chemicals in the saliva of tomato hornworms can cause the leaf cells to produce these proteins.

(4)

(Total for Question 4 = 8 marks)

Exemplar

5 Genetic diversity can be determined by the frequency of different alleles within a population.

(a) The table shows the numbers of individuals of each genotype within three different populations of the same species, P, Q and R.

Genotype	Population		
	P	Q	R
AA	118	37	219
Aa	254	39	286
aa	128	24	395

(i) The table shows the heterozygosity indices for populations P and Q.

(1)

Population	Heterozygosity index
P	0.51
Q	0.39

Which of the following is the heterozygosity index for R?

- ☒ **A** 0.10
- ☒ **B** 0.24
- ☒ **C** 0.32
- ☒ **D** 0.44

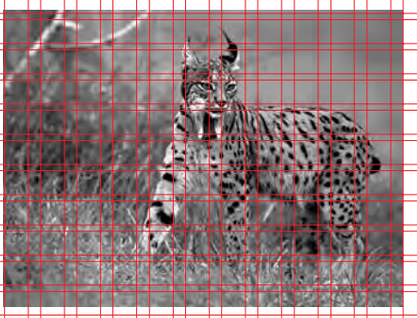
(ii) Inbreeding has taken place in either population P or population Q.

Identify and justify which population has been inbreeding.

(2)

Partial Removal

(b) The Iberian lynx, *Lynx pardinus*, is very rare. The wild population consists of less than 200 individuals.



The Iberian lynx and the Eurasian lynx are both found in Spain. The Iberian lynx inhabits open scrubland and the Eurasian lynx inhabits forests.

The Iberian lynx is smaller than the Eurasian lynx and it hunts smaller animals, such as rabbits.

(i) Explain why the Iberian lynx is not in competition with the Eurasian lynx.

(2)

Exemplar

(ii) The Iberian lynx has low genetic diversity.

Evidence from lynx fossils shows little change in the genetic diversity over the past 50 000 years.

Discuss the potential of a captive breeding programme to conserve the Iberian lynx.

(5)

REMPLAR

(Total for Question 5 = 10 marks)

6 In the 1970s, a theory for a new system of taxonomy was proposed by a scientist called Woese.

(a) Describe the process by which the scientific community critically evaluates new theories.

(3)

(b) This new system of taxonomy identified three domains, J, K and L.

The table gives some of the characteristics of each of these three domains.

Characteristic	Domain J	Domain K	Domain L
True nucleus	Absent	Absent	Present
Mitochondria	Absent	Absent	Present
Ribosome size	70S	70S	80S
Sensitive to antibiotics	Yes	No	No
Cell wall contains peptidoglycan	Yes	No	No
Lipids in cell membranes contain ester bonds	Yes	No	Yes

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(i) Which of the following rows identifies the three domains in the table?

(1)

	J	K	L
☒ **A**	Archaea	Bacteria	Eukaryota
☒ **B**	Bacteria	Archaea	Eukaryota
☒ **C**	Bacteria	Eukaryota	Archaea
☒ **D**	Eukaryota	Bacteria	Archaea

(ii) Describe how molecular phylogeny can be used to determine similarities and differences between the three domains.

(3)

Reflar

(Total for Question 6 = 7 marks)

7 Banana fibres are extracted from the leaves of the banana plant. They can be used to make textiles for clothing as they are very soft and flexible.

An investigation was carried out to determine the strength of banana fibres of different diameters.

(a) The table shows the results and the properties of these fibres.

Diameter of fibre / µm	Mean number of phloem sieve tubes	Mean number of xylem vessels	Mean number of sclerenchyma fibres	Mean tensile strength / MPa
100	3	6	53	711.66
150	3	8	70	773.02
200	4	7	92	789.29
250	5	9	117	793.43

(i) Which diameter of fibre contains the greatest proportion of components containing cytoplasm?

(1)

☒ **A** 100

☒ **B** 150

☒ **C** 200

☒ **D** 250

(ii) Calculate the percentage of tissue containing lignin in the strongest fibre.

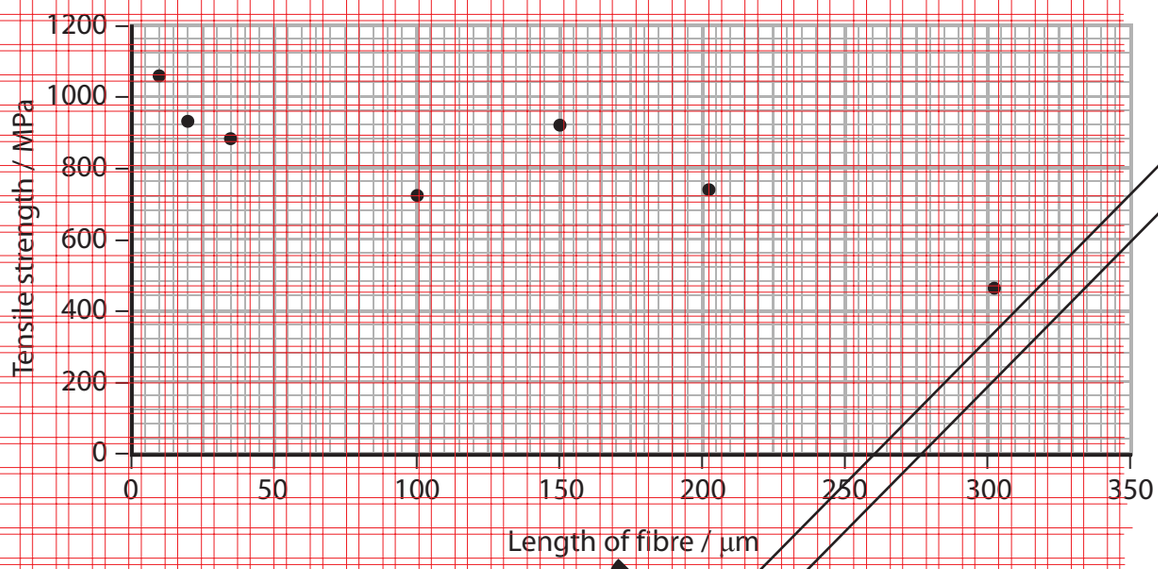
(2)

Answer ..... %

Exemplar

(iii) In another investigation, the tensile strength of banana fibres of various lengths but with the same diameter was measured.

The results are shown in the graph.



Analyse the data from both investigations to deduce the effect of fibre width and length on tensile strength.

(4)

Partial Removal

*(b) The tensile strength of banana fibres is related to the proportion of living to non-living tissue within the fibres.

Devise an investigation to obtain valid evidence to support this statement.

(6)

Exemplar

(Total for Question 7 = 13 marks)

8 Meiosis is involved in the production of haploid nuclei in mammalian gametes.

(a) (i) Which of the following is the best description of the term **haploid nucleus**?

(1)

☒ **A** nucleus with 23 pairs of chromosomes

☒ **B** nucleus with twice the number of chromosomes as a somatic cell

☒ **C** nucleus with homologous pairs of chromosomes

☒ **D** nucleus with half the number of chromosomes as a somatic cell

(ii) Describe how crossing over gives rise to different combinations of alleles in gametes.

(2)

(iii) Explain how independent assortment gives rise to genetically varied gametes.

(2)

Reflar

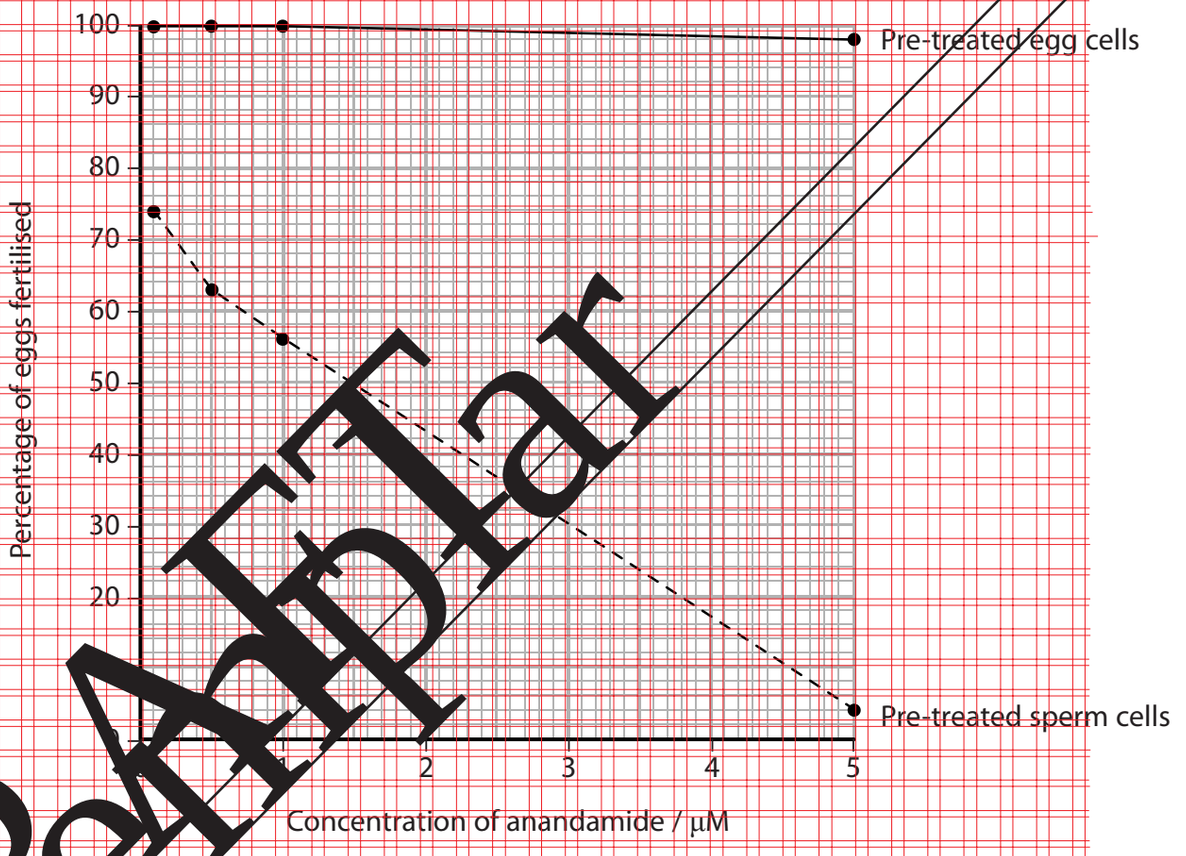
(b) Fertilisation can be affected by anandamide, a chemical found in cannabis.

The effect of anandamide on fertilisation in sea urchins was investigated.

Sperm cells were pre-treated with different concentrations of anandamide. These sperm cells were then mixed with untreated egg cells. The percentage of successful fertilisations was calculated.

A separate investigation was carried out using pre-treated egg cells that were then mixed with untreated sperm cells. The percentage of successful fertilisations was calculated.

The graph shows the results of the investigations.



(i) Calculate the percentage change in fertilisation using pre-treated sperm cells when the concentration of anandamide increased from 0.1 to 1.0 µM.

(2)

Answer ..... %

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(ii) The conclusion from this investigation was that anandamide affects the acrosome reaction.

Analyse the graph to evaluate this conclusion.

(4)

(c) Compare and contrast the acrosome reaction and the cortical reaction.

(3)

(Total for Question 8 = 14 marks)

REPLAY

9 The colour of animal fur can be determined by both genotype and environment.

(a) A gene for fur colour is found at a locus.

(i) State what is meant by the term **locus**.

(1)

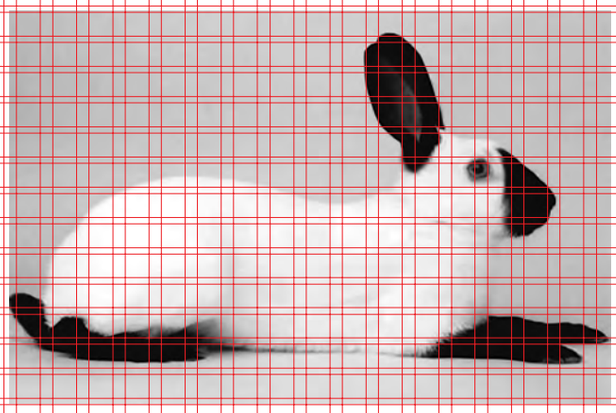
(ii) The darkness of an animal's fur colour could be due to polygenic inheritance.

Explain how polygenic inheritance could affect the darkness of the fur.

(2)

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(b) The photograph shows an adult Himalayan rabbit. These rabbits are white with black fur on their ears, tails and feet.



Himalayan rabbits carry the C gene, which is required for the production of pigment in fur. The C gene is inactive at temperatures above 35 °C.

Baby rabbits cannot maintain their body temperature outside of the nest. The temperature inside the nest of the Himalayan rabbit is usually at least 35 °C.

If a baby Himalayan rabbit falls from the nest it will develop different colouration to the other baby rabbits that remain in the nest.

Explain the difference in the colouration of the baby rabbit that falls out of its nest compared to that of the adult rabbit.

(3)

REPLAY

(c) The colour of some types of mice is affected by the diet of the mother when she is pregnant.

In an investigation, pregnant mice were separated into two groups, A and B. The embryos all had the same genotype that should produce a yellow coat.

Dietary supplements were given to group A and they gave birth to mice with brown coats.

Group B were not given dietary supplements and they gave birth to mice with yellow coats.

Explain how this could provide evidence for epigenetic modification.

(3)

(Total for Question 9 = 9 marks)

TOTAL FOR PAPER = 80 MARKS

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