

Write your name here

Surname

Other names

Pearson Edexcel
Level 3 GCE

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

Biology A (Salters Nuffield)

Advanced

Paper 1: The Natural Environment and Species Survival

Monday 12 June 2017 – Afternoon

Time: 2 hours

Paper Reference

9BN0/01

You must have:

Calculator, HB pencil, ruler

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 100.
- 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 ►

P48174A

©2017 Pearson Education Ltd.

2/2/1/1/1/




Pearson

Answer ALL questions.

Write your answers in the spaces provided.

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 At the start of fertilisation, many sperm cells will surround the ovum.

(a) Fertilisation begins with the acrosome reaction.

(i) Which of the following describes the acrosome reaction?

(1)

- A the ovum releases enzymes that digest the egg cell membrane
- B the ovum releases enzymes that digest the zona pellucida
- C the sperm cell releases enzymes that digest the egg cell membrane
- D the sperm cell releases enzymes that digest the zona pellucida

(ii) Which of the following statements describes the genetic content of a sperm cell?

(1)

	Each sperm cell will contain	Different sperm cells will contain
<input type="checkbox"/> A	one copy of each gene	different alleles of some genes
<input type="checkbox"/> B	one copy of each gene	the same alleles for all genes
<input type="checkbox"/> C	two copies of each gene	different alleles of some genes
<input type="checkbox"/> D	two copies of each gene	the same alleles for all genes

(b) Describe the events of fertilisation that occur after the acrosome reaction.

(3)

.....

.....

.....

.....

.....

.....

.....

(Total for Question 1 = 5 marks)



DO NOT WRITE IN THIS AREA

2 All cells have a cell surface membrane.

(a) Explain how phospholipids form a cell surface membrane.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Cell surface membranes regulate the movement of substances into and out of cells.

(i) Which of the following describes the movement of water by osmosis?

(1)

<input type="checkbox"/> A	against a solute concentration gradient	through a fully permeable membrane
<input type="checkbox"/> B	against a solute concentration gradient	through a partially permeable membrane
<input type="checkbox"/> C	down a solute concentration gradient	through a fully permeable membrane
<input type="checkbox"/> D	down a solute concentration gradient	through a partially permeable membrane



(ii) The concentration of potassium ions inside an animal cell is many times higher than the concentration of potassium ions in the extracellular fluid.

Which mechanism is responsible for the uptake of potassium ions by this animal cell?

(1)

- A** active transport
- B** exocytosis
- C** osmosis
- D** passive diffusion

(iii) Glucose enters cells by facilitated diffusion.

Which part of the cell surface membrane allows facilitated diffusion of glucose?

(1)

- A** cholesterol
- B** glycolipid
- C** phospholipid
- D** protein

(c) Some epithelial cells in the lungs secrete mucus. If the mucus is too 'sticky', it cannot be easily removed from the lungs.

Other epithelial cells in the lungs contain CFTR proteins in their cell surface membranes.

(i) Describe the role of the CFTR protein in ensuring that the mucus produced in the lungs has the right consistency.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA



3 DNA synthesis in bacterial cell cultures has been investigated.

(a) Describe how DNA is organised in a bacterial cell.

(3)

.....

.....

.....

.....

.....

.....

.....

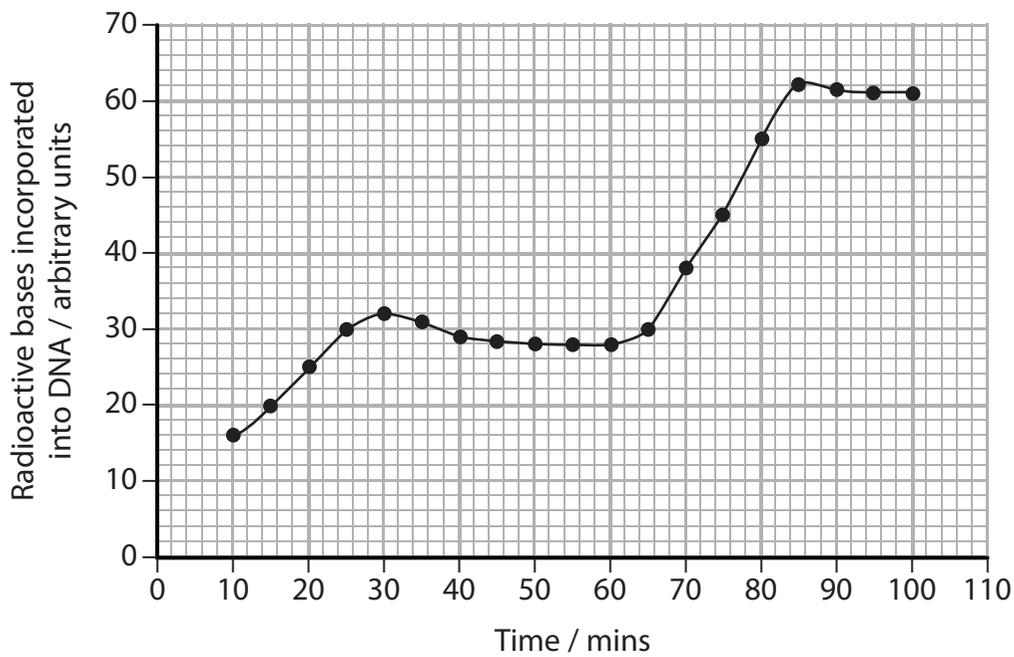
.....

.....

.....

(b) In an experiment, a mixture of radioactive bases was added to a culture of dividing bacteria.

The results are shown in the graph.



DO NOT WRITE IN THIS AREA



(i) Calculate the fastest rate of uptake of bases by these bacteria.

(2)

Answer

(ii) Deduce how many times the bacteria in the culture have divided during this experiment.

(2)

.....

.....

.....

.....

.....

.....

(iii) Explain why the experiment would be improved if all the bases were provided but only the thymine was radioactive.

(2)

.....

.....

.....

.....

.....

.....



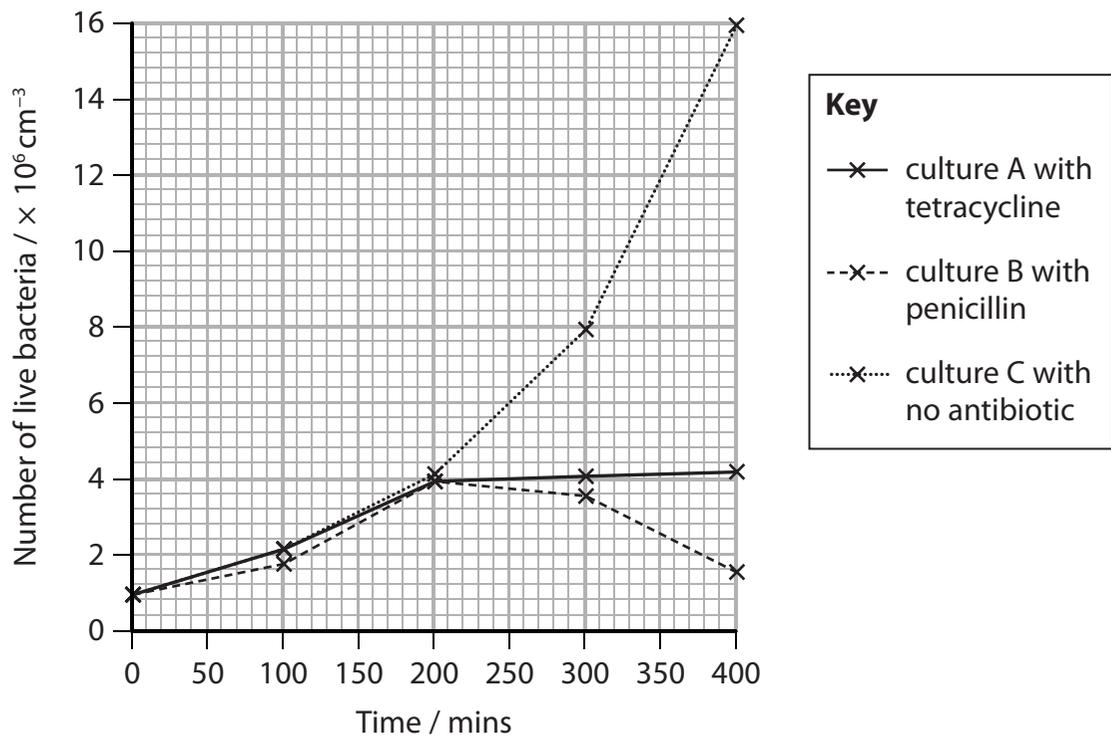
(c) Antibiotics can be used to control bacterial infections.

In an experiment, a culture of bacteria was grown in nutrient broth. The culture was then divided into three separate cultures, A, B and C. The bacterial cultures were grown for 200 minutes.

After 200 minutes the antibiotic tetracycline was added to culture A and the antibiotic penicillin was added to culture B. No antibiotics were added to culture C.

The three cultures were grown for a further 200 minutes.

The results of the experiment are shown in the graph.



Deduce the effects of these antibiotics on the growth of the bacterial cultures.

(2)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 3 = 11 marks)



DO NOT WRITE IN THIS AREA

BLANK PAGE



P 4 8 1 7 4 A 0 9 3 2

(b) The products of the light-dependent reactions are used in the light-independent reactions.

(i) In which part of the chloroplast do the light-independent reactions take place? (1)

- A envelope
- B granum
- C stroma
- D thylakoid

(ii) What is the name of the enzyme used by plants to fix carbon dioxide? (1)

- A GALPase (glyceraldehyde-3-phosphatase)
- B GPase (glycerate-3-phosphatase)
- C RUBISCO (ribulose biphosphate carboxylase/oxygenase)
- D RuBPase (ribulose biphosphatase)

(iii) Which of the following is the immediate product of the light-independent reactions of photosynthesis? (1)

- A glucose
- B GP
- C RuBP
- D starch

(Total for Question 4 = 8 marks)



5 Climate change has been correlated with changing atmospheric carbon dioxide levels.

(a) Scientists studying climate change have examined peat bogs to observe pollen grains such as those shown in the photograph.



Explain how studying pollen grains in peat bogs can provide evidence of climate change. (4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

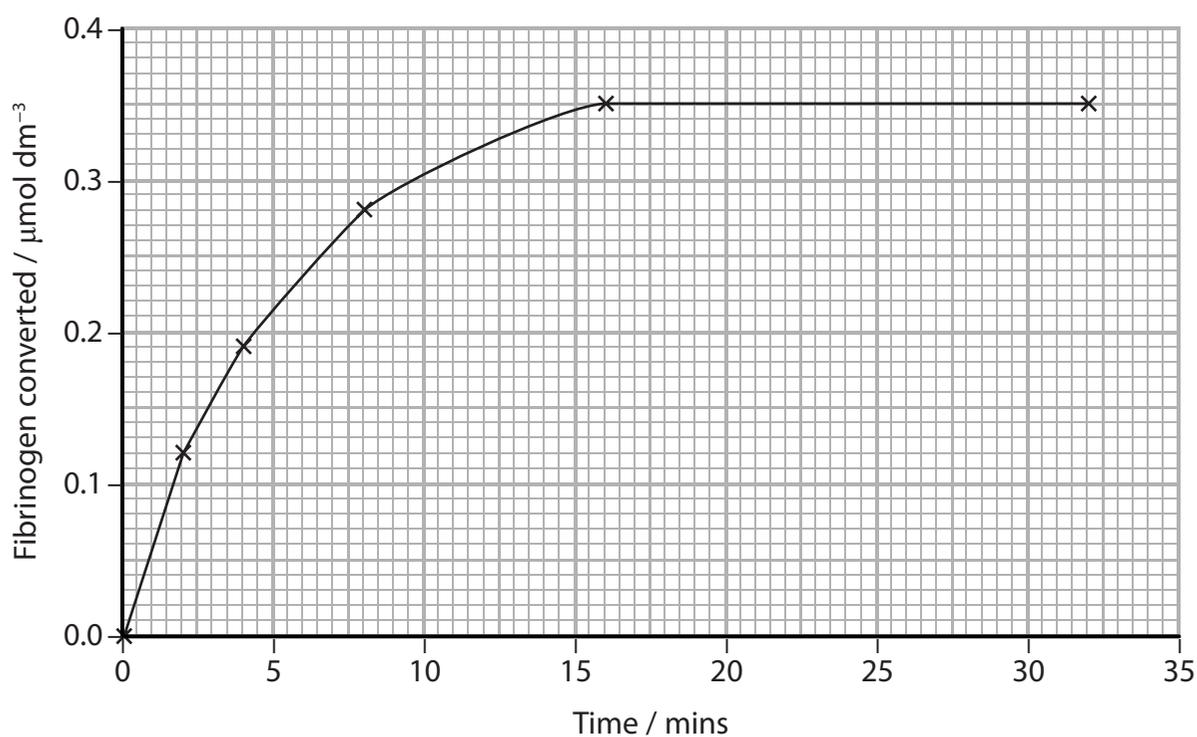
DO NOT WRITE IN THIS AREA



6 Fibrin is involved in the formation of blood clots.

Thrombin is an enzyme that converts fibrinogen to fibrin.

(a) The graph shows the effect of one concentration of thrombin on the conversion of fibrinogen to fibrin.



(i) Calculate the initial rate of reaction.

(2)

Answer

(ii) On the graph, draw a line to show the effect of halving the concentration of thrombin.

(1)

DO NOT WRITE IN THIS AREA



(iii) Explain the effect of changes in the initial rate of reaction on the time taken for a blood clot to form.

(2)

.....

.....

.....

.....

.....

.....

(b) The table shows the results of an investigation into the fibrinogen concentrations in the blood of males and females with and without cardiovascular disease (CVD).

	Mean fibrinogen concentration / mg 100 cm ⁻³	
	With CVD	Without CVD
Males	333 ± 5.16	322 ± 2.00
Females	336 ± 7.25	319 ± 1.89

(i) Explain how the results of this investigation could be used to identify individuals at risk of CVD.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



(ii) Explain how changes in fibrinogen concentration might be a risk factor for CVD. (3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 6 = 11 marks)

DO NOT WRITE IN THIS AREA

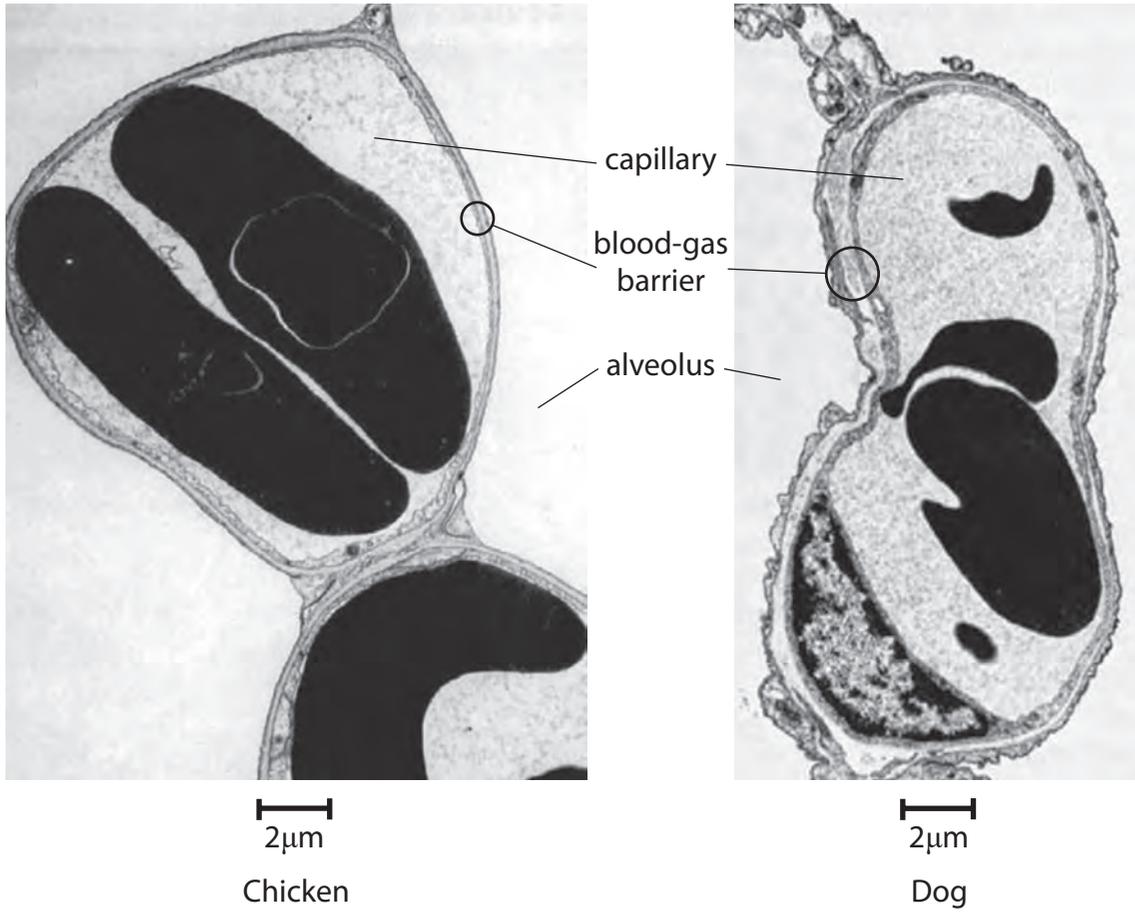


DO NOT WRITE IN THIS AREA

BLANK PAGE



(b) The electron micrographs show the blood-gas barriers for a chicken and a dog.



Explain how the blood-gas barrier of the chicken is adapted to give more efficient gas exchange than the blood-gas barrier of the dog.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 7 = 7 marks)



8 Human papilloma virus (HPV) is a DNA virus.

(a) Some strains of HPV are sexually transmitted and can cause cervical cancer or genital warts.

The table shows some information about the conditions associated with four strains of HPV.

HPV strain	Condition associated with the strain	Percentage of all cases caused by the strain (%)
6	cervical cancer	<1
	genital warts	67
11	cervical cancer	<1
	genital warts	22
16	cervical cancer	55
	genital warts	<1
18	cervical cancer	13
	genital warts	<1

(i) Comment on the relationship between HPV and these two conditions.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA



(ii) The table shows two vaccines developed from different combinations of HPV.

Vaccine	Strains of HPV used in development of the vaccine
Cervarix	16 and 18
Guardasil	6, 11, 16 and 18

Analyse all the data to explain why the Guardasil vaccine is preferred to the Cervarix vaccine.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(iii) Which of the following describes the type of immunity developed by these vaccines?

(1)

- A artificial active immunity
- B artificial passive immunity
- C natural active immunity
- D natural passive immunity



(b) Cervarix and Gardasil have been used in national vaccination programs.

A person who has been vaccinated becomes infected with HPV-16. Explain the role of the T cells in the body of this person.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(c) In agammaglobulinaemia, stem cells in the bone marrow cannot differentiate into B cells.

Agammaglobulinaemia can be a sex-linked condition.

(i) Which of the following describes the production of B cells from bone marrow stem cells?

(1)

- A** from differentiated cells by meiosis
- B** from differentiated cells by mitosis
- C** from undifferentiated cells by meiosis
- D** from undifferentiated cells by mitosis

DO NOT WRITE IN THIS AREA



(ii) State what is meant by the term **sex-linkage**.

(2)

.....

.....

.....

.....

.....

(Total for Question 8 = 14 marks)

DO NOT WRITE IN THIS AREA



9 The coffee husks, shown in the photograph, are a waste product of coffee plantations.

Composting has been suggested as an environmentally friendly way of decomposing these coffee husks.



The effect of adding cow dung to coffee husks, before they are composted, has been investigated.

The table shows the percentages of organic carbon and nitrogen in two compost heaps at the start of composting and after 90 days.

	Husks alone		Husks with added cow dung	
	0	90	0	90
Days composting	0	90	0	90
Organic carbon (%)	54.50	41.70	48.10	35.40
Nitrogen (%)	1.84	2.31	2.76	3.19

(a) Comment on the effect of adding cow dung to composting coffee husks.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA



* (b) The changes in the compost heaps are due to the activity of decomposers and other organisms.

Devise an investigation to determine the effect of the carbon to nitrogen ratio on the succession of species in these compost heaps.

(6)

Area with horizontal dotted lines for writing the answer.

(Total for Question 9 = 9 marks)

DO NOT WRITE IN THIS AREA





DO NOT WRITE IN THIS AREA

BLANK PAGE



10 Scientists have studied behavioural, anatomical and genetic variation in elephants.

The table shows some information about two populations of African elephants.

Population	Location	Feeding behaviour	Anatomical differences
Forest elephant	tropical forest of central and West Africa	feeds on leaves and fruits of high-growing plants such as shrubs and trees	<ul style="list-style-type: none">• lower jaw longer and narrower• tusks straighter and downward facing• overall a much smaller size
Savannah elephant	African savannah	feeds on grass and leaves of low-growing shrubs	<ul style="list-style-type: none">• lower jaw shorter and wider• tusks more curved and upward facing• overall a larger size

The photographs show elephants from the two populations.



Forest elephant



Savannah elephant



DNA samples were collected from these two populations of elephants.

- (a) One of the genes showing variation was the GBA gene. The table shows the frequency of the alleles of the GBA gene in the two populations.

GBA allele	Frequency of allele in the elephant population	
	Savannah elephant	Forest elephant
J	0.05	0.43
K	0.00	0.57
L	0.95	0.00

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

(1)

.....

.....

.....

- (ii) Use the Hardy-Weinberg equation to show that more than 50% of the forest elephant population are homozygous for the GBA gene.

(3)

Answer.....

DO NOT WRITE IN THIS AREA



(b) Scientists have concluded that the forest elephant and the savannah elephant are two different species.

* (i) Analyse the data and the information provided to comment on the validity of this conclusion.

(6)

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

BLANK PAGE



P 4 8 1 7 4 A 0 3 1 3 2

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

Every effort has been made to contact copyright holders to obtain their permission for the use of copyright material. Pearson Education Ltd. will, if notified, be happy to rectify any errors or omissions and include any such rectifications in future editions

