Please check the examination of	details below before entering you	r candidate information
Candidate surname	Other	names
Pearson Edexcel Level 3 GCE	Centre Number	Candidate Number
Thursday 6	lune 2019	
Morning (Time: 2 hours)	Paper Referen	ce 9BN0/01
Biology A (Sal Advanced Paper 1: The Natural		

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.

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.
- 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.

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 ▶



P56710A
©2019 Pearson Education Ltd.
1/1/1/1/1/



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Answer ALL questions.

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

- 1 Photosynthetic plants use light as a source of energy for the synthesis of organic molecules. Photosynthesis is a two-stage process.
 - (a) The light-dependent reactions take place in the chloroplast.
 - (i) Which of the following describes where, in the chloroplast, the light-dependent reactions take place?

(1)

- **A** cristae
- **B** matrix
- C stroma
- **D** thylakoids
- (ii) Which of the following are the products of the light-dependent reactions?

(1)

- A carbon dioxide and reduced NADP
- ☑ B glucose and oxygen
- C reduced NAD, ATP and oxygen
- D reduced NADP, ATP and oxygen
- (iii) Which of the following is the source of the hydrogen produced by the light-dependent reactions?

(1)

- A glucose
- Reduced NAD
- C reduced NADP
- **D** water

DO NOT WRITE IN THIS AREA

Explain why this increase in carbo	on dioxide concentration	n affects the growth of
plants in glasshouses.		(3)
	(Tot	al for Question 1 = 6 marks)



DO NOT WRITE IN THIS AREA

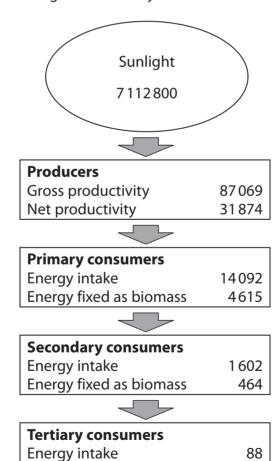
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

2 Silver Springs is a state park in Florida. The photograph shows one of the many waterways in this state park.



(a) Energy flow through this ecosystem has been studied. The results are shown in the flow chart. All values are given in kJ m⁻² yr⁻¹.



21

Energy fixed as biomass

DO NOT WRITE IN THIS AREA

WRITE IN THIS AREA

(i) Calculate how much energy is lost through respiration by the primary consumers.

(1)

Answer	kJ m ⁻²	vr-
/ \\	 ווועו	yı

(ii) The table gives details of energy transfers at the different trophic levels.

Trophic level	Energy fixed as biomass / kJ m ⁻² yr ⁻¹	Transfer efficiency (%)
Producers	31 874	
Primary consumers	4615	14.5
Secondary consumers	464	
Tertiary consumers	21	4.5

Calculate the efficiency of energy transfer between primary consumers and secondary consumers.

(1)

(iii) The efficiency of photosynthesis can be measured as the percentage of energy from sunlight that is converted to gross primary productivity (GPP).

Which of the following shows the percentage efficiency of photosynthesis in this ecosystem?

(1)

- **■ B** 12%
- **C** 36.6%
- **■ D** 55.8%

than the light energy available to the ecosystem. (3)
(Total for Question 2 = 6 marks)

NOT WRITE IN THIS AREA

3 A study of the genetics of grass snakes has led to the identification of a new species of grass snake in the UK.

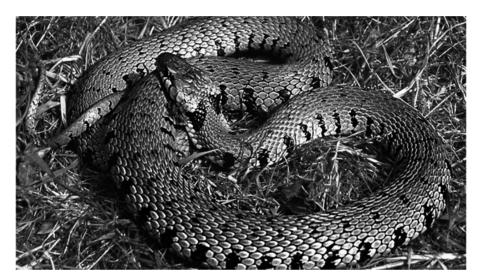
The barred grass snake was thought to be a variation of the common grass snake, *Natrix natrix*.

However, the barred grass snake, *Natrix helvetica*, has been found to be a different species.

Both types of grass snake are normally found in lowland regions in the south of England. The snakes can be more than a metre long, are found near water and eat mainly amphibians such as frogs and newts.

The common grass snake is olive green with a bright yellow collar.

The barred grass snake, shown in the photograph, is grey with black markings.



1	` a`	\ State	what is	meant hy	y the term	snecies
١	a) State	vviiat is	illeant by	y tile tellli	species.





DO NOT WRITE IN THIS AREA

different species.		(4)

DO NOT WRITE IN THIS AREA

(c) Explain how these two species of snake could have arisen from a common ances	etor. (4)
(Total for Question 3 = 9 n	narks)

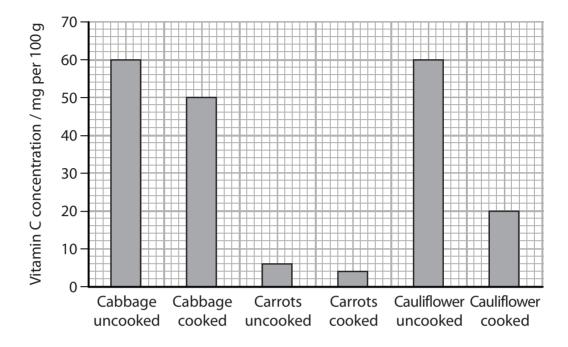
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

4 Vitamin C has antioxidant properties. The human body cannot make or store vitamin C. A healthy diet must contain vitamin C.

The graph shows the concentration of vitamin C in a variety of cooked and uncooked vegetables.



- (a) (i) How many of the following conclusions are valid for these results?
 - cooking destroys all of the vitamin C
 - each vegetable contains less vitamin C when it is cooked than when it is uncooked
 - cabbage contains the most vitamin C

(1)

- B [↑]
- **D** 3



DO NOT WRITE IN THIS AREA

Calculate the mass of cooked caulif	ower that would provide 90 mg of vitamir	ı C.
		(2)
	Answer	
) Devise a procedure that can be used to	investigate the effect of cooking on the	
vitamin C content of cauliflower.	investigate the effect of cooking on the	
		(4)
		•••••
	(Total for Question 4 = 7 mag	arks)



DO NOT WRITE IN THIS AREA

5	The extent of decomposition is important in helping to determine the time of death	
	of a mammal.	
	Body farms are outdoor laboratories where experiments take place to investigate the changes that take place after death in a range of conditions. Body farms use the bodies of pigs or donated human bodies.	
	The effects of factors such as temperature, moisture and position of the body on the rate of decomposition can be studied.	
	(a) Explain the effect of ambient temperature on the rate of decomposition.	
		(3)
•••••		
	(b) Describe the changes that occur inside a body in the first week after death.	
	(a) Describe the changes that becan inside a body in the mot week after death.	(3)
•••••		

DO NOT WRITE IN THIS AREA

bo	Describe how this study sould be carried out	
(1)	Describe how this study could be carried out.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)
(ii)	Explain how the results of this study could be used to help to establish the time of death of a human.	(3)



DO NOT WRITE IN THIS AREA



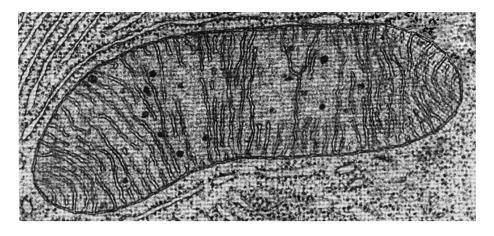
DO NOT WRITE IN THIS AREA

6	Electron r	microscopes have enabled scientists to view the ultrastructure of cells.	
		hich of the following structures is found in animal cells?	
	⋈ A	amyloplast	(1)
	В	chloroplast	
	⊠ C	mesosome	
	□ D	ribosome	
	(ii) W	hich of the following structures is found only in plant cells?	(1)
	⊠ A	amyloplast	(1)
		Golgi apparatus	
	⊠ C	mesosome	
	⊠ D	vacuole	
	(iii) W	hich of the following structures is found in both animal and plant cells?	(1)
	⊠ A	amyloplast	(- /
	В	cell wall	
		pili	
	□ D	smooth endoplasmic reticulum	



DO NOT WRITE IN THIS AREA

(b) The photograph shows an electron micrograph of a mitochondrion from a liver cell.



Magnification ×20 000

Calculate the maximum actual length of this mitochondrion.

(2)

Answer

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) The diagram shows part of a molecule of chitin, a modified polysaccharide found in fungal cell walls.

$$\begin{array}{c} \mathsf{CH_3} \\ \mathsf{C} = \mathsf{O} \\ \mathsf{CH_2OH} \\ \mathsf{OH} \\ \mathsf{H} \\ \mathsf{OH} \\ \mathsf{H} \\ \mathsf{OH} \\ \mathsf{H} \\ \mathsf{OH} \\ \mathsf{CH_2OH} \\ \mathsf{CH_2OH} \\ \mathsf{OH} \\ \mathsf{H} \\ \mathsf{OH} \\ \mathsf{H} \\ \mathsf{OH} \\ \mathsf{OH} \\ \mathsf{H} \\ \mathsf{OH} \\ \mathsf{OH} \\ \mathsf{H} \\ \mathsf{OH} \\ \mathsf{$$

Compare and contrast the structure of chitin with that of a cellulose molecule.

(Total for Question 6 = 8 marks)

(3)

DO NOT WRITE IN THIS AREA

7	Some species of bacteria have developed resistance to antibiotics.
	This has led scientists to investigate many molecules for antimicrobial properties.
	Peptides extracted from broad bean plants and cowpea plants have been studied.
	(a) Describe how a peptide bond is formed. (2)
	(b) The effects of these plant extracts were tested on pathogenic bacteria. It was found that each extract had an effect on its own, but the effect was greater when used together.
	Devise a procedure that scientists may have used to measure the effects of these
	extracts on pathogenic bacteria. (4)

DO NOT WRITE IN THIS AREA

(c)	A bacteriostatic antibiotic works by	(1)
×	A destroying bacteria	
\times	B destroying viruses	
\boxtimes	C preventing the multiplication of bacteria	
\boxtimes	D preventing the development of antibiotic resistance	
(d)	Hospitals have developed practices in response to the increase in hospital acquired infections. Describe the infection control practices hospitals have introduced.	(3)
	(Total for Question 7 = 10 m	arks)



DO NOT WRITE IN THIS AREA

8	Thrombophilia is a condition that increases the risk of blood clots forming.	
	This condition increases the risk of venous thromboembolism (VTE), a condition where a blood clot forms in a vein. Thrombophilia due to the production of overactive factor can be inherited.	
	Factor V is involved in the conversion of prothrombin to thrombin.	
	(a) (i) Describe the role of thrombin in blood clotting.	
	(a), (b) a see	(3)
	(ii) Explain why a mutation in the gene coding for the protein factor V may increas	se
	(ii) Explain why a mutation in the gene coding for the protein factor V may increas the risk of VTE.	
		se (3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) A study was carried out to determine the incidence of VTE in people of different ages. Those who developed VTE were then tested for the factor V gene mutation.

Deduce the relative impact of the genotype and environmental factors on the

The results of this study are shown in the table.

Age range	Percentage incidence of VTE in the study group (%)	Percentage of VTE patients with factor V mutation in the study group (%)	
less than 20 years of age	1.3	49.3	
over 70 years of age	34.0	20.9	

development of VTE.	(4)
	,
 (Total for Question 8 = 10 ma	rks)
(13.13.13. Question 6 = 10 mai	

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

9 An experiment was carried out to determine the effect of temperature on the activity of the enzyme catalase in yeast cells.

The substrate was hydrogen peroxide. A suspension of yeast cells was added to hydrogen peroxide.

The volume of oxygen produced during the initial two minutes was recorded. This was repeated at a range of temperatures.

The results are shown in the table.

Temperature / °C	Mean volume of oxygen / mm³
20	80
30	240
40	540
50	320
60	120

(a) (i) Calculate the temperature coefficient (Q $_{10}$) for this reaction between 20 °C and 30 °C.

(1)

•		
Answer		



DO NOT WRITE IN THIS AREA

(ii) Explain the effects of a temperature increase from 20°C to 30°C on the initial rate of activity of catalase in the yeast cells.	(3)
(iii) Explain what happens to the Q ₁₀ value between 40 °C and 50 °C.	(2)

DO NOT WRITE IN THIS AREA

(b) Leaf rust is a dise such as wheat.	ease caused by a species of fun	gus. Leaf rust affects cereal crop	S
Leaf rust yeast sp	oreads through cereal crops wh	nen the humidity is high.	
Discuss the possi yield of wheat cr		on the effects of leaf rust on the	
,			(4)
		(Total for Question 9 = 10 n	narks)



WRITE

10	The Intergovernmental Panel on Climate Change (IPCC) has issued the following statement:
	"Human influence on the climate system is clear, and recent anthropogenic emissions
	of greenhouse gases are the highest in history. Recent climate changes have had

(a) Explain why anthropogenic emissions of greenhouse gases are affecting the climate.

widespread impacts on human and natural systems."

(3)

*(b) Pteropods are small free-swimming snails found in oceans throughout the world. They are a food source for a variety of fish including salmon, mackerel and herring.

In 2011, the health of these snails was studied in the ocean around Hawaii. A sample of these snails showed that 53% of them had damaged shells.

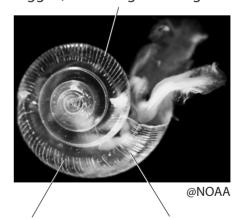
The photographs show a healthy snail and a snail with a damaged shell found in the ocean around Hawaii.

Healthy snail smoothly contoured shell ridges



clear, glass-like shell

Snail with damaged shell ragged, dissolving shell ridges



severe abrasions/weak spots

cloudy shell

The pH of sea water affects shell formation in these snails. The changes in carbon dioxide concentration and pH have been recorded in oceans surrounding several islands.

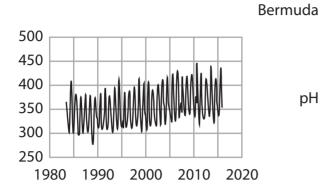


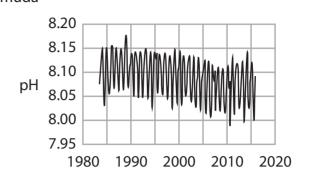
DO NOT WRITE IN THIS AREA

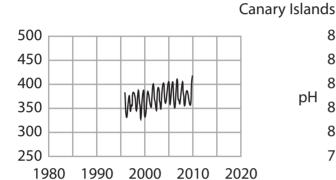
DO NOT WRITE IN THIS AREA

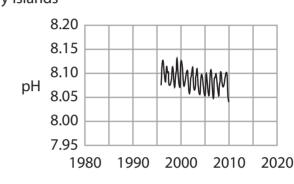
DO NOT WRITE IN THIS AREA

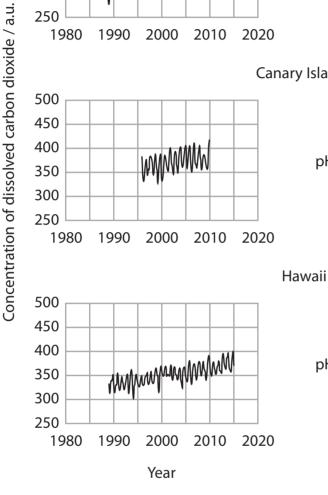
These records are shown in the graphs.

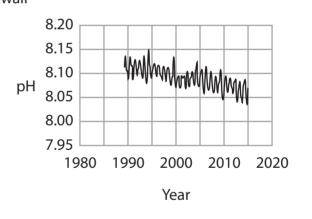












DO NOT WRITE IN THIS AREA

Analyse the data to discuss the likely impact of increased carbon dioxide emission on fish populations in these oceans.	
	(6)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c) Climate change can also affect the life cycle of organisms.

The effect of temperature on the lifespan of fruit flies (Drosophila melanogaster) was investigated.

The results are shown in the table.

Temperature / °C	Lifespan / days
15	130.3
21	86.3
27	41.6
30	20.4

Determine the relationship between the increase in	temperature and the change in lifespan. (2)
(7	Fotal for Question 10 = 11 marks)

DO NOT WRITE IN THIS AREA (b) (i) Parents without Batten disease have a child with Batten disease. Which of the following describes the genotype of the parents? A bb and Bb Bb and Bb BB and BB **D** BB and bb (ii) Draw a genetic diagram to show the probability of their future children developing Batten disease.

11 Batten disease is a rare, inherited disorder of the nervous system. It usually begins in

(a) Explain what is meant by an inherited recessive disorder.

childhood. It is a recessive disorder.

(2)

(1)

(2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

*(c) Genetic testing can be used to identify individuals who have genetic disorders such as Batten disease.

The table shows examples of some types of genetic screening and examples of where they may be used.

Type of screening	Method	Example
Blood test to identify risk of a disease	DNA from a blood sample is examined	Identifying presence of BRCA1 and BRCA2 mutations where there is a family history of breast cancer
Blood test to identify carriers of a genetic disease	DNA from a blood sample is examined	Establishing if a person is heterozygous for a recessive condition such as cystic fibrosis (CF)
Amniocentesis	Fetal DNA from amniotic fluid is tested	Identifying genetic disorders in the fetus
Chorionic villus sampling (CVS)	Fetal DNA from placental tissue is tested	Identifying genetic disorders in the fetus
Non-invasive prenatal diagnosis (NIPD)	Analysis of fetal DNA fragments from blood samples from the mother	Identification of chromosomal disorders and a small number of single gene disorders in the fetus
Pre-implantation genetic diagnosis (PGD)	Combined with IVF to test embryo at 8-cell stage	Ensures only embryos without a genetic disorder such as CF are implanted

DO NOT WRITE IN THIS AREA

Assess the advantages and disadvantages o genetic disorders.	(6)
	(Total for Question 11= 11 marks)
	TOTAL FOR PAPER = 100 MARKS



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