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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Monday 21 October 2019

Morning (Time: 1 hour 30 minutes) | Paper Reference **WBI04/01**

Biology

Advanced

Unit 4: The Natural Environment and Species Survival

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.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- 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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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 Photosynthesis in plants produces GALP.

This molecule is then used to synthesise other molecules, such as carbohydrates and lipids.

(a) (i) Put a cross ☒ in the box next to the two monosaccharides that join together to form maltose.

(1)

☒ **A** fructose and fructose

☒ **B** fructose and glucose

☒ **C** glucose and glucose

☒ **D** glucose and galactose

(ii) Put a cross ☒ in the box next to the main carbohydrate that is transported in the phloem.

(1)

☒ **A** amylose

☒ **B** glucose

☒ **C** lactose

☒ **D** sucrose

(iii) Below is a list of polysaccharides:

- amylose
- cellulose
- glycogen
- starch.

Put a cross ☒ in the box next to the number of these polysaccharides that are composed of alpha (α) glucose molecules and are found in plant cells.

(1)

☒ **A** 1

☒ **B** 2

☒ **C** 3

☒ **D** 4

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(b) Describe how GALP is used to produce lipids.

(4)

(Total for Question 1 = 7 marks)

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2 The presence of pollen in peat bogs can be used as evidence for global warming.

(a) Describe the role of the nuclei in pollen.

(2)

(b) (i) Explain why the presence of pollen in peat bogs can be used as evidence for global warming.

(2)

(ii) Explain how **DNA profiling** can be used to identify the species of plant that the pollen came from.

(3)

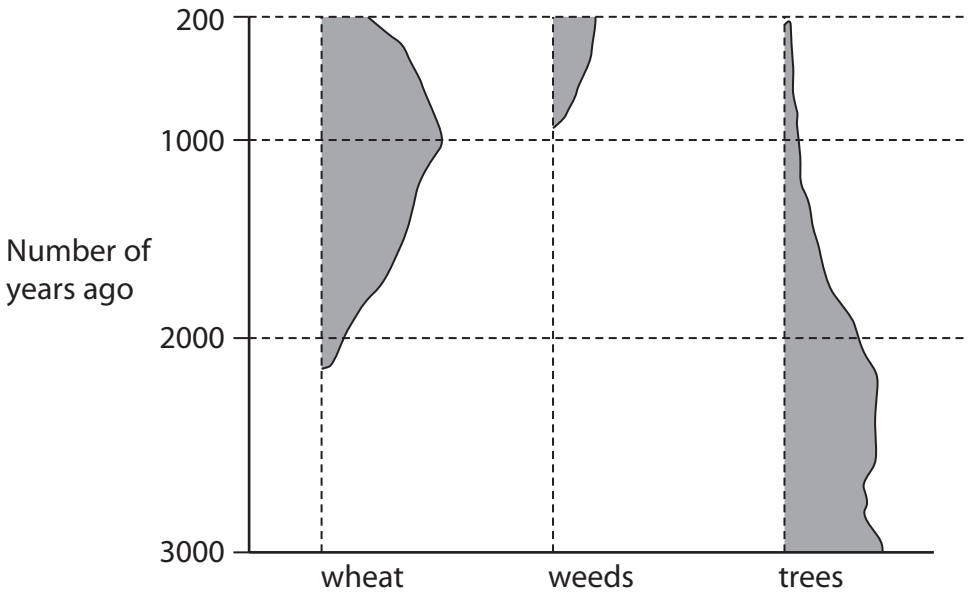
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(c) Pollen was extracted from peat bogs and identified to study the effects of human activity. Changes in human activity can influence the groups of plants growing in a habitat.

The diagram below shows the relative quantities of pollen from three groups of plants.



Relative quantities of pollen from each group of plants

Using the information in the diagram, explain the changes in the types of pollen found between 3000 and 200 years ago.

(3)

(Total for Question 2 = 10 marks)

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3 The features of an organism can be used to classify it into one of three domains.

(a) Name the three domains.

(2)

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(b) Viruses are not included in these three domains.

(i) Suggest why viruses are not included in these domains.

(1)

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(ii) Viruses contain only a few genes.

Explain why viruses contain only a few genes.

(2)

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(c) Giant viruses have been discovered in waste-water treatment centres in Austria.

Scientists analysed the giant viruses and found that they contain transfer RNA (tRNA) and several genes. Some of these genes are similar to those found in prokaryotic and eukaryotic organisms.

(i) Put a cross ☒ in the box next to the study that uses the analysis of tRNA from these viruses.

(1)

☒ **A** dendrochronology

☒ **B** molecular phylogeny

☒ **C** proteomics

☒ **D** topography

(ii) Describe the role of tRNA in protein synthesis.

(3)

(iii) One theory suggested that these giant viruses were derived from a fourth domain.

State what is meant by the term **theory**.

(1)

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(iv) Suggest why scientists thought that these giant viruses might be derived from a fourth domain.

(2)

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(Total for Question 3 = 12 marks)

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4 Individuals can develop natural immunity and artificial immunity.

(a) The table below shows some features of artificial active immunity and artificial passive immunity.

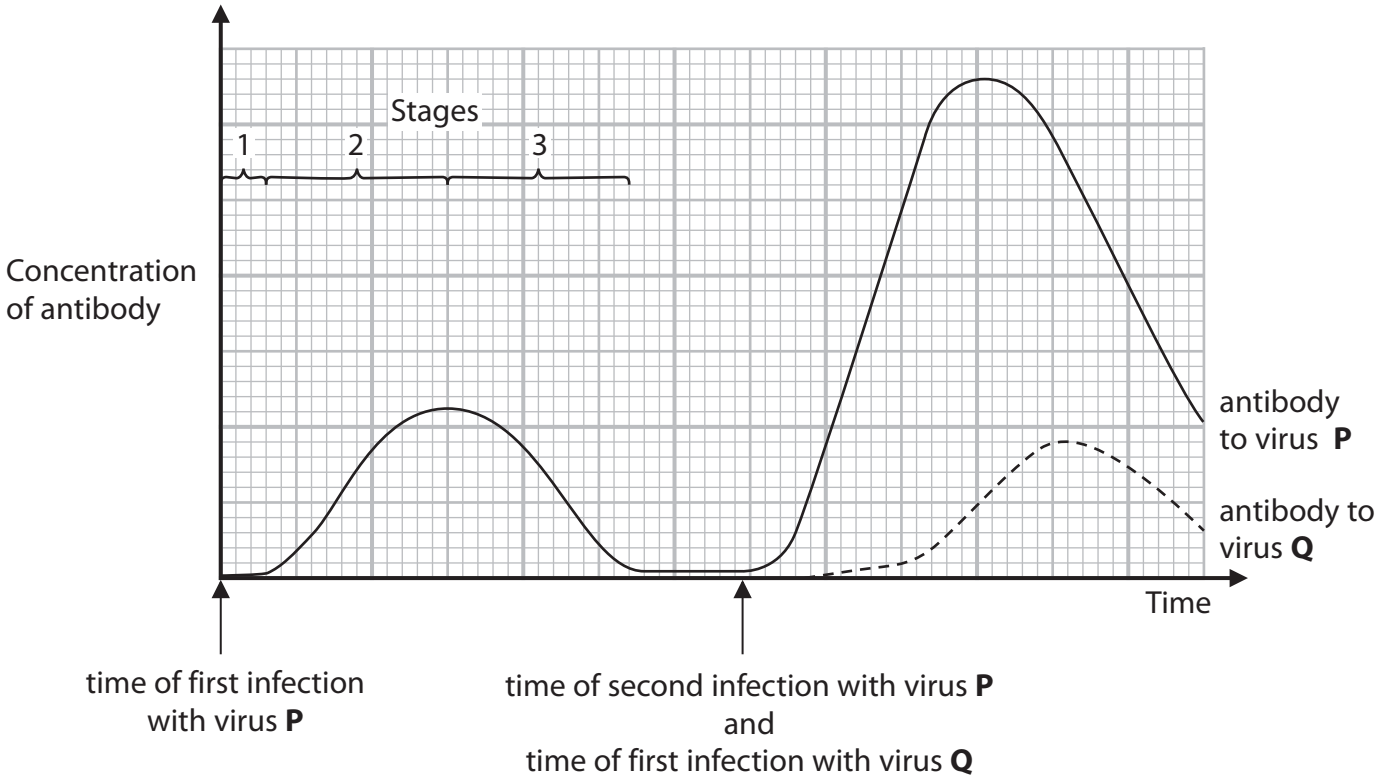
For each feature, put one cross ☒ in the appropriate box in each row to show whether the feature is true for each type of artificial immunity.

(3)

Feature	Artificial immunity			
	active only	**passive only**	**both active and passive**	**not true**
antigen-specific	☒	☒	☒	☒
provides long-term immunity	☒	☒	☒	☒
antibodies injected	☒	☒	☒	☒

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(b) The graph below shows the changes in concentration of antibodies in the blood of a person infected by two different types of virus, virus **P** and virus **Q**.



(i) Explain why there is a delay in the concentration of antibody following the **first** infection of virus **P**, in stage 1.

(4)

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(ii) Suggest why the concentration of the antibody to virus **P** falls in stage 3.

(1)

(iii) Describe the differences in the changes in the concentration of both antibodies following the second infection with virus **P** and the first infection with virus **Q**.

(2)

(iv) Explain the differences in the changes in the concentration of both antibodies following the second infection with virus **P** and the first infection with virus **Q**.

(3)

(Total for Question 4 = 13 marks)

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5 Forensic entomology can be used to determine the time of death of a person.

Blowfly larvae develop through a series of stages before becoming an adult.

The table below shows the minimum and maximum length of time taken to reach each stage of blowfly development, at three different ambient temperatures.

This table could be used by a forensic scientist to determine the time of death of a person.

Stage of development	Time taken to reach each stage of development / hours					
	at 15.8 °C		at 20.7 °C		at 23.3 °C	
	minimum	maximum	minimum	maximum	minimum	maximum
1st instar	40.6	44.4	20.9	23.6	21.0	22.0
2nd instar	94.3	103.3	51.0	53.1	44.8	45.6
3rd instar	135.7	158.7	78.3	95.3	77.0	77.8
prepupal	233.7	246.7	127.9	145.3	145.0	159.5
pupal	382.3	392.3	245.7	356.9	264.0	270.0
adult	775.0	917.0	486.2	647.8	468.5	624.5

(a) Using the information in the table, explain why a forensic scientist uses data at three ambient temperatures.

(3)

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(b) (i) A corpse was found on the 20th September at 18:00 hours.

The forensic scientist found larvae only in the prepupal stage.

The mean ambient temperature at the site where the corpse was found was 23.3 °C.

Using the information in the table, calculate the earliest date and time of death.

(3)

Answer .....

(ii) Discuss the reliability of this estimate for the time of death.

(3)

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(c) The forensic scientist said that forensic entomology was the most accurate method for determining the time of death of a person who had been dead for longer than three days.

Explain why the forensic scientist thought that other methods were not as accurate as forensic entomology.

(3)

(Total for Question 5 = 12 marks)

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6 Groups of wolves hunt moose for food.

The photographs below show a wolf and a moose.



© David Osborn / Alamy Stock Photo



© Ron Sanford / Science Photo Library

Magnification ×0.03

(a) The mean mass of a wolf is 65 kg. The mass of a typical moose is 620 kg.

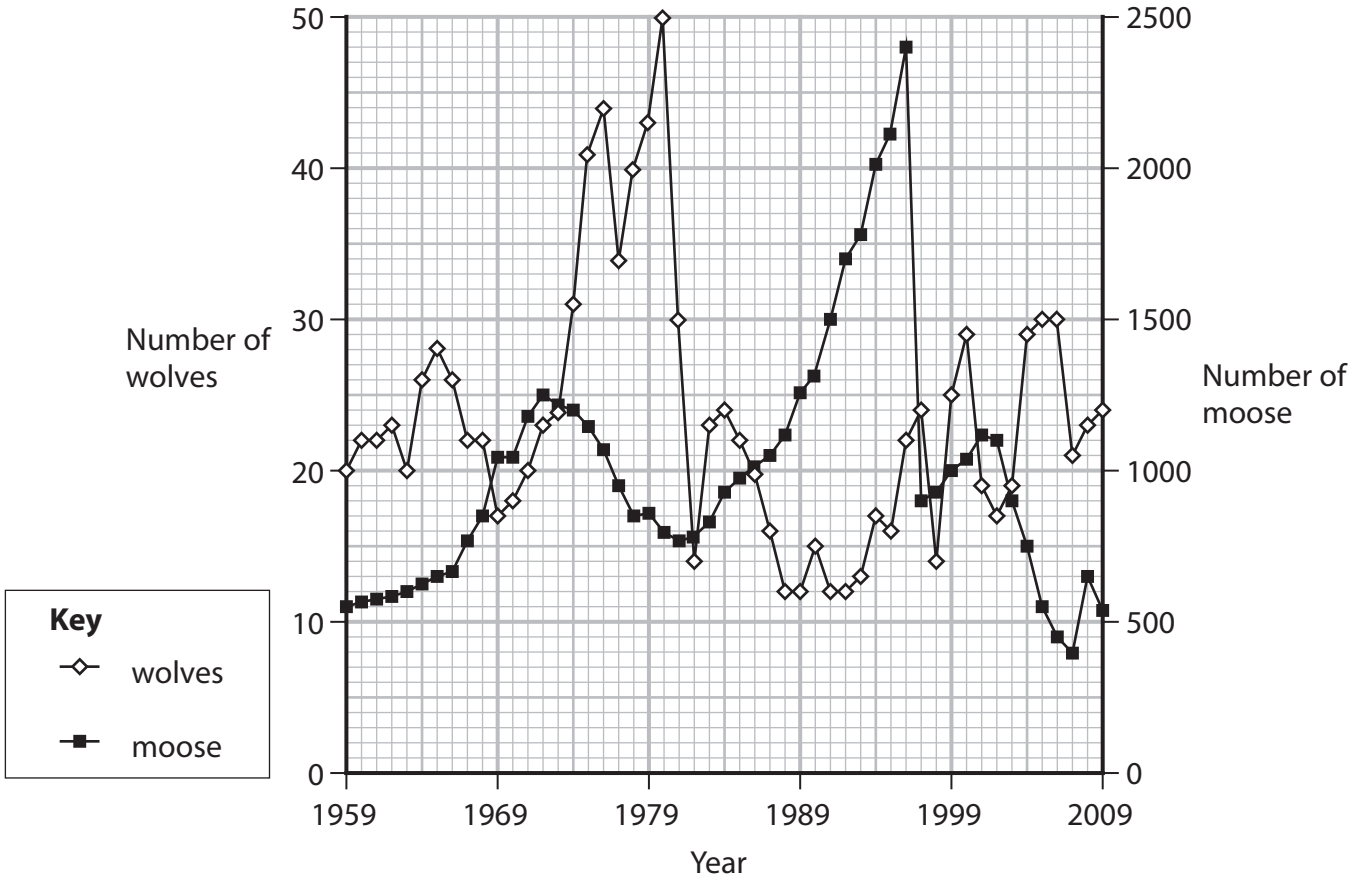
Calculate the ratio of the mean mass of a wolf to the mass of a moose.

(1)

Answer .....

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(b) The graph below shows the changes in the number of wolves and the number of moose from 1959 to 2009, on an island in Canada.



Explain the changes shown in the graph.

(4)

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*(c) Studies have shown that when salmon is available, wolves will hunt salmon and hunt fewer moose.

The table below shows some nutritional information about meat from salmon and meat from moose.

Nutritional information	Meat from salmon	Meat from moose
energy content / kJ kg^{-1}	6.2	3.9
percentage fat content (%)	8.0	2.5
protein content / g kg^{-1}	255.0	202.0

Explain the advantages for wolves of hunting salmon rather than hunting moose.

Use the information in the table and in the rest of the question to support your answer.

(6)

(Total for Question 6 = 11 marks)

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7 The photograph below shows a male giraffe weevil.



Magnification ×5

Below are some facts about giraffe weevils:

- giraffe weevils are found only in Madagascar
- giraffe weevils live on the leaves of small trees
- in the mating season, males try to knock each other off the leaf by beating their necks at each other
- the male giraffe weevil uses his long neck for courtship displays
- the female giraffe weevil lays her egg into a rolled-up leaf
- the rolled-up egg falls to the forest floor.

(a) State the term used to describe 'a species is found in only one area'.

(1)

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(b) Suggest **two** reasons why the female giraffe weevil wraps her egg in a rolled-up leaf.

(2)

*(c) Explain how giraffe weevils evolved to have a long neck.

(6)

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(d) Explain how giraffe weevils evolved to become a new species.

(3)

(Total for Question 7 = 12 marks)

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8 The photograph below shows cattail plants.



Magnification ×0.1

Cattail plants grow as reed beds in freshwater.

The abundance and distribution of cattail plants is increasing due to global warming.

The parts of the plant that fall into the water result in the production of large quantities of methane.

(a) Distinguish between the terms **abundance** and **distribution**.

(2)

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(b) Explain how parts of cattail plants falling into the water result in the production of methane.

(3)

(c) Explain why the production of methane could result in a further increase in the abundance and distribution of cattail plants.

(4)

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(d) Parts from cattail plants falling into water result in more methane produced than parts from conifer trees falling into water.

Scientists have suggested that cattail plants produce different chemicals from conifer trees and that these chemicals do not inhibit the growth of bacteria.

Describe how this suggestion could be tested in the laboratory.

(4)

(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 90 MARKS

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