

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel**  
**International**  
**Advanced Level**

Centre Number

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Candidate Number

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**Tuesday 8 January 2019**

Afternoon (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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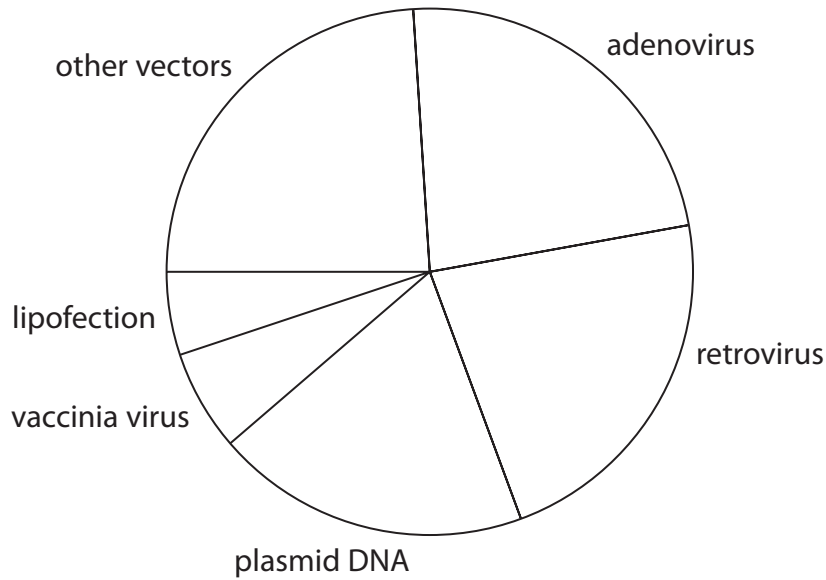
Pearson

**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** Viruses can be used as vectors in gene therapy.

The pie chart below shows the proportion of different vectors used in clinical trials for gene therapy.



(a) Retroviruses include Human Immunodeficiency Virus (HIV).

(i) Describe the structure of HIV.

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(ii) Name the host cell of HIV.

(1)

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(b) (i) Explain why viruses are used as vectors in gene therapy.

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(ii) Suggest why different types of virus have to be used in gene therapy.

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**(Total for Question 1 = 7 marks)**

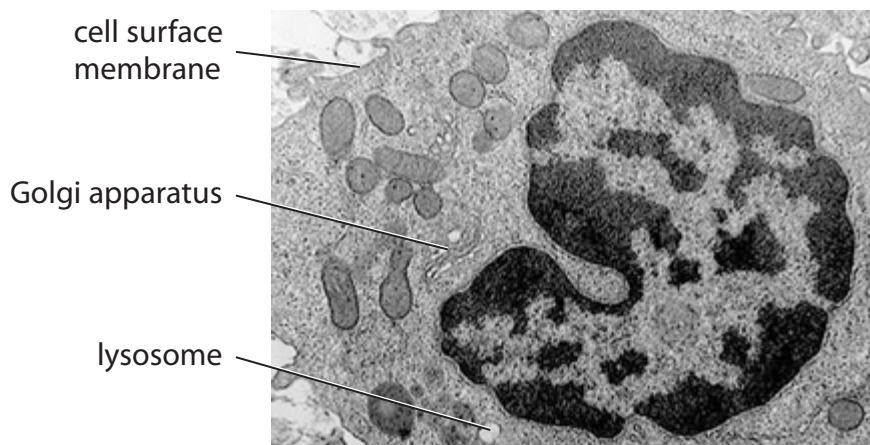
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2 The photograph below shows part of a macrophage as seen using an electron microscope.



© Scott Camazine / Alamy Stock Photo

Magnification  $\times 13\,000$

(a) (i) Describe the structure of the cell surface membrane.

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\*(ii) Macrophages are involved in both the non-specific response and the immune response to infection.

Explain the importance of the cell surface membrane of a macrophage in these responses.

(6)

Area with horizontal dotted lines for writing the answer.

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(b) Describe the roles of each of the following in macrophages.

(i) Golgi apparatus

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(ii) Lysosomes

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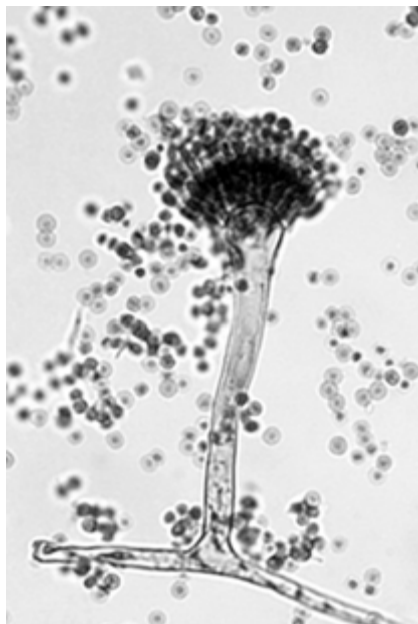
**(Total for Question 2 = 13 marks)**



3 Ear infections can be caused by bacteria, viruses or fungi.

Fungi have nuclei and they have chitin and glucan in their cell walls. Their cell membranes contain ergosterol.

The photograph below shows one type of fungus that can cause ear infections.



Magnification  $\times 500$

(a) Name the domain that includes fungi.

(1)

(b) The table below shows some structures that may be found in bacteria and fungi.

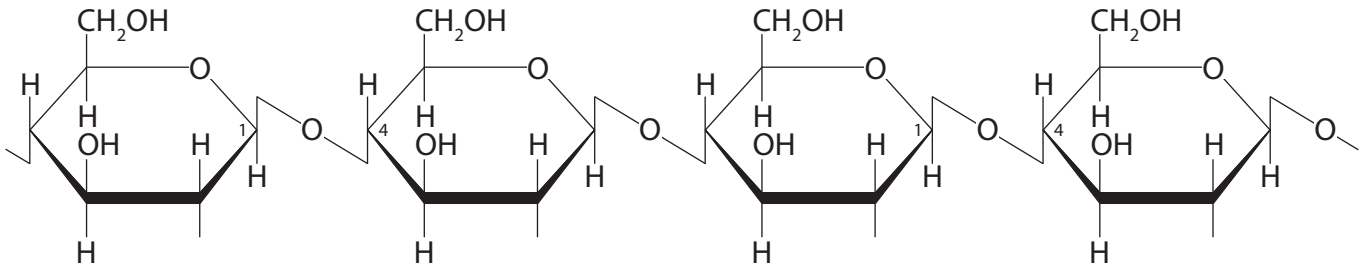
For each structure, put **one** cross (☒) in the appropriate box, in each row, to show which organisms contain the structure.

(3)

Structure	Structure found in			
	Both bacteria and fungi	Bacteria but NOT fungi	Fungi but NOT bacteria	Neither bacteria nor fungi
Cell membrane	☒	☒	☒	☒
Chloroplast	☒	☒	☒	☒
Ribosomes	☒	☒	☒	☒



(c) The diagram below shows part of a molecule of chitin.



Put a cross (☒) in the box to complete the following sentence.

(1)

This part of a molecule of chitin is a

- A lipid
- B nucleic acid
- C polysaccharide
- D protein

(d) (i) Explain why antibiotics can only be used to treat some types of ear infection.

(3)

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(ii) Describe an experiment that could be carried out to determine a suitable antibiotic to use for the treatment of an ear infection.

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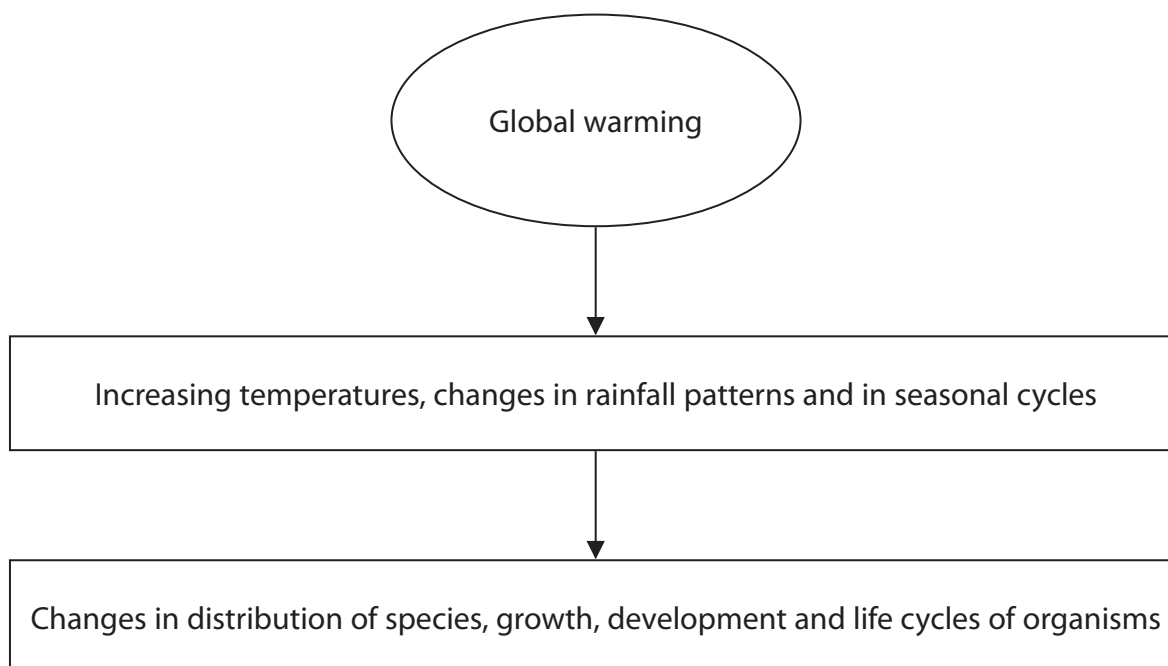
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(Total for Question 3 = 11 marks)



4 The diagram below shows some effects of global warming.



(a) Put a cross (☒) in the box to complete the following sentence.

(1)

Global warming can be caused by increased levels of both of the named gases

- A carbon dioxide and nitrogen
- B methane and carbon dioxide
- C oxygen and methane
- D water vapour and oxygen

(b) Increasing temperatures can affect enzyme activity.

Put a cross (☒) in the box next to the correct description of the effect of an enzyme on a reaction.

(1)

- A lowers the activation energy and decreases the rate
- B lowers the activation energy and increases the rate
- C raises the activation energy and decreases the rate
- D raises the activation energy and increases the rate

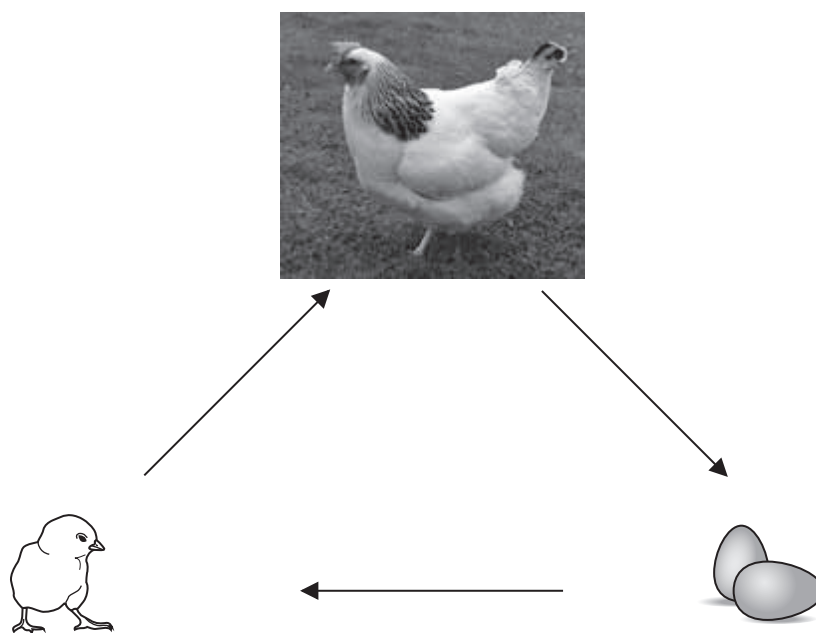
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(c) The diagram below shows the life cycle of a chicken.



Using the information in the diagram, explain the meaning of each of the following terms.

(i) Growth

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(ii) Development

(2)

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(iii) Life cycle

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(d) (i) Explain why dendrochronology can be used as evidence for global warming.

(3)

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(ii) Explain why the pollen found in peat bogs can be used as evidence for global warming.

(2)

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**(Total for Question 4 = 13 marks)**



5 Beta ( $\beta$ ) thalassaemias are inherited blood disorders.

These disorders are caused by mutations in the  $\beta$ -globin gene. The  $\beta$ -globin gene codes for the  $\beta$  subunit of haemoglobin.

Haemoglobin is a protein made of four subunits.

(a) The diagram below shows the template (antisense) DNA strand of the  $\beta$ -globin gene.



(i) Mutations affect transcription.

State the role of the template DNA strand in transcription.

(1)

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(ii) A splice site is a short sequence of bases.

Explain how a mutation in one of the splice sites could affect the  $\beta$  subunit of haemoglobin.

(4)

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(iii) Explain the role of the stop codon in this gene.

(2)

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\*(b) Gel electrophoresis can be used to analyse haemoglobin.

Using your knowledge of gel electrophoresis, explain how this technique could be used to analyse haemoglobin in the diagnosis of  $\beta$  thalassaemia.

(6)

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**(Total for Question 5 = 13 marks)**



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6 Chloroplasts are involved in the light-dependent and the light-independent reactions of photosynthesis.

(a) In the space below, draw and label a diagram to show the structure of a chloroplast. (3)

(b) Describe the roles of the chloroplast membranes in photosynthesis. (4)

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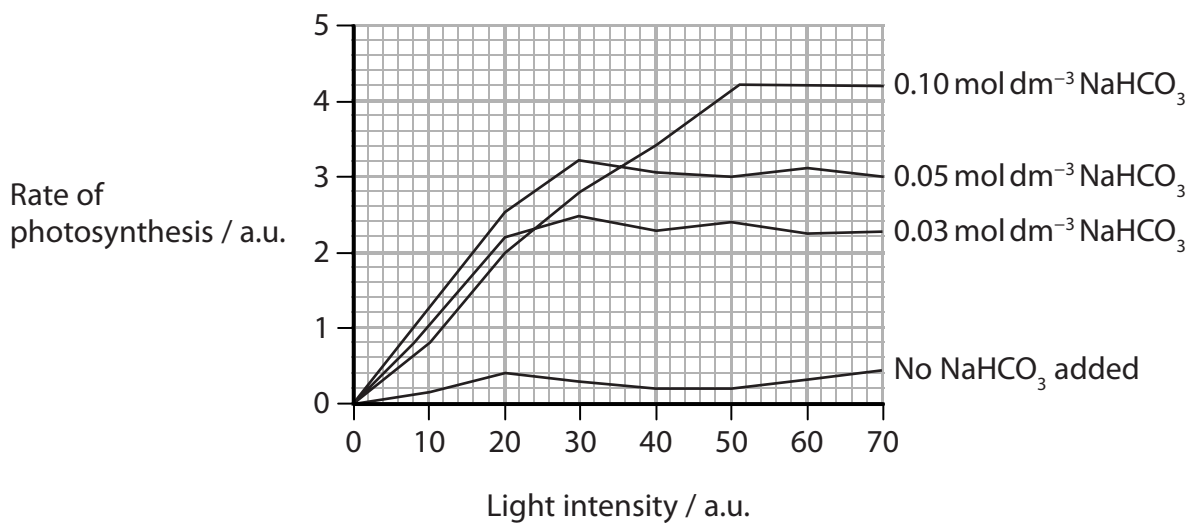
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(c) The graph below shows the effect of light intensity and the concentration of sodium hydrogen carbonate ( $\text{NaHCO}_3$ ) on the rate of photosynthesis of an aquatic plant.

Adding  $\text{NaHCO}_3$  to water increases the availability of carbon dioxide to the aquatic plant.



(i) Suggest how the rate of photosynthesis was measured.

(2)

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(ii) Using the information in the graph, describe the effect of light intensity and the concentration of  $\text{NaHCO}_3$  on the rate of photosynthesis.

(3)

(iii) Suggest why some photosynthesis took place when no  $\text{NaHCO}_3$  had been added.

(1)

**(Total for Question 6 = 13 marks)**

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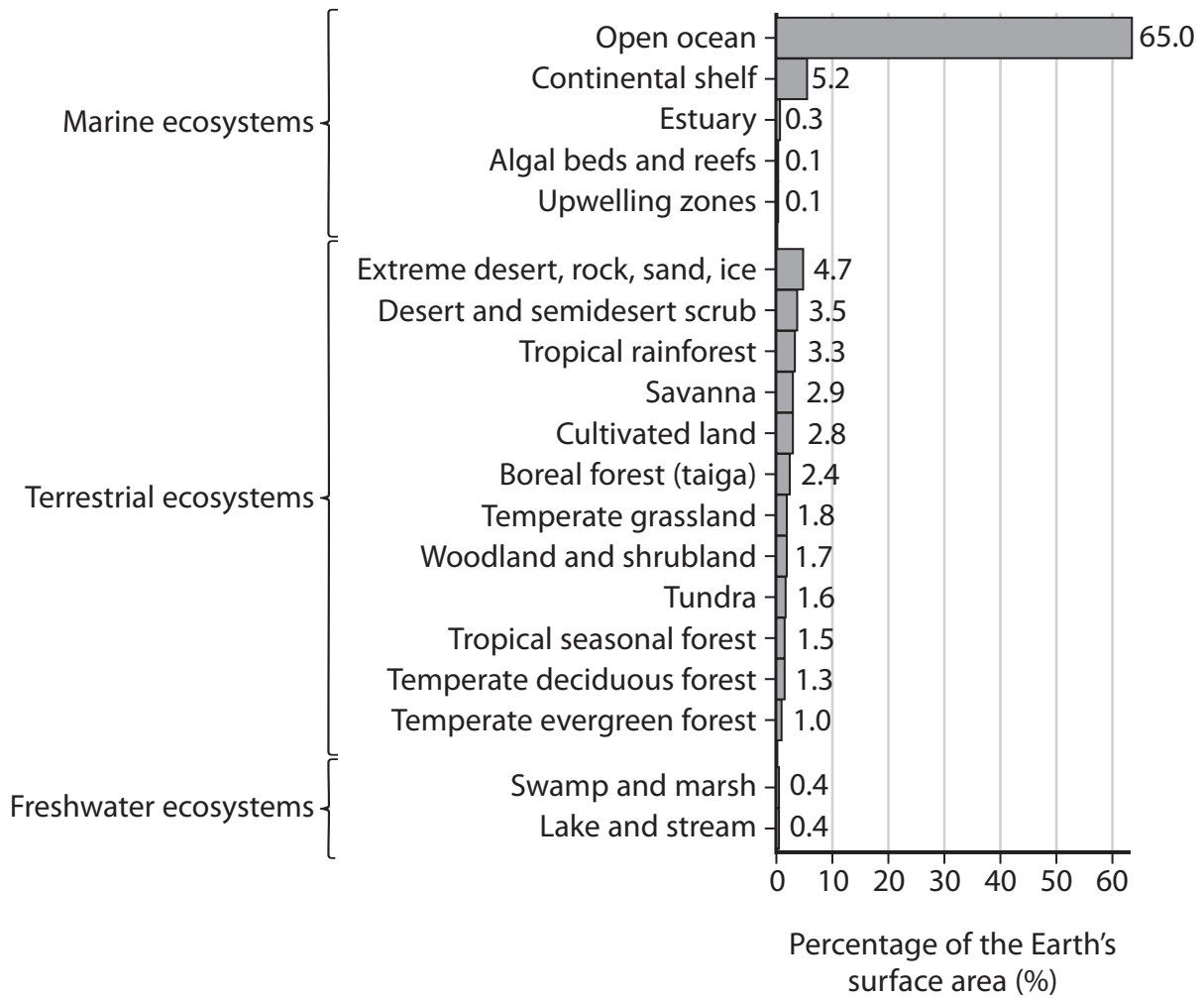
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7 The graph below shows the percentage of the Earth's surface area occupied by marine, terrestrial (land) and freshwater ecosystems.

An ecosystem consists of communities of organisms living in a particular habitat.



(a) Using the information in the graph, calculate the total percentage of the Earth's surface occupied by terrestrial ecosystems.

(1)

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(b) The table below shows information about the net primary productivity (NPP) of some of these ecosystems.

Ecosystem	Net primary productivity / $\text{g m}^{-2} \text{yr}^{-1}$	Percentage of Earth's net primary productivity (%)
Open ocean	125	24.40
Estuary	1500	1.20
Algal beds and reefs	2500	0.90
Extreme desert, rock, sand, ice	3	0.04
Tropical rainforest	2200	22.00
Swamp and marsh	2000	2.30

(i) Calculate the percentage increase in the NPP of the estuary compared with the open ocean.

Show your working.

(2)

..... %

(ii) Using the information in the graph and the table, explain the difference in the percentage of the Earth's NPP of open ocean and estuary ecosystems.

(2)

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(iii) Explain why the NPP of the extreme desert, rock, sand and ice ecosystem is so low. (3)

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(iv) Using the information in the table, explain how the gross primary productivity (GPP) of the swamp and marsh ecosystem would differ from the NPP. (2)

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**(Total for Question 7 = 10 marks)**



8 Feline panleukopenia virus (FPV) is a DNA virus. This virus infects cats and can be fatal.

(a) Most DNA viruses can activate DNA synthesis in their host cells but FPV cannot activate DNA synthesis.

Explain why FPV causes tissue damage only in host cells that are dividing rapidly.

(2)

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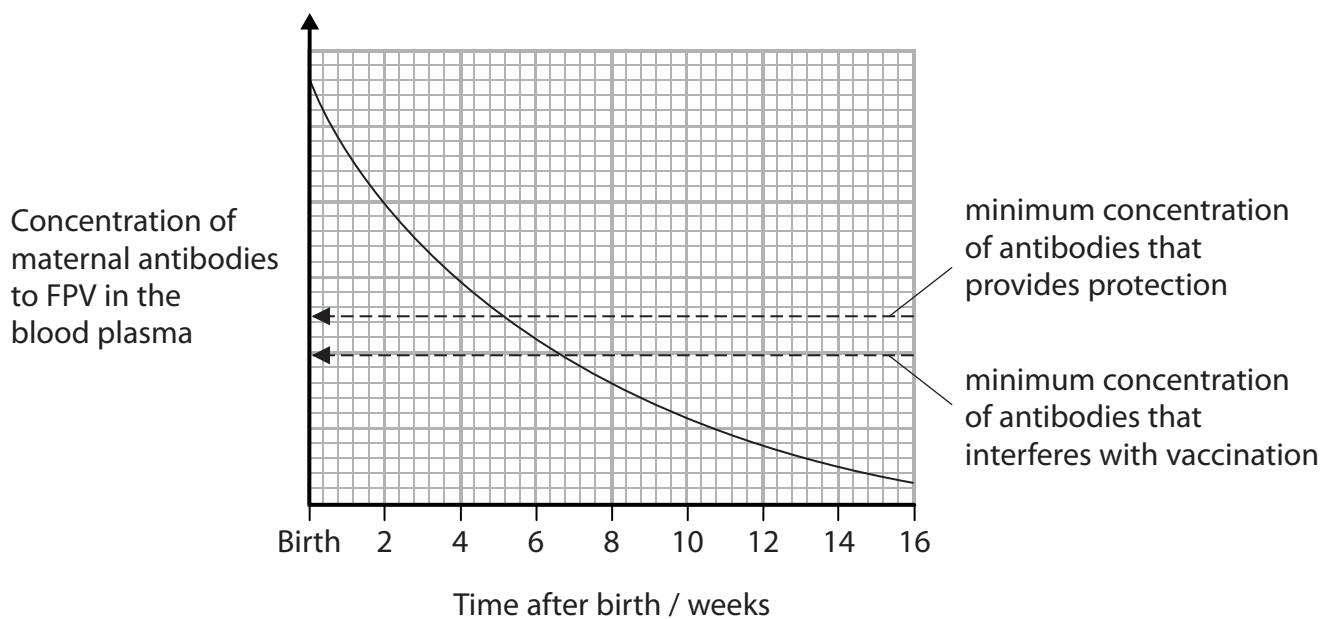
(b) Kittens are born with maternal antibodies to FPV.

Maternal antibodies protect kittens from FPV only when these antibodies are above a certain concentration in the blood plasma.

It is therefore necessary to vaccinate kittens for FPV.

The presence of maternal antibodies, above a certain concentration in the blood plasma, can interfere with vaccination.

The graph below shows the changes in maternal antibodies to FPV in kittens.



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(i) Put a cross (☒) in the box next to the type of immunity that maternal antibodies provide to the kittens.

(1)

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

(ii) Using the information in the graph, give the period of time after birth when the kittens will be most susceptible to FPV infection.

(1)

(iii) Explain how vaccination leads to immunity of kittens to FPV.

(4)

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(iv) Suggest how the presence of maternal antibodies can interfere with vaccination. (2)

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**(Total for Question 8 = 10 marks)**

**TOTAL FOR PAPER = 90 MARKS**

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