

Write your name here

Surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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Biology

Advanced

Unit 4: The Natural Environment and Species

Survival

Thursday 7 June 2018 – Morning

Time: 1 hour 30 minutes

Paper Reference

WBI04/01

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.
- 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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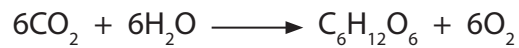
Pearson

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 The process of photosynthesis can be summarised by the word equation and the formula equation

carbon dioxide + water \longrightarrow glucose + oxygen



- (a) In the light-dependent reactions, water is split into hydrogen ions, electrons and an oxygen atom.

(i) Name this stage of the light-dependent reactions.

(1)

- (ii) Put a cross (☒) in the box next to the location in the chloroplast where this stage of the light-dependent reactions takes place.

(1)

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

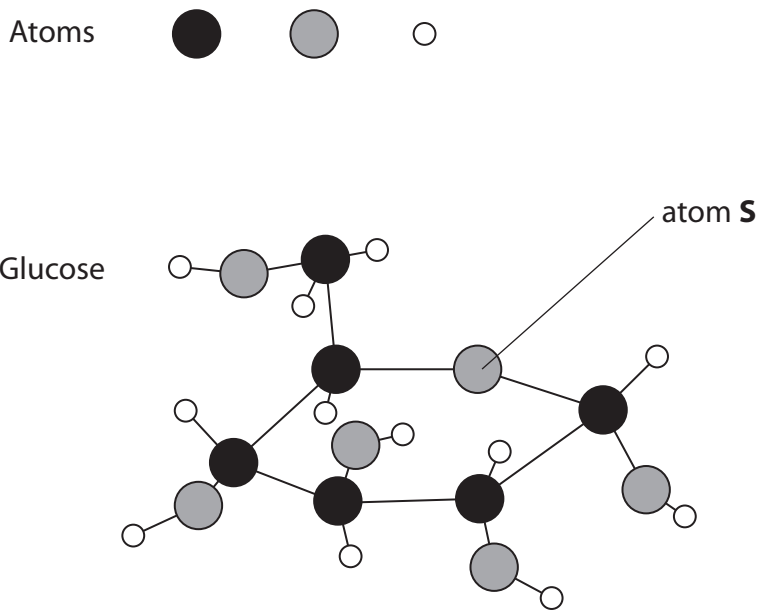
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(b) The diagram below shows three atoms and how they are arranged in a glucose molecule.



(i) Put a cross (☒) in the box next to the name of atom **S**.

(1)

- A** carbon
- B** hydrogen
- C** nitrogen
- D** oxygen

(ii) Use the information in the diagram to explain why this is an alpha-glucose molecule.

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(iii) Put a cross (☒) in the box next to the source of oxygen for the synthesis of glucose in photosynthesis.

(1)

- A ATP
- B carbon dioxide only
- C carbon dioxide and water
- D water only

(c) Explain the roles of the stroma in the synthesis of glucose.

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(d) Glucose is used for the synthesis of sucrose in plants.

Describe how sucrose is synthesised from glucose.

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(Total for Question 1 = 10 marks)



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2 The photographs below show three species of baobab trees found in Madagascar.



Magnification $\times 0.01$

Below are some facts about baobab trees and Madagascar:

- there are nine species of baobab trees
- six of the species are found only in Madagascar
- two species are found in mainland Africa
- one of the species found in mainland Africa is also found in Madagascar
- one species is found in Australia
- all baobab trees are found in dry areas
- baobab trees can store thousands of litres of water
- baobab trees shed their leaves in the dry season
- baobab trees produce large, heavy seeds
- tortoises eat these seeds
- some species of tortoises have become extinct in Madagascar.

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(a) Using the information given, explain what proportion of baobab tree species are endemic to Madagascar.

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(b) The species of baobab trees found in mainland Africa and Australia look almost identical. Suggest **one** reason for each of the following.

(i) These two species look almost identical.

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(ii) The trees are two separate species.

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(c) Using the information given, explain how baobab trees are adapted to living in dry areas.

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(d) Some of the baobab trees in Madagascar are listed as endangered species.

(i) Climate change is thought to be partly responsible.

Explain how climate change could affect the populations of baobab trees.

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(ii) Suggest **two** reasons, other than climate change, for baobab trees becoming endangered.

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(Total for Question 2 = 11 marks)

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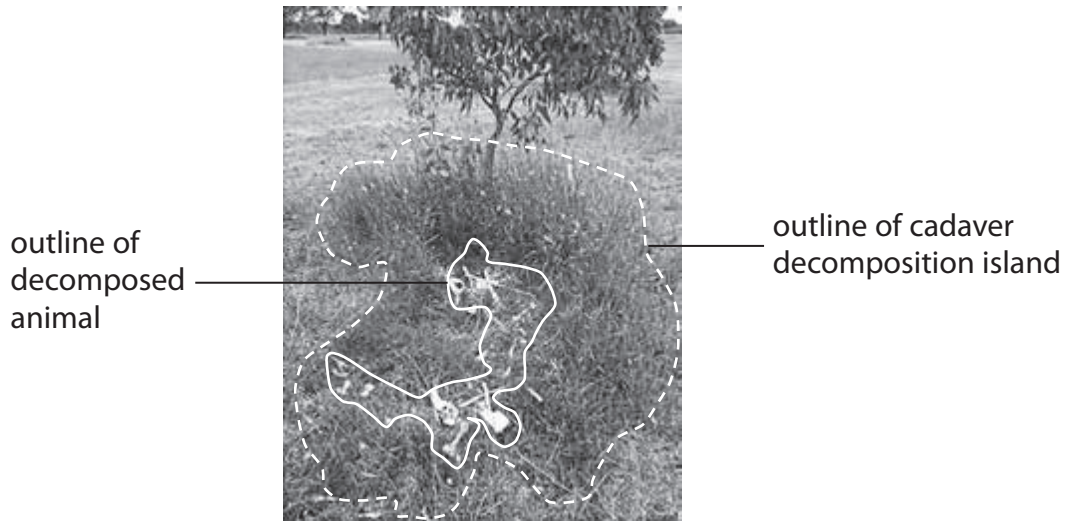
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3 When a dead animal (cadaver) decomposes, an area called a cadaver decomposition island can form.

The photograph below shows a cadaver decomposition island.



Magnification $\times 0.01$

(a) Describe the role of microorganisms in recycling the organic matter in a dead animal. (4)

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*(b) Below are two statements about cadaver decomposition islands.

1. The formation of a cadaver decomposition island is an example of succession.
2. Cadaver decomposition islands increase the biodiversity of an area.

Using the information in the photograph and your own knowledge, explain these two statements.

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(Total for Question 3 = 10 marks)

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- 4 Entomology and DNA analysis can both be used in forensics to identify a murder suspect.
The photograph below shows a mosquito.



Magnification $\times 3$

- (a) Mosquitos feed on human blood.

Mosquitos inject saliva into the skin before sucking blood from a person.
The saliva prevents the blood from clotting.

Explain how injecting saliva allows blood to be sucked up into mosquitos.

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(b) The body of a woman was found at the scene of a crime.

A person was suspected of murdering this woman.

At the home of this person, a pathologist found a dead mosquito.

The blood in the mosquito was analysed using gel electrophoresis.

The blood contained DNA from the murdered woman, indicating that she had been in the home of this person.

(i) Explain how gel electrophoresis could be used to analyse the DNA in the blood. (4)

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(ii) Explain why it was also necessary to analyse the DNA of the mosquito. (2)

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(Total for Question 4 = 10 marks)



5 Predator-prey relationships and trophic levels influence the species found within a habitat.

(a) Explain what is meant by the term **trophic level**.

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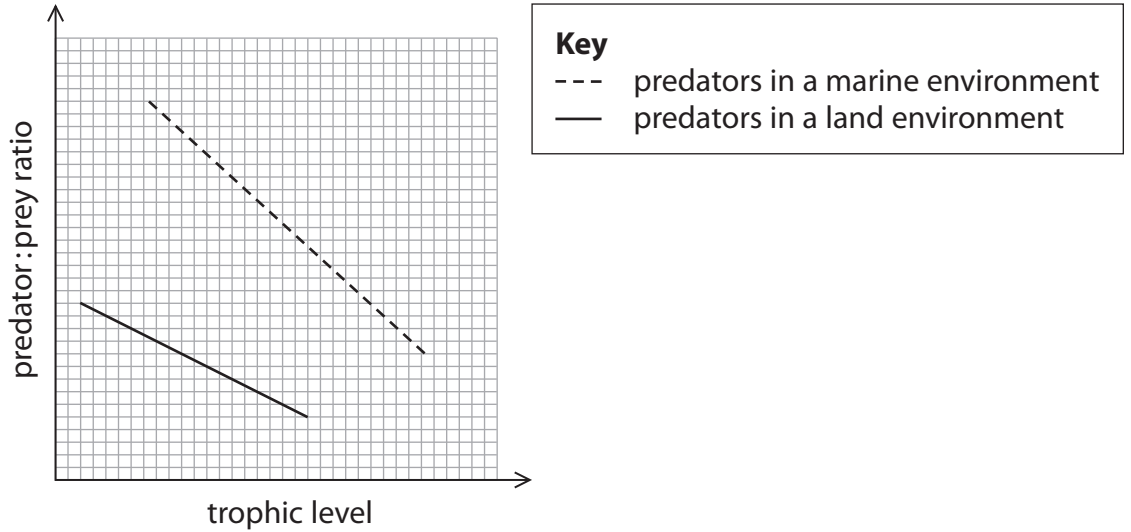
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(b) A study of predators in a marine environment and in a land environment was carried out.

The trophic level of each predator and the ratio of the numbers of each predator to its prey (predator : prey ratio) were determined.

The graph below shows the results of this study.



Describe conclusions that could be made from this study.

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- (c) As part of this study, the energy content of organisms at each trophic level in one food chain was determined. The energy content represents the energy available to the next trophic level.

The results of this study are shown in the table below.

Trophic level	Energy content / $\text{kJ m}^{-2} \text{yr}^{-1}$
1	88 000
2	2 800
3	120

- (i) Put a cross (☒) in the box next to the term used to describe the energy content in trophic level 1, shown in this table.

(1)

- A** biomass
- B** gross primary productivity
- C** net primary productivity
- D** organic matter

- (ii) Calculate the percentage of energy lost between trophic level 2 and trophic level 3.

Show your working.

(2)

Answer%



(iii) Suggest why there were only three trophic levels in this food chain.

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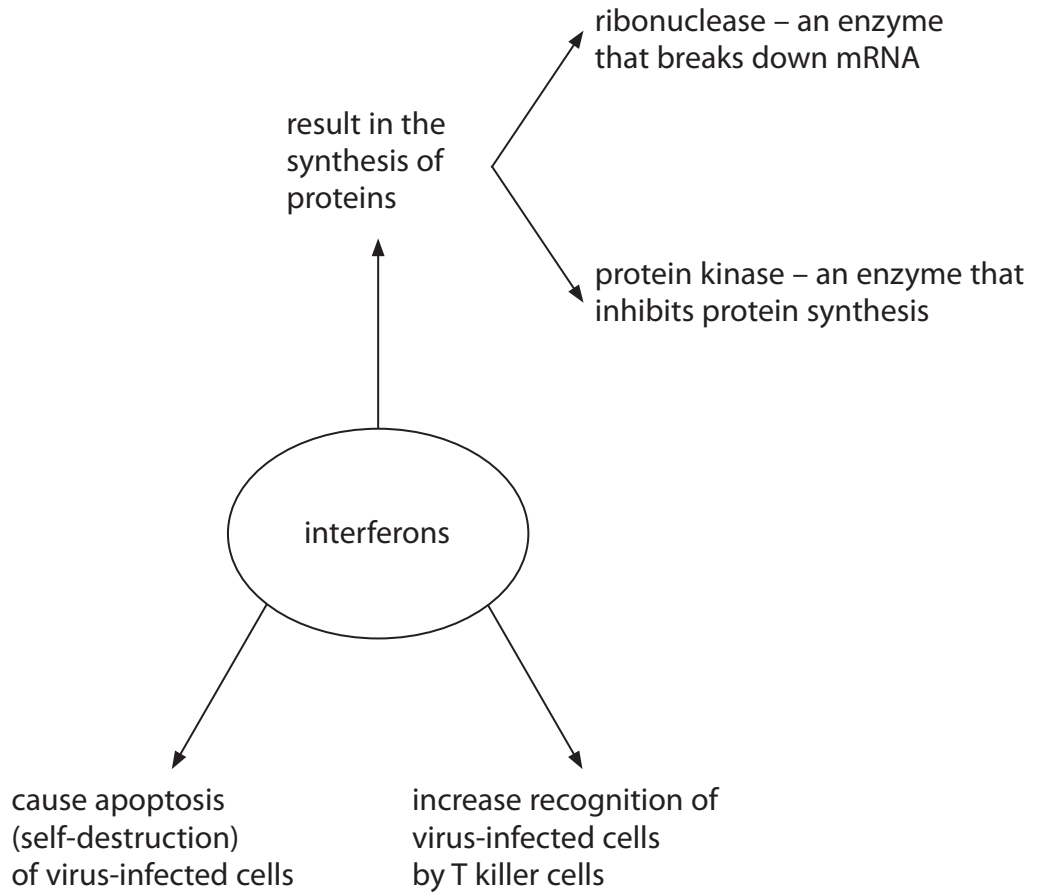
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- 6 Viral infections result in both non-specific responses and immune responses of the body.
(a) Production of interferons is a non-specific response of the body to viral infection.

The diagram below shows some of the effects of interferons.



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*(i) Using the information in the diagram, explain the role of interferons in viral infections.

(6)

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Area with horizontal dotted lines for writing the answer.



(ii) Suggest possible disadvantages for cells of producing ribonuclease and protein kinase.

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(b) Describe the immune response of the body to viral infections.

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(Total for Question 6 = 13 marks)



P 5 1 8 6 5 A 0 2 1 2 8

- 7 Elephants and woolly mammoths have evolved from a common ancestor.

The diagram below shows a woolly mammoth.

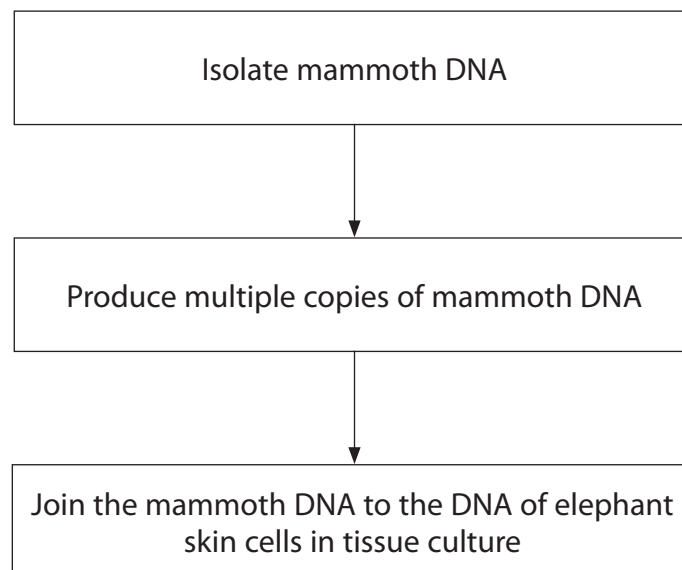


The woolly mammoth became extinct approximately 4000 years ago.

The woolly mammoth lived in cold environments. It was protected from the cold by its thick, woolly coat.

Recently, scientists claimed that they had inserted some genes from a woolly mammoth into skin cells from an elephant.

- (a) The diagram below shows some of the steps in the process used by the scientists.



(i) Explain how multiple copies of mammoth DNA could be produced.

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(ii) Put a cross (☒) in the box next to an enzyme that could be used to catalyse the formation of phosphodiester bonds between the mammoth DNA and the elephant DNA.

(1)

- A** DNA helicase
- B** DNA ligase
- C** restriction enzymes
- D** reverse transcriptase

(iii) This work has not yet been reported in a scientific journal.

Explain why the claims made by these scientists have to be treated with caution.

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(b) The DNA inserted into the elephant skin cells included genes coding for the woolly coat.

It is claimed that it may be possible to create an elephant that has some features of the mammoth.

An embryo containing these genes could be implanted into the uterus of an elephant.

(i) Suggest **two** reasons why this procedure may be unethical. (2)

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(ii) Elephants live on the African plains and in the rain forests of Africa and South East Asia.

Elephants are endangered.

Suggest why scientists are hoping that this procedure may help to conserve the elephant. (2)

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(iii) Some scientists are concerned that this procedure could reduce conservation efforts to protect elephants and other organisms found in their habitat.

Suggest why some scientists are concerned that this procedure could reduce the number of elephants and other organisms found in these habitats.

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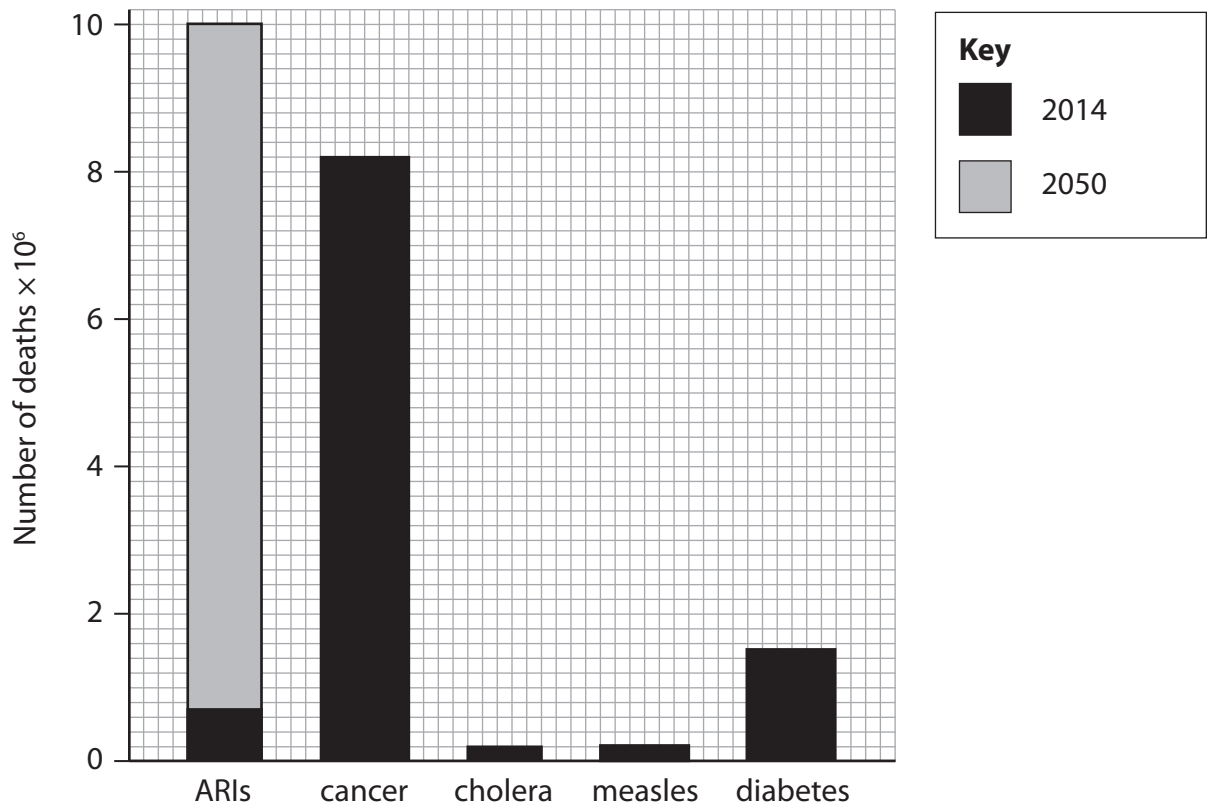
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P 5 1 8 6 5 A 0 2 5 2 8

- 8 The graph below shows the number of deaths in 2014 caused by antibiotic resistant infections (ARIs), cancer, cholera, measles and diabetes.

The graph also shows the estimated number of deaths in 2050, caused by ARIs.



- (a) Diabetes can develop when the immune system attacks the pancreas. As a result, glucose cannot be removed from the blood and stored in the liver.

Put a cross (☒) in the box next to the polysaccharide stored in liver cells.

(1)

- A amylose
- B glucose
- C glycogen
- D starch



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(b) Measles is caused by a virus. Cholera is caused by bacteria.

(i) The table below shows some features of a virus and of a bacterium.

For each feature, put one cross (⊗) in the appropriate box in each row, to show whether the feature is found in a virus only, a bacterium only, both a virus and a bacterium or not found in either.

(3)

feature	virus only	bacterium only	virus and bacterium	not found in either a virus or a bacterium
contains both DNA and RNA	⊗	⊗	⊗	⊗
has cytoplasm	⊗	⊗	⊗	⊗
DNA may be single-stranded	⊗	⊗	⊗	⊗

(ii) Vaccines produce artificial immunity in people. Vaccines can be used to protect people from measles and cholera.

Vaccines are partly responsible for the low number of deaths from measles and cholera.

Describe how vaccines produce artificial immunity.

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(c) Explain why antibiotics cannot be used to treat people with cancer. (2)

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(d) Explain why the number of deaths from antibiotic resistant infections (ARIs) in 2050 is expected to be so high. (4)

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(Total for Question 8 = 13 marks)

TOTAL FOR PAPER = 90 MARKS

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