

**1** Some diseases can be cured by using antibiotics or prevented by vaccination.

(a) (i) Explain fully why antibiotics cannot be used to cure viral diseases.

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**(2)**

(ii) There has been a large increase in the populations of many antibiotic-resistant strains of bacteria in recent years.

Explain why.

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**(2)**

(b) A person can be immunised against a disease by injecting them with an inactive form of a pathogen.

Explain how this makes the person immune to the disease.

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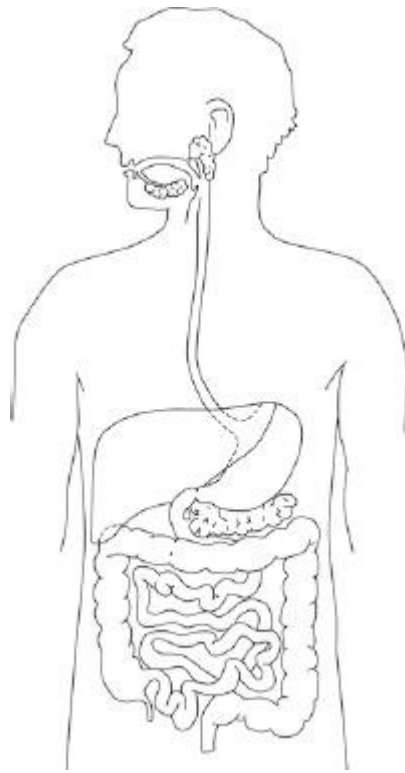
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**(3)**

**(Total 7 marks)**

2

The diagram below shows the human digestive system.



(a) Label the stomach and pancreas on the diagram.

(1)

(b) Many people suffer from stomach ulcers caused by a species of bacteria called *Helicobacter pylori*.

The stomach is lined with a protective lining of mucus.

*Helicobacter pylori* are acid-tolerant bacteria which can damage this mucus lining.

Suggest how an infection with *Helicobacter pylori* might result in a stomach ulcer developing.

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(2)

(c) *Helicobacter pylori* can also cause stomach cancer.

Describe how a person infected with *Helicobacter pylori* could also develop liver cancer.

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**(3)**

(d) Gluten is a form of protein found in some grains.

Describe the test you would use to find out if protein is present in food.

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**(2)**

(e) Coeliac disease is a disease of the digestive system.

It damages the lining of the small intestine when foods that contain gluten are eaten.

When people with coeliac disease eat foods that contain gluten:

1. their immune system forms antibodies to gluten
2. these antibodies attack the lining of the small intestine
3. this causes inflammation in the intestines and damages the villi.

Symptoms of coeliac disease include poor growth.

Suggest why a person with coeliac disease might have this symptom.

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(4)

(Total 12 marks)

3

Drugs must be trialled before the drugs can be used on patients.

- (a) (i) Before the clinical trials, drugs are tested in the laboratory.  
The laboratory trials are **not** trials on people.

What is the drug tested on in these laboratory trials?

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(1)

(ii) Drugs must be trialled before the drugs can be used on patients.

Give **three** reasons why.

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(3)

(b) Read the information about cholesterol and ways of treating high cholesterol levels.

Diet and inherited factors affect the level of cholesterol in a person's blood.

Too much cholesterol may cause deposits of fat to build up in blood vessels and reduce the flow of blood. This may cause the person to have a heart attack.

Some drugs can lower the amount of cholesterol in the blood.

The body needs cholesterol. Cells use cholesterol to make new cell membranes and some hormones. The liver makes cholesterol for the body.

Some drugs can help people with high cholesterol levels.

**Statins** block the enzyme in the liver that is used to produce cholesterol.

People will normally have to take statins for the rest of their lives. Statins can lead to muscle damage and kidney problems. Using some statins for a long time has caused high numbers of deaths.

**Cholesterol blockers** reduce the absorption of cholesterol from the intestine into the blood.

Cholesterol blockers can sometimes cause problems if the person is using other drugs.

Evaluate the use of the two types of drug for a person with high cholesterol levels.

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(6)

(Total 10 marks)

**4**

White blood cells protect the body against pathogens such as bacteria and viruses.

(a) (i) Pathogens make us feel ill.

Give **one** reason why.

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(1)

- (ii) White blood cells produce antibodies. This is one way white blood cells protect us against pathogens.

Give **two** other ways that white blood cells protect us against pathogens.

1. \_\_\_\_\_

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2. \_\_\_\_\_

\_\_\_\_\_

**(2)**

- (b) Vaccination can protect us from the diseases pathogens cause.

- (i) One type of virus causes measles.

A doctor vaccinates a child against measles.

What does the doctor inject into the child to make the child immune to measles?

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\_\_\_\_\_

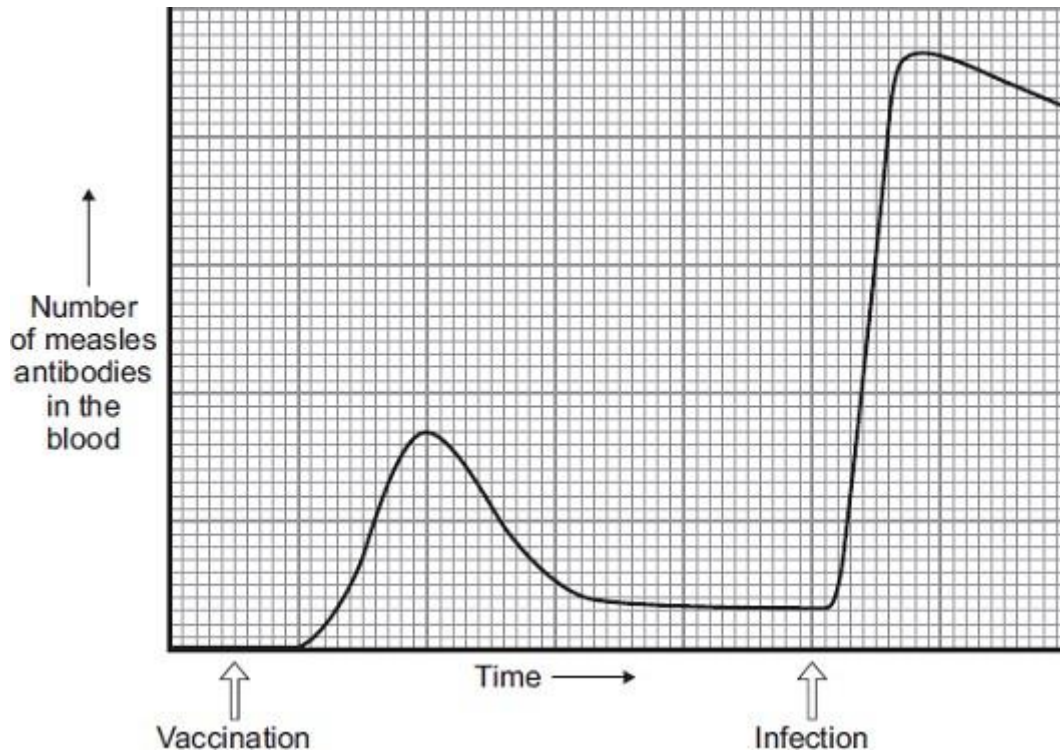
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**(2)**

- (ii) A few weeks after the vaccination, the child becomes infected with measles viruses from another person.

The graph shows the number of measles antibodies in the child's blood from before the vaccination until after the infection.



More measles antibodies are produced after the infection than after the vaccination.

Describe other differences in antibody production after infection compared with after vaccination.

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(3)

- (iii) Vaccination against the measles virus will **not** protect the child against the rubella virus.

Why?

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(1)



(c) What is the advantage of vaccinating a large proportion of the population against measles?

(1)  
(Total 10 marks)

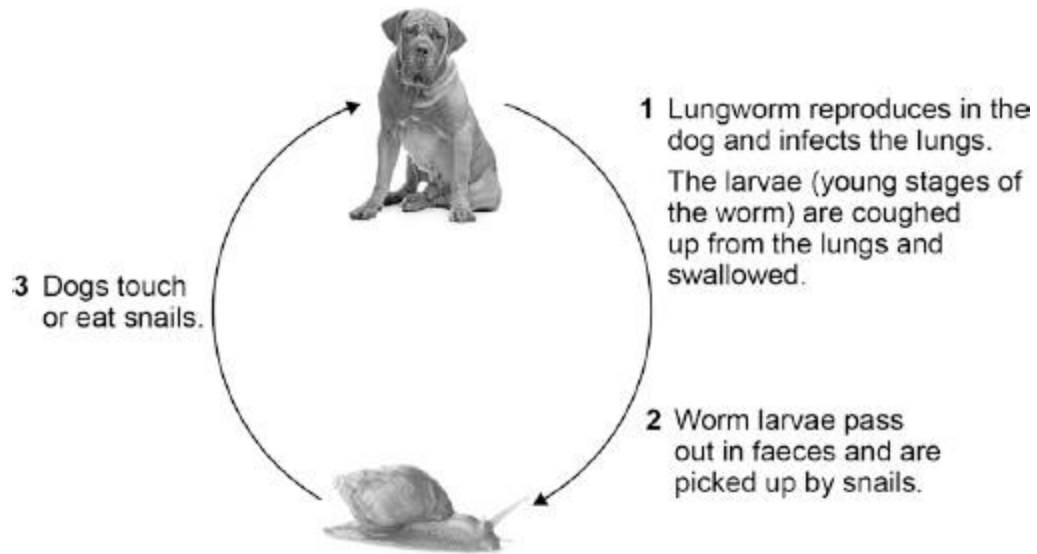
5

Lungworm is an infection.

Lungworm can kill dogs.

It is caused by a small worm.

The diagram below shows the lifecycle of the lungworm.



Dog © Eriklam/iStock/Thinkstock, snail © Karandaev/iStock/Thinkstock

(a) What type of organism is represented by the snail in the lifecycle of the lungworm?

Tick **one** box.

Fungus

Parasite

Protist

Vector

(1)

(b) Suggest how the spread of the lungworm disease can be prevented.

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**(3)**

(c) Malaria is a disease spread by mosquitoes.

Describe **two** ways to control the spread of malaria.

1. \_\_\_\_\_

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2. \_\_\_\_\_

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**(2)**

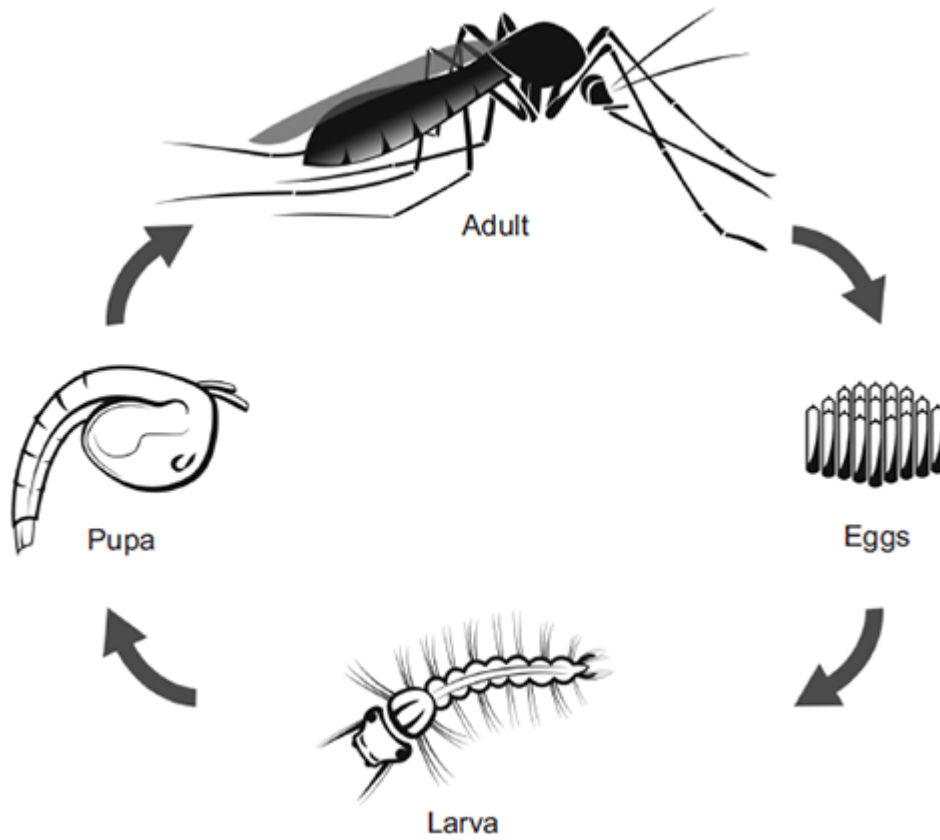
**(Total 6 marks)**

6

Malaria is a disease caused by a microorganism carried by mosquitoes.

The microorganism is transferred to humans when adult female mosquitoes feed on human blood.

The figure below shows the life cycle of a mosquito.



© watcharapon/iStock

The World Health Organisation estimates that  $3 \times 10^8$  people are infected with malaria every year.

Scientists estimate that malaria kills  $2 \times 10^6$  people every year.

The people who are infected with malaria but do not die, may be seriously ill and need health care for the rest of their lives.

(a) Based on the estimated figures, what percentage of people infected with malaria die from the disease?

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(2)

(b) An internet article states:

- 1 Mosquito larvae are at the start of the food chain for some fish.
- 2 Adult mosquitoes provide food for bats and birds.
- 3 Mosquitoes are also important in plant reproduction because they feed from flowers of crop plants.

(i) The first sentence in the article is **not** correct.

Explain why.

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(2)

(ii) A company plans to produce genetically modified (GM) adult male mosquitoes. The GM mosquitoes will carry a gene from bacteria. The gene causes the death of offspring before they become adults.

Male mosquitoes do **not** feed on blood.

Scientists are considering releasing millions of adult male GM mosquitoes into the wild.

Do you think scientists should release millions of male GM mosquitoes into the wild?

In your answer you should give advantages and disadvantages of releasing GM mosquitoes into the wild.

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(4)

(iii) Describe the process for creating a GM mosquito.

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**(3)**  
**(Total 11 marks)**

## Mark schemes

- 1** (a) (i) viruses live inside cells 1
- viruses inaccessible to antibiotic  
*allow drug / antibiotic (if used)*  
*would (have to) kill cell* 1
- (ii) any **two** from eg 2
- non-resistant strains killed (by antibiotics)
  - so less competition
  - overuse of antibiotics / antibiotics prescribed for mild infections  
*if no marks gained allow one mark for 'people do not finish course of antibiotics'*
- (b) (stimulate) antibody production 1
- ignore antitoxin*
- (by) white cells 1
- rapidly produce antibody on re-infection  
*ignore antibodies remain in blood* 1
- [7]**
- 2** (a) stomach and pancreas correctly labelled 1
- (b) bacteria not killed (by stomach acid / HCl) and so they damage mucus lining 1
- so acid / HCl damages stomach tissue / causes an ulcer  
*allow bacteria infect stomach tissue* 1
- (c) if the cancer is malignant 1
- (cancer) cells can spread to other organs 1
- via the blood forming a secondary tumour  
*do not award marking points 2 or 3 without marking point 1* 1

- (d) add Biuret reagent to food sample  
*allow sodium / potassium hydroxide (solution) + copper sulfate(solution)*

1

mauve / purple colour shows protein present

1

- (e) damaged villi reduce surface area for absorption (of food molecules)

1

(therefore) fewer amino acids and glucose absorbed

1

with less glucose transfer of energy from respiration is reduced

1

and fewer amino acids available to build new proteins

1

[12]

3

- (a) (i) any **one** from:

- cells
- tissues
- (live) animals / named  
*allow mammals*

1

- (ii) any **three** from:

(to test for)

- toxicity / check not poisonous / not harmful  
*allow side-effect*  
*allow converse*
- interaction with other drugs
- efficacy **or** to see if they work **or** check if they treat the disease  
*allow converse*
- dosage **or** how much is needed

3

**(b) argued evaluation**

*comparison can be written anywhere in evaluation allow use of 'only' for implied comparison for each point eg **only** statins damage muscles / kidneys / organs*

any **six** from:

- statin can damage / muscles / kidneys / organs but cholesterol blockers don't  
*ignore liver*  
*if neither of the first 2 points are given accept for 1 mark*
- statins can cause death but cholesterol blockers don't  
*statins are more dangerous than cholesterol blockers **or** statins have more side effects*
- cholesterol blockers can interfere with action of other drugs but statins don't
- statins are for a life time but cholesterol blockers are not
- statins (might) reduce cholesterol to zero but cholesterol blockers only reduce it **or** statins reduce cholesterol more  
*allow statins (might) stop membrane / hormone production but cholesterol blockers don't*
- statins better for people with inherited high cholesterol
- cholesterol blockers better for people with dietary cholesterol problems
- taking/using statins/cholesterol blockers is better than dying from heart attack or build up of fat in blood vessels or reduced blood flow

6

[10]

**4**

(a) (i) any **one** from:

- (produce) toxins / poisons
- (cause) damage to cells  
*kill / destroy cells*  
*allow kills white blood cells*

1

(ii) produce antitoxins

1

*engulf / ingest / digest pathogens / viruses / bacteria / microorganisms*  
*accept phagocytosis or description*  
*ignore eat / consume / absorb for engulf*  
*ignore references to memory cells*

1



- (b) (i) dead / inactive / weakened  
*accept idea of antigen / protein* 1
- (measles) pathogen / virus  
*ignore bacteria* 1
- (ii) (after infection)  
*accept converse if clearly referring to before vaccination* 1
- rise begins sooner / less lag time
- steeper / faster rise (in number) 1
- longer lasting **or** doesn't drop so quickly  
*idea of staying high for longer*  
*ignore reference to higher starting point* 1
- (iii) antibodies are specific or needs different antibodies  
*accept antigens are different **or** white blood cells do not recognise virus* 1
- (c) reduces spread of infection / less likely to get an epidemic  
*accept idea of eradicating measles* 1

[10]

- 5** (a) vector 1
- (b) any **three** from:  
  - destroy the snails
  - isolate infected dogs
  - treat infected dogs*allow vaccination*  
  - educate owners about picking up dog faeces 3
- (c) stop mosquitoes breeding  
*allow correct description* 1
- use mosquito nets  
*allow use of insect repellent* 1

[6]

6

(a) 0.67(%)

*allow 0.6̇ or 0.7*

*allow 1 mark for evidence of  $(2 \times 10^6) \div (3 \times 10^8)$*

**or**

*allow 1 mark for 0.0067 or 0.6*

2

(b) (i) idea that food chains start with plants / producers

*allow food chains do not start with animals **or** larvae are consumers*

1

idea that these make food (for other organisms in the chain)

*allow idea that plants / producers photosynthesise **or** plants / producers get energy from the sun*

*allow mosquito larvae do not make food / photosynthesise **or** mosquito larvae do not get energy from the sun*

1

(ii) any **four** from:

- reasoned argument for **or** against release  
*must refer to at least one advantage and one disadvantage.*  
*max 3 marks for either only advantages **or** only disadvantages*

advantages:

- fewer mosquitos biting **or** spreading malaria
- fewer people get / die from malaria  
*allow people won't get / die from malaria*
- lower medical costs (for those infected **or** for treatment) **or** less healthcare needed
- better economically for developing / tropical countries.

disadvantages:

- fewer crops reproduce  
*allow fewer crops pollinated*
- poorer crop yield
- possible starvation (of people)
- high cost of GM production / mosquito release
- less food for bats / birds **or** bats / birds die  
*allow disruption to food chain / ecosystem **or** reduction of biodiversity*
- gene could 'escape' into other wildlife / species  
*ignore into plants*

4

(iii) any **three** from:

- gene from bacteria cut out  
*allow allele for gene*
- ref to enzymes (anywhere in process)  
*allow at any point in process, ie in cutting or in splicing*
- (gene) transferred to chromosome of mosquito  
*allow DNA for chromosome*
- at an early stage of development  
*allow egg / embryo*

3

[11]