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9790/03

May/June 2017

1 hour 45 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO NOT WRITE IN ANY BARCODES.

Section A

Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B

Answer **one** question.
Write your answer in the space provided on the Question Paper.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
Section A	
3	
4	
5	
Total	

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 3 Pre-U Certificate.

This document consists of **12** printed pages.

Section A – Case Study

Read the passages carefully and answer **all** of the questions.

You are advised to spend no more than 50 minutes on this section.

1 A vaccine for malaria

Malaria is a serious disease that is thought to affect more than 220 million people around the world. Every year, over three quarters of a million people die from malaria, 90% of whom are in Africa. The disease is caused by a group of parasitic protoctists.

People with malaria show several symptoms including headache, fever and vomiting. These symptoms often appear some 10 to 15 days after the initial infection. The disease can rapidly affect many vital organs and become life threatening. Preventative measures include anti-malarial drugs based on a chemical called artemisinin, extracted from *Artemisia* plants. In recent years, the malarial parasite has shown increasing resistance to artemisinin-based drugs.

In humans, the malarial parasite has also developed a wide range of defences against the immune system, making an effective vaccine difficult to develop. After repeated exposure to a variety of malarial strains, some people develop a natural immunity to the disease.

Randomised trials have taken place of a new vaccine called RTS,S. In 2011, 894 children aged 5–17 months from Kenya and Tanzania were vaccinated with either the RTS,S vaccine or with a rabies vaccine. Neither the children nor their families were told which vaccine they were given. The children were monitored to see if they developed malaria. The results are shown in Table 1.1.

Table 1.1

	vaccine given	
	RTS,S	rabies
number of subjects	447	447
number that developed malaria	38	86
percentage that developed malaria	8.5	19.2

These results were shown to be statistically significant ($p < 0.001$).

The drug company that developed the vaccine came to the conclusion that the RTS,S vaccine had an effectiveness of 56% and suggested that it could be used as an effective vaccination against malaria in the future. Other researchers have suggested that alternative approaches to preventing malaria should be considered.

- (a)** Name the genus of the parasite that causes malaria **and** explain how it is transmitted.

[4]

- (b)** Suggest how the malarial parasite may have developed defences to the human immune system.

[4]

- (c)** Repeated exposure to a variety of strains of the malarial parasite can result in a person developing natural immunity.

Suggest how a person could develop natural immunity to malaria.

[4]

- (d)** Discuss the use of the rabies vaccine in the trial described.

[3]

- (e) One way of producing immunity to malaria is to inject a vaccine consisting of irradiated malarial parasites that are unable to divide.

Explain how such irradiation changes the pathogen so that it is unable to divide.

[2]

- (f) Discuss reasons for and against the introduction of a large-scale vaccination programme using RTS,S.

[5]

[Total: 22]

- 2 (a) One method of controlling malaria is to set up a local education programme in an affected area, combined with the issuing of mosquito nets impregnated with insecticide. The effectiveness of this practice was measured in a small town in India by monitoring the annual occurrence of malaria over a five-year period, beginning in 2007.

This was done in two ways:

- people were asked to fill in a questionnaire to record the occurrence of fever
- admissions for malaria at the local hospital were recorded.

The results, given as a percentage of the annual occurrence of malaria in the town in 2007, are shown in Fig. 2.1.

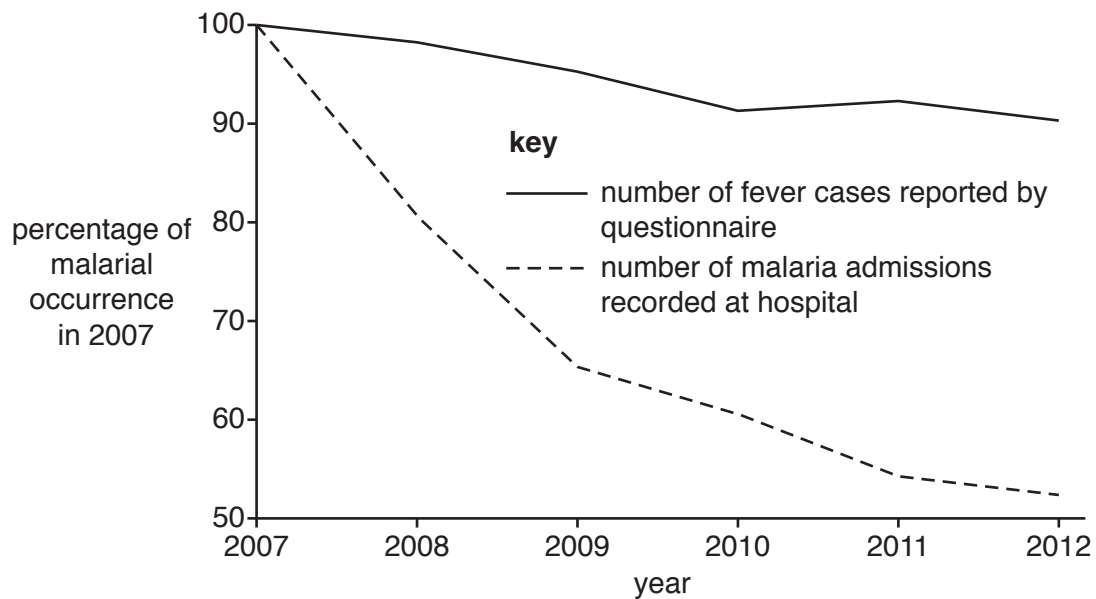


Fig. 2.1

- (i) In this investigation, the researchers placed more confidence in the hospital admissions data than in the results of the questionnaire.

Suggest why.

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.....[2]

- (ii) Suggest what information should be included in a malaria education programme.

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.....[3]

- (b) Another method of controlling malaria is to reduce the number of mosquitoes. This can be achieved by spraying with the persistent insecticide DDT.

Extensive use of DDT has been associated with significant loss of biodiversity. Species at the tops of food chains, such as birds of prey, may be particularly affected.

Explain how the loss of species at the tops of food chains leads to further loss in biodiversity in ecosystems.

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.....[3]

[Total: 8]

[Total: 30]

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