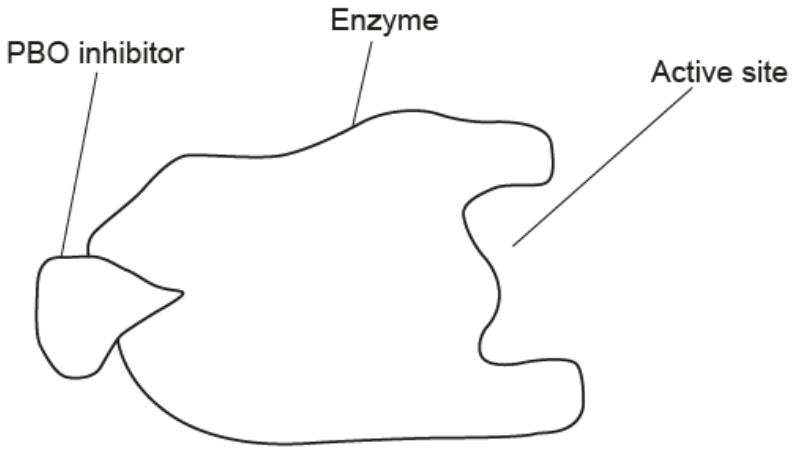
Communicable diseases, disease prevention and immune system – 2021/20 GCE AS Biology A

1. Nov/2021/Paper_H020/2/No.4

(a) Mosquito nets help to prevent the spread of malaria. They are often treated with an insecticide called permethrin. Some mosquitoes have developed resistance to the insecticide permethrin. Resistant mosquitoes produce an enzyme to detoxify the permethrin.

Scientists discovered that piperonyl butoxide (PBO) inhibits the activity of this enzyme in mosquitoes. The diagram shows how PBO acts on this enzyme.



With reference to the diagram, describe how PBO is acting as an enzyme inhibitor.

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..... **[3]**

(b) The malarial pathogen, *Plasmodium*, is a protoctist.

State **two** features of organisms that belong to the Kingdom Protoctista.

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2 .....

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[2]

2. Nov/2020/Paper_H020/2/No.2(d)

(d) Sjogren's syndrome is an autoimmune condition.

- Family members of Sjogren's syndrome sufferers can often have other autoimmune diseases such as Lupus
- Lupus affects approximately 1 in 1350 of the world's population
- In 2018 the world population was estimated at 7.7×10^9
- The world population is estimated to increase by 1.11% a year
- Around 60% of Lupus sufferers are photosensitive, meaning their symptoms can be triggered by going out in direct sunlight.

(i) Using the information provided, calculate how many of the world's Lupus sufferers by the end of 2019 would be photosensitive.

number of photosensitive Lupus sufferers = ... **[2]**

(ii) Lupus symptoms include pain in joints, inflammation, fatigue, fever and a skin rash.

Suggest what component of sunlight causes photosensitivity and which symptom is likely to be more common in photosensitive sufferers.

Component of sunlight .....

Symptom .....

[1]

(iii) Explain what is meant by an autoimmune disease **and** suggest why members of the same family can be sufferers of autoimmune diseases.

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..... **[2]**

3. Nov/2020/Paper_H020/2/No.3

(a) Different types of pathogen cause communicable diseases in plants and animals.

Complete the table by adding the correct type of pathogen for each communicable disease.

The first one has been done for you.

Type of Pathogen	Communicable Disease
bacterium	tuberculosis (TB)
.....	potato late blight
.....	malaria

[2]

(b) People with malarial pathogens generate distinct odours on their skin. Scientists in Gambia have carried out trials using dogs that have been trained to identify malarial infection in children. The dogs sniff clothing worn by the children. The dogs were trained to sniff each sample and to freeze if they detected malaria, or move on if they did not.

- In one trial the dogs sniffed the socks from 175 children
- 17% of these children had malaria
- The dogs correctly identified 70% of children with malarial infection by sniffing their socks.

(i) Calculate how many of the children who were suffering from malaria were correctly identified by the dogs.

number of children = ... **[2]**

(ii) Suggest **one** limitation of this trial.

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..... **[1]**

(c) Some people are immune to malaria. They produce a specific type of antibody. One way in which antibodies defend the body is by acting as agglutinins.

Outline the action of agglutinins.

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..... **[2]**

4. Nov/2020/Paper_H020/2/No.4

A program has been developed for vaccinations against the influenza virus and is updated yearly. It is recommended that the vaccination be given to adults aged 65 years and over and those under 65 years with 'at-risk' health conditions. However, not all the people in these groups take up the offer of the influenza vaccination.

The data in Fig. 4.1 show the number of influenza cases in four different environments within a single city during three consecutive winter periods from 2015–2018.

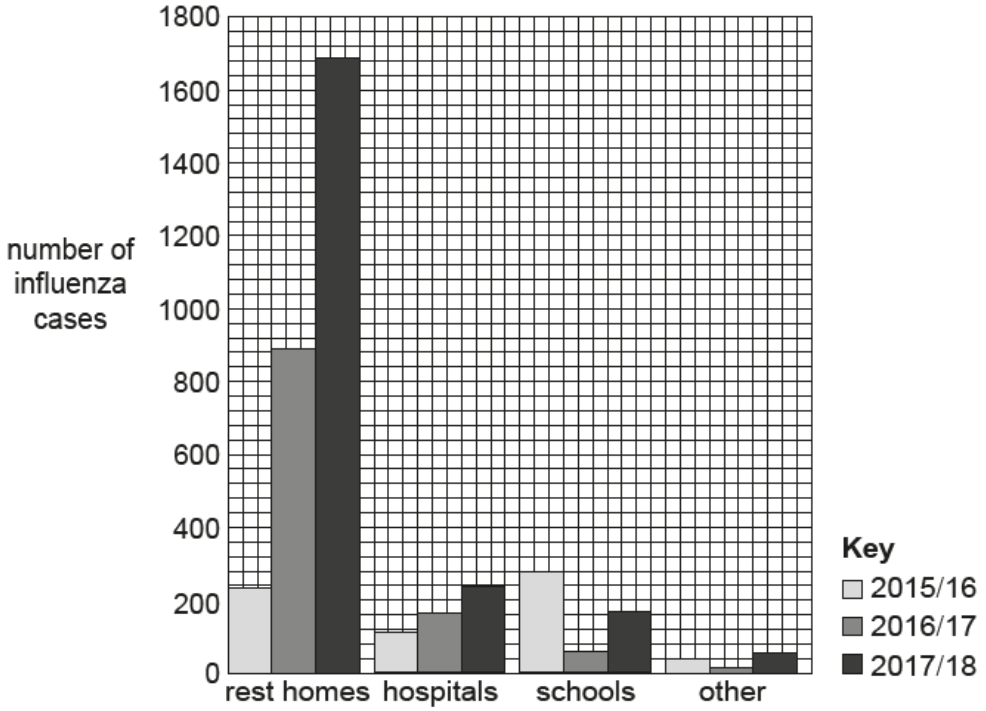

Fig. 4.1

The data in Fig. 4.2 show the percentage uptake of the influenza vaccine in four different environments in the same city during three consecutive winter periods from 2015–2018.

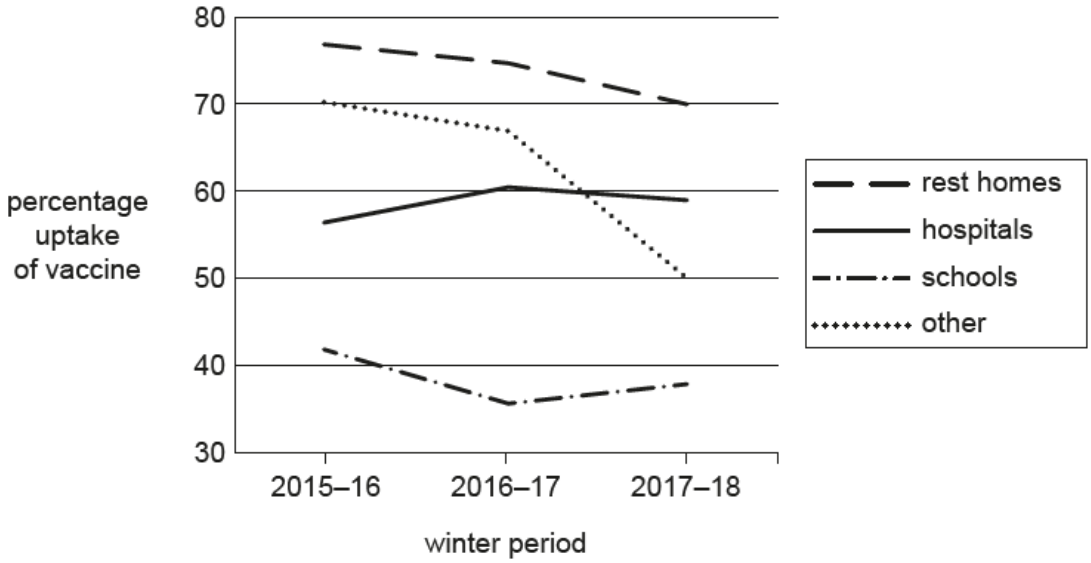

Fig. 4.2

(a) A student looking at the data in Fig. 4.1 and Fig. 4.2 made the following conclusion:

'The data shows that a vaccination program is a successful way of reducing influenza cases in this city, as there is a direct correlation between uptake of the influenza vaccine and the number of influenza cases.'

Evaluate the validity of this statement, based on the data in Fig. 4.1 and Fig. 4.2.

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..... **[4]**

(b) Complete the following sequence to outline how a vaccine gives an individual immunity. The first two steps have been completed for you.

Step 1: A vaccine is produced that is a safe form of an antigen.

Step 2: A small amount of vaccine is injected into blood of the individual to be vaccinated.

Step 3: .....

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Step 4: .....

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Step 5: .....

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[3]

(c) Measles is a highly contagious viral infection.

In October 2018, an outbreak of the disease on the island of Madagascar resulted in more than 50 000 cases of measles. Fewer than 50% of the population was vaccinated when the outbreak began. The government of Madagascar hoped to bring the epidemic under control by vaccinating 90% of the population.

Discuss why this response was likely to bring the measles outbreak on Madagascar under control.

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