

## Revision Pack Topic 3 Infection & Response

Topic area	R/A/G
<p><b><u>The spread of disease</u></b>            Students should be able to explain how the spread of diseases can be reduced or prevented.</p>	
<p>Pathogens are microorganisms that cause infectious disease. Pathogens may be viruses, bacteria, protists or fungi. They may infect plants or animals and can be spread by direct contact, by water or by air.</p>	
<p><b><u>How pathogens cause disease</u></b>            Bacteria and viruses may reproduce rapidly inside the body. Bacteria may produce poisons (toxins) that damage tissues and make us feel ill.            Viruses live and reproduce inside cells, causing cell damage.</p>	
<p><b><u>Viral diseases</u></b>  <b>Measles</b> is a viral disease showing symptoms of fever and a red skin rash. Measles is a serious illness that can be fatal if complications arise. For this reason most young children are vaccinated against measles. The measles virus is spread by inhalation of droplets from sneezes and coughs.   <b>HIV</b> initially causes a flu-like illness. Unless successfully controlled with antiretroviral drugs the virus attacks the body's immune cells. Late stage HIV infection, or AIDS, occurs when the body's immune system becomes so badly damaged it can no longer deal with other infections or cancers. HIV is spread by sexual contact or exchange of body fluids such as blood which occurs when drug users share needles.   <b>Tobacco mosaic virus (TMV)</b> is a widespread plant pathogen affecting many species of plants including tomatoes. It gives a distinctive 'mosaic' pattern of discolouration on the leaves which affects the growth of the plant due to lack of photosynthesis.</p>	
<p><b><u>Bacterial diseases</u></b>  <b>Salmonella</b> food poisoning is spread by bacteria ingested in food, or on food prepared in unhygienic conditions. In the UK, poultry are vaccinated against Salmonella to control the spread. Fever, abdominal cramps, vomiting and diarrhoea are caused by the bacteria and the toxins they secrete.   <b>Gonorrhoea</b> is a sexually transmitted disease (STD) with symptoms of a thick yellow or green discharge from the vagina or penis and pain on urinating. It is caused by a bacterium and was easily treated</p>	

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<p>with the antibiotic penicillin until many resistant strains appeared. Gonorrhoea is spread by sexual contact. The spread can be controlled by treatment with antibiotics or the use of a barrier method of contraception such as a condom.</p>	
<p><b><u>Fungal diseases</u></b></p> <p>Rose black spot is a fungal disease where purple or black spots develop on leaves, which often turn yellow and drop early. It affects the growth of the plant as photosynthesis is reduced. It is spread in the environment by water or wind. Rose black spot can be treated by using fungicides and/or removing and destroying the affected leaves.</p>	
<p><b><u>Protist diseases</u></b></p> <p>The pathogens that cause malaria are protists.</p> <p>The malarial protist has a life cycle that includes the mosquito.</p> <p><b>Malaria</b> causes recurrent episodes of fever and can be fatal. The spread of malaria is controlled by preventing the vectors, mosquitos, from breeding and by using mosquito nets to avoid being bitten.</p>	
<p><b><u>Defence against disease</u></b></p> <p>Students should be able to describe the non-specific defence systems of the human body against pathogens, including the skin, nose, trachea and bronchi and stomach.</p>	
<p>Students should be able to explain the role of the immune system in the defence against disease.</p> <p>If a pathogen enters the body the immune system tries to destroy the pathogen.</p> <p>White blood cells help to defend against pathogens by:</p> <ul style="list-style-type: none"><li>• phagocytosis</li><li>• antibody production</li><li>• antitoxin production</li></ul>	
<p><b><u>Preventing &amp; treating disease</u></b></p> <p>Students should be able to explain how vaccination will prevent illness in an individual, and how the spread of pathogens can be reduced by immunising a large proportion of the population.</p> <p><b>Vaccination</b> involves introducing small quantities of dead or inactive forms of a pathogen into the body to stimulate the white blood cells to produce antibodies. If the same pathogen re-enters the body the white blood cells respond quickly to produce the correct antibodies, preventing infection.</p>	

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<p>Students should be able to explain the use of <b>antibiotics</b> and other medicines in treating disease.</p> <p>Antibiotics, such as penicillin, are medicines that help to cure bacterial disease by killing infective bacteria inside the body. It is important that specific bacteria should be treated by specific antibiotics.</p> <p>The use of antibiotics has greatly reduced deaths from infectious bacterial diseases. However, the emergence of strains resistant to antibiotics is of great concern.</p> <p>Antibiotics cannot kill viral pathogens.</p> <p><b>Painkillers</b> and other medicines are used to treat the symptoms of disease but do not kill pathogens.</p> <p>It is difficult to develop drugs that kill viruses without also damaging the body's tissues.</p>	
<p><b><u>Drug development</u></b></p> <p>Students should be able to describe the process of discovery and development of potential new medicines, including preclinical and clinical testing.</p> <p>Traditionally drugs were extracted from plants and microorganisms.</p> <ul style="list-style-type: none"><li>• The heart drug digitalis originates from foxgloves.</li><li>• The painkiller aspirin originates from willow.</li><li>• Penicillin was discovered by Alexander Fleming from the Penicillium mould.</li></ul> <p>Most new drugs are synthesised by chemists in the pharmaceutical industry. However, the starting point may still be a chemical extracted from a plant.</p> <p>New medical drugs have to be tested and trialled before being used to check that they are safe and effective.</p> <p>New drugs are extensively tested for toxicity, efficacy and dose. Preclinical testing is done in a laboratory using cells, tissues and live animals.</p> <p>Clinical trials use healthy volunteers and patients.</p> <ul style="list-style-type: none"><li>• Very low doses of the drug are given at the start of the clinical trial.</li><li>• If the drug is found to be safe, further clinical trials are carried out to find the optimum dose for the drug.</li><li>• In double blind trials, some patients are given a placebo.</li></ul>	




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## Pathogens

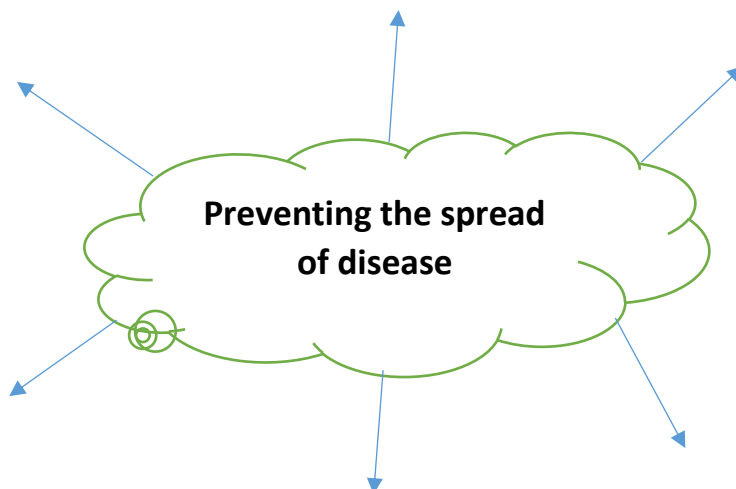
A pathogen is a \_\_\_\_\_ . There are 4 types of pathogen:

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_

Diseases caused by pathogens can be spread to other people. We say they are communicable. There are 3 main ways pathogens can be spread:

How pathogen is spread	Explanation
Air 	
Infected water 	
Direct contact 	

Make a mind map to show how the spread of disease can be prevented:



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Complete the table below to show details of key diseases that you need to know for your exam:

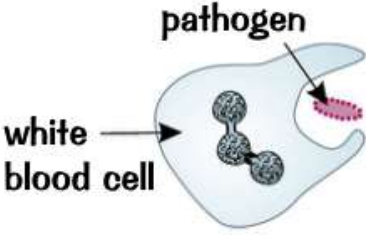
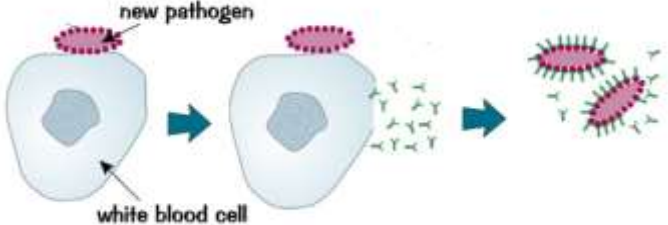
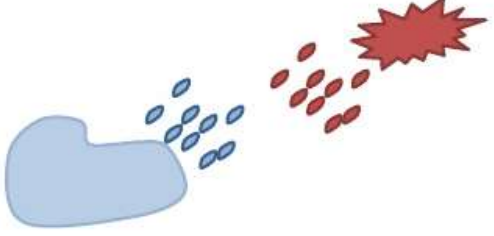
<b>Disease</b>	<b>Type of pathogen</b>	<b>How it is spread</b>	<b>Symptoms</b>	<b>How the spread can be prevented</b>
Salmonella food poisoning				
Gonorrhoea				
Measles				
HIV				
Malaria				
Tobacco mosaic virus				
Rose black spot				

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### Defence against disease

The human body has an immune system made up of \_\_\_\_\_ cells.

Explain the 3 key ways that white blood cells prevent disease. Ensure you use all the key words.

1	 <p>A diagram showing a large, light blue, irregularly shaped cell labeled 'white blood cell'. Inside the cell, several small, dark grey, spherical particles are being engulfed. One of these particles is labeled 'pathogen' with an arrow pointing to it. The cell's membrane is shown curving inward to surround the pathogen.</p> <p>Keywords: Pathogen, white blood cell, engulf</p>	
2	 <p>A diagram showing a sequence of three stages. In the first stage, a light blue 'white blood cell' is shown with a 'new pathogen' (a pink, oval-shaped particle with spikes) on its surface. An arrow points to the second stage, where the white blood cell is releasing small, Y-shaped particles (antibodies) towards the pathogen. A second arrow points to the third stage, where the antibodies have attached to the pathogen, causing it to clump together with other pathogens.</p> <p>Key words: antigen, pathogen, antibody, attach, clump</p>	
3	 <p>A diagram showing a light blue, irregularly shaped cell on the left. It is releasing a stream of small, blue, oval-shaped particles (antitoxins) towards a cluster of red, oval-shaped particles (toxins) on the right. The toxins are shown exploding or being neutralized, represented by a red starburst shape.</p> <p>Key words: bacteria, toxin, white blood cell, antitoxin, neutralise</p>	

The defence method in box 2 above can lead to **immunity**, because the second time a pathogen invades, its antigens are recognised more quickly. This allows antibodies to be produced very quickly, which kills the pathogen before you become ill.

Explain how vaccines use this idea to make people immune to a disease without making them ill.

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.....

.....

Keywords: dead, weakened, pathogen, injection, white blood cells, antigens, immunity

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## Painkillers

Many are sourced from p\_\_\_\_\_ (e.g. aspirin from willow trees) or m\_\_\_\_\_ (e.g. penicillin from mould)



## Antibiotics

Discovered by \_\_\_\_\_







These can kill \_\_\_\_\_ and \_\_\_\_\_, but not \_\_\_\_\_.

## Antibiotic resistance

## Drug testing

Placebo	
Blind trial	
Double blind trial	
Peer review	

Fill in the gaps in the drug testing process below:

<p>Drug company bosses have a meeting to decide what to spend their research budget on.</p> 	
	<p>The drug is tested in animals to check it really is safe. This phase continues _____ years to check long-term <u>side effects</u>.</p> 
	
<p>The drug is tested on hundreds of patients to check it is effective. Doctors give half the patients the old drug (the _____) and half the new drug, and see who does better.</p>	<p>If these trials are successful, the drug is licensed. Only around 11% of drugs that begin animal testing reach this stage!</p>

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## Exam questions

**Q1.** Pathogens cause infectious diseases in animals and plants.

- (a) Draw **one** line from each disease to the type of pathogen that causes the disease.

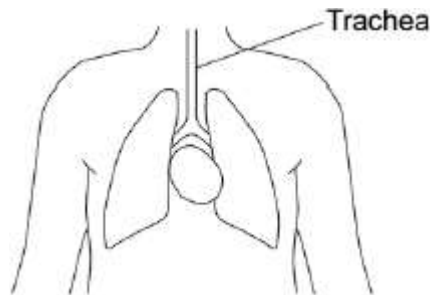
Disease	Type of pathogen
Gonorrhoea	Bacterium
Malaria	Fungus
Measles	Protist
	Virus

(3)

- (b) Some parts of the human body have adaptations to reduce the entry of live pathogens.

Look at **Figure 1**.

**Figure 1**



Explain how the trachea is adapted to reduce the entry of live pathogens.

.....

.....

.....

.....

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.....

.....

(4)

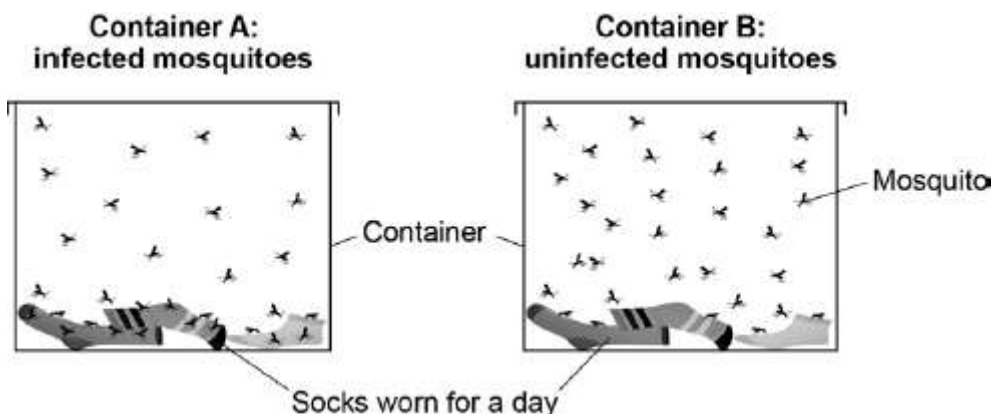


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- (c) Malaria is a serious disease that can be fatal. Malaria is spread to humans by infected mosquitoes.

Scientists investigated the behaviour of mosquitoes to understand how the spread of malaria could be controlled.

**Figure 2** shows the equipment the scientists used.



This is the method used.

1. 30 mosquitoes **infected with malaria** were placed in Container **A**.
2. 30 **uninfected** mosquitoes were placed in Container **B**.
3. The total number of times the mosquitoes landed on the socks was recorded.

Name the dependent variable and suggest **one** control variable in this investigation.

Dependent variable

.....

Control variable

.....

(2)

- (d) Infected mosquitoes landed on the socks three times more often than uninfected mosquitoes.

Explain how this information can be used to reduce the spread of malaria.

.....

.....

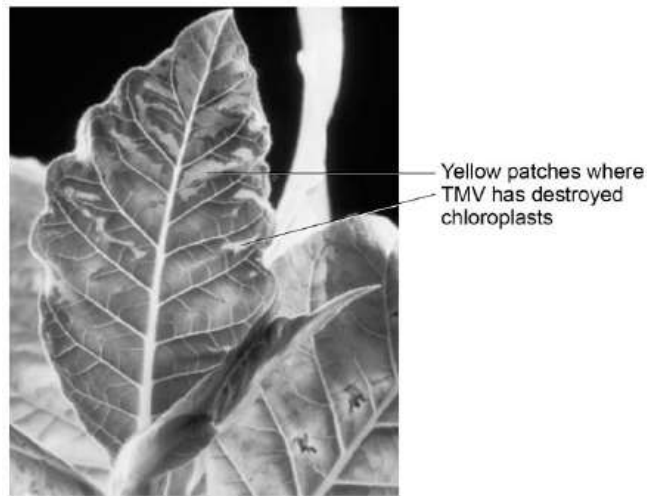
.....

.....(2)

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- (e) Tobacco mosaic virus (TMV) affects many species of plant.

**Figure 3** shows a leaf infected with TMV.



TMV destroys chloroplasts in the leaf. Explain how this could affect the growth of the plant.

.....

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.....

.....

.....

(3)

**Q2.** Bacteria and viruses can reproduce quickly inside the body and make people feel ill. (a) Use the correct answer from the box to complete the sentence.

<b>antibodies</b>	<b>antitoxins</b>	<b>toxins</b>
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Bacteria and viruses make us feel ill because they produce .....

- (b) (i) Antibiotics can be used to treat some infections.

Use the correct answer from the box to complete the sentence.

<b>bacteria</b>	<b>bacteria and viruses</b>	<b>viruses</b>
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Antibiotics are medicines that kill .....

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- (ii) New strains of pathogens have developed which are resistant to antibiotics.

Use the correct answer from the box to complete the sentence.

<b>are short of food</b> <b>invade body cells</b> <b>mutate</b>
-----------------------------------------------------------------

New strains are produced when pathogens ..... (1)

- (iii) What will scientists have to develop to kill these new resistant strains?  
..... (1)

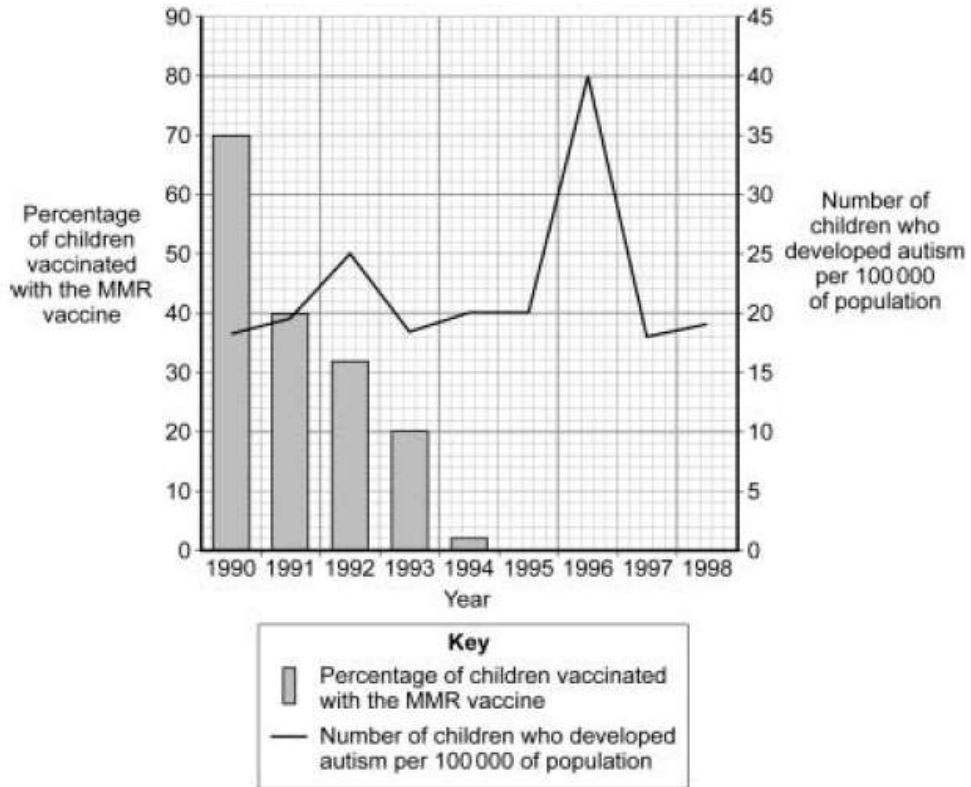
- Q3.** (i) Give **two** ways in which white blood cells protect us from disease.  
1 .....  
.....  
2 .....  
..... (2)

- (ii) Explain, as fully as you can, how immunisation protects us from disease.  
.....  
.....  
.....  
.....  
..... (3)

- Q4.** (a) In the 1990s many people thought that the MMR vaccine caused autism in some children. This is why the Japanese government stopped using the MMR vaccine.

The graph gives information about the percentage of Japanese children who developed autism during the 1990s.

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The data in the graph support the view that there is **no** link between MMR vaccination and autism.

Explain why.

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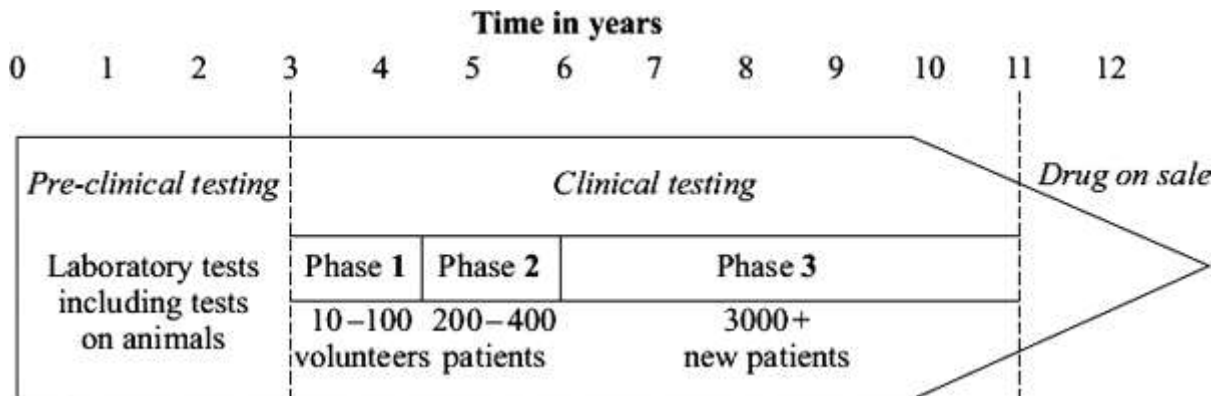
.....

(4)  
(Total 7 marks)

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5. New drugs have to be thoroughly tested before they are sold.

The diagram shows a time line for the testing of a new drug.



- (a) What is the main purpose of *pre-clinical testing*?

.....  
 .....

(1)

- (b) In Phase 1 of the *clinical testing*, very low doses of the new drug are used on a small number of volunteers.

- (i) What is the main purpose of Phase 1 testing?

.....  
 .....

(1)

- (ii) In Phase 1 testing, healthy volunteers are used rather than patients.

Suggest **one** reason for this.

.....  
 .....

(1)

- (c) What is the main purpose of the Phase 2 and Phase 3 testing?

.....  
 .....

(1)

- (d) During Phase 3 testing, many of the patients are given a *placebo*.

- (i) What is meant by a *placebo*?

.....

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(ii) During the testing, who knows which patients are receiving the *placebo*?

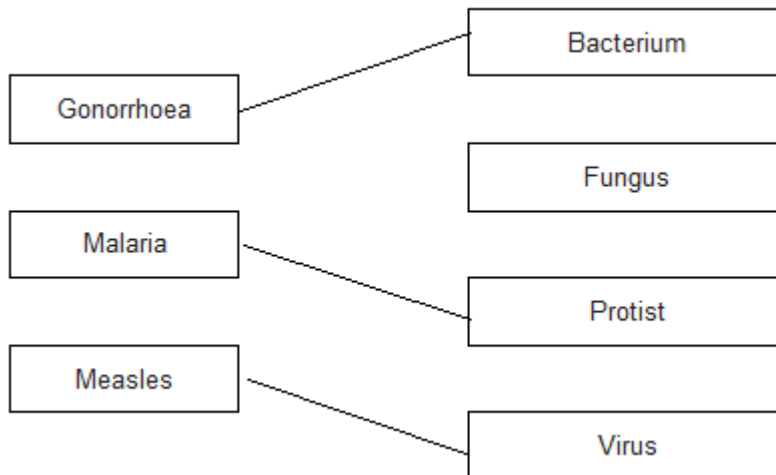
Tick (✓) **one** box.

Only the patients	<input type="checkbox"/>
Only the doctors	<input type="checkbox"/>
Both patients and doctors	<input type="checkbox"/>
Neither patients nor doctors	<input type="checkbox"/>

(1)  
(Total 6 marks)

### Mark scheme

**M1.(a)**



3

(b) (trachea) has mucus

1

to trap pathogens

1

(trachea) has cilia

1

to move mucus out of trachea

1

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- (c) **dependent variable:**  
number of times mosquitoes landed on socks 1
- control variable:**  
any **one** from:
- number of mosquitoes in each container
  - length of time socks worn
  - dampness of socks
  - same type of socks
  - size of container
  - time
  - temperature
  - species of mosquito
  - age of mosquito 1
- (d) use worn socks  
**or**  
use chemical from worn socks 1
- to attract / trap infected mosquitoes 1
- or accept:*  
*wear clean socks / change socks regularly (1)*  
*to reduce the chance of attracting mosquitoes (1)*
- (e) less chlorophyll present 1
- (so) less light absorbed 1
- (so) reduced photosynthesis  
**or**  
(so) less sugar / food made 1
- M2.(a)** toxins 1
- (b) (i) bacteria 1
- (ii) mutate 1
- (iii) new / different antibiotic  
*allow new / different drug*  
*do **not** allow vaccine* 1

[14]

[4]

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- M3.** (i) 2 of:  
ingest microbes; )allow higher level answers  
produce antibodies; )allow cause and effect  
produce antitoxins )eg antitoxins neutralise poisons = 2  
*each for 1 mark* 2
- (ii) injection of dead/weak microbes;  
stimulates antibody production;  
these can be produced again quickly on new infection  
**or** remain for long time to 'combat' new infection  
*each for 1 mark* 3 **[5]**
- M4.** the percentage of children vaccinated fell to zero in 1995 1
- but the number of children developing autism rose and fell during the period when % vaccinations was falling 1
- number of children developing autism peaked after MMR vaccination had ceased 1
- which suggests that something other than MMR vaccination was causing autism 1 **[7]**
- M5.** (a) testing for toxicity / see if it is safe /see if it is dangerous / to see if it works  
*ignore side effects unqualified* 1
- (b) (i) testing for side effects / testing for reactions (to drug)  
*ignore to see if it works*  
*do **not** accept dosage* 1
- (ii) any **one** from  
*ignore immune system*
- dose too low to help patient
  - higher risk for patient
  - might conflict with patient's treatment / patient on other drug
  - effect might be masked by patient's symptoms / side effects clearer 1



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(c) to find optimum dose

*allow testing on larger sample **or** it makes results more reliable*

*allow to find out if drug is effective /find out if drug works on ill people (not just if drug works)*

1

(d) (i) (tablet / drug / injection) that does not contain drug

*allow control / fake / false*

*allow tablet / injection that does not affect body*

*do **not** accept drug that does not affect body*

1

(ii) neither patients nor doctors

1

**[6]**