

A. Infection and Response part 1 – Communicable diseases (viral, bacterial, fungal and protist)

1. Tuberculosis (TB) is a communicable disease caused by a bacterium. TB is spread by droplets in the air when an infected person sneezes or coughs.

a) Suggest which organ will be infected first when a person contracts TB. (1)

Lungs

b) Explain why people who live in densely populated areas are more likely to be infected with tuberculosis than people who live in less densely populated areas. (3)

More people likely to be infected with TB in densely populated area

Greater chance of droplets containing TB being in the air

Greater chance of inhaling droplets containing TB and becoming infected

c) Give reasons why a person infected by a very small number of TB bacteria may not actually develop the disease. (2)

White blood cells produce enough antibodies rapidly to destroy pathogens

Before the pathogens can reproduce sufficiently to cause symptoms

2. Polio is a communicable disease caused by a virus. It can cause irreversible paralysis which often leads to death. The following data shows the number of cases reported and deaths in the UK.

Year	Total cases of Polio reported	Total deaths due to Polio
1959	1028	87
1960	378	46
1965	91	19
1968	24	15
1975	3	18
1985	4	29
1990	1	1
1996	1	1

a) Use the graph paper and a suitable method to display the data relating to deaths from polio using the table (Remember to add labels). (4)

- *Bar chart (1)*
- *Axis labelled correctly (1)*
- *Bars plotted correctly (1)*
- *Gap between the bars (1)*

b) Calculate the percentage decrease in deaths from 1959 to 1975. (2)

Give your answer to 2 significant figures.

Show your working:

$$\text{Actual decrease } 87-18 = 69$$

1 mark for showing working and mention of 69

$$69/87 = 0.79$$

1 mark for correct final answer

$$0.79 \times 100 = 79\%$$

.....%

c) Suggest an explanation for the fall in the number of reported cases between 1959 and 1960 (1)

Vaccination campaign began in 1959

People did not report as many cases to the authorities in 1960

d) Suggest why there are more deaths than reported cases in some years. (1)

People suffered with the disease for many months or years before they actually died

3. Measles is a highly infectious viral disease which can be fatal. Children are normally vaccinated at 1 year of age and then again at 3 years 4 months of age.

a) Explain how the disease spreads from one person to another (2)

Measles is spread via inhalation of droplets

From sneezes and coughs from an infected person

b) Suggest 2 explanations why children need a follow up vaccination at 3 years 4 months of age. (2)

Two from:

Vaccination may not be 100% effective

Child about to start to mix with lots of other children at Nursery or School

So chances of becoming infected are increased

4. Explain why plants with Tobacco Mosaic Virus (TMV) usually have stunted growth. (2)

Leaves become damaged and chlorophyll damaged so plant cannot photosynthesize as effectively

The plant does not produce enough glucose/sugar for optimum growth

5. Smoking can cause diseases such as cancer. Explain why this is not a communicable disease. (2)

Cancers caused by smoking cannot be passed from one person to another

The cancer is not caused by a pathogen

6. Extended response question:

A group of Year 12 students are going from a school in the UK to Central Africa. They have purchased insecticide treated malaria nets. Explain why these nets are more effective than non-insecticide nets.

Suggest what other control measures should be put in place and why they reduce the chance of becoming seriously ill with malaria. (6)

- Level 3 (5-6 marks)

All control measures named AND linked to explanations including detailed explanation regarding insecticide vs. non insecticide net effectiveness

- Level 2 (3-4 marks)

Most control measures named AND explanations given. Explanation regarding insecticide vs. non insecticide net effectiveness

- Level 1 (1-2 marks)

Simple explanation about why insecticide nets are more effective and some other control measures named

Biology content

Non insecticide treated nets prevent the human from being bitten

Insecticide treated nets prevent the human from being bitten and also kill the mosquito

This prevents the mosquito from breeding and increasing the mosquito population and/or biting another person possibly infecting them with malaria.

Research areas with high numbers of malaria cases before travelling

Avoid areas with high malaria cases to reduce chances of being bitten if possible

If these areas cannot be avoided make sure everyone knows the risks and to take further

precautions.

Wear long sleeved shirts and trousers to reduce the amount of exposed skin.

Keep windows and doors closed to prevent entry of mosquitoes

Use insect repellent to reduce the chances of being bitten

Take anti malaria drugs before travel and for up to four weeks after travel as it can take up to 4 weeks for the symptoms of malaria to show.

Get a test early on if you feel ill as treatment more effective if started early.

B. Infection and response part 1b - Human defence systems, Vaccination,

Antibiotics and painkillers

1. The Andaman Islands of India are very remote and remain untouched by modern civilization. A British expedition visited in order to carry out a survey of the islands. In a strategy to try and demonstrate friendliness, the expedition kidnapped an elderly couple and 4 children. The prisoners were taken to the mainland and given lots of food and gifts. After a couple of days, the prisoners were taken back to the Islands and released with gifts for the tribe.

The British expedition team was accused of starting a measles outbreak amongst the Andamese people. The outbreak killed the elderly couple and left many others very ill. Nobody on the expedition team was ill.

Explain how this could be possible.

(4)

2 marks for describing why the expedition team did not become ill and 2 marks for why the tribes people did become ill.

Expedition team may have been vaccinated against measles and so they were immune.

Expedition team may have suffered the disease themselves and developed immunity to measles.

Tribe people did not have any immunity to the measles virus

Expedition team may have been infected but did not show symptoms because their immune system made antibodies rapidly to destroy the measles pathogen before it had reproduced to sufficient quantities to cause symptoms to develop

Tribe people had no antibodies against measles as they had never been infected by the pathogen before.

It would take several days before the Tribe people's immune system would begin to have an effect on the pathogens. They would become ill.

The elderly couple died because their immune system was not as effective as a younger person.

Elderly couple and children were taken off the Island and they may have come into contact with other people who were infected with measles.

It takes a few days for the symptoms to be apparent and the elderly couple and children were back on the Island by this time.

- The measles vaccine is now combined with that for two other serious diseases - mumps and rubella. This is called the MMR vaccine. Measles can lead to serious complications such as pneumonia, blindness, miscarriage in pregnant women and inflammation of the brain (encephalitis).

The table below shows the risk of a complication occurring in children who have had the MMR vaccine and in unvaccinated children who get infected with measles.

Complication	Statistical Risk associated with the MMR vaccine	Statistical Risk associated with a measles infection
Diarrhoea	0	1 in 6 people
Ear Infection	0	1 in 20 people
Pneumonia	0	1 in 25 people
Fits (convulsions)	1 in 1000 people	1 in 200 people
Meningitis/encephalitis	1 in 100 000 people	1 in 1000 people
Severe allergic reaction	1 in 24 000 people	0
Death	0	1 in 5000 people
Serious brain complications	0	1 in 8000 people

Using the information from the table above and your own knowledge, describe the benefits to the individual, family and wider community of a parental decision to vaccinate their child and suggest why some parents may decide not to vaccinate their child. (5)

*Three benefits (1 mark each) to individual and family and wider community discussed
A reason (1 mark) given for why parents may choose not to vaccinate USING information from the table.*

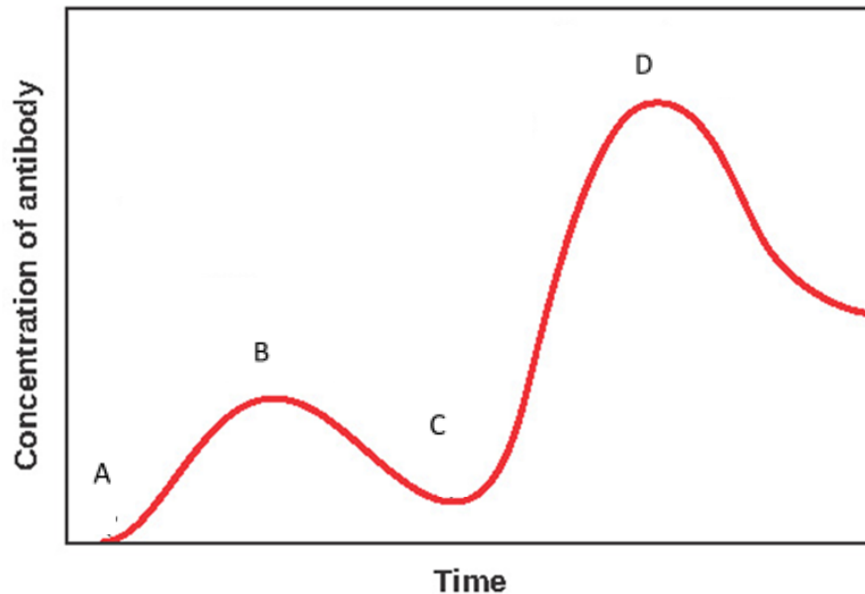
A reason (1 mark) given for not vaccinating which may or may not involve using data from the table.

Content:

	<i>Benefit of vaccination</i>	<i>Reason why a parent may decide not to vaccinate</i>
<i>Individual</i>	<p><i>Vaccine prevents measles for which there is no cure.</i></p> <p><i>5 x less likely to have a fit than someone who becomes infected with measles.</i></p> <p><i>Credit any other accurate use of data in table</i></p>	<p><i>Risk of child having a fit is 1 in 1000 (or any other use of data from table)</i></p> <p><i>Do not want child to have to go through having an injection</i></p> <p><i>Won't suffer a severe allergic reaction to the vaccine.</i></p> <p><i>Because most children are now vaccinated against measles it is rare.</i></p>
<i>Family</i>	<p><i>Will not have to take time off work to care for child sick or dying from measles.</i></p> <p><i>Will not see child suffer from measles.</i></p> <p><i>Anyone with a weakened immune system is not compromised.</i></p>	<p><i>Parents may feel vaccination is unnecessary now because of this.</i></p>
<i>Wider community</i>	<p><i>Less chance of an epidemic</i></p> <p><i>Child will not be a risk to others including pregnant women and those with weak immune systems.</i></p> <p><i>Will not use costly resources to care for measles infected child e.g. hospital</i></p> <p><i>Will be able to mix with other children and not be in danger if a measles</i></p>	

	<i>outbreak occurs.</i>	
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3. sketch graph shows the rate of antibodies production when a person becomes infected with the chicken pox virus. Annotate the graph below to describe what is occurring at each of the 4 stages of the immune response to the pathogen. (5)



Two from:

A = Initial infection by pathogen

White blood cells start to manufacture specific antibodies but slowly

The pathogen is reproducing and causing the symptoms of the infection

One from:

B = Large amounts of antibody have been released and this is destroying the pathogens

reducing their numbers

The infection is under control

White blood cells reduce the rate of antibody production

One from:

C = Secondary infection by pathogen occurs

White blood cells begin to produce antibodies rapidly to destroy the pathogen before it can reproduce in large numbers

One from:

D = Infection under control and the white blood cells reduce the rate of antibody production

Extended response question:

4. A salmon farm uses large quantities of antibiotics to increase fish production. Large numbers of salmon of similar ages are kept together in tanks.

Describe the economic benefits and drawbacks of this approach. (6)



- Level 3 (5-6 marks)

Detailed analysis of at least three economic benefits AND at least three drawbacks are provided in a clear, logical and coherent reasoned answer.

- Level 2 (3-4 marks)

A partial answer with at least two of the economic benefits and two drawbacks discussed with some reasoning.

- Level 1 (1-2 marks)

One or two benefits and/or one or two drawbacks are considered with little logical reasoning

Biological content:

Lots of fish in a small area means if one fish becomes infected with a bacterial disease, the disease spreads rapidly. (Drawback)

Keeping fish in densely populated tanks means it is easier to manage and more cost effective. (Benefit)

The dosage of antibiotics/food can be changed according to the age of the fish (Benefit)

People are unlikely to buy fish if they are diseased (Drawback)

The disease may reduce how well the fish grow (Drawback)

The farmer will receive less income for small/diseased fish (Drawback)

Antibiotics kill bacterial pathogens (Benefit)

The farmer will make more profit if he has healthy large fish to sell. (Benefit)

The fish may not need antibiotics and so it is an unnecessary cost (Drawback)

The fish may contract a viral disease which will not be treated by costly antibiotics (Drawback)

It is not expected at this point that most students will link the overuse of antibiotics to development of bacterial resistance as this has not been taught in detail. There is a link to this in the specification so it is possible students may include this in their answer and this should be credited.

By using lots of antibiotics the farmer may increase the chance of bacterial resistance developing. (Drawback)

C. Infection and Response part 2 – Discovery and development of Drugs, Monoclonal antibodies (HT Biology only)

1. Why in the past might people have chewed on the bark of a willow tree if they had a headache? (2)

Aspirin is found naturally occurring here

It is a painkiller

2. a) Drug trials are used to find out about dosage.

Why is this important both to the patient and economically? (2)

1 mark relating to the patient:

The dose is sufficient to treat the disease without being toxic

The dose does not give undesirable side effects

1 mark relating to economic importance:

To use the least amount of drug to get the maximum effect to save costs

- b) In the initial stages of a clinical trial a low dose of the drug is used on healthy volunteers.

Suggest why this is not used with patients at this point. (2)

Patients need to take their prescribed drug which has been proved to be effective for their condition - their condition may get worse if they are not taking this medication

The new drug may have side effects that patients can't cope with because they are unwell.

3. Traditionally drugs were extracted from plants or micro-organisms. Most new drugs are now made in a laboratory but the initial starting point may still have been a naturally occurring chemical in a plant.

Suggest why it is advantageous to use synthetic drugs rather than extracting it from a plant. (2)

Can produce the drug faster and in sterile conditions in laboratory

Plant drug has to be purified first.

Lots of space is needed to grow enough plants to make it worthwhile.

4. Some people have severe allergic reactions to monoclonal antibodies. Why might this occur? (2)

Monoclonal antibodies come from mouse tissue

Some humans may be allergic to mice

5. Extended response question: (Biology HT only)

Evaluate the personal benefit of using monoclonal antibodies for diagnostic testing (6)

- **Level 3 (5-6 marks)**

A clear, logical and coherent answer which shows the student understands the benefits of monoclonal antibodies to individuals.

- **Level 2 (3-4 marks)**

A partial answer with some discussion of the benefits to an individual

- **Level 1 (1-2 marks)**

One or two relevant points but concentrates more on how monoclonal antibodies are produced or work which is not relevant.

Biology Content:

Pregnancy test kits - easy to use, readily available and accurate indicator of pregnancy

No need to consult a GP

Can start to take care of health of fetus from day one

Use to identify certain chemicals in blood or urine quicker and less invasive than traditional methods, e.g. early indication of prostate cancer, illegal drug use in horses and athletes.

STD testing done without embarrassment of attending a clinic. Get early treatment if positive

result and reduce spread of STD potentially.

D Infection and Response – part 3 Plant Disease (Biology only)

1. Suggest how the following plants have evolved to defend themselves against pathogens and herbivores. (6)



Leaves curl when touched.

Any insects on the leaves then fall off so less likely to be damaged and allow pathogens entry.

Movement makes the animals wary and so they move away.



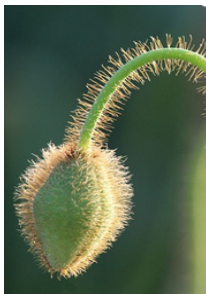
This acacia plant has hollow thorns which are colonised by ants.

Thorns are sharp and so deter the herbivores as they are painful to touch and eat.

Thorns are large in comparison to leaves so very obvious.

Ants live inside the thorns and if the thorns are disturbed the ants may attack. This puts off other insects/herbivores from eating the leaves and allowing pathogens entry into the plant.

Cody Hinchliff 2004 - English Wikipedia



Hairy stems and leaves deter animals and insects as may contain a chemical - like nettles which sting or be like fine thorns e.g. in a cactus.

May make animals and insects think the plant is unhealthy and starting to rot.

Deters insects from laying eggs so young larvae won't eat leaf etc.

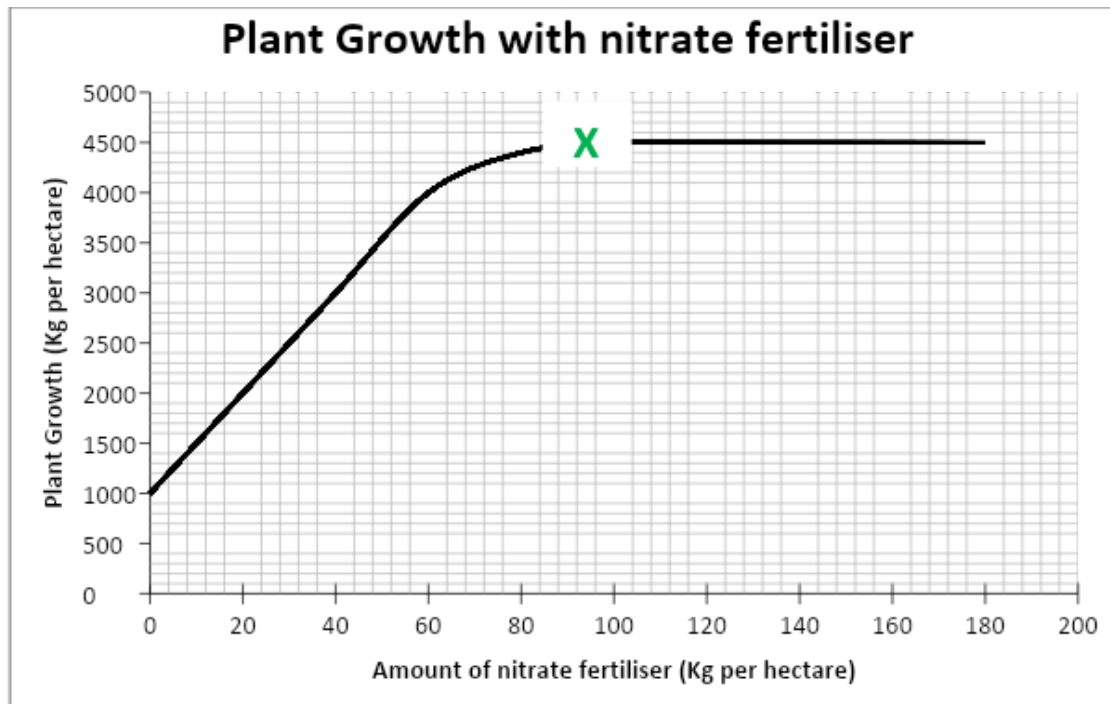
2. Describe why a tree needs magnesium ions for healthy growth. (3)

Magnesium is required for the production of chlorophyll.

A deficiency in magnesium ions will lead to chlorosis and so plant will not photosynthesize efficiently

Resulting in poor growth.

3. An agricultural student was conducting research into the most effective amount of nitrate fertiliser needed to gain the maximum plant growth using a computer modelling programme. Here is a graph of the results.



- a) Mark on the graph (with an X) the point at which nitrate ions no longer limit plant growth.

Explain why you chose this position for X. (2)

X placed in correct position (1)

After X (90 Kg per hectare) however much the amount of nitrate fertiliser is increased there is no further increase in plant growth. Another factor is now limiting the rate of plant growth.

- b) Calculate the percentage increase in plant growth when the amount of fertiliser is increased from 20kg per hectare to 70kg per hectare. Show your working. (2)

$$4250 - 2000 = 2250 \text{ change}$$

$$2250 / 2000 = 1.125 \times 100 = 112.5\%$$

- c) Why does the model indicate that plants still grow when nitrate ions are not being added? (1)

Nitrate ions present in the soil already so growth will still occur.

Some candidates may know about nitrogen fixing bacteria in soil/nitrification/organic material on soil but this is not expected as it has not yet been taught. These answers are to be credited as



correct.

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- d) Suggest a reason why these results would not be immediately transferable to all farms in the UK. (1)

**Amount of nitrate ions in the soil already may be very different.
Different climate/weather/soil type**

4. Rose black spot is a fungal disease.



- a) Describe how the plant became infected with rose black spot disease. (2)

Rose black spot is a fungal disease

Its spores are spread by wind

Or in water drop splashes when it rains.

- b) Suggest what the benefits are to the rose plant of its leaves turning yellow and dropping off once they become infected? (2)

Damaged leaf could be reducing light to other healthier leaves

Yellow leaves have had useful substances removed before the infected leaf is excreted so the materials can be reused

The infected leaves fall off to protect the rest of the plant.

- c) What can a gardener do to reduce the risk of more rose plants becoming infected with rose black spot disease? (3)

Remove all infected leaves and plants

Burn the leaves/plants to destroy any spores

Treat all rose plants with fungicide

Plant disease resistant varieties