

OCR GCSE GATEWAY BIOLOGY A • J247

BIOLOGY



EXAM QUESTION PACK

B6.3 MONITORING AND MAINTAINING HEALTH (PACK 1)

SCORE

/249

PERCENTAGE

%

STEMUP

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Gateway Biology A (9-1)

Monitoring and maintaining health

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:

Additional resources may be supplied with this paper.

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate
forename

Candidate
surname

Centre number

Candidate number

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **249**.
- The total number of marks may take into account some 'either/or' question choices.

1 Different diseases are caused by different pathogens.

Which type of pathogen causes tobacco mosaic disease?

- A a bacterium
- B a fungus
- C a virus
- D a protist

Your answer

[1]

2 What may a vaccine contain?

- A small numbers of live harmful microbes
- B dead microbes
- C antibiotics specific to the microbe
- D memory cells

Your answer

[1]

3 Scientists want to make human stem cells from body cells rather than getting stem cells from embryos.

Why is this?

- A Stem cells cannot be found in human embryos.
- B Some people object to destroying human embryos.
- C The cells in human embryos are all differentiated.
- D Human embryos are single-celled.

Your answer

[1]

4 New drugs are tested on humans, animals and tissues.
In which order are they tested?

- A tissues – humans – animals
- B humans – animals – tissues
- C animals – tissues – humans
- D tissues – animals – humans

Your answer

[1]

5 Why is it difficult to kill cancer cells in the body?

- A They are foreign cells that are not destroyed by antibiotics.
- B They are body cells and so the body's defence system does not attack them.
- C They hide inside other body cells away from the body's defences.
- D They divide very slowly.

Your answer

[1]

6 Heart disease affects a large number of people.

Which of these factors contributes to heart disease?

- A lack of exercise
- B low fat diet
- C being a non-smoker
- D not drinking alcohol

Your answer

[1]

7 Look at the table.

It shows the death rates from coronary heart disease (CHD) in the UK in 2008.

Death rates from CHD per 100,000 population			
Age 55–64		Age 65–74	
men	women	men	women
175	47	443	179

In 2008 the total number of deaths per 100 000 in both age ranges was 844.

What percentage of these deaths were women?

- A 5.6%
- B 21.2%
- C 22.6%
- D 26.8%

Your answer

[1]

8(a) Different parts of the body's have natural defence mechanisms to stop pathogens infecting the body.

These defences include:

- skin
- tears
- secretions from the stomach.

Describe how each defence stops pathogens infecting the body.

[4]

- (b) Sometimes the body's defence mechanisms do **not** work and pathogens enter the body.
They may then be treated with antibiotics.

What is an antibiotic?

[2]

- (c) Probash is ill and is having tests in hospital.

His doctors monitor his body temperature frequently.

Explain why it is important to monitor Probash's body temperature frequently.

[2]

- (d) Probash's doctors want to check that the bacteria causing his illness are not resistant to the antibiotic erythromycin.

They set up an experiment to test this.

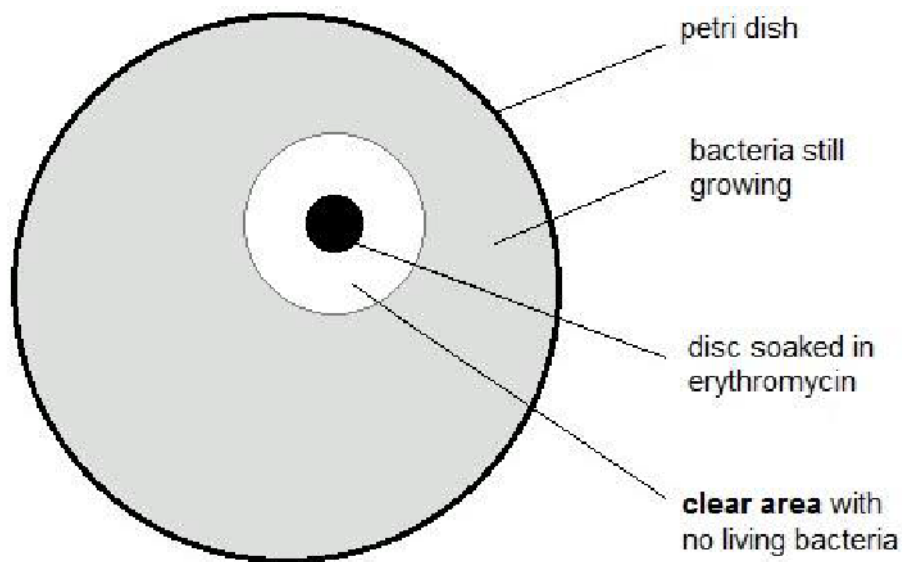
This is the method they use:

- a petri dish is made that has the bacteria growing evenly over the surface
- a disc of filter paper is soaked in erythromycin
- the disc is placed on the agar in the centre of the petri dish
- the lid of the dish is fixed on with a piece of tape
- the dish is then incubated.

- (i) Why did the doctors tape the lid on the petri dish?

[1]

- (ii) The diagram shows the doctor's results.



Use a ruler to measure the diameter of the **clear area** in mm.

Use this diameter to calculate the area of the circle where there are no living bacteria.

(the area of a circle = πr^2 and $\pi = 3.14$)

area = _____ mm²

[3]

(iii) This table is used to analyse the results of the experiment.

Area clear of bacteria including the area of the disc (mm ²)	Level of resistance
less than 133	resistant
133 to 416	intermediate resistance
more than 416	not resistant

Use your result from part (ii) to judge the level of resistance in the microbe.

----- [1]

9(a) Rheumatic fever is a rare disease in the UK.

Look at this information.

Rheumatic fever information leaflet

Bacteria can enter the mouth and cause sore throats.

This may develop into rheumatic fever.

Rheumatic fever is much more likely if a person does not get enough food or lives in overcrowded conditions.

White blood cells in the body make protein molecules to kill these bacteria.

However, sometimes these molecules attack heart valves making them leaky.

(i) Put ticks (✓) in the **two** boxes that best describe rheumatic fever.

a communicable disease	
a disease that is caused by defective alleles	
a non-communicable disease	
a disease that is affected by lifestyle	

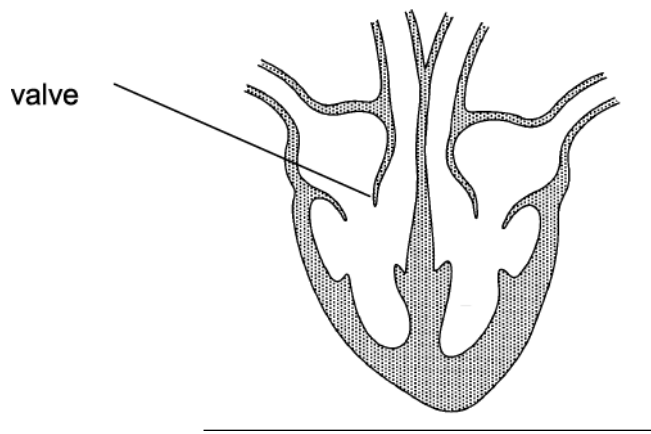
[1]

(ii) White blood cells make protein molecules to kill the bacteria.

What is the name of these protein molecules?

-----[1]

(iii) The diagram shows one of the valves that can be made leaky by rheumatic fever.



People who have this leaky valve often have these symptoms:

- they get out of breath easily
- they do not seem to have much energy and feel tired.

Write about the job of this valve and how damage to it may cause these symptoms.

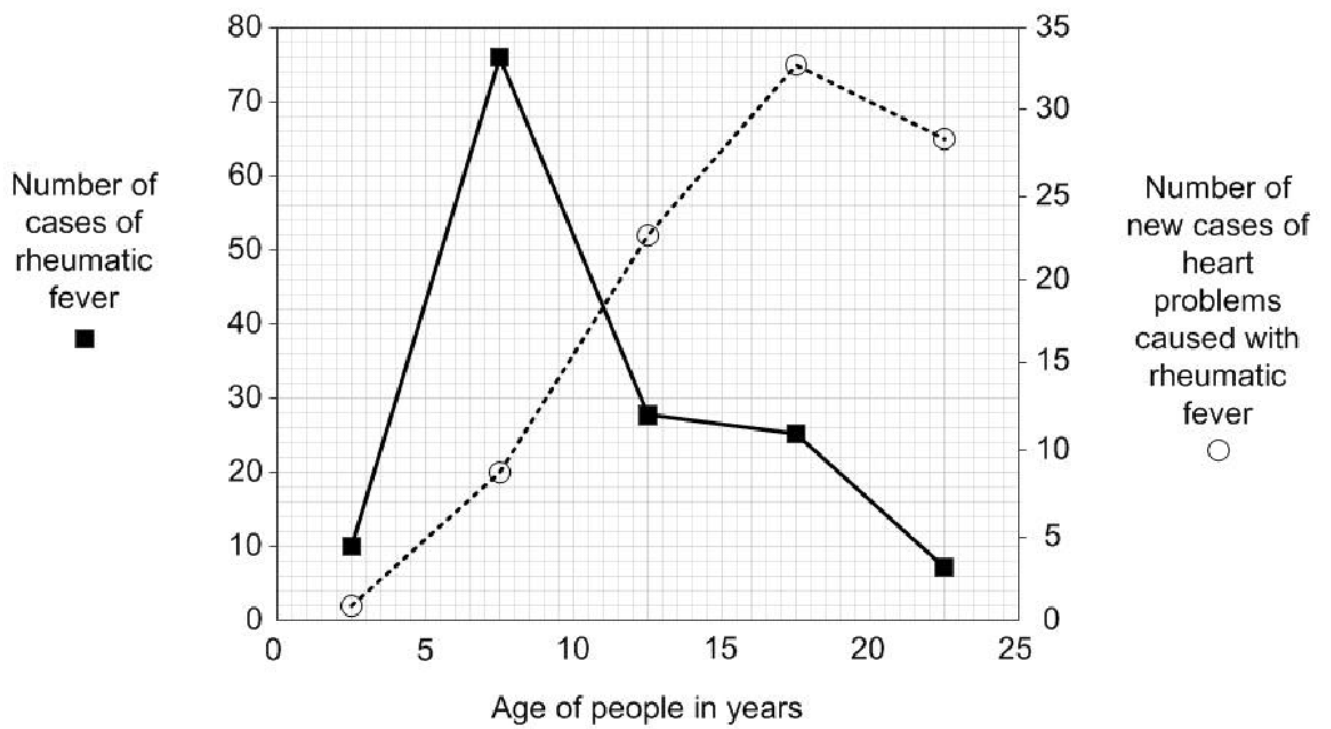
[4]

(b) Look at the graph.

It gives data about people of different ages in one area.

It shows the number of cases of rheumatic fever.

It also shows the number of new cases of heart problems caused by rheumatic fever.



(i) At what age do you most commonly find people with rheumatic fever?

answer = _____ years

[1]

(ii) How many years after getting rheumatic fever is it most common to get heart problems?

How can you tell this from the graph?

[2]

10 Different diseases are caused by different pathogens.

Which row in the table shows the type of pathogen that causes each disease?

	HIV / AIDS	Tobacco Mosaic Disease
A	virus	virus
B	bacterium	virus
C	bacterium	fungus
D	virus	fungus

Your answer

[1]

11 Which of these examples of human defence mechanisms against disease is non-specific?

- A antibodies in the blood system
- B memory cells
- C hydrochloric acid in the stomach
- D lymphocytes

Your answer

[1]

12 New medicines are tested before they can be used.

There are people that object to some forms of testing.

Which form of testing is likely to cause the **least** objection?

- A animal testing
- B computer simulation testing
- C human tissue testing
- D microbial testing

Your answer

[1]

13 Stem cells are used in treating some medical conditions because they:

- A are unspecialised
- B bind to and immobilise pathogens
- C destroy cancer cells
- D differentiate into many different types of cell.

Your answer

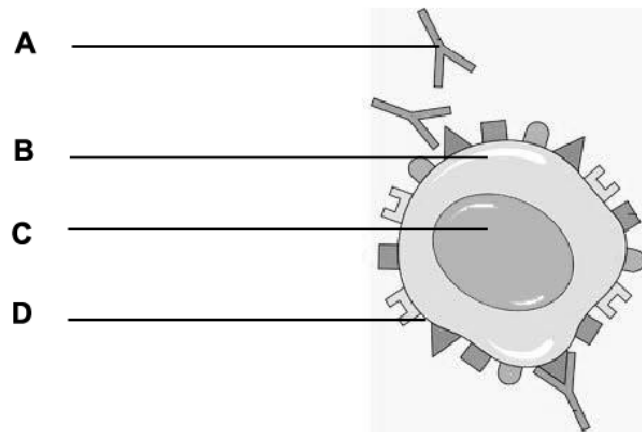
[1]

14 Monoclonal antibodies can be used to treat some kinds of cancer.

Look at the diagram of a cancer cell.

It is being treated using monoclonal antibodies.

Which label, A, B, C or D, shows the monoclonal antibodies?



Your answer

[1]

15 Scientists have tested the genes of a number of people who have diabetes.

They have found that there are about four different versions of a gene that can cause diabetes.

Why might this discovery be important?

- A Diabetes cannot be treated at the current time.
- B Different patients with diabetes can be given different drugs.
- C All types of diabetes can be treated by changing the diet.
- D Glucagon injections will be able to treat these four types of diabetes.

Your answer ☐

[1]

16(a) Erythromycin is an antibiotic drug.

What is an antibiotic?

[2]

(b) It is important to get the dose of erythromycin right.

Too much erythromycin can be harmful.

However, recently some strains of bacteria have developed resistance to low concentrations of erythromycin.

To see how effective erythromycin is, it is tested using bacteria grown on agar plates.

This method is used:

- A petri dish is used that has the bacteria growing evenly over the surface.
- A disc of filter paper is soaked in erythromycin.
- The disc is placed on the agar in the centre of the petri dish using sterile forceps.
- The dish is incubated at 37°C.

(i) Why did the scientists incubate the dish at 37°C rather than at higher or lower temperature?

----- [2]

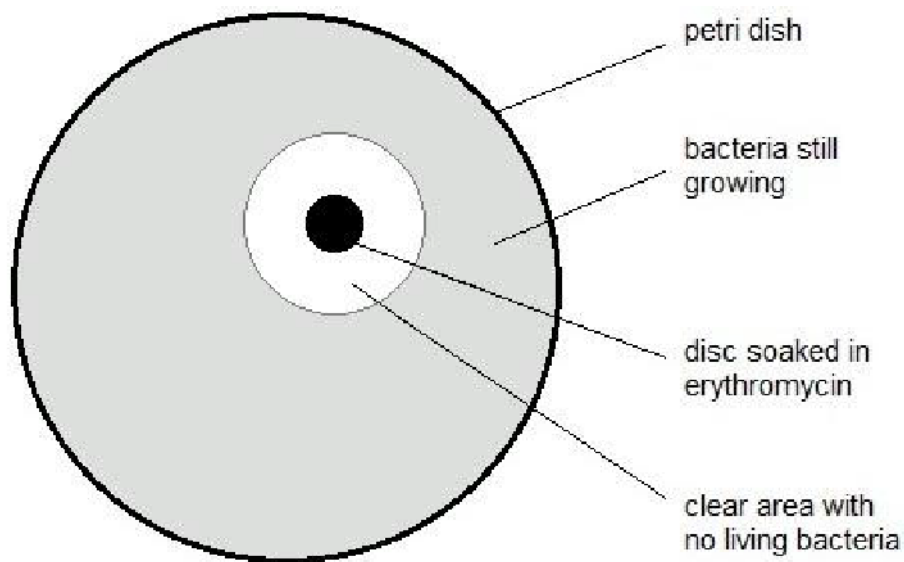
(ii) Why is the filter paper disc moved using sterile forceps?

----- [1]

(c)

(i)

The diagram shows the actual size of the dish after incubation.



This table is used to analyse the results of the experiment.

Area clear of bacteria including the area of the disc in mm ²	Level of resistance
less than 133	resistant
133 to 416	intermediate resistance
more than 416	not resistant

Use the results of the experiment and the table to judge the level of resistance in this strain of bacteria. (The area of a circle = πr^2 and $\pi = 3.14$.)

answer = _____ mm²

[3]

(ii) Suggest any limitations to measuring the level of resistance with this method.

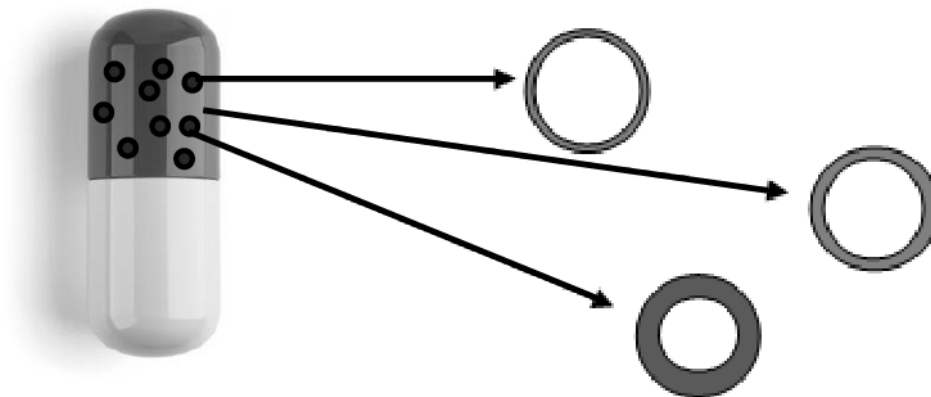
[2]

(d) Erythromycin is usually given to patients in a capsule.

The capsule has lots of small spheres containing the drug.

The walls of the spheres are different thicknesses.

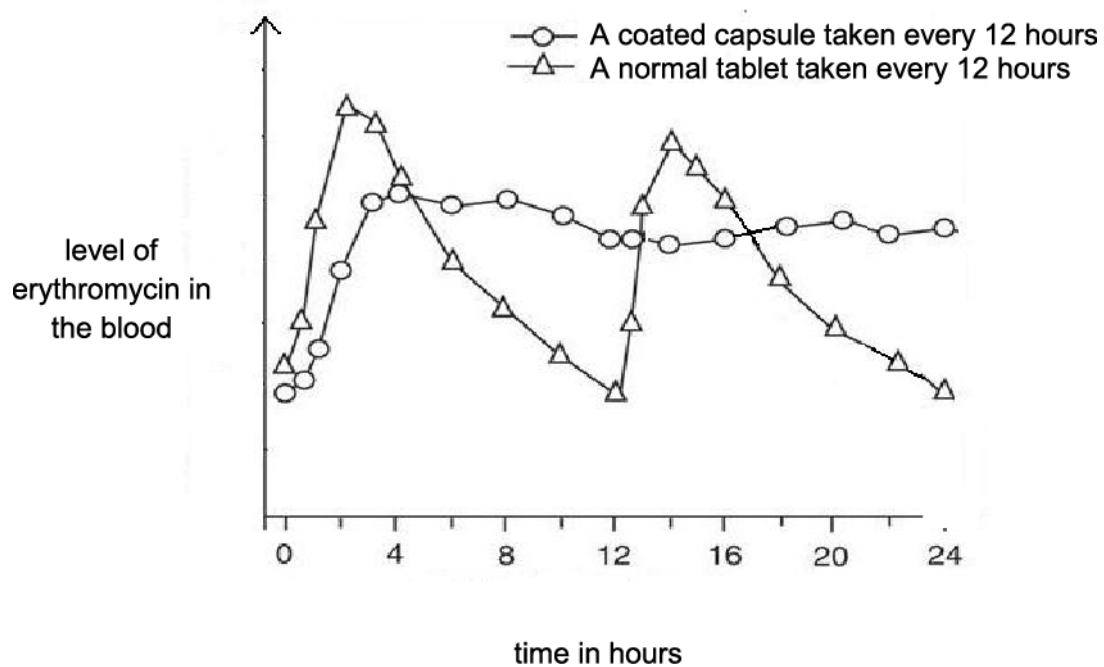
They are made of a carbohydrate polymer.



(i) Explain why the drug is released from the spheres in the small intestine.

[2]

(ii) * The graph shows the levels of erythromycin in the blood when given using this capsule and in a normal tablet.



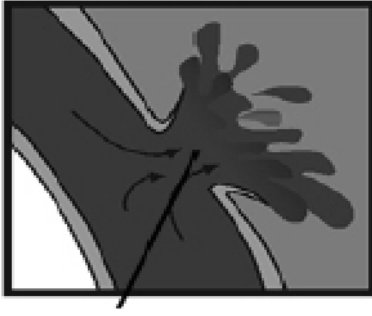
Explain the shape of the two graphs and why it is better to give erythromycin in capsules.

[6]

17 Strokes are a type of cardiovascular disease.

One cause of a stroke is an artery in the brain bursting.

Hemorrhage



Blood bursts through wall

Strokes can have many risk factors.

Scientists are trying to investigate whether the risk of having a stroke is increased by pollution.

They looked at data from 28 different countries, involving six million people.

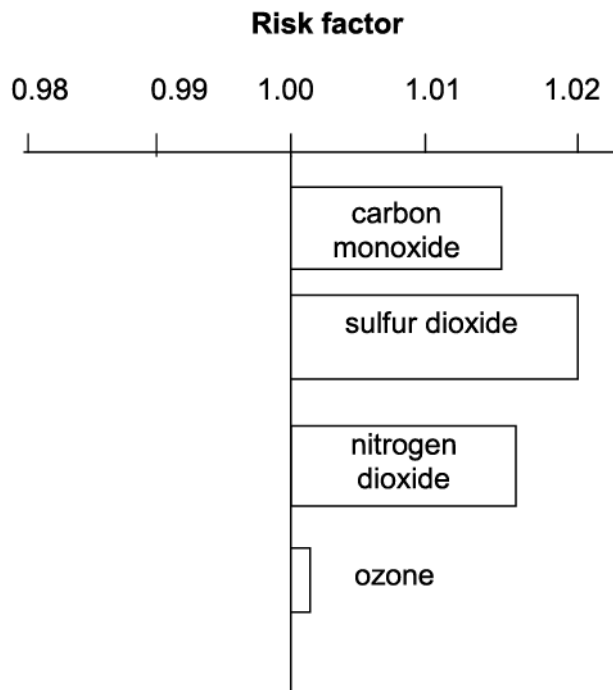
They looked at the number of people who had a stroke soon after an increase in pollution.

They compared this to the number of people who had a stroke after no increase in pollution.

This formula was used to produce a risk factor:

$$\text{risk factor} = \frac{\text{number of people who had a stroke soon after an increase in pollution}}{\text{number of people who had a stroke after no increase in pollution}}$$

The graph shows their results.



- (i) If the risk factor for a pollutant was 1.00, what conclusion could the scientists make?

----- [2]

- (ii) Which pollutant is least likely to be a risk factor for a stroke?

----- [1]

- (iii) The risk factors calculated by the scientists are quite small.

However, they still think that pollution is an important factor in strokes.

How did the nature of the data they used help to convince them of this?

----- [2]

18(a) Singapore is a small country.

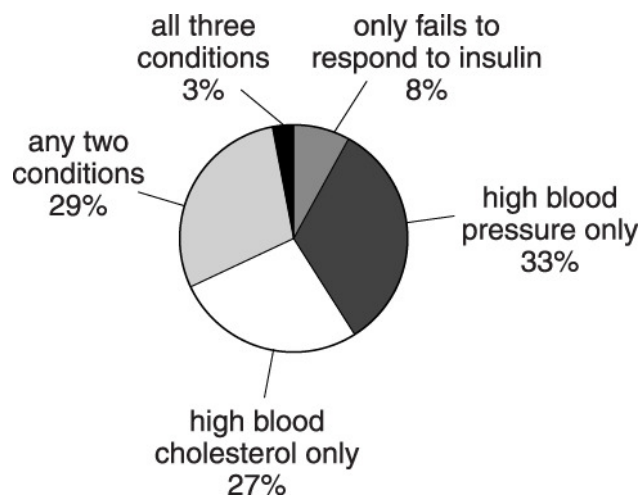
Everyone living in Singapore was offered a health check to test for three conditions.

They were tested:

- for high blood pressure
- for high levels of blood cholesterol
- to see if they failed to respond to insulin.

The check found that one million people had at least one of these conditions.

The pie chart shows the results for these one million people.



The government is worried about the possible consequences of these results for many of the people.

Explain the most serious consequences of these results for the health of the people.

Use calculations to support your answer.



The quality of written communication will be assessed in your answer to this question.

-----[6]

(b) It is **not** possible from the pie chart to work out how many of the one million people have high blood pressure.

Explain why.

-----[1]

19 Singapore is a small country.

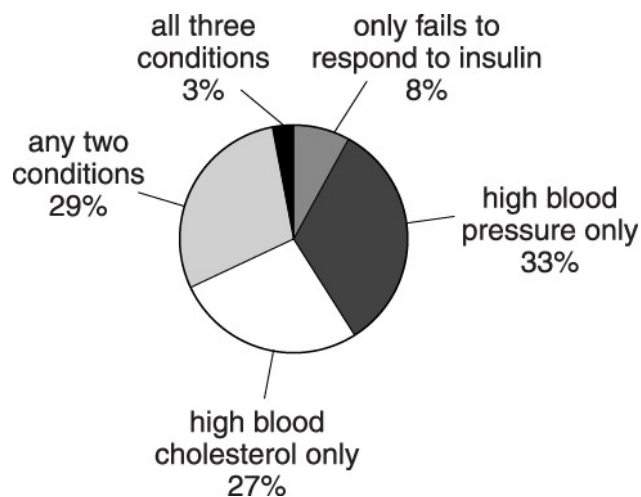
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They were tested:

- for high blood pressure
- for high levels of blood cholesterol
- to see if they failed to respond to insulin.

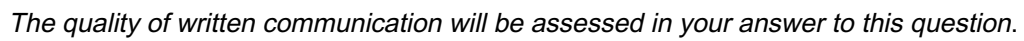
The check found that one million people had at least one of these conditions.

The pie chart shows the results for these one million people.



The government is worried that large numbers of people may develop serious diseases.

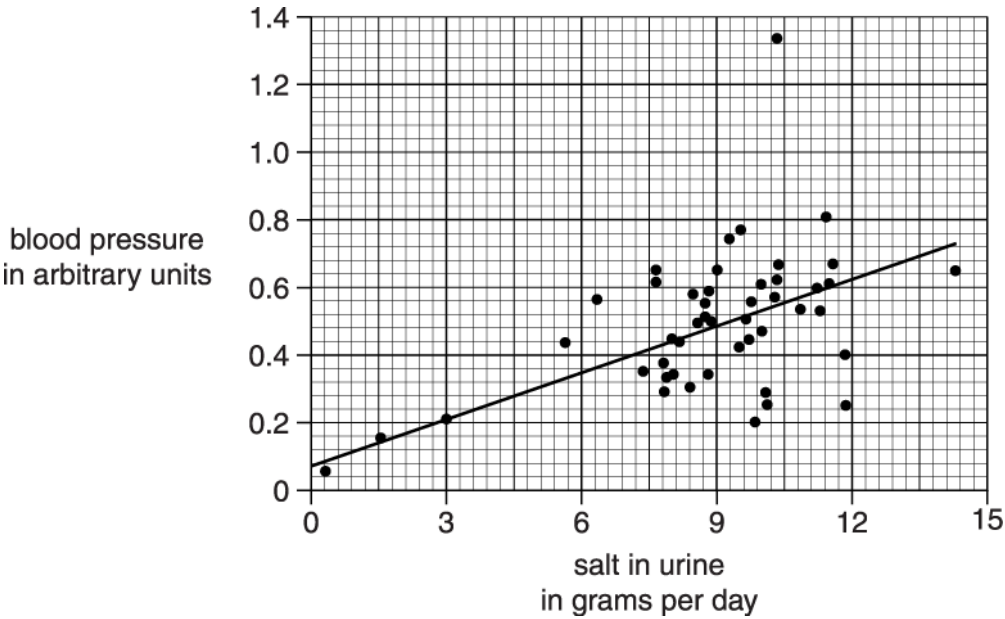
In your answer, include the links between the conditions tested for and the diseases they may cause. Include calculations to support your answer.



[6]

20 More salt in the diet gives a higher amount of salt in the urine.

Look at the graph.
It shows the relationship between the amount of salt in urine and blood pressure.



Nicola wants to avoid having too much salt in her diet.
Use the information in the graph and your scientific knowledge to explain why.

[2]

21 The table shows information about the contents of two types of sausage.

All the figures are for 100 g of the sausages.

	Pork sausages	Vegetarian sausages
		
protein in g	10	9
fat in g	22	8
carbohydrate in g	10	13
fibre in g	0	6

A boy makes two comments about eating vegetarian sausages rather than pork sausages.



I think that eating vegetarian sausages is better overall for your health.

They contain less fat and fat is linked to developing heart disease.

For each of the boy’s comments write about whether it contains scientific **facts** or just **opinion**.

[2]

22(a) Read this article about a disease that occurs in South America.

Doctors concerned about spread of disease

Zika is a disease that is caused by a virus.

It is spread by mosquitoes.

In most people the disease is quite mild.

However, there is evidence that in pregnant women it can slow the growth of the baby's brain.

The disease cannot be treated by antibiotics.

Scientists are trying to develop a vaccine for the zika virus.

The mosquito spreads zika but the disease is caused by a virus.

What word is used to describe the role of the **virus** in this disease?

Put a **ring** around the correct answer.

- antiviral
- pathogen
- protozoa
- vector

[1]

(b) The human body has defences against the entry of microorganisms that cause disease.

Describe **two** of these defences and explain why they can **not** stop the zika virus.

[3]

(c) Scientists are trying to develop a vaccine for the zika virus.

Explain why vaccines are tested before they are used on the whole population.

[2]

23

The table shows two components of blood.

Component	Job
red blood cells	-----
platelets	-----

Complete the table by writing the jobs in the empty boxes.

[2]

24 The table shows information about the contents of two types of sausage.

All the figures are for 100 g of the sausages.

	Pork sausages 	Vegetarian sausages 
energy in kJ	1200	740
protein in g	10	9
fat in g	22	8
carbohydrate in g	10	13

A boy makes two comments about eating vegetarian sausages rather than pork sausages.



I think that eating vegetarian sausages is better overall for your health.

They contain less fat and fat is linked to developing heart disease.

For each of the boy’s comments write about whether it contains scientific **facts** or just **opinion**.

[2]

25(a) Read this article about a disease that occurs in South America.

Doctors concerned about spread of disease

Zika is a disease that is caused by a virus.

It is spread by mosquitoes.

In most people the disease is quite mild.

However, there is evidence that in pregnant women it can slow the growth of the baby’s brain.

The disease cannot be treated by antibiotics.

Scientists are trying to develop a vaccine for the zika virus.

Scientists are making a vaccine against this virus.

Explain what the vaccine is likely to contain and how it will work.

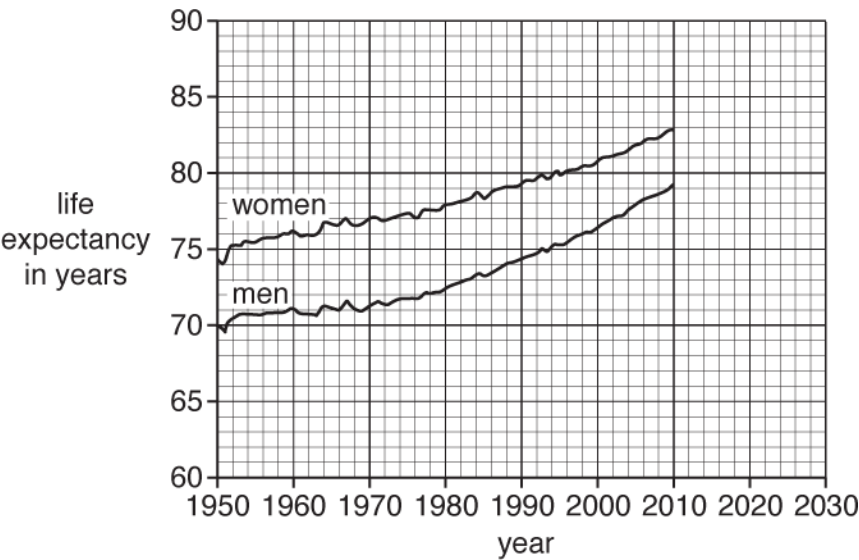
[3]

(b) When scientists develop new medicines they test the medicine in trials using placebos.

What is a **placebo** and why is it used?

[2]

26(a) The graph shows how life expectancy has changed in England and Wales from 1950 to 2010.



Suggest **two** reasons for the change in life expectancy since 1950.

[2]

(b) Continue the two lines on the graph to predict the life expectancy ages in 2030.

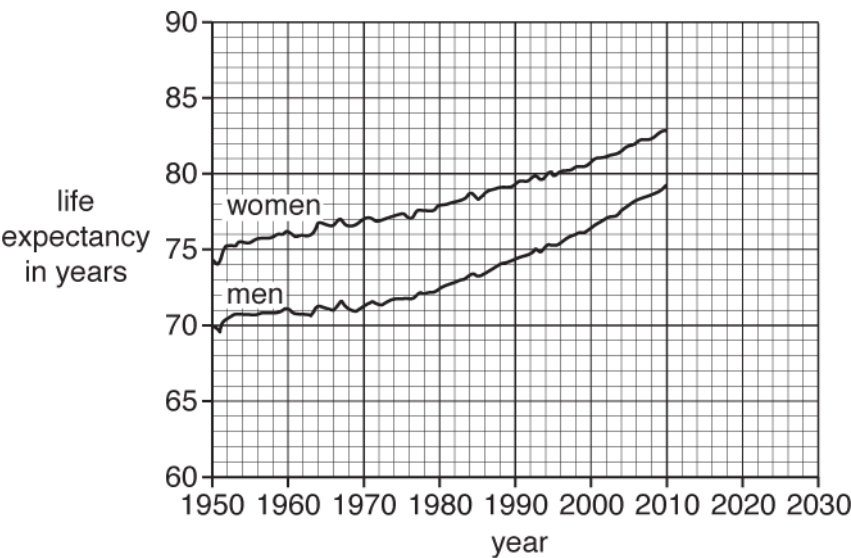
(i) Write down **two** conclusions about the predicted life expectancies in 2030.

[2]

(ii) Suggest **one** reason why any prediction may **not** be correct.

[1]

27(a) The graph shows how life expectancy has changed in England and Wales from 1950 to 2010.



Suggest **two** reasons for the change in life expectancy since 1950.

----- [2]

(b) Continue the two lines on the graph to predict the life expectancy ages in 2030.

(i) Write down **two** conclusions about the predicted life expectancies in 2030.

----- [2]

(ii) Suggest **one** reason why any prediction may **not** be correct.

----- [1]

28 Tears and stomach juices are important in the body's response to pathogens.

	Tears	Stomach juices
A	Acid	Antibiotics
B	Antibiotics	Antibodies
C	Antibodies	Lysozyme
D	Lysozyme	Acid

Which row of the table correctly describes what substances are found in tears and stomach juices?

Your answer

[1]

29 Which statement describes how vaccines work?

- A Cause the body to produce antibodies.
- B Cause the release of antigens.
- C Contain antiviral drugs.
- D Make platelets more active.

Your answer

[1]

30 Which is a **chemical** defence of plants?

- A Antimicrobial substances
- B Cell walls
- C Leaf cuticles
- D Thorns

Your answer

[1]

31 Retinitis pigmentosa is a genetic condition.

It is caused by a mutation to a gene. This mutation produces a recessive allele.

If people have retinitis pigmentosa then the cells in their retina are damaged.

(i) Scientists want to use stem cells as a treatment for this condition.

Why might stem cells be able to repair the retina?

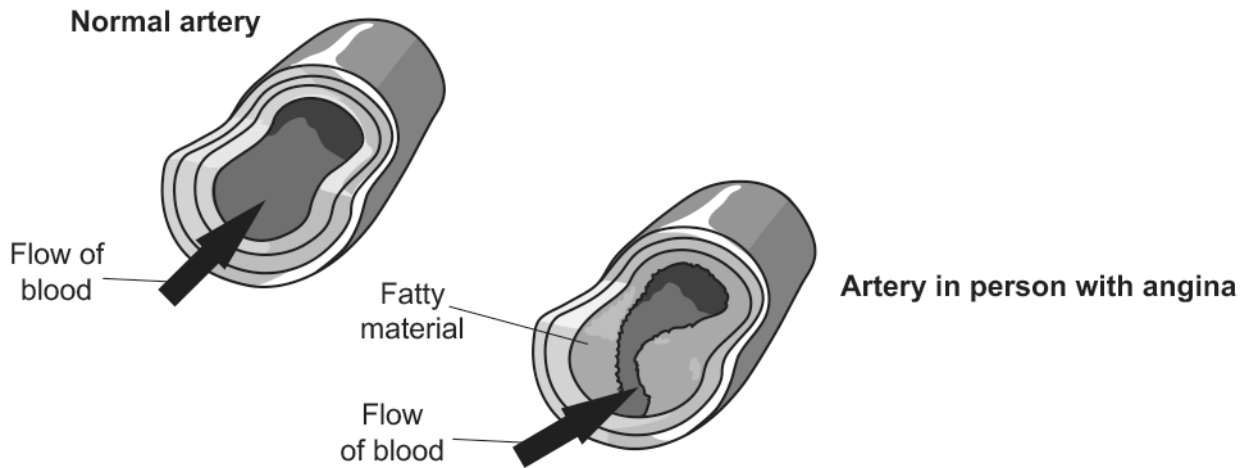
----- [2]

(ii) Write down **two** reasons why medical treatments are tested on animals first.

----- [2]

32(a) Angina is caused by a problem in the arteries that supply the heart muscle.

Fatty material (cholesterol) builds up in these arteries.



In angina the heart muscle starts to carry out anaerobic respiration.

Explain why this happens.

Use the information in the diagram and your biological knowledge.

[3]

- (b) Angina is often the first sign of a disease called coronary heart disease (CHD).

The table is used to estimate the risk of getting CHD. The more points a person scores, then the higher the risk of getting CHD.

Risk factor	Number of points		
	1	2	3
Age in years	<20	21–30	31–40
Blood cholesterol level	Low	Medium	High
Number of cigarettes smoked per day	0	1–10	11–20
Mass	Below average	Average	Above average
Number of parents with coronary heart disease (CHD)	0	1	2

- (i) How many points are scored by smoking 20 cigarettes a day?

-----[1]

- (ii) What is the effect of age on the chance of getting CHD?

-----[1]

- (iii) Here is some information about two people.

Person A
25 years old
Non-smoker
Low blood cholesterol level
Average mass
One parent with CHD

Person B
19 years old
Smokes 20 cigarettes a day
Low blood cholesterol level
Below average mass
No parents with CHD

Use the table to work out whether Person A or Person B is most likely to develop CHD.

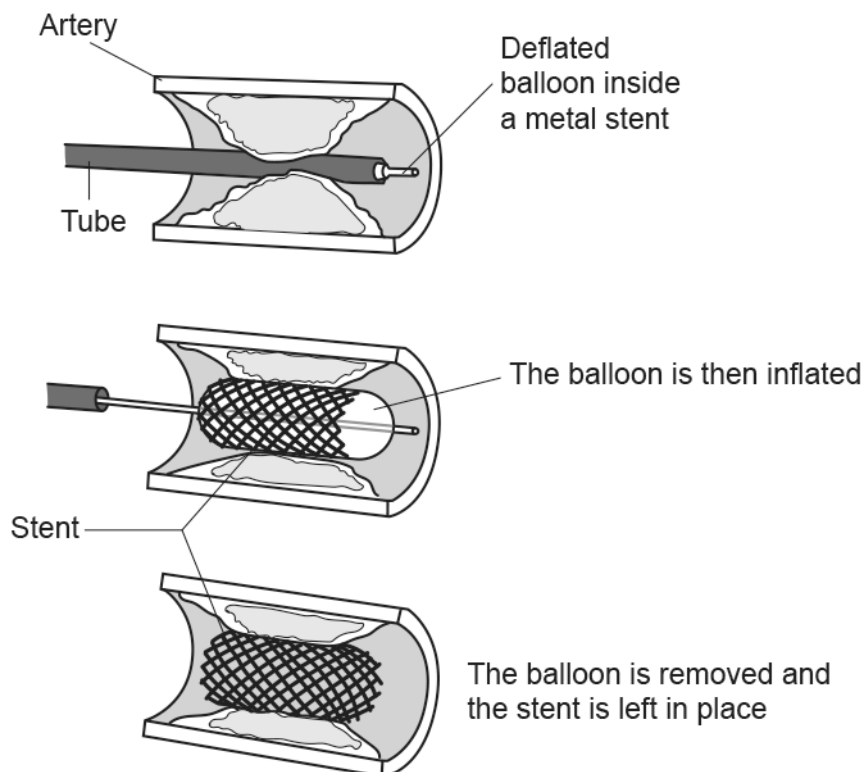
Show how you worked out your answer.

[3]

(c) There are several treatments for coronary heart disease (CHD).

One of these is an operation.

In this operation, doctors insert a metal grid called a stent into the artery.



(i) Look at the diagram.

Why does using a stent help treat CHD?

----- [2]

(ii) Taking a drug called statins is a treatment for CHD.

The drug is taken every day and lowers the level of cholesterol in a person's blood.

Suggest one **advantage** and one **disadvantage** of taking statins.

Advantage -----

Disadvantage -----

[2]

33 Which is a **chemical** defence of plants?

- A Antimicrobial substances
- B Cell walls
- C Leaf cuticles
- D Thorns

Your answer

☐

[1]

34 Which is the **most** effective treatment for HIV?

- A Antibiotics
- B Antigens
- C Antiseptics
- D Antivirals

Your answer

[1]

35 Heart disease kills thousands of people in Britain every year.

Why is it difficult to decide why a person gets heart disease?

- A Heart disease is caused by the interaction of many factors.
- B It is not possible to measure any of the risk factors.
- C Many microorganisms cause heart disease.
- D There is no genetic link to heart disease.

Your answer

[1]

36 Which of these is an adaptation of white blood cells?

- A The ability to make clotting enzymes.
- B They can change their shape to pass out of capillaries.
- C They can synthesise antibiotics.
- D They lack a nucleus.

Your answer

[1]

37 Females aged between 12 and 13 are offered a vaccination for the human papilloma virus (HPV).

Which statement describes the reason for offering this vaccine?

- A Contracting HPV greatly increases the risk of developing AIDS.
- B Having the vaccination will prevent cervical cancer.
- C HPV can be treated with antibiotics but cervical cancer cannot.
- D HPV has been linked to about 70% of cases of cervical cancer.

Your answer

[1]

38 Retinitis pigmentosa is a genetic condition that affects the eyes.

It is caused by a mutation to a gene. This mutation produces a recessive allele.

The condition causes rod cells in the retina to break down.

(i) Explain why stem cells could be used as a treatment for this condition.

[2]

(ii) Why is it an advantage to use stem cells from the patient rather than from another person?

[1]

39(a) Methamphetamine is a drug.

Scientists are investigating the use of antibodies as a treatment to control the negative effects of the drug.

What is an antibody?

-----[2]

(b) As the human body does not naturally make antibodies against methamphetamine, scientists are using mice to make antibodies.

Describe how large amounts of the antibodies can be made using monoclonal antibody techniques.

-----[4]

(c) These antibodies would **not** work against other drugs.

Explain why.

-----[2]

40 Which statement about health is true?

- A Health is the absence of disease.
- B A person who is free from disease must be healthy.
- C A person can have a serious disease and be healthy.
- D A person can be free from disease and not be in good health.

Your answer

☐

[1]

41 Which of these gives a correct risk factor for the named disease?

	Disease	Risk factor
A	bronchitis	exercise
B	cardiovascular disease	diet rich in saturated fat
C	type 1 diabetes	alcohol
D	cirrhosis of the liver	smoking

Your answer

☐

[1]

42 What do most vaccines contain?

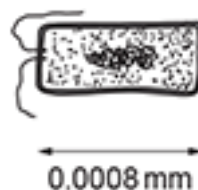
- A Antivirals
- B Dead or weakened pathogens
- C Specific antibiotics
- D White blood cells

Your answer

☐

[1]

43 Look at the bacterial cell that causes disease in humans.



The human eye can see objects 0.1 mm in size.

What **minimum** magnification will be needed before the eye can see this bacterial cell?

- A 12.5×
- B 125×
- C 1250×
- D 12500×

Your answer

[1]

44(a) Some people get very painful headaches called migraines. Scientists think that these are caused by a protein in the brain called CGRP. Levels of the CGRP protein are higher in the brains of people who get migraines.

Doctors are trying to find a treatment to prevent migraines. They have produced an antibody against the CGRP protein.

Complete these sentences to describe how **antibodies** are made in the body.

Use words from the list.

Each word can be used once, more than once, or not at all.

antibiotics antigens antivirals

platelets red blood cells white blood cells

Foreign cells have chemical groups on their surface called

These chemical groups are detected by which then produce antibodies.

[2]

(b) The doctors test the antibody treatment on migraine patients.

The patients are divided into two groups:

- One group is given an injection of the antibody.
- The second group receives an injection of a placebo which does not contain the antibody.

They record the mean number of days each patient had migraines before and after treatment.

The table shows their results.

Treatment	Mean number of migraine days per patient before treatment	Mean number of migraine days per patient after treatment	Percentage decrease in migraine days per patient
antibody injection	9.1	4.4	51.6
placebo	9.1	6.4	29.7

(i) The placebo group does **not** receive the antibody.

Suggest why this group is included in the study.

----- [1]

(ii) The total number of **migraine days** for the patients on the placebo **after treatment** was 480.

The mean number of migraine days per patient after treatment was 6.4.

Calculate the number of patients in the placebo group.

Number of patients = ... [2]

(c) Explain why it is important that a second group of doctors should repeat this test.

[2]

45(a) A salt marsh is a large, muddy area of land where a river joins the sea.

Student A and student B study the plants growing on a salt marsh.

They both sample the plants present by laying out two tape measures at right angles across the salt marsh.

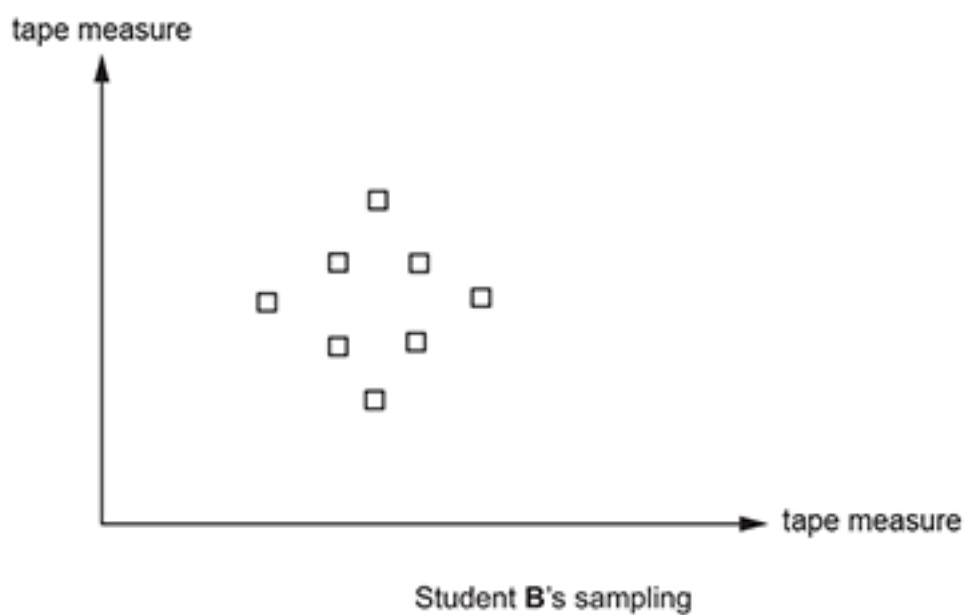
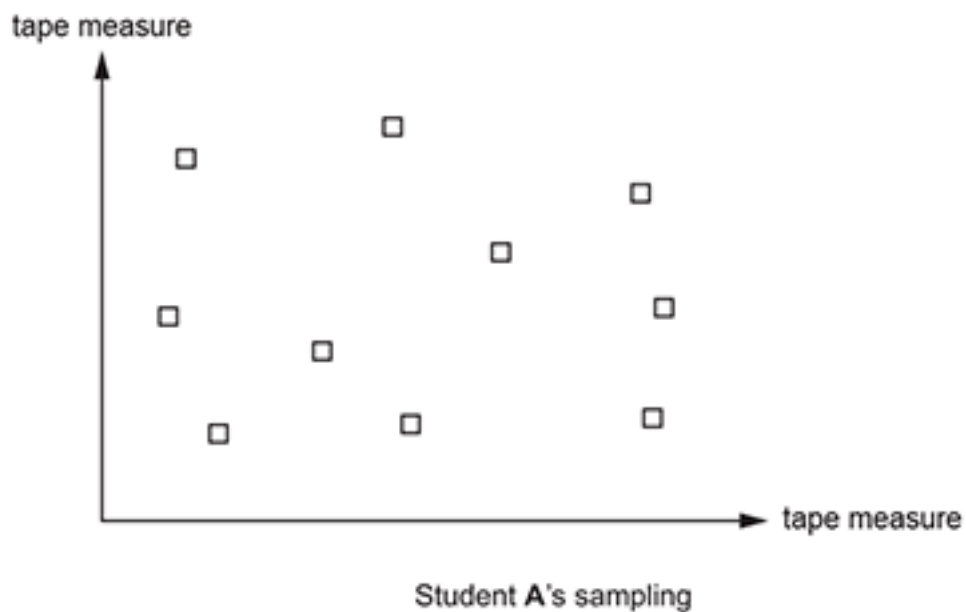
They then place a square frame on the ground in different places and count the number of plants in the square, as shown below.



What is the name of the square frame that they use to sample the plants?

[1]

- (b) The diagrams show the position of each student's samples across the salt marsh.
Each small square in the diagrams represents one sample.



- (i) The whole salt marsh has an area of 2500 m^2 .

Each square frame has an area of 0.25 m^2 .

Calculate the percentage of the whole salt marsh that was sampled by student A.

Percentage = ... % [3]

(ii) Look at the two students' sampling shown in the diagrams.

Explain which student is likely to get the most accurate estimate for the number of plants in the salt marsh.

student

explanation

.....

.....

.....

.....

[3]

(iii) Their teacher said that they should take care as there may be harmful bacteria in the salt marsh.

State **two** things that the students could do to reduce the risk of infection from the harmful bacteria.

1

.....

2

.....

[2]

46(a) Look at the list of four diseases.

AIDS

Type 2 diabetes

Crown gall disease

Barley powdery mildew

Write each disease in the correct column of this table.

Communicable disease			Non-communicable disease
Caused by a disease bacterium	Caused by a fungus	Caused by a virus	

[3]

(b) Sinusitis is an infection that can be caused by bacteria or viruses.

Sinusitis causes a runny nose and bad headaches.

(i) Doctors only give antibiotics to patients with these symptoms if they are sure their illness is caused by bacteria.

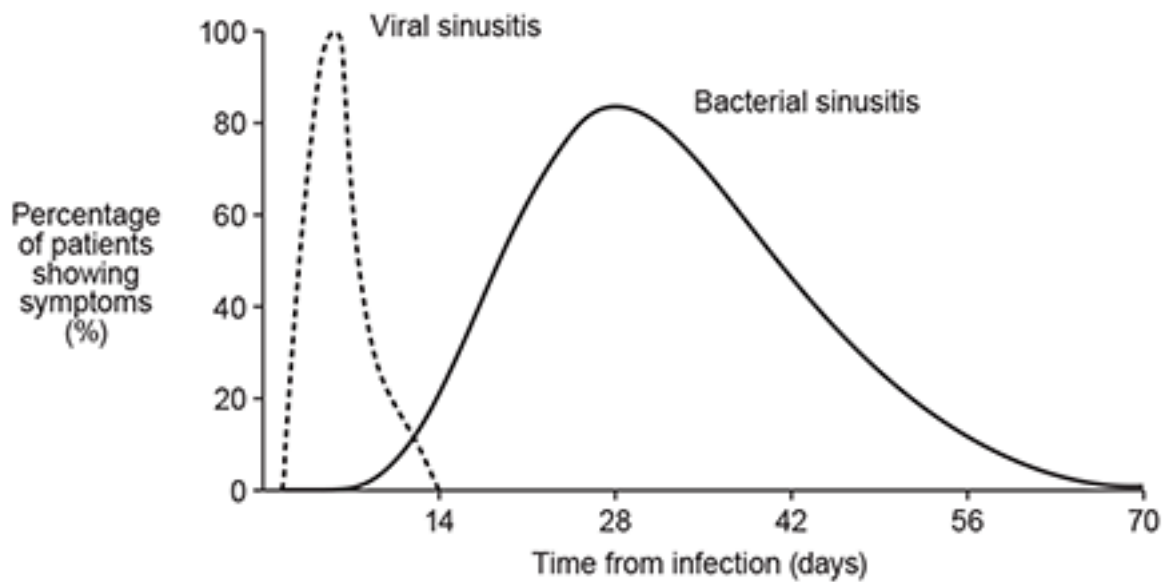
Write down **two** reasons why.

1

2

[2]

(ii) Look at the graph. It shows the length of time that patients show symptoms of sinusitis.

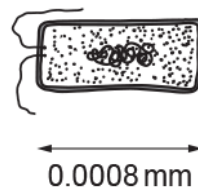


Doctors usually wait 14 days after infection before giving patients antibiotics for sinusitis.

Use the graph to explain why.

[2]

47 Look at the bacterial cell that causes disease in humans.



The human eye can see objects 0.1 mm in size.

What **minimum** magnification will be needed before the eye can see this bacterial cell?

- A 12.5×
- B 125×
- C 1250×
- D 12500×

Your answer

[1]

48 Many human diseases are caused by risk factors.

Food and drink can be major risk factors.

Which disease does **not** have food or drink as a major risk factor?

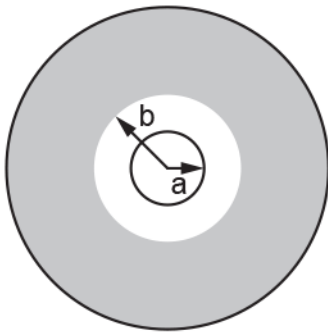
- A Type 1 diabetes
- B Cirrhosis of the liver
- C Type 2 diabetes
- D Cardiovascular disease

Your answer

[1]

49 A student places an antibiotic disc onto the surface of agar that is covered in bacteria.

She calculates the area around the disc that is free from bacteria.



Which formula should she use?

- A $2\pi b^2 - 2\pi a^2$
- B $\pi b^2 + \pi a^2$
- C $\pi b^2 - \pi a^2$
- D $\pi(b - a)^2$

Your answer

[1]

50 Which row on the table is correct for HIV?

	Destroyed by antibiotics	Causes cervical cancer	Sexually transmitted
A	✓	X	X
B	X	X	✓
C	X	✓	✓
D	✓	✓	✓

Your answer

[1]

51 Which is a definition of cancer?

- A An infection of foreign cells which divide uncontrollably.
- B Body cells that divide uncontrollably many times.
- C Body cells that lose the ability to divide and make stem cells.
- D Pathogens that grow and divide unchecked.

Your answer

[1]

52 What does a vaccine contain that protects a person from infection?

- A Antibiotics that will attach to antigens.
- B Antigens that will stimulate antibody production.
- C Antibiotics that kill pathogens.
- D Antivirals that destroy viruses.

Your answer

[1]

53 New drugs are tested using preclinical trials.

Which statement describes a preclinical trial?

- A One group of volunteers are given a placebo, another group the drug.
- B The drug is tested on human cells.
- C Volunteers are given a placebo only.
- D Volunteers are given the new drug.

Your answer

[1]

54 What is the role of antibiotic resistance markers in producing genetically engineered bacteria?

- A To identify which genes to insert into the bacteria.
- B To identify which bacteria have taken up the plasmid.
- C To identify which plasmids contain the genes.
- D To identify which proteins are produced by the bacteria.

Your answer

[1]

55(a) Two farmers grow barley in their fields.

They both have a problem with barley powdery mildew infecting their crops.

Powdery mildew is caused by a fungus.

Describe how fungal infections can spread and how they enter plant leaves.

[3]

(b) The farmers want to prevent their crops from getting powdery mildew.

(i) Explain how burning plants after the barley has been harvested can protect the crops.

[1]

(ii) Explain how growing barley in the fields one year, then wheat the next year can protect the crops.

[2]

(c) The farmers test two different fungicides.

They each grow barley in one of their fields. Each farmer sprays a different fungicide on their field. They then compare the crop yield in the two different fields.

How could you improve the farmers' experiment?

Explain your answer.

----- [2]

56 Some people get very painful headaches called migraines.

Scientists think that this is caused by a protein in the brain called CGRP.

Levels of the CGRP protein are higher in the brains of people who get migraines.

Doctors are trying to find a treatment to prevent migraines.

They have produced an antibody against the CGRP protein.

Describe how antibodies are usually made in the human body.

----- [2]

57(a) Huntington's disease is a genetic condition. It is caused by a **dominant allele**.

Explain what is meant by the term dominant allele.

----- [2]

(b) *The symptoms of Huntington's disease usually appear after the age of 40.

There is no cure and people with the disease usually die after 10-15 years.

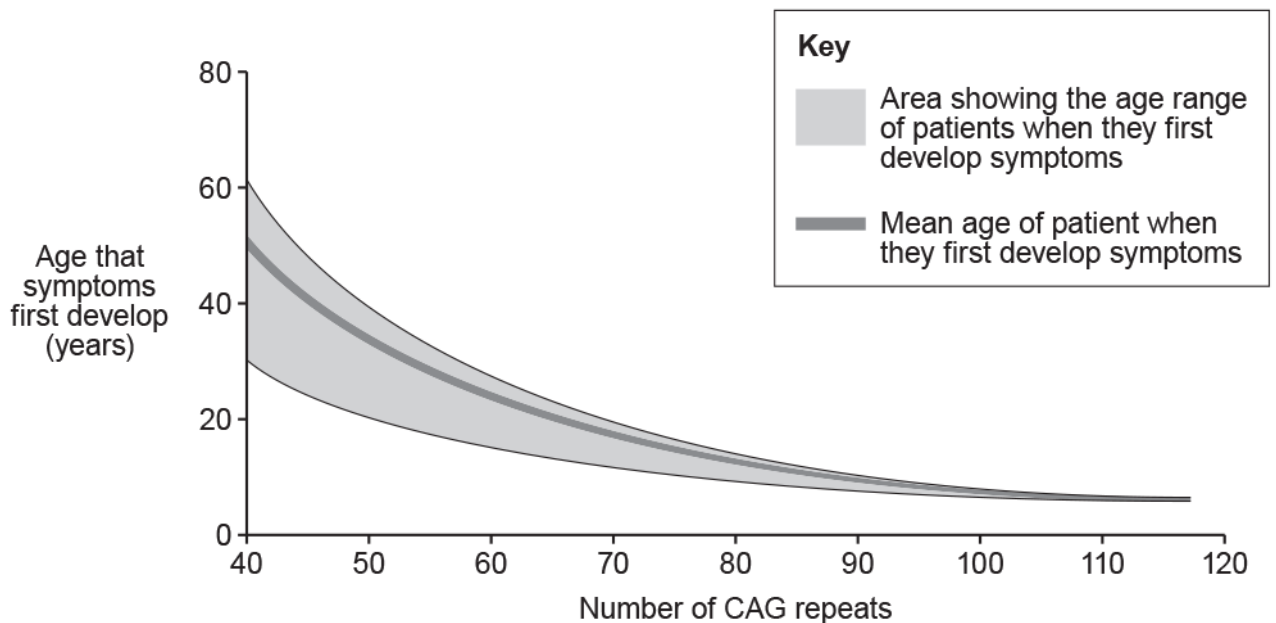
Scientists now know that there are a number of different forms of the allele that causes Huntington's disease. The allele has a sequence of three bases, CAG, that repeats many times. The number of repeats varies between patients.

Patients can be tested to see if they have the allele and how many repeats it has.

Doctors have studied many patients to see:

- The number of CAG repeats a patient has
- The age that the patient starts to show symptoms of the disease.

The results are shown on the graph.



Discuss how useful the gene test and the graph are for people who have a history of Huntington's disease in their family.

[6]

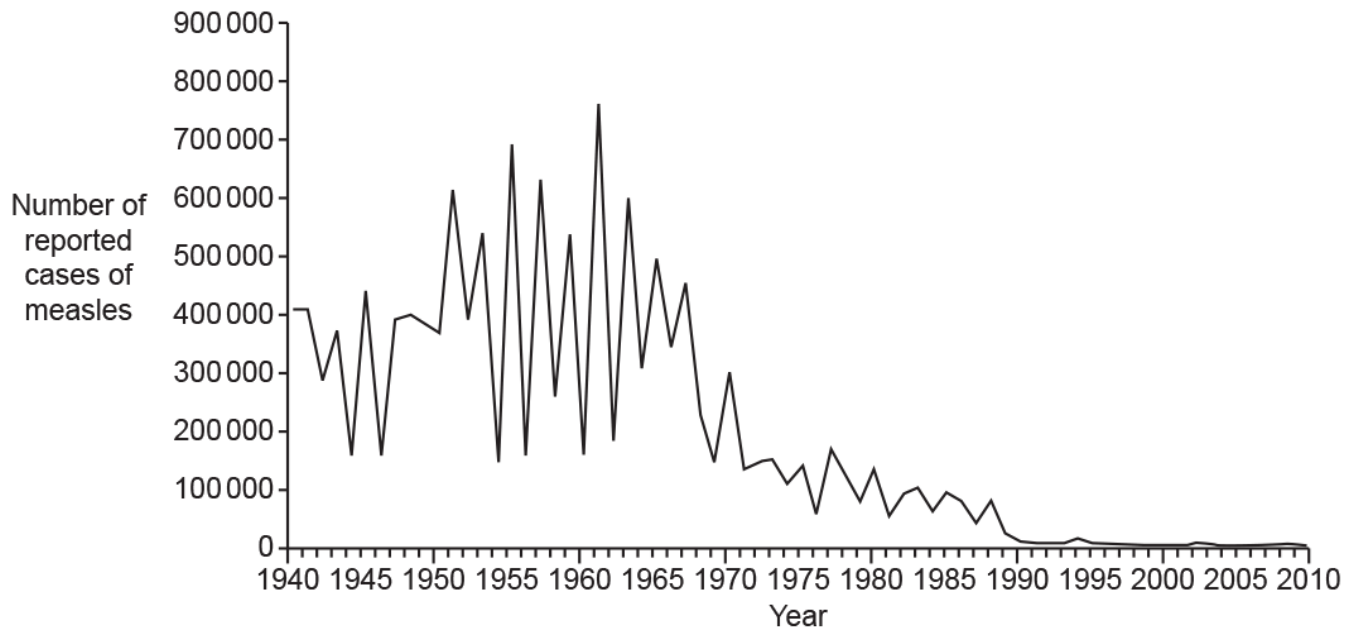
- (c) A new study is giving hope for a treatment for Huntington's disease.

Doctors gave patients an injection of a drug that blocks the action of mRNA that is produced by the Huntington allele.

Explain how this drug could prevent the symptoms of Huntington's disease.

[6]

58 The graph shows the number of reported cases of measles in England and Wales between 1940 and 2010.



In which year was the measles vaccine likely to have been introduced?

- A 1940
- B 1952
- C 1968
- D 1982

Your answer

[1]

59 The drawing shows a leaf from a tobacco plant that has tobacco mosaic disease.



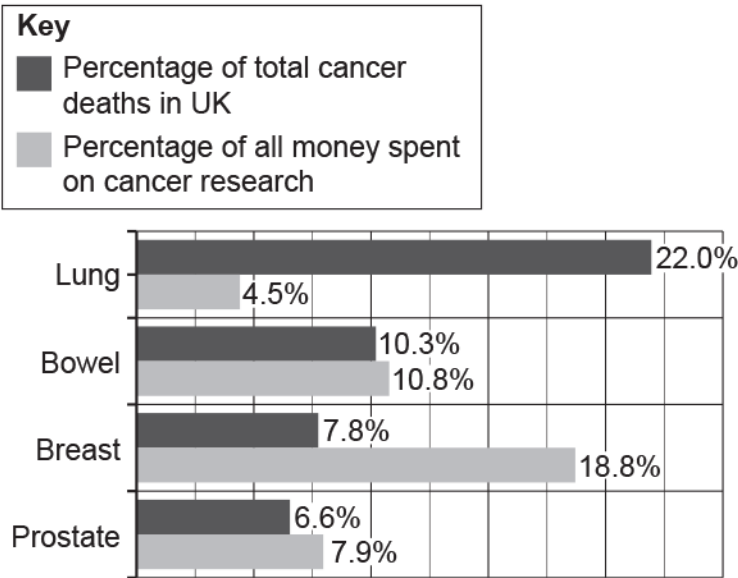
What type of pathogen causes tobacco mosaic disease in plants?

- A Bacterium
- B Fungus
- C Protist
- D Virus

Your answer

[1]

60(a) The graph shows information about the four most common types of cancer in the UK.



Which type of cancer has the **largest** difference between the percentage of total deaths and the percentage of money spent on research?

Tick (✓) **one** box.

Lung

☐

Bowel

☐

Breast

☐

Prostate

☐

[1]

(b) Treatment for cancer often involves powerful medicines that stop cells dividing all over the body.

Write down the name of the type of cell division that occurs when body cells divide.

[1]

61(a) Fanconi anaemia is a genetic disorder. The disorder causes a decrease in the number of platelets in the blood.

Write down **one** possible symptom of Fanconi anaemia.

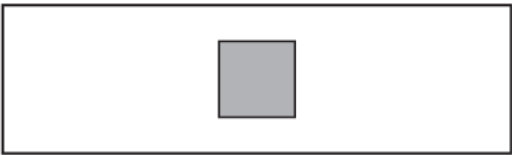
[1]

(b) Fanconi anaemia also causes a decrease in white blood cells and red blood cells.

The table shows ranges for blood components in people **without** Fanconi anaemia.

Blood component	Number per mm ³
red blood cell	4.5 million – 6.5 million
white blood cell	6.0 thousand – 16.0 thousand
platelet	0.15 million – 0.40 million

(i) The diagram shows a microscope slide containing blood from a patient.



The volume of blood under the slide is 0.1 mm³ and it contains 1000 white blood cells.

Calculate the number of white blood cells per mm³ of blood.

Number = ... per mm³ [2]

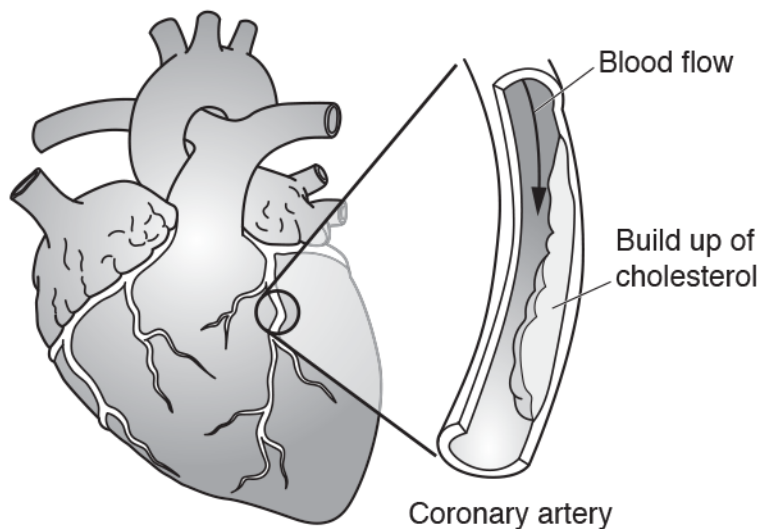
(ii) Does the blood sample provide evidence that the patient has Fanconi anaemia?

Use the table and your answer to part (i) to justify your answer.

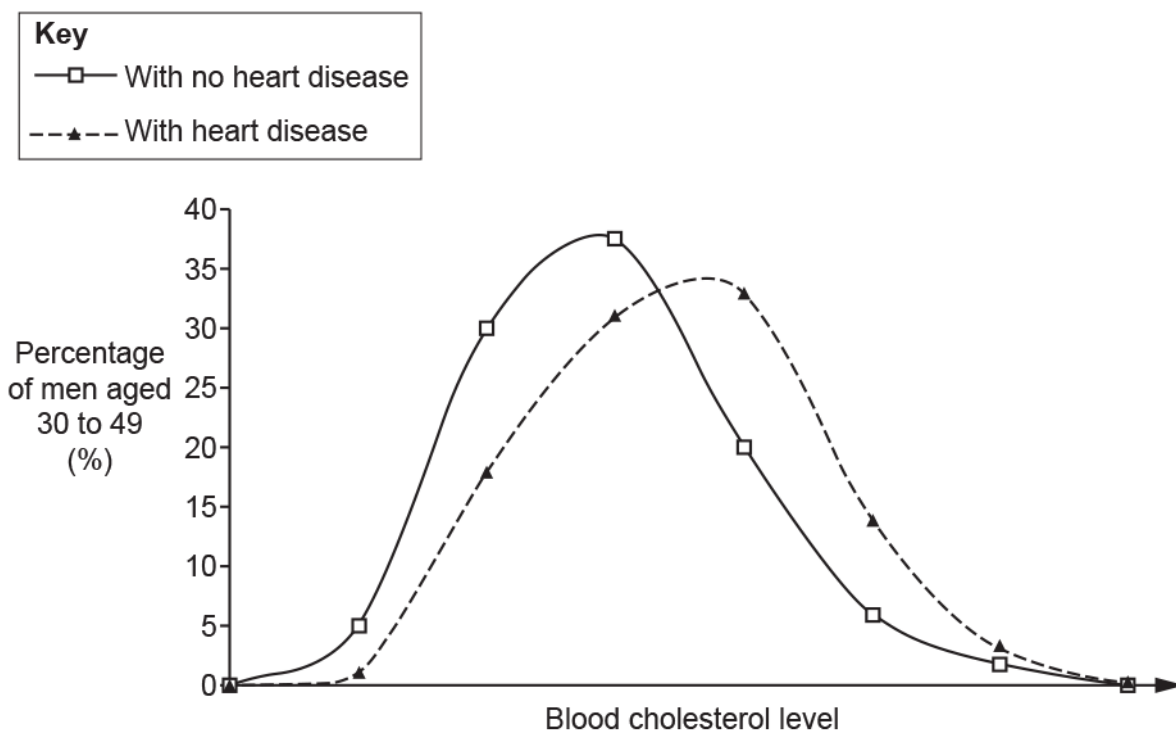
----- [1]

62 Hypercholesterolemia (HC) is caused by a dominant allele on chromosome 19. This allele has mutations which cause a change in the order of DNA nucleotides.

* People with HC are more likely to get heart disease. The diagram shows the heart of a person who has heart disease.



The graph shows the results of a study of men aged 30 to 49. The study measured the cholesterol levels in the blood of the men. It also recorded if the men developed signs of heart disease.



Explain the possible link between cholesterol and heart disease and if this link is supported by the graph.

[6]

[6]

- 63 The table shows estimated data about the global population and the number of deaths from HIV and tuberculosis (TB).

	Year	
	2000	2017
Total population in millions	6143.5	7464.0
Number of people with HIV in millions	36.1	36.8
Percentage of total population with HIV	0.6	0.5
Total number of HIV related deaths in millions	3.0	1.0
Total number of TB deaths in millions	2.2	1.6
Number of TB deaths in people with HIV in millions	0.5	0.3

Which is a correct conclusion from the data in the table?

- A Half of HIV related deaths were due to TB in 2000.
- B HIV became more life-threatening between 2000 and 2017.
- C People with HIV are more likely to die from TB than people without HIV.
- D The percentage of HIV in the population has increased between 2000 and 2017.

Your answer

[1]

- 64 Doctors are able to offer a diagnosis and treatment targeted to a patient's genome, known as genomic medicine.

Which is an example of the type of treatment used in genomic medicine?

- A Comparing patients' phenotypes so the best treatment can be given.
- B Designing drugs that are specific to a particular variant of a gene.
- C Using genetic engineering to produce new drugs.
- D Using monoclonal antibodies to destroy pathogens.

Your answer

[1]

65 When a person has measles they are unlikely to be ill again with the disease for many years.

What is the reason for this?

- A Antigens from the pathogen remain in the body.
- B Memory cells remain in the blood and can release antibodies.
- C The disease can now be treated with antibiotics.
- D White blood cells engulf the pathogens before antibodies are made.

Your answer ☐

[1]

66(a) Fanconi anaemia is a genetic disorder. It results in the bone marrow being destroyed.
This causes a decrease in the numbers of red blood cells, white blood cells and platelets.

Explain **two** possible symptoms of Fanconi anaemia.

1 -----

2 -----

[2]

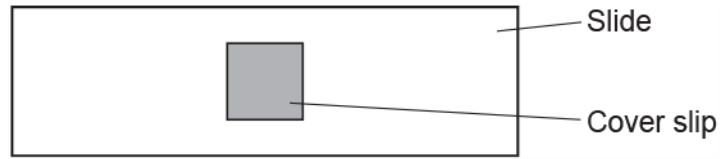
(b) **Table 19.1** shows normal ranges for blood components in people **without** Fanconi anaemia.

Blood component	Number per mm ³
red blood cell	$4.5 - 6.5 \times 10^6$
white blood cell	$6.0 - 16.0 \times 10^3$
platelet	$1.5 - 4.0 \times 10^5$

Table 19.1

(i) Suggest why there is such a wide range of white blood cell numbers.

(ii) The diagram shows a microscope slide containing blood from a patient.



The square cover slip is 10 mm wide and the thickness of the blood underneath is 0.001 mm.

Calculate the volume of blood under the cover slip.

Volume of blood = ... mm³ [1]

(iii) Under the cover slip are 1000 white blood cells.

Does the blood sample provide evidence that the patient has Fanconi anaemia?

Use **Table 19.1** and your answer to part (ii) to justify your answer.

[3]

(c) There are many different genetic disorders that can affect blood cells. Details of three of these are found in **Table 19.2**.

Name of disorder	Cause of disorder	Symptom
D-B anaemia	dominant allele	low red blood cell numbers
S-D syndrome	recessive allele	low white blood cell numbers
Fanconi anaemia	recessive allele	small numbers of all blood cells

Table 19.2

A blood smear from another patient shows that he has 3×10^6 red blood cells per mm^3 of blood. Neither of his parents have a blood disorder.

Use **Table 19.1** and **Table 19.2** to explain which blood disorder the patient could have.

Name of disorder

Explanation

.....

.....

.....

[3]

67(a) Fig. 20.1 is a diagram of an antibody molecule. Antibodies are protein molecules.
The ends of the antibody molecule bind with a particular antigen molecule.

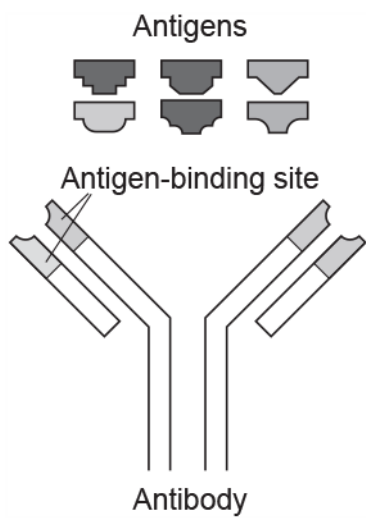


Fig. 20.1

Explain why a different antibody molecule is needed for each antigen.

[2]

(b) Large quantities of one type of antibody can be made by the process shown in Fig. 20.2.

These antibodies are called monoclonal antibodies.

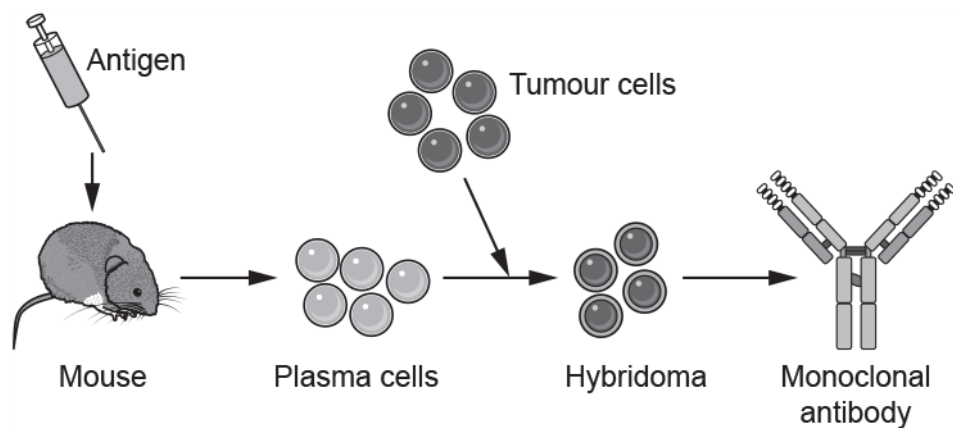


Fig. 20.2

(i) Give **two** uses of monoclonal antibodies.

1 _____

2 _____

[2]

(ii) Why are tumour cells used in this process?

[1]

68(a) Hypercholesterolemia (HC) is the result of a mutation in the genome. It is caused by a dominant allele on chromosome 19. The mutation involved causes a change in the DNA nucleotides.

People with HC are more likely to develop heart disease. Fig. 21.1 shows the heart of a person who has heart disease.

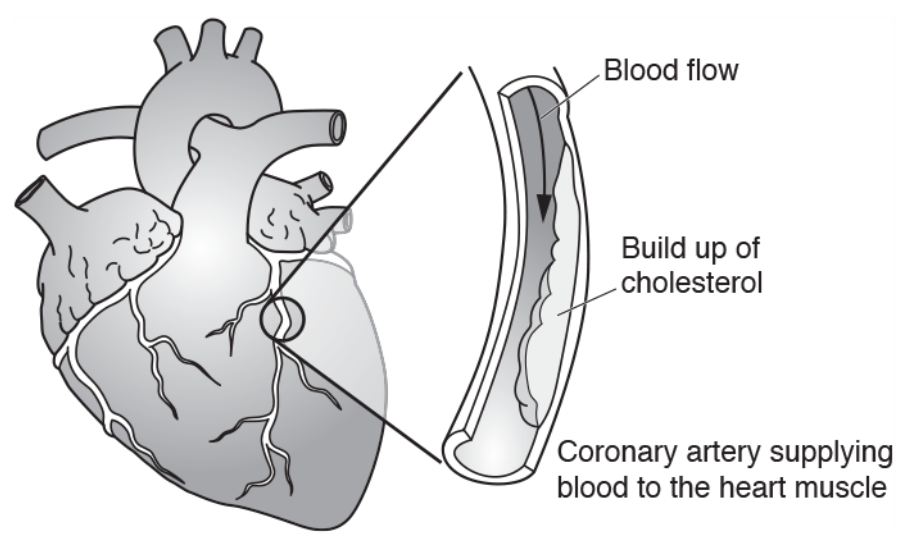


Fig. 21.1

The LDL receptor protein is found on the cell membrane of liver cells. The receptor picks up cholesterol from the blood and transports it into the liver cell. Inside the liver cell the cholesterol is broken down or used.

Explain why people who have the mutation in the allele for the LDL receptor are much more likely to develop heart disease.

- (b) A drug is being developed that might help protect people from heart disease. To test the drug patients were divided into three groups. Each group was given a different treatment and their blood cholesterol measured.

The results are shown in Fig. 21.2.

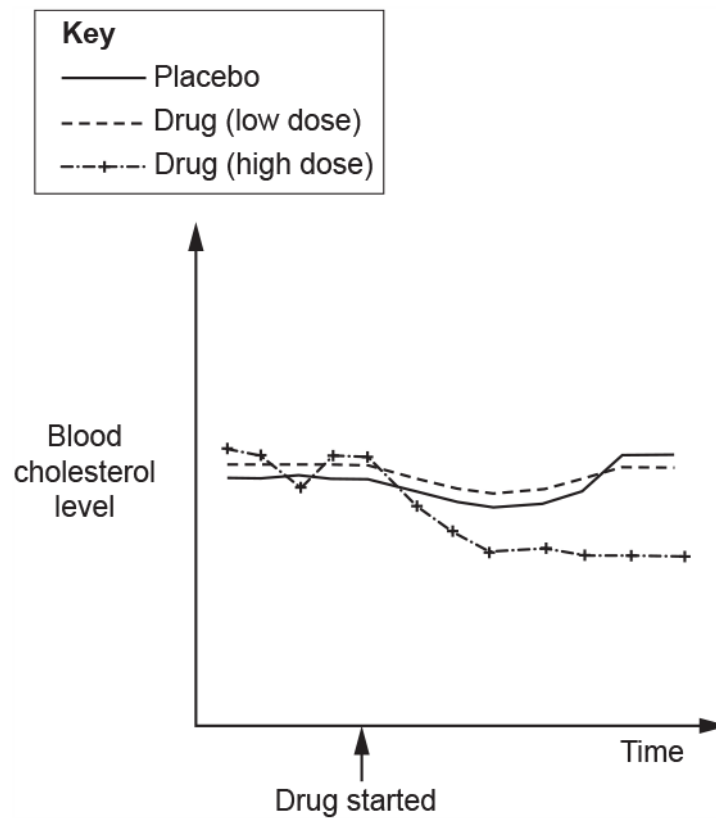


Fig. 21.2

Evaluate the results of the test.

[3]

69 A chemical in stevia leaves makes them taste sweet. This chemical is **not** a sugar.
People with diabetes need to know if the food they eat contains sugar.

(i) Describe how you could test some stevia leaves to prove that they do **not** contain sugar.

Reagent used

Method

.....

Expected result

.....

[3]

(ii) Will using stevia in foods help people with type 2 diabetes?

Explain your answer.

.....

.....

.....

.....

[2]

70(a) Scientists investigate antibiotic pollution in two different lakes.

They collect samples of water from the two lakes. The scientists then use aseptic techniques to investigate how resistant the bacteria in the water are to antibiotics. **Fig. 22.2** shows the apparatus they use.

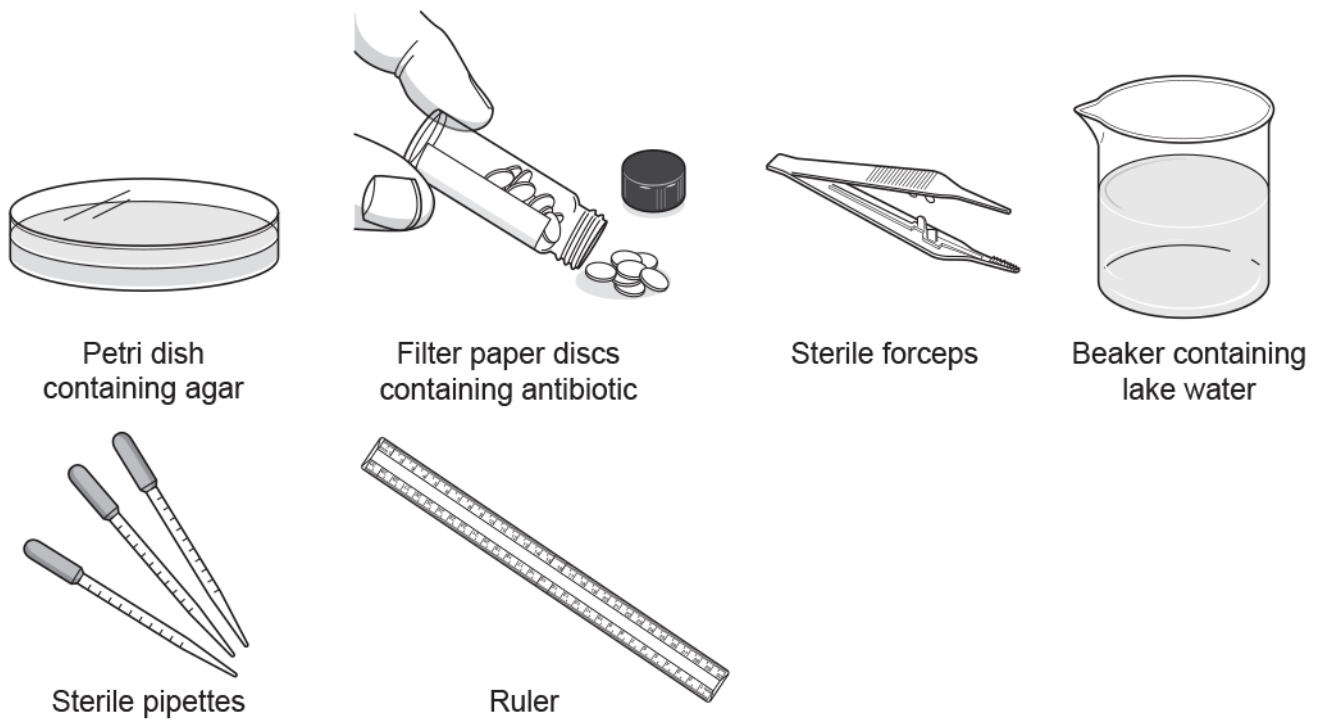


Fig. 22.2

Describe how the scientists could use **this** apparatus to **measure** how resistant the bacteria are to antibiotics.

[4]

- The scientists found these results.

Which lake has the **highest** levels of antibiotic pollution?

Tick (✓) one box.

Lake Bellandur

11

Lake Jakkur

11

Explain your answer.

[2]

71(a) Scientists investigate antibiotic pollution in two different lakes.

They collect samples of water from the two lakes. The scientists then use aseptic techniques to investigate how resistant the bacteria in the water are to antibiotics. **Fig. 16.2** shows the apparatus they use.

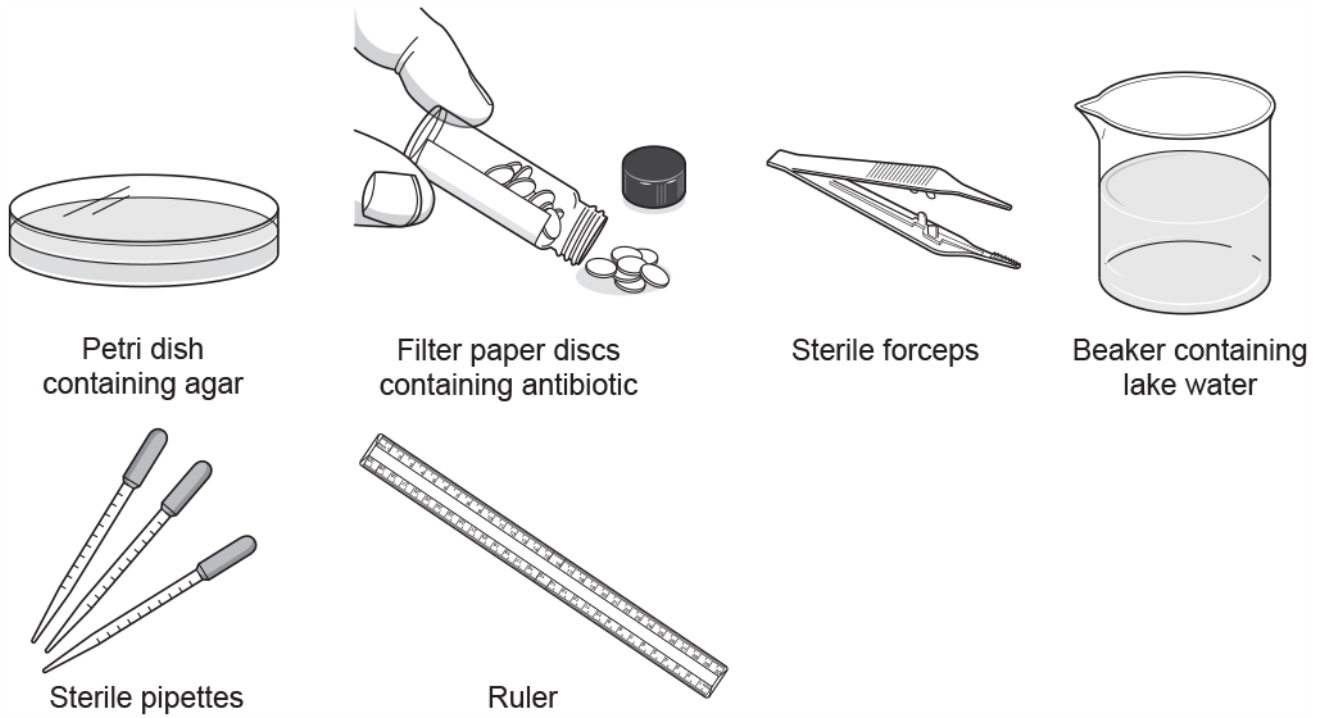


Fig. 16.2

Describe how the scientists could use **this** apparatus to **measure** how resistant the bacteria are to antibiotics.

[4]

(b) The scientists also counted how many species of bacteria were resistant to antibiotics and how many species of bacteria were killed by antibiotics.

The scientists found these results.

	Number of different species of bacteria	
	In Lake Bellandur	In Lake Jakkur
Resistant to antibiotics	53	35
Killed by antibiotics	28	37

Which lake has the **highest** levels of antibiotic pollution?

Tick (✓) **one** box.

Lake Bellandur ☐

Lake Jakkur ☐

Explain your answer.

[2]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			C	1	
			Total	1	
2			B	1	
			Total	1	
3			B	1	
			Total	1	
4			D	1	
			Total	1	
5			B	1	
			Total	1	
6			A	1	
			Total	1	
7			D	1	
			Total	1	
8	a		skin forms a barrier (1)	1	
			enzymes in tears (1)	1	
			acid in the stomach (1)	1	
			acid / enzymes break down microbes (1)	1	
	b		two from:	1	
			a chemical (usually) made by fungi / microbes (1)	1	
			that kills (other) microbes / kills bacteria (1)		
			does not destroy viruses (1)		
	c		idea that it is a sign of the extent of the disease (1)	1	
			temperatures far away from normal can be dangerous (1)	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	d	i	to prevent other people taking in the microbe (1)	1	allow to prevent other microbes starting to grow / contamination allow to prevent release of the bacteria if the dish is dropped / knocked
		ii	correct area = $452(\text{mm}^2)$ (3) or correct measurement of diameter to calculate radius (1) correct calculation using calculated radius (2)	3	allow 452.2
		iii	not resistant (1)	1	allow ECF from (ii)
			Total	13	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
9	a	i	a communicable disease	1	Both correct answers are required for the mark
			a disease that is caused by defective alleles		
			a non-communicable disease		
			a disease that is affected by lifestyle		
		ii	antibodies (1)	1	
		iii	idea that it stops blood flowing backwards (1)	1	
		iii	inefficient circulation to lungs / less blood would go to the lungs (1)	1	
		iii	Increased ventilation required for gaseous exchange (1)	1	
		iii	idea of less oxygen available to the tissues / fatigue / oxygen debt (1)	1	
	b	i	7.5 (years) (1)	1	
		ii	10 years (1)	1	
		ii	idea of time between two peaks (1)	1	
			Total	9	
10			A	1	
			Total	1	
11			C	1	
			Total	1	
12			B	1	
			Total	1	
13			D	1	
			Total	1	
14			A	1	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
15			B	1	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
16	a		two from: a chemical (usually) made by fungi / microbes (1)	1	Allow broken down allow optimum temperature for the bacteria / bacterial enzymes allow spread out slower
			that kills (other) microbes / kills bacteria (1)	1	
	b	i	any higher and the bacteria might be killed / bacterial enzymes denatured (1)	1	
		i	any lower and the erythromycin would diffuse slower / bacteria would reproduce more slowly so takes longer to get the results (1)	1	
		ii	prevent contamination by other microbes (1)	1	not germs / bugs
	c	i	correct area = $452(\text{mm}^2)$ (2)	2	allow 452.2
		i	not resistant (1)	1	allow one mark for correct calculation and interpretation using incorrect radius
		ii	only one plate used / no replicates (1)	1	
		ii	only gives limited information ie one of three choices (1)	1	
	d	i	coat is digested (1)	1	
		i	by enzymes present in small intestine (1)	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	* Please refer to the marking instructions on point 10 for guidance on how to mark this question. Level 3 (5–6 marks) Explains the shapes of the two graphs in the effectiveness / safety of the drugs delivery system. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Explains the shapes of the two graphs the total dosage of the drugs. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Simply describes the patterns in the graph. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i> 0 marks <i>No response or no response worthy of credit.</i>	6	AO3.2a: Analyse the information and judge the relative effectiveness of the two delivery systems - links this to the advantages / disadvantages of keeping a steady, intermediate level in the blood - with tablet high levels may be toxic - if reduce the dose, then when levels low it may not kill all bacteria - reference to allowing resistant strains to develop AO2.2: Apply knowledge to demonstrate an understanding of how the capsules and tablets work in delivering the drug - any statement regarding the total dosage for the two delivery methods - dosage rises rapidly because of rapid absorption into the blood stream - dosage falls fast because it is rapidly broken down - capsules allow staggered release of drug dosage - this is because walls are different thicknesses of the capsule - therefore different digestion time - conventional tablet releases drug all at once - tablet may not have a coating AO2.1: Apply knowledge and understanding in reading the graphical information - Simple description of the patterns of the two lines on the graph.
			Total	18	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
17		i	number of people having strokes is the same after pollution compared to when there is no pollution (1)	1	
		i	pollution is not a risk factor in strokes (1)	1	
		ii	ozone (1)	1	
		iii	data from 28 countries / 6 million people / large sample (1)	1	
		iii	even a small risk factor number means a lot of people (were affected) (1)	1	
			Total	5	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
18	a	[Level 3] Explains implications of all three conditions, at least one of them in detail and at least one calculation that indicates the number of people that may be involved. Quality of written communication does not impede communication of the science at this level. (5–6 marks) [Level 2] Explains implications of two conditions and at least one calculation that indicates the number or a calculated percentage of people that may be involved or two conditions at least one of them in detail. Quality of written communication partly impedes communication of the science at this level. (3–4 marks) [Level 1] Explains implications of at least one condition. Quality of written communication impedes communication of the science at this level. (1–2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to A. Indicative scientific points at level 3 may include: • plaque formation / fatty deposits in the coronary arteries can lead to reduced blood supply to heart muscle / lack of oxygen and or glucose to heart muscle / thrombosis • high blood pressure is linked to (an increased risk of) thrombosis / strokes / kidney damage • allow Type 2 diabetes causes kidney damage / blindness / poor circulation / ulcers Indicative scientific points at level 1, 2 may include: • too much cholesterol in the blood can form plaques in the walls of arteries ignore high blood cholesterol is linked to (an increased risk of) heart disease (low demand) • failure to respond to insulin is failure to control blood sugar levels / Type 2 diabetes • ignore failure to respond to insulin is diabetes (low demand) Indicative scientific points at level 1 only: • high blood pressure is linked to (an increased risk of) heart disease / heart attack • allow 1 mark for correct calculation only with no other explanations example of calculations • 30 000 people in Singapore have all three conditions (or similar calculation) • 330 000 have high blood pressure only • 68% have a single condition • 60% have at least one heart related / circulatory disease Use L1, L2, L3 annotations in scoris; do

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					not use ticks. Examiner's Comments There were some good descriptions of the effects of cholesterol and high blood pressure. A number of candidates simply repeated the data given in the pie chart without any type of numerical calculations. The distinction between type 1 and 2 diabetes was often confused and this often limited access to the higher marks.
	b		29% have two of the conditions only but we do not know which two (1)	1	allow some people have two conditions but we don't know which one Examiner's Comments This was generally well answered.
			Total	7	

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Question	Answer/Indicative content	Marks	Guidance
19	Level 3 (5-6 marks) Answer includes reference to heart disease AND diabetes. The link between type 2 diabetes and failure to respond to insulin AND between high blood pressure / cholesterol and heart disease is made. At least one calculation indicates the number of people that might be involved. Quality of written communication does not impede communication of the science at this level. Level 2 (3-4 marks) Answer includes reference to heart disease OR diabetes. There is some attempt to link diabetes with failure to respond to insulin OR to link heart disease with high blood pressure / cholesterol Quality of written communication partly impedes communication of the science at this level. Level 1 (1-2 marks) Answer includes some reference to heart disease OR diabetes. Quality of written communication impedes communication of the science at this level. Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.	6	This question is targeted at grades up to C Relevant points include: • high blood pressure is linked to an increase risk of heart disease • high blood cholesterol is linked to an increase risk of heart disease • failure to respond to insulin indicates type2 diabetes • too much cholesterol in the blood can form plaques in the walls or arteries • 30 000 people in Singapore have all three conditions (or similar calculation). allow higher level answers involving blood pressure and strokes / kidney damage and the consequences of plaque formation in the coronary arteries Level 3 - full answer but no/wrong calculation then max 5 marks allow level 1 (2 marks max) for correct calculation with no reference to heart disease/diabetes if refer only to heart attacks instead of heart disease then allow 1 mark (level 1) or 3 marks (level 2) Use L 1, L2, L3 annotations in scoris. Do not use ticks. Examiner's Comments This 6 mark extended answer question was targeted across low and standard demand. Accordingly, although two thirds of candidates gained some credit, very few went beyond 4, the most common mark. The question asked candidates to not only use the data provided but also their own biological knowledge and also to include calculations. Some candidates wrote at great length but only described what the pie chart showed, without adding anything

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					extra, and were not awarded any marks. To gain level 1 (1 or 2 marks) candidates had to appreciate that the conditions could lead to heart disease or diabetes. For level 2 (3 or 4 marks) they had to correctly link heart disease or diabetes to the specific conditions tested for. To gain level 3 (5 or 6 marks), candidates should have stated that failure to respond to insulin is linked specifically to type 2 diabetes, as well as include at least one calculation using the data given, eg to state that 30 000 people had all three conditions. Very few attempted any calculations.
			Total	6	
20			increased salt (in diet) leads to higher blood pressure (1) high blood pressure leads to increased risk of developing heart disease / risk of stroke / blood vessels bursting (1)	2	allow positive correlation between salt in diet and blood pressure ignore high salt in urine causes high blood pressure Examiner's Comments The main issue for some candidates was the failure to differentiate between salt in the diet leading to higher blood pressure and the salt in the urine being an indicator of salt in the diet.
			Total	2	
21			Comment 1 / about being better for health overall is an opinion (1) Comment 2 / difference in fat content / link between fat and heart disease are scientific facts (1)	2	must clearly link each statement to opinion or fact allow comment one is opinion and comment 2 is fact (2)
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
22	a		pathogen (1)	1	allow answer ringed, underlined or ticked more than one answer= 0
	b		any two from: trapped by mucus (in the airways) (1) (hydrochloric) acid in the stomach (1) blood clotting (1) skin (providing a barrier) (1) and the virus is injected into the body / the virus is injected bloodstream (by a mosquito) / virus enters directly into the blood (1)	3	Allow ear wax prevents the entry of pathogens via the ear canal Allow tears prevent the entry of pathogens via the eye ignore reference to cilia / hairs Allow mosquito can break the skin
	c		any two from: to see if they work / are effective (1) to see if there are any side effects / to see if they are harmful (1) to work out the dose (1)	2	allow prevent deaths caused by vaccine / allergic reactions
			Total	6	
23			red blood cells – carry oxygen (1) platelets – clotting (of blood) (1)	2	allow stops bleeding ignore heals / forms scabs / blocks wounds
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
24			comment 1 / about being better for health overall is an opinion (1) comment 2 / difference in fat content / link between fat and heart disease are scientific facts (1)	2	must clearly link each statement to opinion or fact allow comment 1 is opinion, comment 2 is fact (2)
			Total	2	
25	a		contains a dead / weakened / harmless form of the virus (1) (white blood cells) make antibodies (1) the antibodies / memory cells remain / are still present (1)	3	allow pathogen / antigens not bacteria ignore small amount of the virus / weakened dose of disease ignore antitoxins / antivirals allow on reinfection then antibodies made faster (2)
	b		a tablet / dose / medicine that does not contain any drug / medicine (1) idea to see if any effect is psychological / to see if thinking you had the drug makes a difference (1)	2	allow fake drug / sugar pill / inactive drug ignore pill that has no effect allow effect of drug can be compared to placebo effect / feel good factor / to prevent bias / to compare the results between the real drug and the placebo / to see if the drug works / has any effect
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
26	a		Any two from: less industrial disease / accidents (1) healthier diet (1) healthier life style (1) better medical treatments / healthcare / cures for disease (1) better housing / sanitation / hygiene (1)	2	allow better health and safety (1) allow better diet / balanced diets (1) allow more exercise / less smoking (1) ignore less pollution ignore better standard of living ignore just better technology
	b	i	life expectancy continues to rise (1) life expectancy for males and females will become the same / converge / get closer together (1)	2	allow people will live longer (1) allow answers that match their lines drawn e.g. life expectancy for females remains higher than males (1) allow marks for age quoted for 2030 that matches line drawn e.g. women may live till they are 90 (1) e.g. women may live till they are 90 and males 86 (2) e.g. people will live longer women may live till they are 90 (2)
		ii	Idea that line of the graphs may not rise at the same gradient. Other factors could stop the age reaching the predicted level	1	e.g. slope of graph may change / rise more steeply / level off (1) e.g. trend may change (1) ignore no evidence / no data e.g. such as new diseases / epidemics / outbreak of disease / increased resistance of bacteria to antibiotic / increased pollution levels / natural disasters (1) ignore illnesses can occur / the future is uncertain
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
27	a		Any two from: less industrial disease / accidents (1) healthier diet (1) healthier life style (1) better medical treatments / healthcare / cures for disease (1) better housing / sanitation / hygiene (1)	2	allow better health and safety (1) allow better diet / balanced diets(1) allow more exercise / less smoking (1) allow better lifestyle (1) ignore less pollution ignore better standard of living ignore just better technology
	b	i	life expectancy continues to rise (1) life expectancy for males and females will become the same / converge / get closer together (1)	2	allow people will live longer (1) allow answers that match their lines drawn e.g. life expectancy for females remains higher than males(1) allow marks for age quoted for 2030 that matches line drawn e.g. women may live till they are 90 (1) e.g. women may live till they are 90 and males 86 (2) e.g. people will live longer women may live till they are 90 (2)
		ii	idea that line of the graphs may not rise at the same gradient / other factors could stop the age reaching the predicted level (1)	1	e.g. slope of graph may change / rise more steeply / level off (1) e.g. trend may change (1) ignore no evidence / no data e.g. such as new diseases / epidemics / outbreak of disease / increased resistance of bacteria to antibiotic / increased pollution levels / natural disasters (1) ignore illnesses can occur / the future is uncertain
			Total	5	
28			D ✓	1 (AO1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
29			A ✓	1 (AO1.1)	
			Total	1	
30			A ✓	1 (AO1.1)	
			Total	1	
31		i	idea that stem cells are not differentiated / can still specialised ✓ they can replace damaged cells / develop into/change/divide/become retina cells ✓	2 (AO 1.2)	ALLOW stem cells are unspecialised / can differentiate/grow into any (type of) cell ALLOW can differentiate/specialise into retina cells = 2 marks IGNORE can repair retina <u>Examiner's Comments</u> There were some good examples demonstrating their knowledge and understanding of stem cells in this answer. Most common non-credited answers were just repeating the question that they can repair the retina but not describing how. Exemplar 6 gained full marks. Exemplar 6 Why might stem cells be able to repair the retina? ✓ <i>stem cells are undifferentiated cells meaning they can be modified to do anything. So scientists are able to modify stem cells to replace the faulty cells in the retina.</i> [2]
		ii	any two from: to see if it works ✓ make sure it is safe / identify side effects ✓ to find the correct dosage ✓	2 (AO 1.2)	ALLOW see results ALLOW could go wrong / unknown effect IGNORE can't test on humans <u>Examiner's Comments</u> The vast majority of candidates scored at least 1 mark here for side effects / make sure it is safe. The least scored marking point was to find the correct dosage.
			Total	4	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
32	a		blood vessels / arteries are blocked/narrowed ✓ (heart muscle) gets less blood ✓ (heart muscle) gets less oxygen ✓	3 (AO 2.1)	ALLOW atheroma / plaque formed IGNORE no blood IGNORE no oxygen IGNORE references to blood circulation to body cells <u>Examiner's Comments</u> Over half of candidates scored at least one mark here mainly for less blood flow (to the heart muscle). A lot of candidates got confused with the blood flow to the heart muscle with blood flow to the body cells, therefore not gaining credit. Exemplar 8 demonstrates this confusion and is not credited any marks. Exemplar 8 Use the information in the diagram and your biological knowledge. The lack of consistent ^{through} patent flow of blood ~~the~~ the body causes the body to have to adapt as less blood flow means and causes a for less oxygen flow. The body induces around this by using anaerobic respiration to ensure enough respiration occurs in the body.
	b	i	Three / 3 ✓	1 (AO 2.2)	<u>Examiner's Comments</u> The majority of candidates scored this mark. Those who didn't gain the mark incorrectly identified the age range 31-40 instead of the number of points.
		ii	the older a person is, the greater the risk ✓	1 (AO 3.1a)	ORA IGNORE the older the more points

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	Person A has total of 8 points ✓ Person B has a total of 7 points ✓ Person A has a greater risk ✓	1 (AO 2.2) 1 (AO 2.2) 1 (AO 3.2b)	If no totalled points on the answer lines then check text boxes must be correct deduction based on the total of points ALLOW correct deduction even if there is an error in the calculation of points <u>Examiner's Comments</u> Most candidates scored at least one mark here for person A. Higher ability candidates achieving full marks here was common.
	c	i	idea that it widens/opens the (lumen) of the artery ✓ more blood/oxygen will be able to reach the heart muscle ✓	1 (AO 2.2) 1 (AO 3.1b)	IGNORE expands the artery <u>Examiner's Comments</u> Most common credited mark was for the idea the stent widens/opens up the artery. Few candidates stated that more blood/oxygen would be able to reach the heart muscle.
		ii	advantage: avoids an operation ✓ disadvantage: could be side effects of the drug / must take it on a regular basis ✓	2 (AO 2 × 2.1)	ALLOW named side effect e.g. liver damage/upset stomach ALLOW may forget to take the drug / misuse of the drug <u>Examiner's Comments</u> Most candidates didn't gain the marks for the advantage of taking statins because they just repeated the question and stated it lowers the level of cholesterol in a person's blood. A number of candidates achieved the disadvantage marking point, with the most common answer being that they have to take it on a regular basis. A number of candidates stated that the blood cholesterol would become too low, which wasn't credited.
			Total	12	

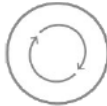
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
33			A ✓	1 (AO1.1)	
			Total	1	
34			D ✓	1 (AO1.1)	
			Total	1	
35			A ✓	1 (AO2.1)	
			Total	1	
36			B ✓	1 (AO1.1)	<u>Examiner's Comments</u> This question was designed to test recall of knowledge AO1.1. It was clear from the responses of the majority of candidates, that there was a lack of the knowledge of white blood cells and their ability to move out of capillaries by changing their shape.  The ability of white blood cells to leave the circulatory system through the capillary walls should be taught in the context of white blood cells destroying pathogens.
			Total	1	
37			D ✓	1 (AO1.2)	<u>Examiner's Comments</u> This AO1.2 question required knowledge of scientific enquiry and procedures linked to interactions of diseases. Higher ability candidates were able to identify the link between HPV and cervical cancer, but some candidates assumed incorrectly that the vaccine prevents cervical cancer.
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
38		i	stem cells are not differentiated/can still specialise ✓ they could become rod cells ✓	1 (AO 1.2) 1 (AO 2.1)	ALLOW stem cells are unspecialised / can grow into any type of cell / have ability to differentiate <u>Examiner's Comments</u> Most candidates were able to describe what a stem cell is assessing AO1.1, and many had the AO2.1 idea that they could become rod cells. Some missed the AO2.1 mark by referring to damaged or mutated cells, instead of the rod cells.
		ii	idea it would not be detected as foreign cells (by the immune system/WBC) ✓ OR idea it would not be rejected (by the body) ✓	1 (AO2.2)	ALLOW accepted (by the body) / (body) more likely to accept <u>Examiner's Comments</u> This AO2 question was generally answered well. Lower ability candidates stated that stem cells from another person "wouldn't work". Marks are scored more frequently when candidates avoid general terms, and responses are specific to the question asked.
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
39	a		Any two from: a protein molecule ✓ made by the immune system ✓ destroys/kills pathogens / clumps them together / attaches to antigens ✓	2 (AO 2 × 1.1)	ALLOW made by WBC / found in WBC IGNORE germs and disease IGNORE attack or fight pathogens Examiner's Comments This AO1 recall question did identify some areas for improvement. Candidates struggled with using correct terminology, referring to disease instead of pathogen and attacking and fighting instead of describing the mode of action of antibodies. Few candidates stated that an antibody is a protein.  When developing examination technique, candidates should be encouraged to use mark schemes to appreciate the importance of detail and terminology appropriate to GCSE level of study.
	b		Any four from: (inject) methamphetamine/drug into mice ✓ lymphocytes made/collected ✓ fuse with tumour cells ✓ hybridoma cells made ✓ hybridoma make antibodies against methamphetamine/drug ✓	4 (AO 4 × 1.2)	ALLOW WBC made/collected ALLOW fuse with cancer/myeloma cells Examiner's Comments This AO1.2 question allowed candidates to demonstrate their knowledge of a scientific technique. There were some excellent maximum mark responses by higher ability candidates and most were able to gain 1 or 2 marks. Whilst some candidates knew this process, many forgot what the role of the

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					antibodies specific to this question was, talking in generic terms and mixing up this example with others. Those that did know this process often wrote about fusing antibodies not lymphocytes with cancer cells, however, many scored the mark for knowing the term hybridoma. Those that scored zero often got confused and wrote about genetic engineering in terms of cutting and splicing DNA. Exemplar 4 techniques. A mouse is injected with the methamphetamine. Lymphocytes within the mouse do not replicate enough so they bind to the methamphetamine to form hybridomas. This then replicate to form monoclonal antibodies which are large amounts of antibodies to fight off this methamphetamine. [4] This candidate has been credited with 3 marks. They have identified specifically that it is methamphetamine that is injected rather than generic antigens. The have identified that lymphocytes are involved, but not gained a mark as they haven't recognised the need to harvest these. Likewise they have incorrectly linked the fusing of these to methamphetamine rather than tumour cells, so have missed that marking point. However, they have recognised that a hybridoma is formed, so get that marking point. Although this last marking point was seldom seen due to many candidate responses describing antibody production in generic terms, here the candidate has identified that the production of large amounts of antibodies is specifically for the methamphetamine so gets a third mark.

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Question			Answer/Indicative content	Marks	Guidance
	c		Any two from: antibodies are specific ✓ only (binds) to one drug/antigen (shape) ✓	2 (AO 1.1) (AO 1.1)	ALLOW they would not fit together with other drugs <u>Examiner's Comments</u> Although this AO1.1 question was mostly answered successfully there were common errors shown by lower ability candidates. Often lower ability candidates referred to specific antigen rather than specific antibody. Occasionally they would write about bacteria, and in some cases confused this with the lock and key hypothesis and ideas about enzymes.
			Total	8	
40			D	1 (AO 1.1)	
			Total	1	
41			B	1 (AO 1.1)	
			Total	1	
42			B	1 (AO 1.2)	
			Total	1	
43			B	1 (AO 2.2)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
44	a		antigens ✓ white blood cells ✓	2 (AO 1.1)	<u>Examiner's Comments</u> This question differentiated well, with the majority of higher ability candidates correctly gaining full marks here and the lower ability candidates did not. This question required the candidates to demonstrate their knowledge and understanding on the immune response.
	b	i	as a control / to compare the results ✓	1 (AO 1.2)	ALLOW show the drug is having the effect/works /no psychological effect <u>Examiner's Comments</u> This question was correctly answered by about half of all candidates, which required demonstration of their knowledge of the role of a placebo group. Most responses which didn't score focused on the placebo not receiving the antibody, which repeated the stem of the question.
		ii	FIRST CHECK ANSWER ON THE ANSWER LINE If answer = 75 (patients) award 2 marks 480/6.4 ✓ =75 (patients) ✓	2 (AO 2.2)	<u>Examiner's Comments</u> Just over half of candidates were able to correctly calculate the number of patients in the placebo group. This question contributed to the papers ten percent allocation to the mathematical element.
	c		Any two from: for peer review ✓ idea of checking the results ✓ to increase the number of patients tested ✓ conclusions more valid ✓	2 (AO 2.2)	IGNORE get accurate results ALLOW check for safety/bias ALLOW conclusions are more reliable <u>Examiner's Comments</u> The majority of candidates did not gain full marks on this question, but a significant number of candidates gained one mark. The most common awarded mark was the idea of checking. Most candidates did not use the accepted language of measurement and the correct use of the term validity.
			Total	7	

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Question			Answer/Indicative content	Marks	Guidance
45	a		quadrat ✓	1 (AO 1.2)	Examiner's Comments The majority of higher ability candidates gained this mark. Those candidates that didn't score couldn't recall the piece of equipment as a quadrat. Common errors included square frame and Punnett square.
	b	i	FIRST CHECK ANSWER ON THE ANSWER LINE If answer = 0.1 (%) award 3 marks 10x0.25 or 2.5 (m²) ✓ 2.5 ?00 / 0.001 ✓ = 0.1 (%) ✓	3 (AO 2 x 2.2)(AO 1.2)	ALLOW correct conversion of the fraction of the area sampled into a percentage Examiner's Comments Just over half of candidates did not achieve any marks for this mathematical application question and lower ability candidates found having to work out the fraction of the field sampled then convert it into a percentage challenging. The candidates benefited if they showed their working out as there was an error carried forward mark for the correct percentage from an incorrect fraction.
		ii	(student A): has taken more samples/quadrats than B ✓ has sampled all over/spread out/ random over the marsh OR A ✓ samples more likely to be representative / not bias / valid ✓	3 (AO 3.1a x2) (AO 3.2a)	If student B chosen = No marks IGNORE A = 10 and B = 8 samples IGNORE plants more spread out Examiner's Comments The majority of higher ability candidates achieved at least one mark here, with the most common credited mark that student A's sample was random. Very few candidates appreciated the sample would be more valid/representative, using the accepted language of measurement.

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Question			Answer/Indicative content	Marks	Guidance
		iii	Any two from: wash hands (after sampling) ✓ not to eat / do not put hands to mouth (whilst sampling) ✓ protective clothing (whilst sampling) ✓ Cover cuts with plasters ✓	2 (AO 3.3b)	ALLOW sterilise equipment after use <u>Examiner's Comments</u> Half of candidates achieved one mark on this question. The most common credited response was protective clothing, which was given by candidates analysing the information and making suggestions to improve experimental procedures.
			Total	9	

Mark Scheme

Question			Answer/Indicative content				Marks	Guidance
46	a		Communicable disease		Non-communicable disease		3 (AO 1.1)	4 correct = 3 marks, 2 or 3 correct = 2 marks, 1 correct = 1 mark <u>Examiner's Comments</u> The majority of candidates were able to achieve at least one mark on this question which required demonstration of knowledge and understanding on causes of various diseases. Roughly half of all candidates were given full marks.
			Caused by a disease bacterium	Caused by a fungus	Caused by a virus			
			crown gall disease	barley powdery mildew	AIDS	type 2 diabetes		
			✓✓✓					
	b	i	viruses are not destroyed/killed by antibiotics ✓ wants to avoid the spread of antibiotic resistant (bacteria) ✓				2 (AO 2.1)	ALLOW antibiotics are ineffective in treating viruses / antibiotics only kill bacteria DO NOT ALLOW viruses can become antibiotic resistant <u>Examiner's Comments</u> Candidates found this question one of the most challenging on the paper. Only the higher ability students scored a mark here, with the most common mark awarded for antibiotics only work on bacteria or don't work on viruses. There were a lot of responses which were too vague and not specific. Very few candidates were given the antibiotic resistance mark. ? Misconception Candidates demonstrated confusion between immunity and resistance to antibiotics. Exemplar 3 highlights this misconception Exemplar 3 <i>1 The patients will become immune to the antibiotics</i> <i>2 Antibiotics will not work and the patient will get worse.</i>

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Question			Answer/Indicative content	Marks	Guidance
		ii	virus sinusitis patient's should be getting better / the symptoms should have disappeared/only last 14 days ✓ any symptoms/infection (after 14 days) is caused by bacteria ✓	2 (AO 3.1a)	IGNORE time for bacteria need to grow <u>Examiner's Comments</u> This question required the candidates to analyse and interpret the graph. There were some good responses that correctly explained why doctors wait 14 days after infection before giving antibiotics.
			Total	7	
47			B	1 (AO 2.2)	
			Total	1	
48			A	1 (AO 1.1)	
			Total	1	
49			C	1 (AO 1.2)	
			Total	1	
50			B	1 (AO 1.1)	<u>Examiner's Comments</u> This is an AO1.1 question testing recall of HIV and interaction with cervical cancer. In general, candidates chose either B or C. Candidates who performed well overall chose the correct answer B.
			Total	1	
51			B	1 (AO 1.1)	<u>Examiner's Comments</u> In this AO1.1 question, many candidates incorrectly put A, indicating they are unsure of what an infection is, and also why cancer is not an infection. They do, however, seem to be aware of cancer being linked to uncontrollable cell division.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
52			B	1 (AO 1.2)	<u>Examiner's Comments</u> Recalling their knowledge of a scientific technique in this AO1.2 question; this was generally well answered by candidates. Some candidates were distracted by A and this may show a rushed approach to reading each option. Care must be taken to read technical terms very carefully.
			Total	1	
53			B	1 (AO 1.1)	
			Total	1	
54			B	1 (AO 1.2)	<u>Examiner's Comments</u> Recalling their knowledge of a scientific technique in this AO1.2 question, candidates generally answered this well. Some candidates were distracted by A and C.
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
55	a		spread by wind ✓ spores ✓ enters leaves through the stomata ✓	3 (AO 1.1)	ALLOW spread by water/ air / contact ALLOW enters leaf pores IGNORE holes in leaf / wounds / roots / stem <u>Examiner's Comments</u> On this AO1.1 recall question, most candidates were able to describe a method of spread. Fewer were able to recall the term spore. A much smaller number of candidates knew that the point of entry was stomata, however, responses referring to entry through damage, cuts or wounds and via the roots were more common but did not score.
	b	i	kills the spores / fungus ✓	1 (AO 2.1)	ALLOW kills/burns/eradicates the (barley) powdery mildew <u>Examiner's Comments</u> Many candidates did not score on this AO2.1 question because of the lack of reference to the specific organisms in the question. A common mistake is to give generic responses using terms like disease and infection. Rather unexpected, but throughout this question about a fungus a lot of candidates referred to bacteria and viruses.
		ii	the spores left by the fungus growing on the barley cannot infect wheat / the fungus does not grow on wheat / wheat is not a host for the fungus ✓ (after two years) there will be less spores/fungus population / the spores/fungus will die ✓	2 (AO 2.1)	AW barley powdery mildew for fungus AW pathogen for fungus ALLOW wheat resistant to barley powdery mildew <u>Examiner's Comments</u> This AO2.1 question was approached more like a recall question by many candidates. A substantial number described crop rotation ideas about depletion/replacement of nutrients. Again, many candidates wrote about killing infections or diseases rather than spores or fungi.

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Question			Answer/Indicative content	Marks	Guidance
	c		(control using) the same field and divide it into two ✓ because different fields may have different types of soil / different minerals / different levels of light ✓	2 (AO 3.3b)	ALLOW any suitable improvement e.g. control light / pH / temperature / same location / use optimum concentration of each fungicide / a control explanation must link to suitable improvement e.g. light because photosynthesis would affect growth/yields <u>Examiner's Comments</u> This AO3.3b question was considering ways of improving experimental design. Many candidates were able to describe the need for a control, less were able to apply their ideas to the scenario in the question, often describing inappropriate ideas such as putting plants in greenhouses or closed systems.
			Total	8	
56			(made by) white blood cells / lymphocytes ✓ when stimulated by antigens / antigens detected ✓	2 (AO 1.1)	DO NOT ALLOW phagocytes IGNORE fight off/combat antigens <u>Examiner's Comments</u> Candidates have a very good understanding of this AO1.1 question recalling knowledge of antibody production. Most used the correct term lymphocyte and knew antibody production was in response to antigens.
			Total	2	

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Question			Answer/Indicative content	Marks	Guidance
57	a		an allele is a form/version of a gene ✓ dominant means that it always expresses itself when present ✓	2 (AO 1.1)	ALLOW only needs one allele present to be expressed/shown in the phenotype ALLOW allele which is expressed instead of another <u>Examiner's Comments</u> This AO1.1 question proved to be very challenging, even for some higher ability candidates. Many candidates did not define the term allele at all, limiting their maximum mark to 1.  AfL Candidates should be encouraged to learn definitions. Many candidates didn't seem to really understand the term dominant, in a biological context, using words like stronger, override or overpower.
	b		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5-6 marks) What the results of the test tell the patient. AND Correctly interprets the information in the graph. AND Includes an analysis of usefulness of having the test. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3-4 marks) What the results of the test tell the patient. OR Correctly interprets the information in the graph. AND Includes an analysis of usefulness of having the test.	6 (AO 3 x 2.2) (AO 3 x 3.2a)	AO2.2 Applies knowledge and understanding to interpret the results of the test and the information in the graph - the test can tell them if they have the allele and are therefore likely to get the disease - the test will tell them the number of repeats they have - the graph will tell them the mean age that symptoms first develop in somebody who has a certain number of repeats - symptoms develop earlier with an increased number of CAG repeats / ORA - lower number of CAG repeats means a much larger age range in which symptoms first develop / ORA AO3.2a Analyses information and ideas to make judgements and draw conclusions. - the person may decide not to have

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
	<i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1-2 marks) What the results of the test tell the patient. OR The answer correctly interprets the information in the graph. OR Includes an analysis of usefulness of having the test. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>		children and therefore will not pass on the allele • there is a wide range of ages that a person of a certain age can first show symptoms • it does not show how bad the symptoms are or how long the person will live for • some people would rather not know when, or if, they are likely to become ill • it's useful to be aware and prepare for when the first symptoms will show • less useful/reliable/predictable test of when the first symptoms will show with a lower number of CAG repeats. • less useful as there is no cure only limited treatment for symptoms <u>Examiner's Comments</u> There were a lot of good responses to this Level of Response question covering AO2 and AO3. Many candidates understood what was going on regarding the test and graph, and were able to evaluate the usefulness of these, in some cases in a very well-developed response. Most candidates understood that the test could tell the patient how many CAG repeats they have, and this information, together with the graph, may tell them when symptoms may present. Higher ability candidates appreciated that the information from the graph had limitations. There was, however, some confusion about what the test and graph were for in lower ability candidates. Some were using the graph to decide if they were old enough to take the test so they could find out if they had a history of Huntington's disease. Quite a few suggested the test and graph would allow them to be cured. Quite a few incorrectly explained how somebody's age determined the number of repeats they would have and that this would decrease as they got older. A common misconception was that if 'caught' early, the disease could be prevented or cured. Some candidates seemed to have read the next part of the question (Q22(c)) about

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					potential treatments and adapted their Level of Response answer, despite it saying a cure was not possible in the stem of the question. Exemplar 1 It's useful because there is no cure so people with the disease die after 10-15 years so by knowing if it's doing the test and seeing how many CAG bases you have or alleles you can make the decision to not have children so they can't get the disease. Huntington's disease. The graph is useful because it shows the mean age of patients when they first develop symptoms. Symptoms are lower which means if you see how many CAG repeats you have you'll be prepared. However it may not be useful as it could stress people out or scare people if they see how many CAG repeats they have. [6] This exemplar represents an excellent example of how to gain maximum marks. The candidate has clearly identified that the gene test identifies how many CAG bases are present. They also identify that the test will show if the allele is present and links this to a usefulness of making decisions about having children. The graph analysis is also evidenced in the recognition that it identifies the mean age when first symptoms develop and there is a link to the usefulness of being able to prepare, avoid stress and also mentioned about being scared. Communication is clear, concise and as all aspects of the AO2 and AO3 assessment targeted by the question have been covered it gains maximum 6 marks.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c		mRNA prevented from carrying the code (for the protein to the ribosomes) ✓ this stops protein synthesis ✓	2 (AO 2.1 x2)	ALLOW translation cannot take place / ribosomes don't receive the code from mRNA IGNORE references to transcription ALLOW protein (that causes symptoms) is not made/less is made <u>Examiner's Comments</u> In this AO2.1 question a significant number of candidates thought that blocking the code meant the code would not be made at all (i.e. no transcription). A large number thought the method would somehow reduce the number of CAG repeats, and lower ability candidates thought this would get rid of the defective allele somehow. For candidates gaining 2 marks this was often for responses including ideas on 'preventing translation' so 'no protein synthesis or protein made'.
			Total	10	
58			C ✓	1 (AO2.2)	
			Total	1	
59			D ✓	1 (AO1.1)	
			Total	1	
60	a		lung ✓	1 (AO2.2)	
	b		mitosis ✓	1 (AO1.1)	
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
61	a		the blood is less likely to clot / wounds bleed for longer/longer to heal ✓	1 (AO1.1)	ALLOW bruise easily / excessive bleeding ALLOW tiredness / fatigue / infections
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 10 000(per mm ³) award 2 marks 1000 ÷ 0.1 OR 1000 x 10 ✓ = 10 000 (per mm ³) ✓	2 (AO2 x 2.2)	
		ii	no (no mark) (because 10 000) is in the normal range / levels / range without Fanconi anaemia✓	1 (AO3.2a)	ALLOW ECF from (i) ALLOW 10 000 is between 6000 and 16000
			Total	4	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
62	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Provides a detailed explanation linking cholesterol to heart disease. AND Provides a detailed analysis to explain if this link is supported by the graph. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Provides a detailed explanation linking cholesterol to heart disease. OR Provides a detailed analysis to explain if this link is supported by the graph. OR Provides a basic explanation linking cholesterol to heart disease. AND Provides a basic analysis of the information to explain if this link is supported by the graph. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Provides a basic explanation linking cholesterol to heart disease. OR Provides a basic analysis of the information to explain if this link is supported by the graph. OR Demonstrates knowledge of the importance of the blood supply to the heart muscle. <i>There is an attempt at a logical structure with a line of reasoning. The information is</i>	6 (AO2 x 1.1) (AO2 x 2.1) (AO2 x 3.1b)	AO1.1 Demonstrate knowledge and understanding of the importance of the blood supply to the heart muscle. - coronary artery carries blood to heart/muscle - blood takes oxygen/glucose to the heart/muscle - heart/muscle carries out aerobic respiration/needs energy - energy is needed for the heart/muscle to contract AO2.1 Apply knowledge and understanding of the requirements of the heart muscle - cholesterol build up (partially) blocks the blood flow in the artery - this reduces blood/oxygen/glucose carried to the heart/muscle - heart/muscle carries out less aerobic respiration/less energy released - heart/muscle can't contract as forcefully AO3.1b Analyse information and ideas to interpret the results on the study Support the link: - men with heart disease had (on average) a higher blood cholesterol level. - Men without heart disease had (on average) a lower blood cholesterol level. - build-up of cholesterol can lead to heart disease Doesn't support the link: - considerable overlap between the two groups - men can still have heart disease with low blood cholesterol levels - Men without heart disease can still have high blood cholesterol levels

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			<i>in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit</i>		
			Total	6	
63			C ✓	1 (AO2.1)	
			Total	1	
64			B ✓	1 (AO1.1)	
			Total	1	
65			B ✓	1 (AO2.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
66	a		Any two from: anaemia / tiredness / lack of energy due to lack of red blood cells ✓ inability to fight off infections / prone to infections due to lack of white blood cells/WBC ✓ slow blood clotting due to lack of platelets ✓	2 (AO2 x 1.1)	DO NOT ALLOW incorrectly matched symptom to blood cell type ALLOW less immunity / reduced immune response / weakened immune system due to lack of white blood cells/WBC ALLOW (recurring) nosebleeds / bruise easily due to lack of platelets
	b	i	people may be ill with infection / have a pathogen / just recovering from infection ✓ therefore have produced more white blood cells to destroy the pathogen/produce antibodies ✓ OR weakened immune system/cancer/cancer treatment reducing white blood cell number so less white blood cells to defend against pathogens/produce antibodies	2 (AO2 x 2.1)	IGNORE fighting(off) pathogens
		ii	Area = $10 \times 10 = 100(\text{mm}^2)$ Volume = $100 \times 0.001 = 0.1 (\text{mm}^3)$ ✓	1 (AO2.2)	
		iii	No (no mark) $1000 \div 0.1$ OR 1000×10 ✓ number of white blood cells/mm^3 is 10×10^3 / 1.0×10^4 / 10000 ✓ within the range of $6.0 - 16.0 \times 10^3$ ✓	3 (AO2 x 2.2) (AO3.2b)	ALLOW ECF from (ii) ALLOW number of white blood cells /mm^3 = 10 000 ALLOW within the normal white blood cell range/ 6000 – 16000

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c		(Fanconi anaemia) (no mark) (3 x 10⁶ is a) low red blood cell count ✓ must be Fanconi anaemia because: caused by recessive allele ✓ obtained from heterozygous/carrier parents who don't have a blood disorder ✓ OR cannot be D-B anaemia because: neither parents have a blood disorder ✓ it is caused by a dominant allele ✓	3 (AO3x3.2 b)	if incorrect disorder then no marks IGNORE low numbers of all cells
			Total	11	
67	a		antigens are different shapes ✓ idea that antigen binding site/antibody needs to fit the antigen ✓	2 (AO2 x 1.1)	ALLOW idea of each antigen being specific ALLOW idea of antigen binding site/antibody complementary to antigen IGNORE 'lock and key' IGNORE antibody bind/bonds to antigen (in stem of question)
	b	i	Any two from: pregnancy testing ✓ detecting diseases/cancer ✓ treating disease/cancer ✓	2 (AO2 x 2.1)	ALLOW specific diseases e.g. malaria ALLOW pathogen identification ALLOW vaccine development ALLOW drug testing
		ii	they divide rapidly / rapid mitosis / divide indefinitely / can produce many cells ✓	1 (AO2.1)	
			Total	5	

Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
68	a	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Demonstrates a knowledge of the importance of the blood supply to the heart. AND Applies knowledge to explain why a failure of this blood supply can lead to heart disease. AND Analyses the information to explain the link between a lack of LDL protein and heart disease. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Demonstrates a knowledge of the importance of the blood supply to the heart. AND Applies knowledge to explain why a failure of this blood supply can lead to heart disease. OR Demonstrates a knowledge of the importance of the blood supply to the heart. AND Analyses the information to explain the link between a lack of LDL protein and heart disease. OR Applies knowledge to explain why a failure of this blood supply can lead to heart disease. AND Analyses the information to explain the link between a lack of LDL protein and heart	6 (AO2 x 1.1) (AO2 x 2.1) (AO2 x 3.1a)	AO1.1 Demonstrate knowledge and understanding of the importance of the blood supply to the heart muscle. • blood in the coronary artery supplies heart muscle • oxygen / glucose is supplied to the muscle • this is needed for the muscle to contract/for respiration AO2.1 Apply knowledge and understanding of the requirements of the heart muscle • without oxygen / glucose the heart muscle cannot <u>respire</u> • <u>energy</u> from respiration is needed for the muscle to contract AO3.1a Analyse information and ideas to interpret the effects of lack of LDL receptor protein. • without LDL receptor protein there will be more cholesterol in the blood / cholesterol levels will be too high to be removed/broken down • increased build up of cholesterol in the coronary artery will increase the risk of heart disease / decrease blood flow to the heart muscle

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			disease. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Demonstrates a knowledge of the importance of the blood supply to the heart. OR Applies knowledge to explain why a failure of this blood supply can lead to heart disease. OR Analyses the information to explain the link between a lack of LDL protein and heart disease. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit</i>		
	b		low dose of the drug does not seem to have any effect ✓ because the effect is very similar to the placebo ✓ high dose of the drug lowers blood cholesterol level most and would be the best way to administer the drug ✓	3 (AO3 x 3.1b)	
			Total	9	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
69		i	use Benedicts (reagent) ✓ heat / boil ✓ no change in colour / stays blue / does not go red ✓	3 (AO3 x 1.2)	
		ii	Yes (no mark) blood sugar levels will be controlled/not rise ✓ idea of a sugar replacement ✓	2 (AO1 x 3.2a) (AO1 x 2.1)	If No chosen = 0 marks IGNORE blood sugar levels will decrease ALLOW less sugar eaten
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
70	a		idea that water is added from (each) lake to a (separate) Petri dish using (sterile) pipette ✓ filter paper/antibiotic disc is placed in (the centre of) each dish with the (sterile) forceps ✓ Petri dishes are incubated ✓ idea that the inhibition zone/clear area/area with no bacteria growth around the discs is measured ✓	4 (AO4 x 1.2)	ALLOW idea of repeats ALLOW idea of setting up a control
	b		Lake Bellandur– no mark Any two from: more (antibiotic) resistant bacteria / more species of bacteria are resistant to antibiotics / ORA ✓ Lower number of bacteria killed by antibiotics / less species of bacteria killed by antibiotics / ORA ✓ this lake contains a higher ratio of resistant bacteria compared to bacteria killed by antibiotics✓ (antibiotic) resistant bacteria more likely to survive/reproduce with more (antibiotic) pollution ORA✓	2 (AO2 x 3.2a)	Incorrect or no lake given then no marks ALLOW bacteria are more resistant (antibiotic) DO NOT ALLOW more resistant to bacteria IGNORE immune ALLOW only 28 species are killed ALLOW idea of natural selection causing increased resistant bacteria with more (antibiotic) pollution
			Total	6	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
71	a		idea that water is added from (each) lake to a (separate) Petri dish using (sterile) pipette ✓ filter paper/antibiotic disc is placed in (the centre of) each dish with the (sterile) forceps ✓ Petri dishes are incubated ✓ idea that the inhibition zone/clear area/area with no bacteria growth around the discs is measured ✓	4 (AO4 x 1.2)	ALLOW idea of repeats ALLOW idea of setting up a control
	b		Lake Bellandur– no mark Any two from: more (antibiotic) resistant bacteria / more species of bacteria are resistant to antibiotics / ORA ✓ Lower number of bacteria killed by antibiotics / less species of bacteria killed by antibiotics / ORA ✓ this lake contains a higher ratio of resistant bacteria compared to bacteria killed by antibiotics✓ (antibiotic) resistant bacteria more likely to survive/reproduce with more (antibiotic) pollution ORA ✓	1 (AO2 x 3.2a)	Incorrect or no lake given then no marks ALLOW bacteria are more resistant (antibiotic) DO NOT ALLOW more resistant to bacteria IGNORE immune ALLOW only 28 species are killed ALLOW idea of natural selection causing increased resistant bacteria with more (antibiotic) pollution
			Total	6	