OCR GCSE GATEWAY BIOLOGY A · J247

BIOLOGY



EXAM QUESTION PACK

B6.3 MONITORING AND MAINTAINING HEALTH (PACK 1)

SCORE	PERCENTAGE
/249	%

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.

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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]

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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]

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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]

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(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?

---

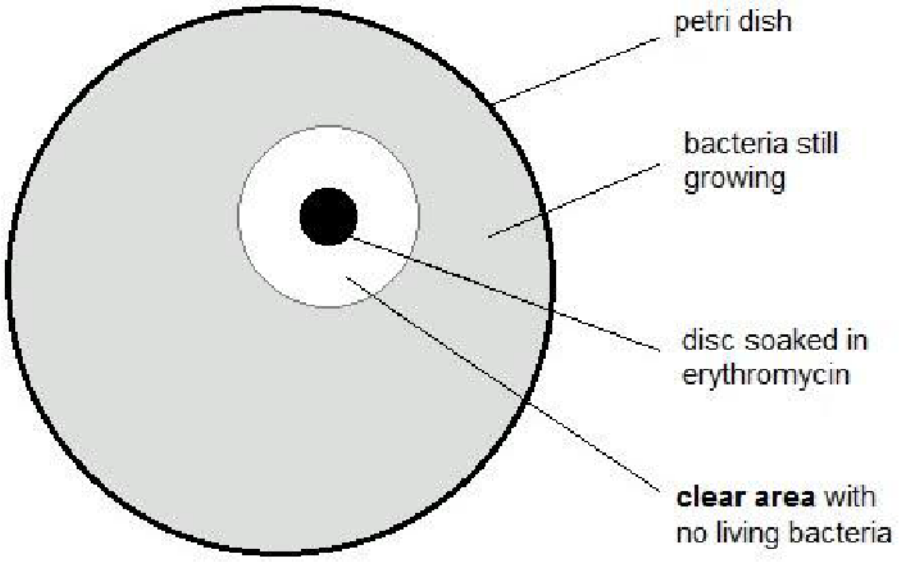
[1]

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

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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 = _____ mm^2

[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?

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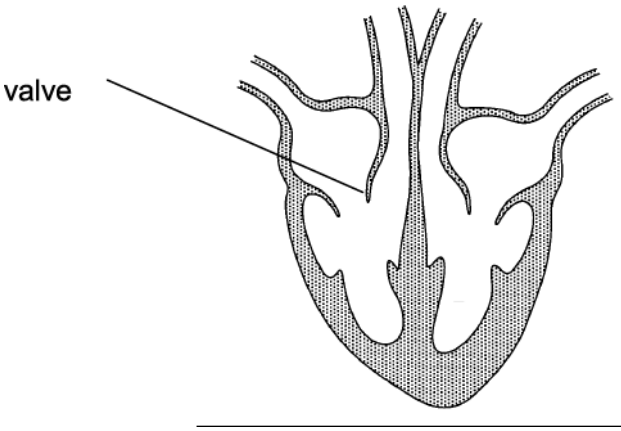
[1]

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

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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.

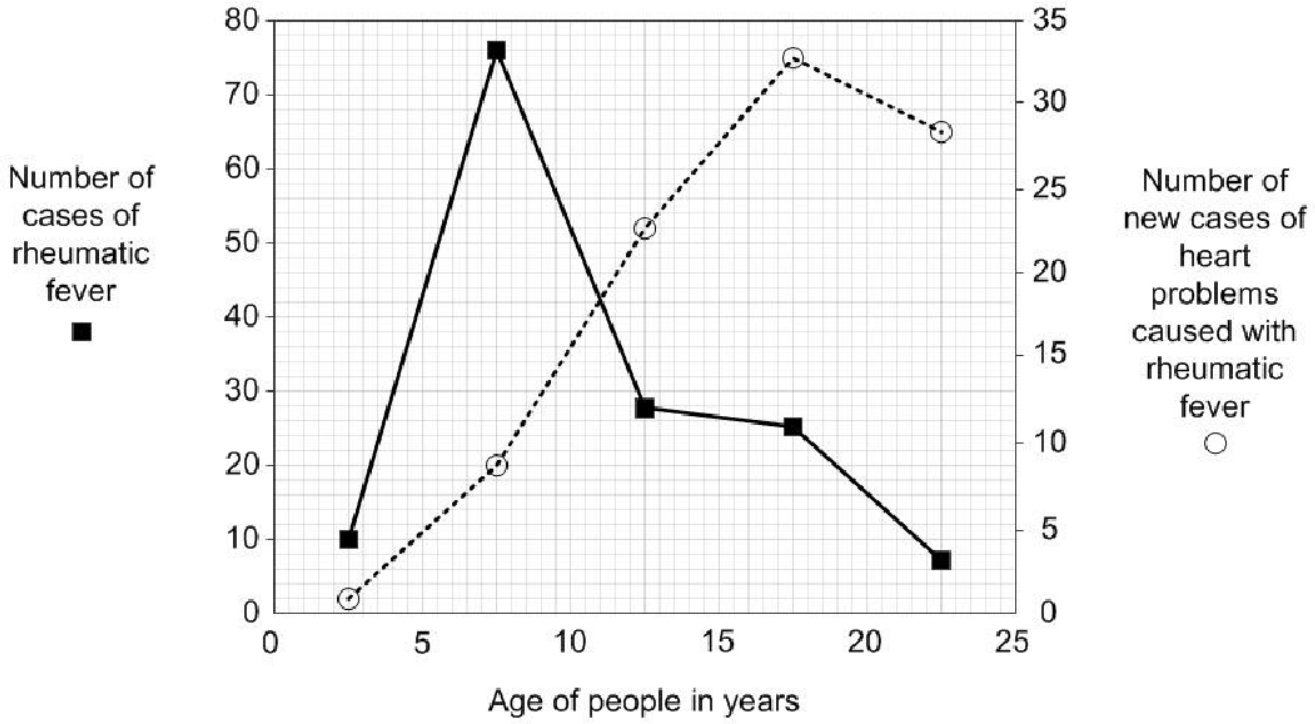
It shows the number of cases of rheumatic fever.

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

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(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]

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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]

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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 ☐

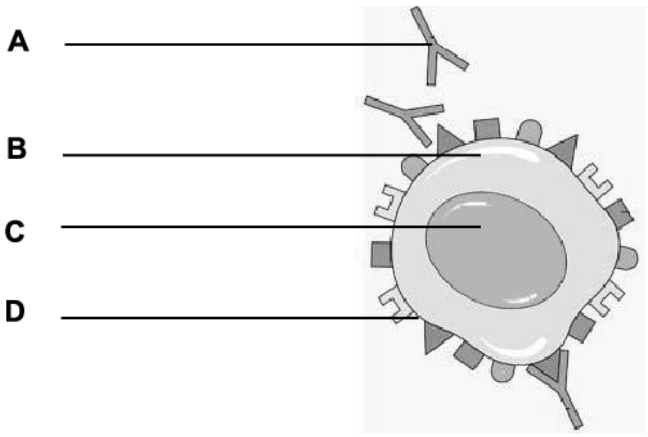
[1]

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]

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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]

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(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?

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[2]

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

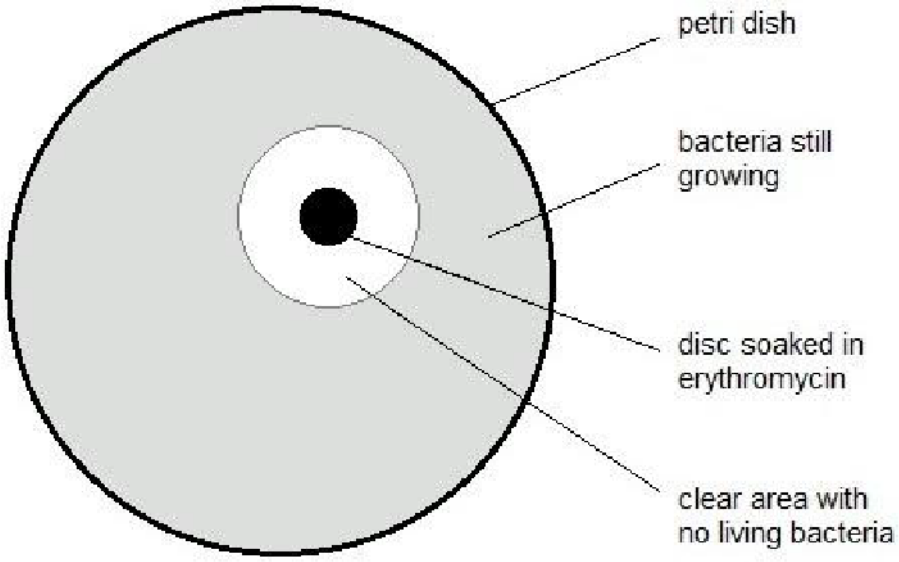
---

[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 = _____ mm^2 **[3]**

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

_____

_____

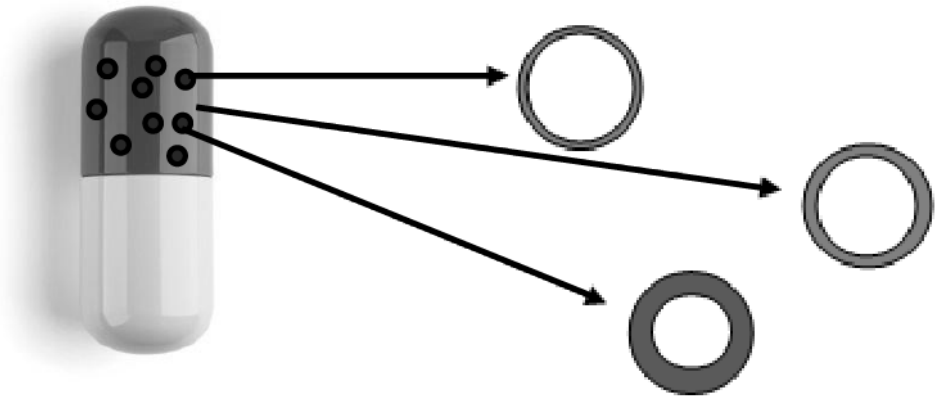
_____ **[2]**

(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.

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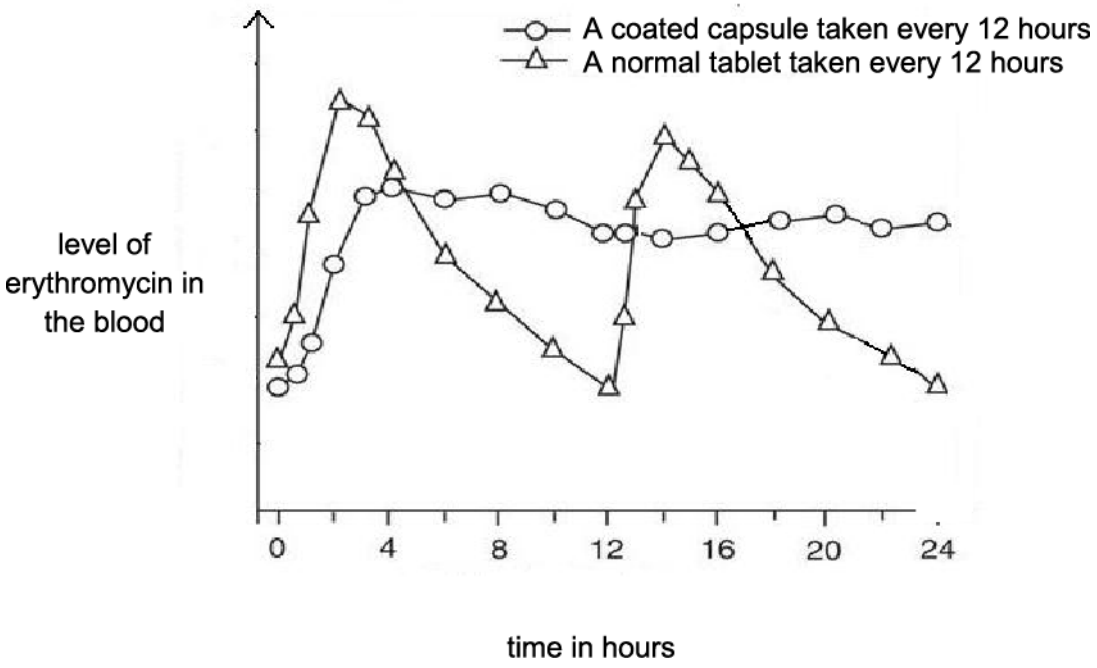
[2]

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

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

[6]

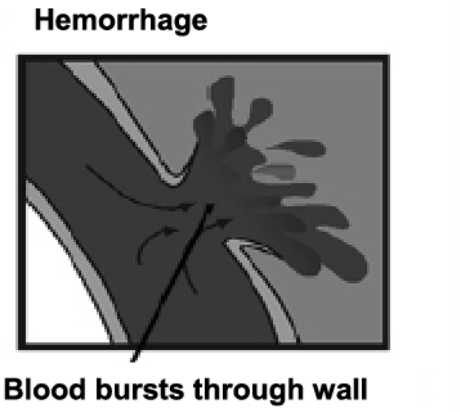
17 Strokes are a type of cardiovascular disease.

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

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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:

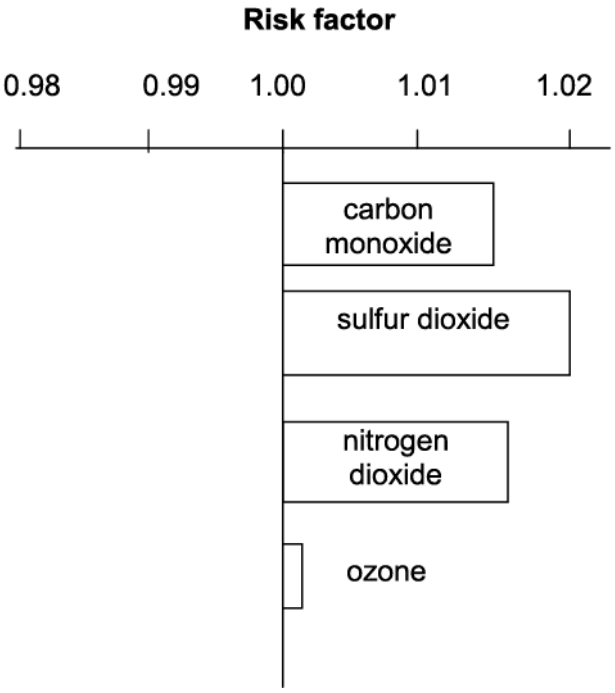
$$\text{risk factor} = \frac{\text{number of people who had a stroke soon after an increase in pollution}}{\text{number of people who had a stroke after no increase in pollution}}$$

The graph shows their results.

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(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]

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18(a) Singapore is a small country.

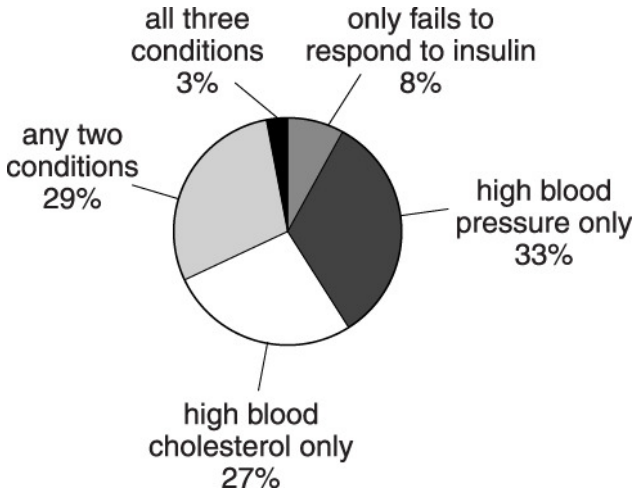
Everyone living in Singapore was offered a health check to test for three conditions.

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.

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---

[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.

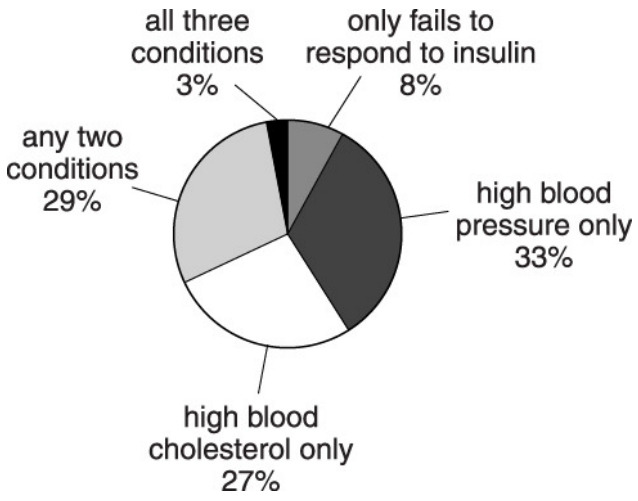
Everyone living in Singapore was offered a health check to test for three conditions.

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 that large numbers of people may develop serious diseases.

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Use the data and your biological knowledge to explain why the government is worried.
In your answer, include the links between the conditions tested for and the diseases they may cause. Include calculations to support your answer.



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

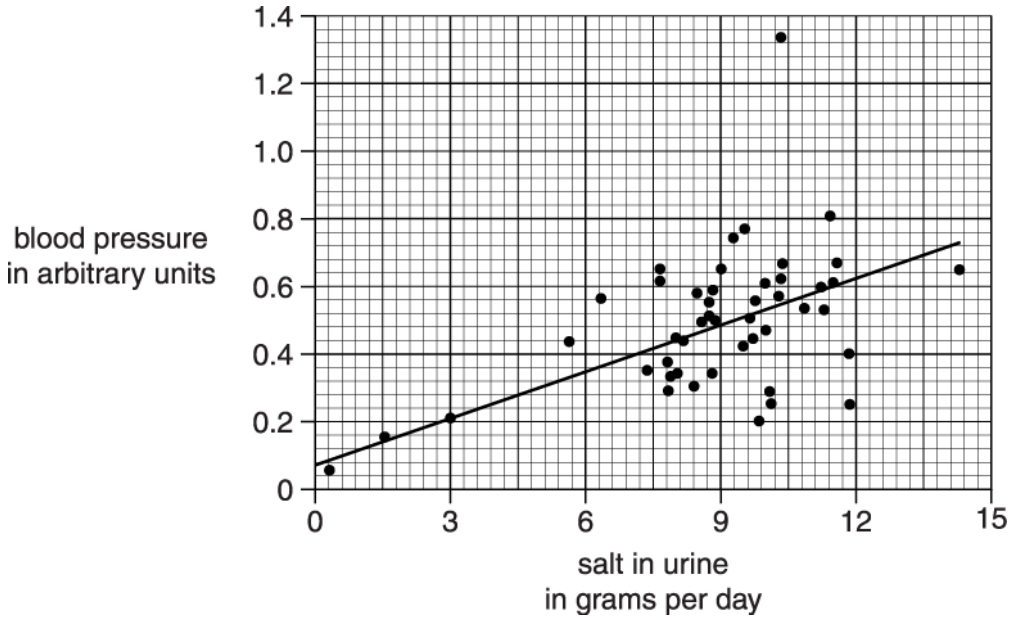
[6]

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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.

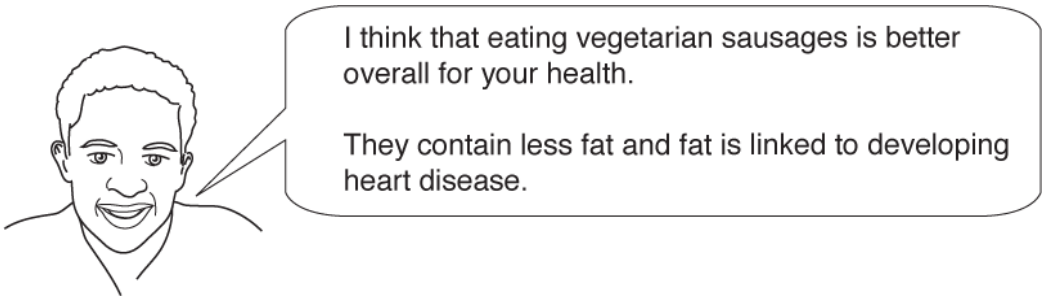
--- [2]

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.



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]

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(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]

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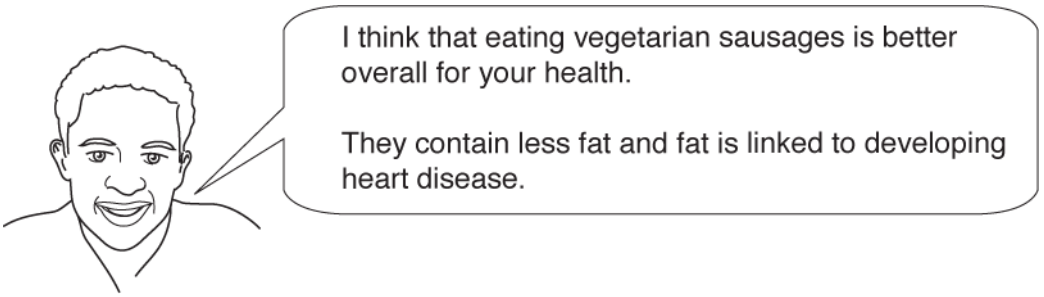
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24 The table shows information about the contents of two types of sausage.

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.



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.

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[3]

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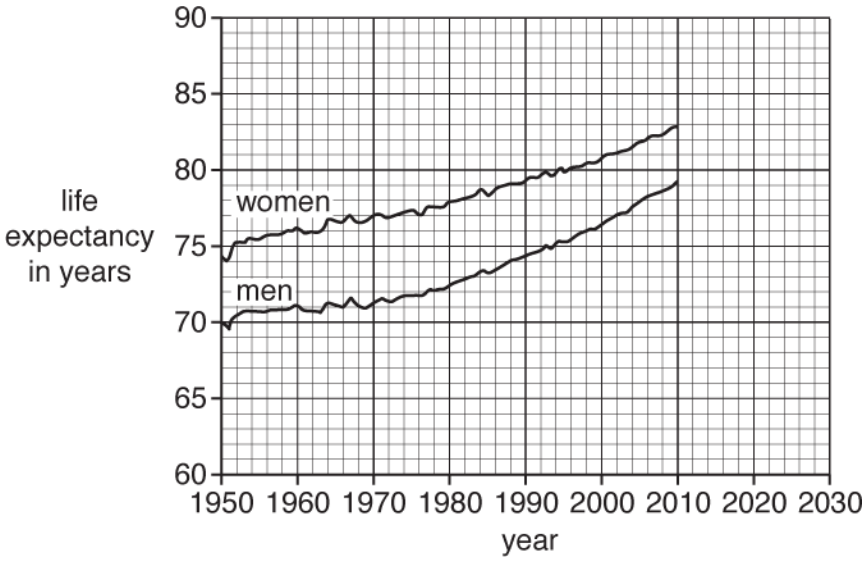
(b) When scientists develop new medicines they test the medicine in trials using placebos.

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.

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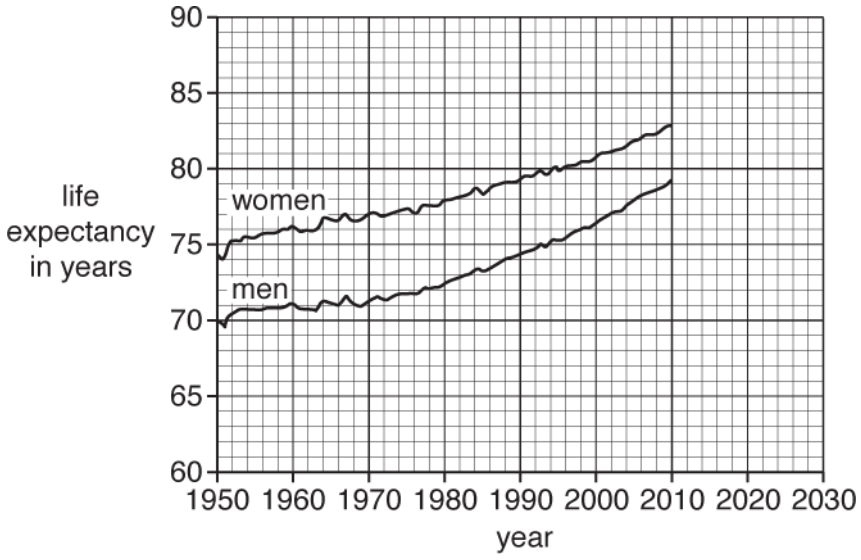
[2]

(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.

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[2]

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(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]

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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]

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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?

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[2]

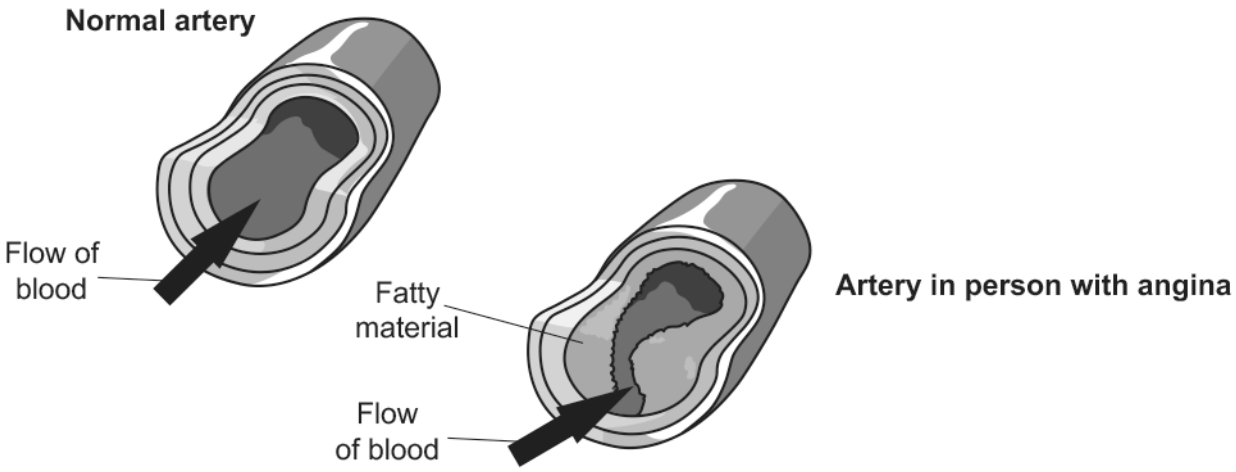
(ii) Write down **two** reasons why medical treatments are tested on animals first.

---

[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

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

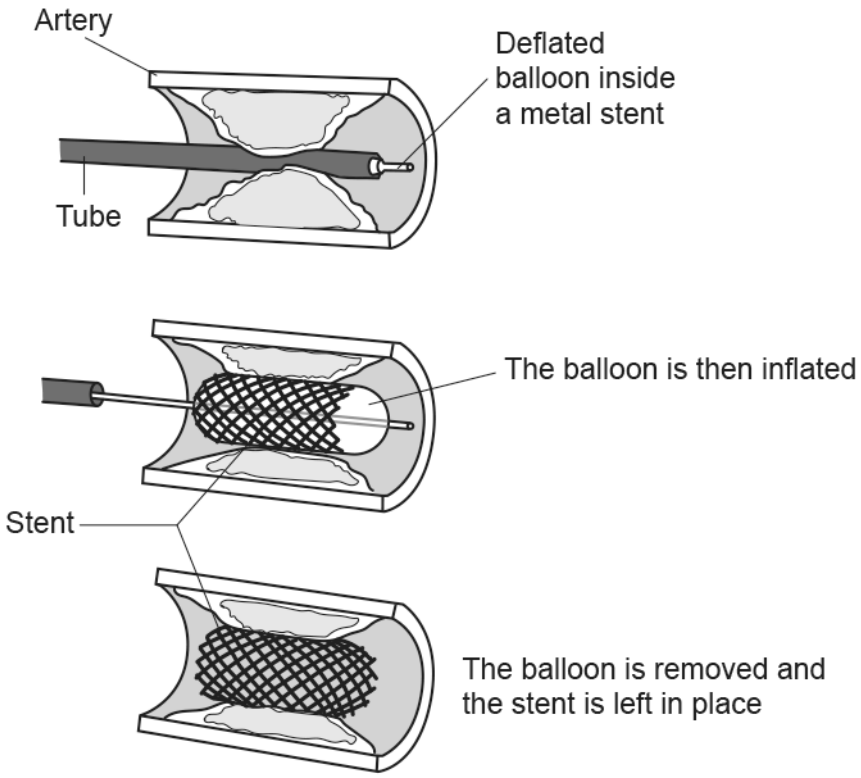
Show how you worked out your answer.

---[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.



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(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]

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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]

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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

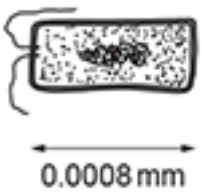
Your answer [1]

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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]

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(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.

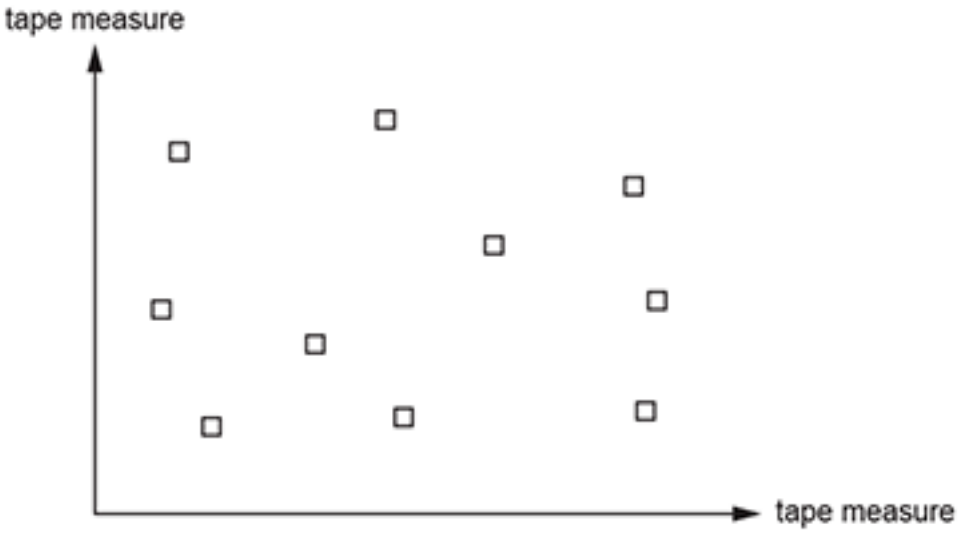
They then place a square frame on the ground in different places and count the number of plants in the square, as shown below.



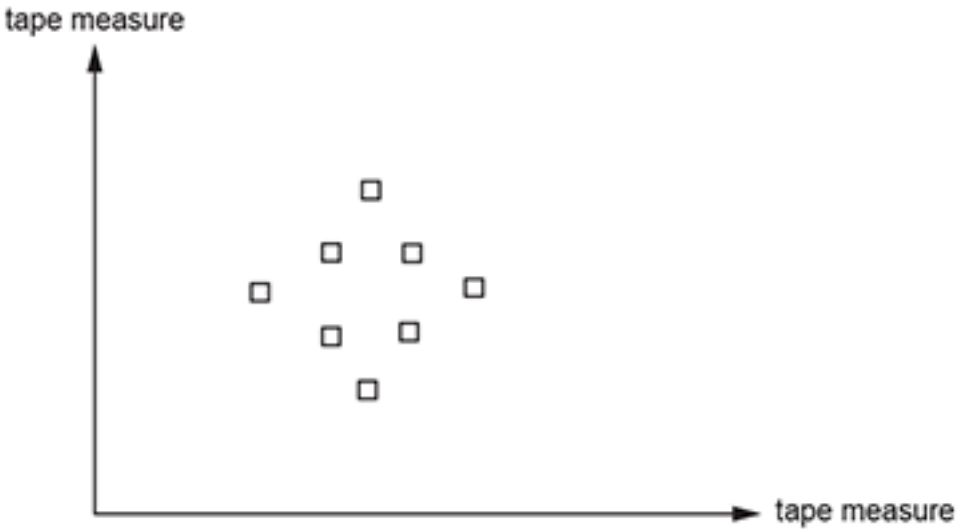
What is the name of the square frame that they use to sample the plants?

[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.



Student **A**'s sampling



Student **B**'s sampling

(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.

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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]

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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 ----------

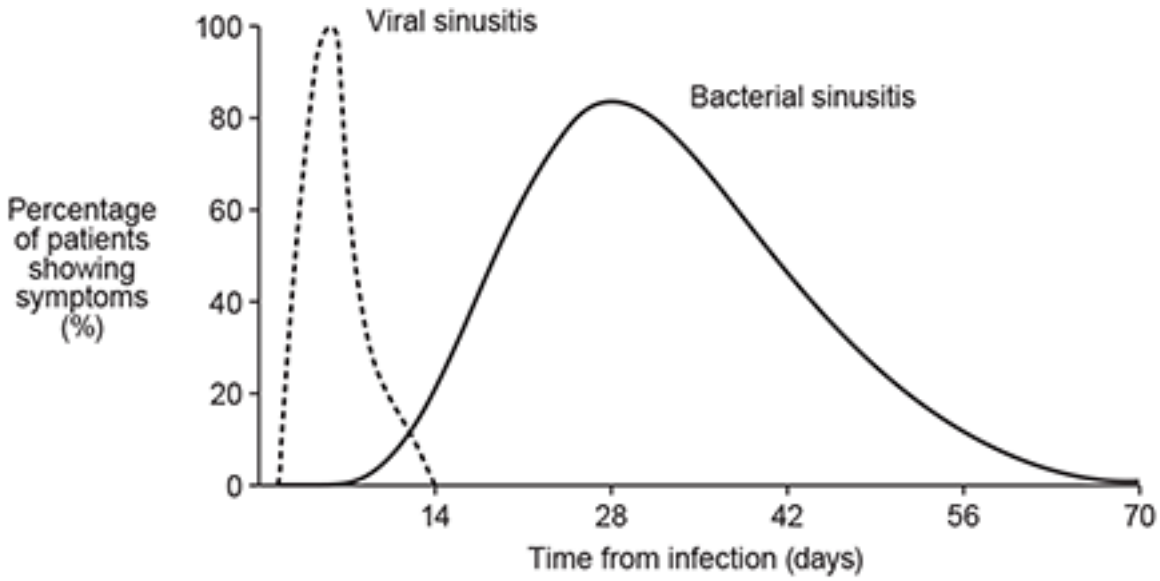
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2 ----------

---

[2]

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

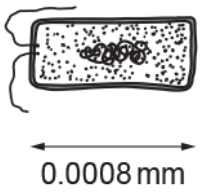


Doctors usually wait 14 days after infection before giving patients antibiotics for sinusitis.

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]**

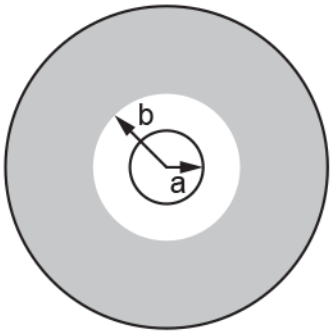
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49 A student places an antibiotic disc onto the surface of agar that is covered in bacteria.

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]**

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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]

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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]

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(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]

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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.

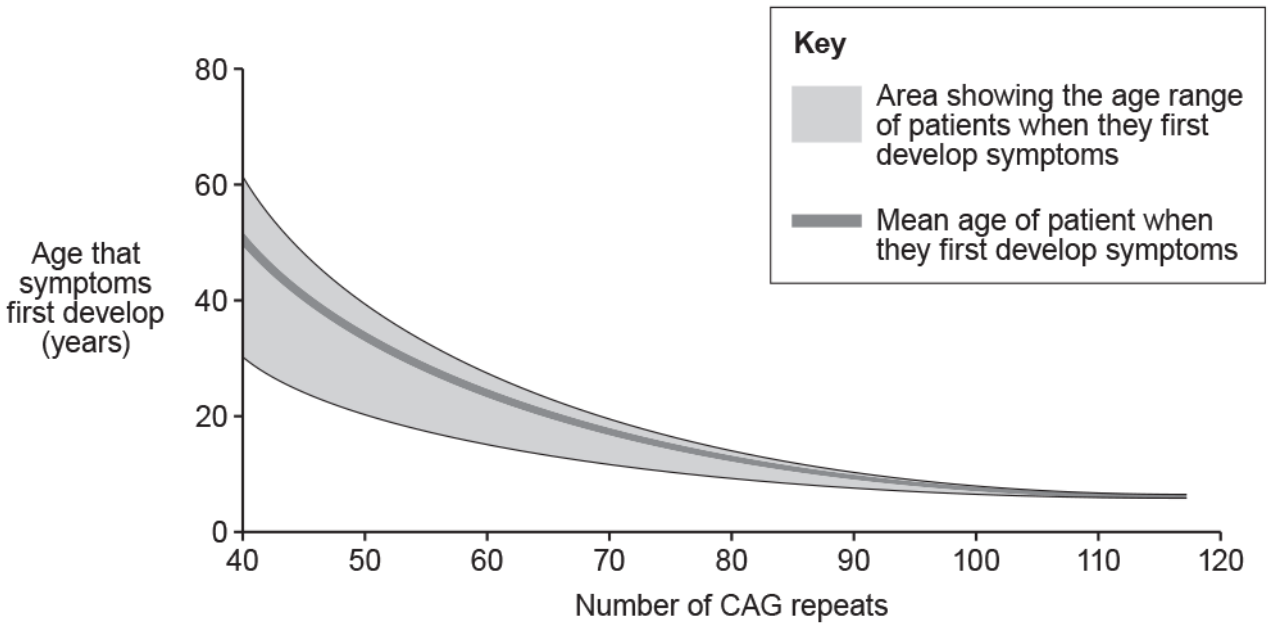
Scientists now know that there are a number of different forms of the allele that causes Huntington's disease. The allele has a sequence of three bases, CAG, that repeats many times. The number of repeats varies between patients.

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.



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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.

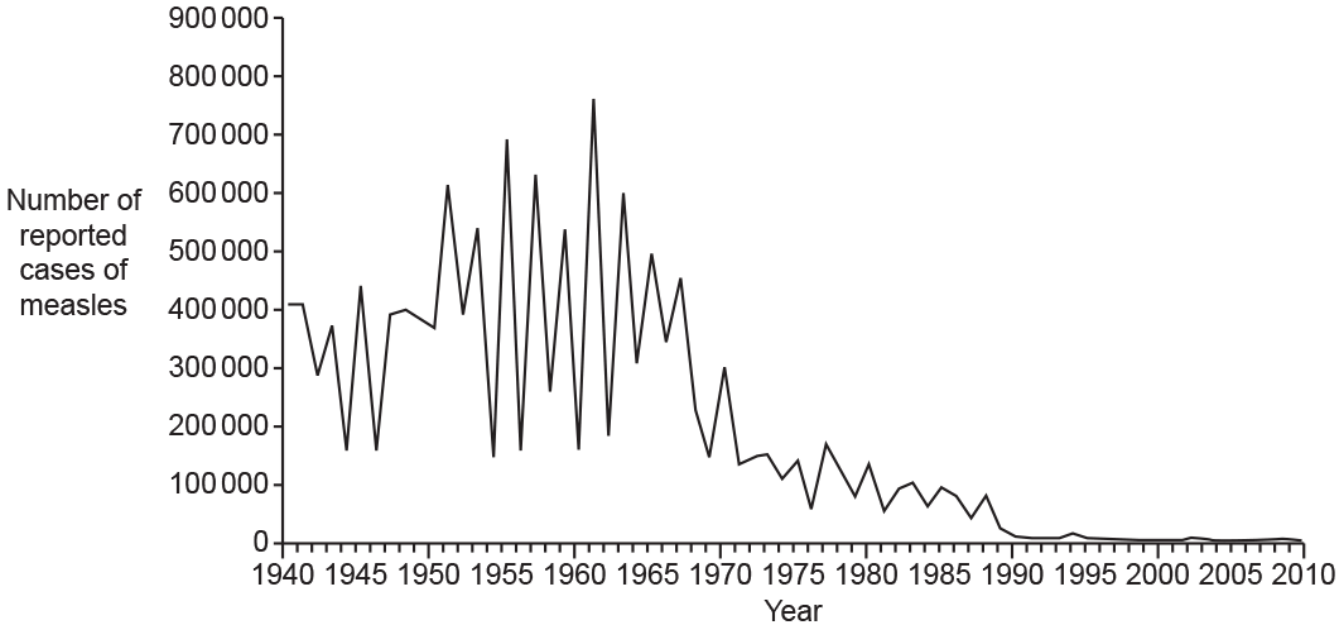
[6]

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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]

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



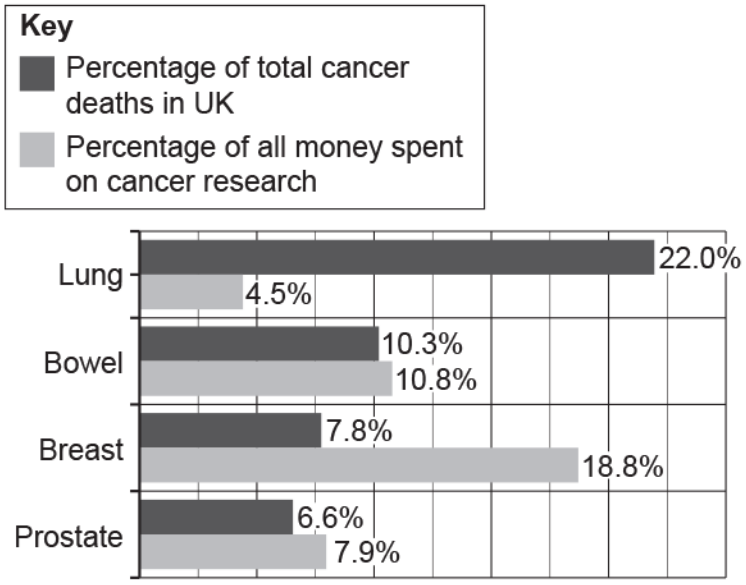
What type of pathogen causes tobacco mosaic disease in plants?

A Bacterium
B Fungus
C Protist
D Virus

Your answer [ ] [1]

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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]

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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]

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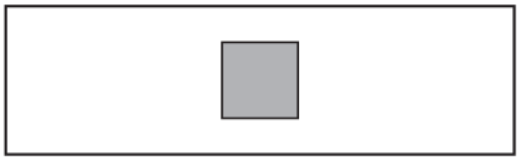
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(b) Fanconi anaemia also causes a decrease in white blood cells and red blood cells.

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 mm^3 and it contains 1000 white blood cells.

Calculate the number of white blood cells per mm^3 of blood.

Number = ... per mm^3 **[2]**

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

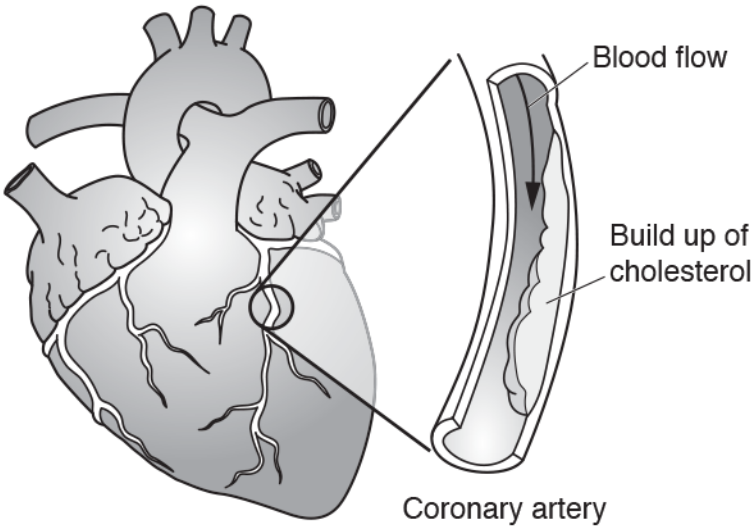
Use the table and your answer to part **(i)** to justify your answer.

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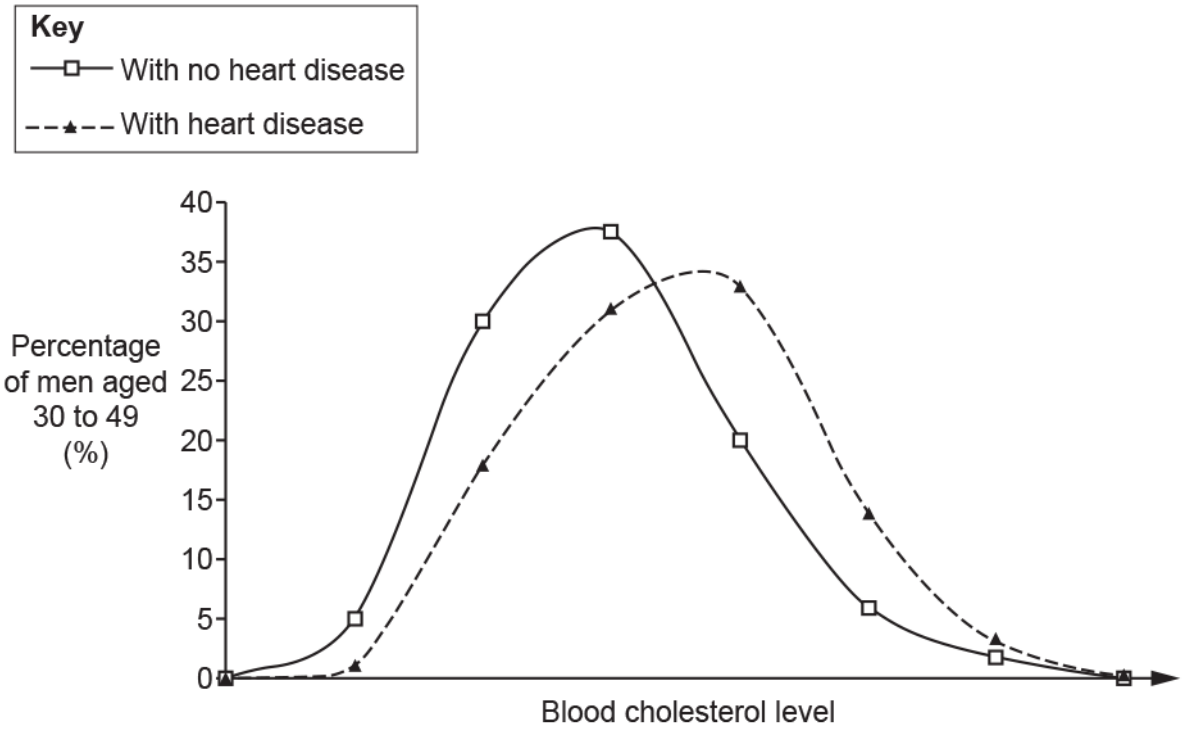
[1]

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.

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Use evidence from the diagram and the graph in your answer.

[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]**

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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.

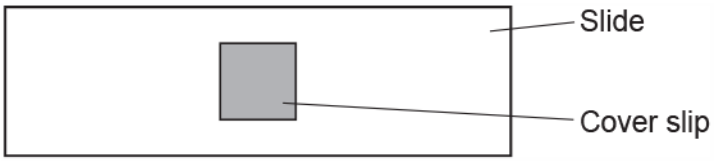
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[2]

(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 = ... mm^3 **[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]

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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.

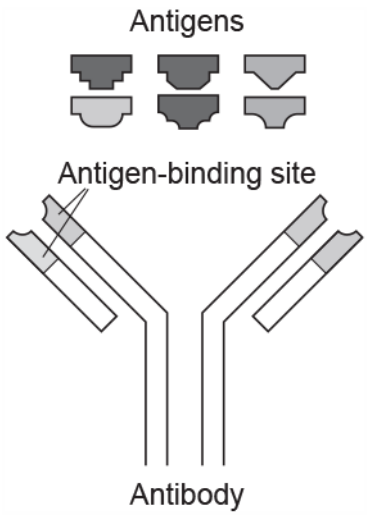


Fig. 20.1

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

---

[2]

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(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.

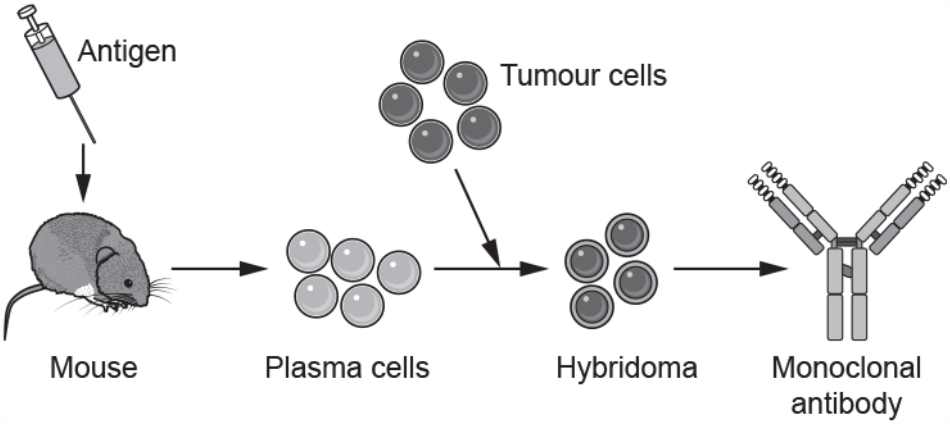


Fig. 20.2

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

1 _____

2 _____

[2]

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

_____

_____ **[1]**

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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.

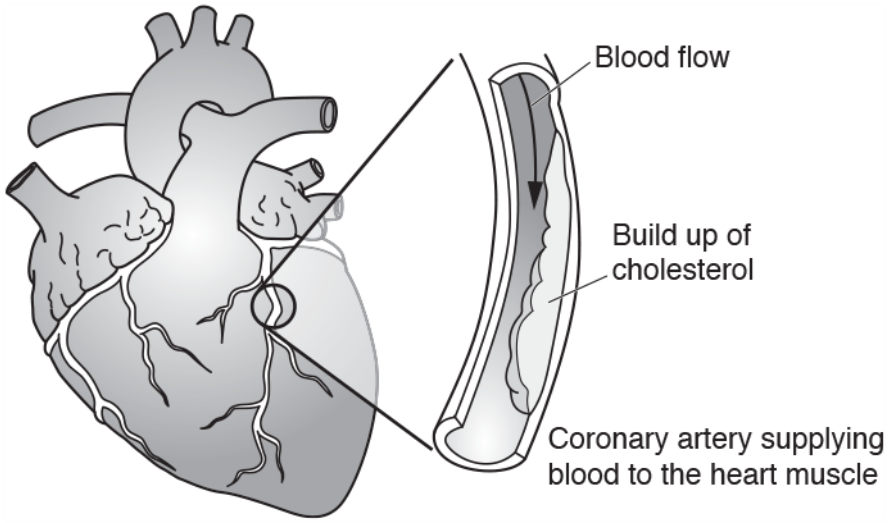


Fig. 21.1

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.

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[6]

(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.**

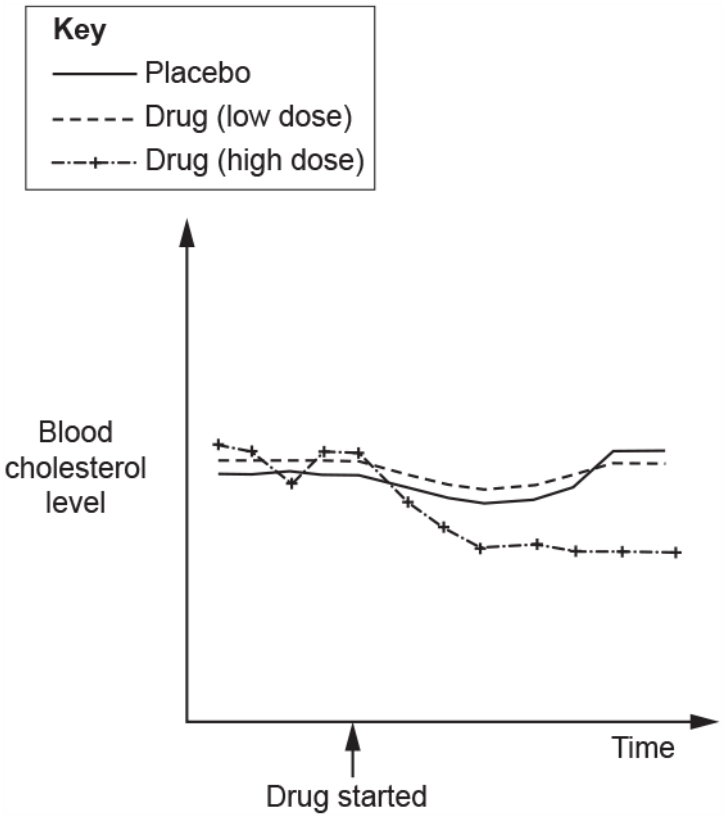


Fig. 21.2

Evaluate the results of the test.

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[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.

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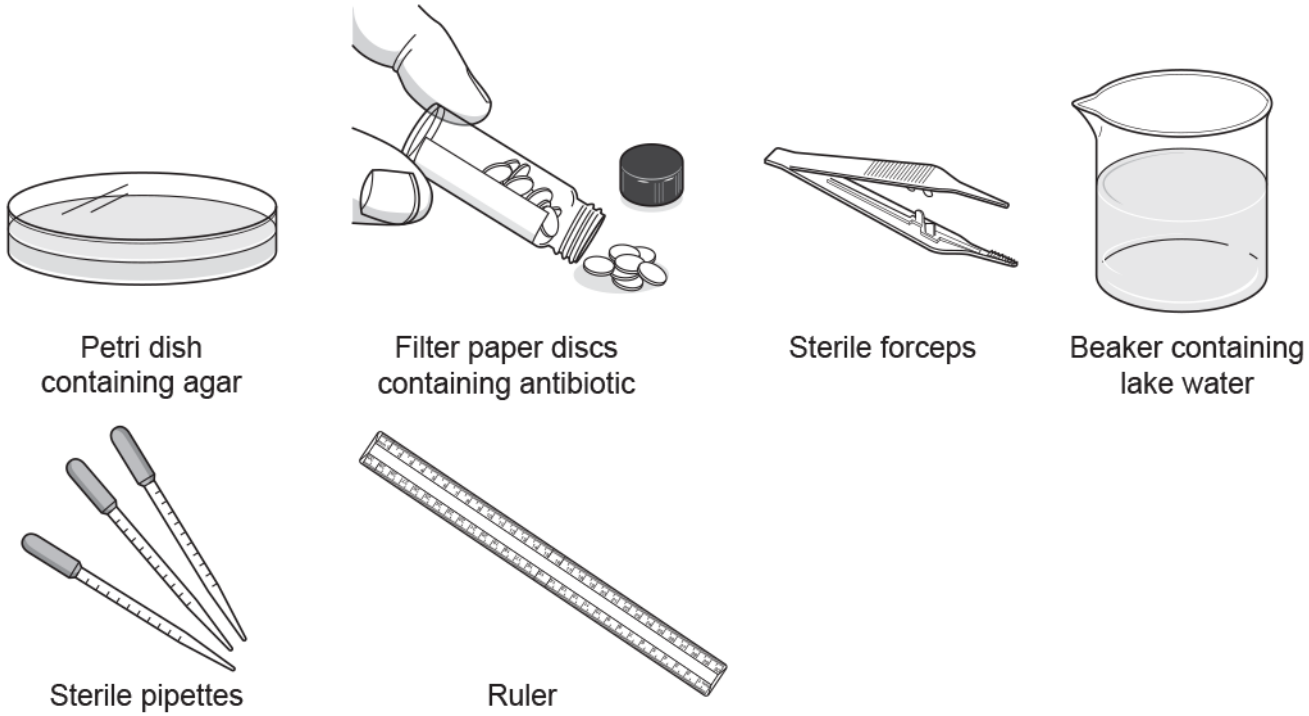


Fig. 22.2

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]

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.

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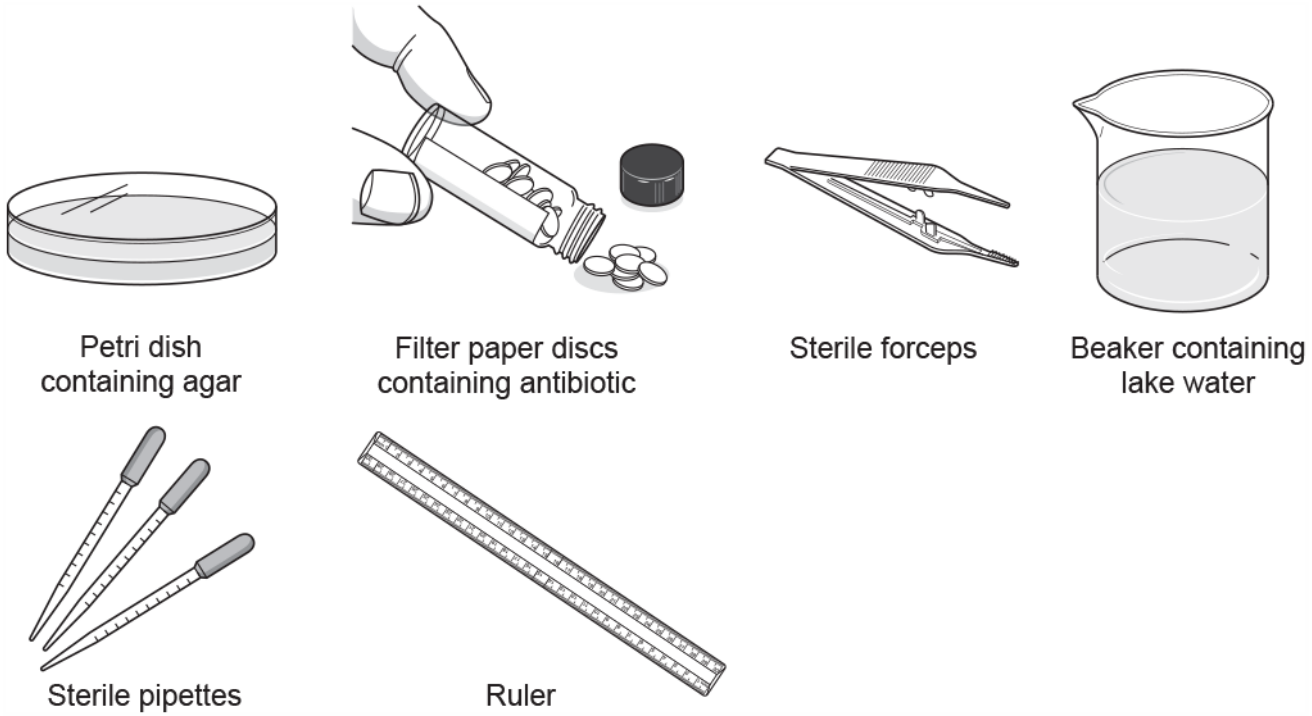


Fig. 16.2

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.

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	Number of different species of bacteria	
	In Lake Bellandur	In Lake Jakkur
Resistant to antibiotics	53	35
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Which lake has the **highest** levels of antibiotic pollution?

Tick (✓) **one** box.

Lake Bellandur ☐

Lake Jakkur ☐

Explain your answer.

---

[2]

END OF QUESTION PAPER

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