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EDEXCEL GCSE BIOLOGY: QUESTIONS BY TOPIC

Health, Disease and the Development of Medicines (5)

GCSE Biology (Foundation) Topic 5

20 questions · 215 marks · Mark schemes included

Pearson Edexcel GCSE (9-1) Biology 1BI0, Foundation Tier, June 2018 - June 2025

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 Piccadilly Business Centre, Unit C, Aldow Enterprise Park
Blackett Street, Manchester, M12 6AE

HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

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QUESTIONS

20 questions · 215 marks · lowest tariff first



7-MARK QUESTIONS

2 questions in this booklet



1 (a) Pathogens cause disease.

Draw one straight line from each type of pathogen to the disease that is caused by that pathogen.

(2)**type of pathogen**

fungus

virus

disease

AIDS

malaria

tuberculosis

cholera

Chalara ash dieback

(b) Antibiotics can be used to treat diseases.

Antibiotics kill

(1)

- ☐ **A** antibodies
- ☐ **B** antigens
- ☐ **C** bacteria
- ☐ **D** viruses

(c) Figure 1 shows the number of white blood cells in blood samples from three patients.

	Patient X	Patient Y	Patient Z
Number of white blood cells per μl	8 500	5 700	12 500

Figure 1

Explain why the data suggests that Patient Z has a bacterial infection.

(2)

.....

.....

.....

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.....

.....

(d) HIV is diagnosed by blood tests.

State **two** safety precautions that need to be taken when handling blood samples.

(2)

1.....

.....

2.....

.....

(Total for Question 1 = 7 marks)



1 Some bacteria cause disease.

(a) Which word describes an organism that causes disease?

(1)

- ☐ A pathogen
- ☐ B culture
- ☐ C antibiotic
- ☐ D platelet

(b) Draw **one** straight line from each disease to the main way that the disease is spread.

(2)

disease

main way the
disease is spread

cholera

malaria

in the air

by animal vectors

in body fluids

by a vaccination

in water



(c) A scientist investigated the effect of temperature on the growth of bacteria.

The bacteria were grown at 10°C and 20°C.

The number of bacteria grown at each temperature were counted every two hours.

Figure 1 shows the result.

time in hours	number of bacteria at 10°C in thousands	number of bacteria at 20°C in thousands
0	10	10
2	20	47
4	30	74
6	40	80
8	50	80

Figure 1

Figure 2 shows a graph of the results at 20°C.

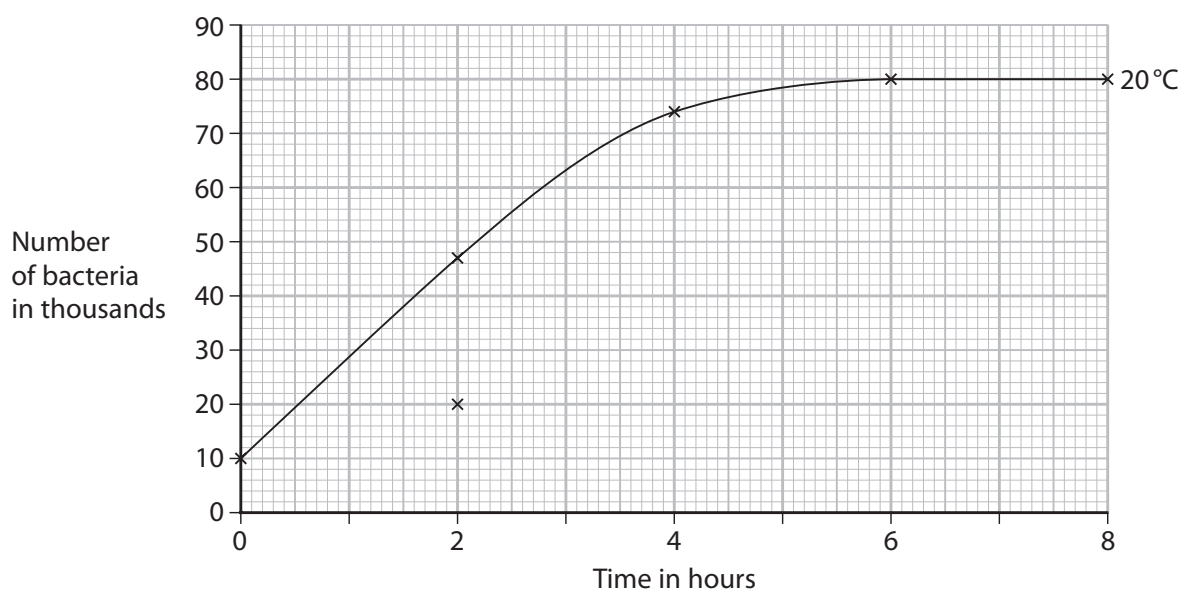


Figure 2

(i) Plot the points on the graph for the number of bacteria at 10°C.

The first two points have been plotted for you.

(1)

(ii) Draw a line of best fit on the graph for 10°C.

(1)



(iii) Describe how the growth of bacteria at 10°C was different from the growth of bacteria at 20°C.

(2)

(Total for Question 1 = 7 marks)



8-MARK QUESTIONS

1 question in this booklet



1 Figure 1 shows human blood seen using a light microscope.

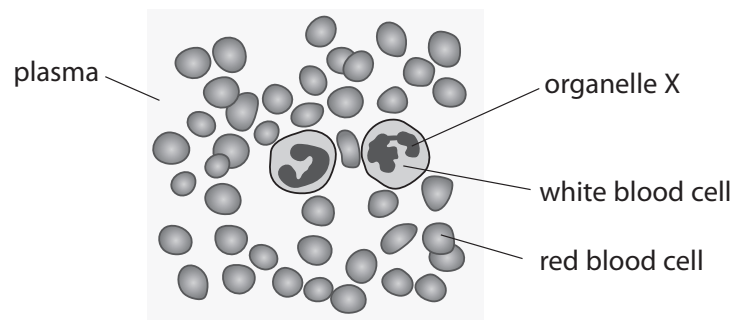


Figure 1

(a) (i) The organelle labelled X controls the activities of the white blood cell.

What is the name of organelle X?

(1)

- ☐ A mitochondrion
- ☐ B ribosome
- ☐ C chromosome
- ☐ D nucleus

(ii) Use words from the box to complete the sentences.

(2)

gas	haemoglobin	hormone
liquid	platelet	solid

Red blood cells contain the substance

Blood plasma is a

(iii) Describe **two** ways that white blood cells protect the body from disease.

(2)

1

.....

2

.....

(b) Figure 2 shows a white blood cell on a 100 μm scale.

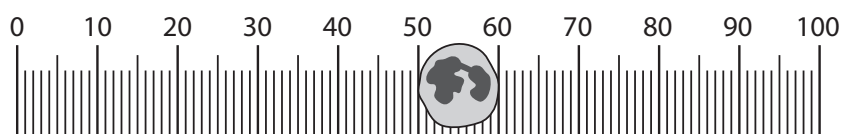


Figure 2

State the width of the white blood cell.

(1)

..... μm

(c) Figure 1 shows human blood seen using a light microscope.

Explain why using an electron microscope shows the structures in the white blood cells more clearly.

(2)

.....

.....

.....

.....

.....

(Total for Question 1 = 8 marks)

9-MARK QUESTIONS

1 question in this booklet



5 A student investigated the antibiotic properties of garlic.

Bacteria were spread on an agar plate.

A paper disc soaked in garlic extract was placed on this agar plate.

Figure 9 shows the agar plate after 24 hours.

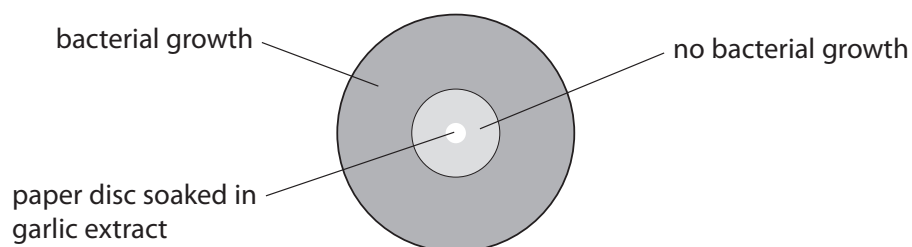


Figure 9

(a) (i) Suggest why there is an area with no bacterial growth.

(1)

- (ii) The student repeated the investigation using three separate agar plates with different concentrations of garlic extract.

Figure 10 shows the results.

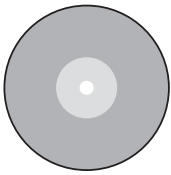
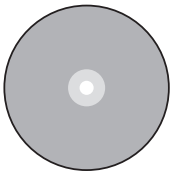
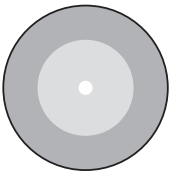
appearance of the agar plates after 24 hours		
A	B	C
		

Figure 10

The concentrations of garlic extract used were 10 mg/cm^3 , 40 mg/cm^3 and 100 mg/cm^3 .

Explain which agar plate, shown in Figure 10, has the paper disc containing the 100 mg/cm^3 garlic extract.

(2)

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.....

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.....

.....

- (iii) Give **one** way the student could improve their results.

(1)

.....

.....

.....

(iv) The area with no bacterial growth for agar plate B has a radius of 5 mm.

Calculate the area with no bacterial growth for agar plate B.

The area of a circle is πr^2 .

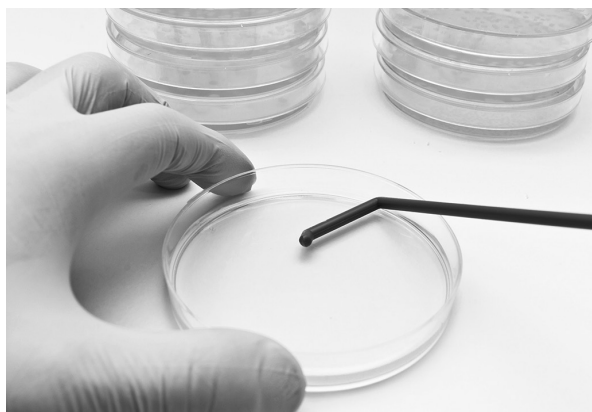
Use $\pi = 3.14$

(2)

area = ... mm²



(b) Figure 11 shows bacteria being spread on an agar plate.



(Source: © Chatchouliya/Shutterstock)

Figure 11

- (i) State the reason for heating the spreader in the flame of a Bunsen burner before use.

(1)

.....

.....

- (ii) Give **two** other ways of working safely with microorganisms.

(2)

1

.....

2

.....

(Total for Question 5 = 9 marks)

10-MARK QUESTIONS

4 questions in this booklet



- 5 (a) (i) Which row of the table shows the endocrine gland and hormone involved in the control of blood glucose concentration?

(1)

	endocrine gland	hormone
☐ A	ovary	oestrogen
☐ B	ovary	insulin
☐ C	pancreas	oestrogen
☐ D	pancreas	insulin

- (ii) State a target organ for the hormone that controls blood glucose concentration.

(1)

- (b) People with a high BMI are more likely to develop type 2 diabetes.
Figure 11 shows the mass, height and BMI for two people.

person	mass in kilograms	height in metres	BMI
A	110	2.0	?
B	85	1.5	38

Figure 11

- (i) Use the formula to calculate the BMI for person A

$$\text{BMI} = \frac{\text{mass}}{\text{height}^2}$$

(2)



(ii) Person B develops type 2 diabetes.

Describe **two** lifestyle changes person B should make to help to control their blood glucose concentration.

(2)

1

2

(c) (i) Which row of the table shows the type or types of respiration that use glucose?

(1)

	aerobic respiration	anaerobic respiration
☐ A	yes	yes
☐ B	yes	no
☐ C	no	yes
☐ D	no	no

- (ii) A scientist measured the rate of respiration in a person when sleeping and then running at different speeds.

Figure 12 shows the results.

activity	speed in km per hour	respiration rate in kJ per minute
sleeping	0	3
running slowly	8	90
running quickly	12	130

Figure 12

Explain the trend shown in Figure 12.

(3)

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(Total for Question 5 = 10 marks)

5 In Ireland during the 19th century, a mould caused potato plants to rot.

(a) Explain how this mould affected food security in Ireland.

(2)

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.....

(b) A group of pupils investigated the effect of temperature on mould growth on bread.

Figure 8 shows the bread after being kept at different temperatures for seven days.

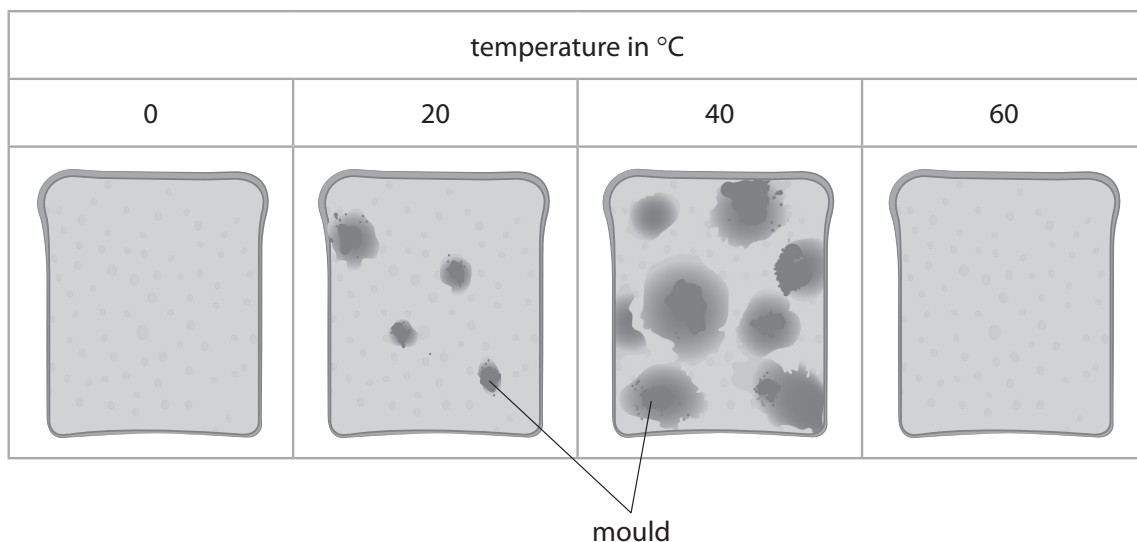


Figure 8

(i) Which is the best estimate of the percentage cover of mould on the bread at 40°C?

(1)

- ☐ **A** 0%
- ☐ **B** 25%
- ☐ **C** 50%
- ☐ **D** 75%

- (ii) State **two** conclusions that can be made about the growth of mould on the bread from 0 °C to 40 °C shown in Figure 8.

(2)

1

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2

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- (iii) Explain why there was no mould growing on the bread kept at 60 °C.

(2)

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- (c) Figure 9 shows some part-baked bread in a sealed bag.

The gas in the bag is nitrogen, which prevents the bread from going mouldy.



Figure 9

If the bag is opened, the bread goes mouldy within days.

State why the bread goes mouldy.

(1)

.....

.....

(d) Explain why keeping food in a fridge slows down the growth of mould.

(2)

(Total for Question 5 = 10 marks)



4 Alcohol is broken down by liver cells.

(a) Which process moves alcohol from the blood into the liver cells?

(1)

- ☐ **A** diffusion
- ☐ **B** respiration
- ☐ **C** osmosis
- ☐ **D** transpiration

(b) If a person drinks too much alcohol, liver cells die and the person can develop cirrhosis of the liver.

The relative risk of developing cirrhosis of the liver is affected by two factors.

1. The volume of alcohol a person drinks in one week.
2. Whether the person drinks the alcohol on its own or with a meal.

Figure 7 shows how these two factors affect the relative risk of people developing cirrhosis of the liver.

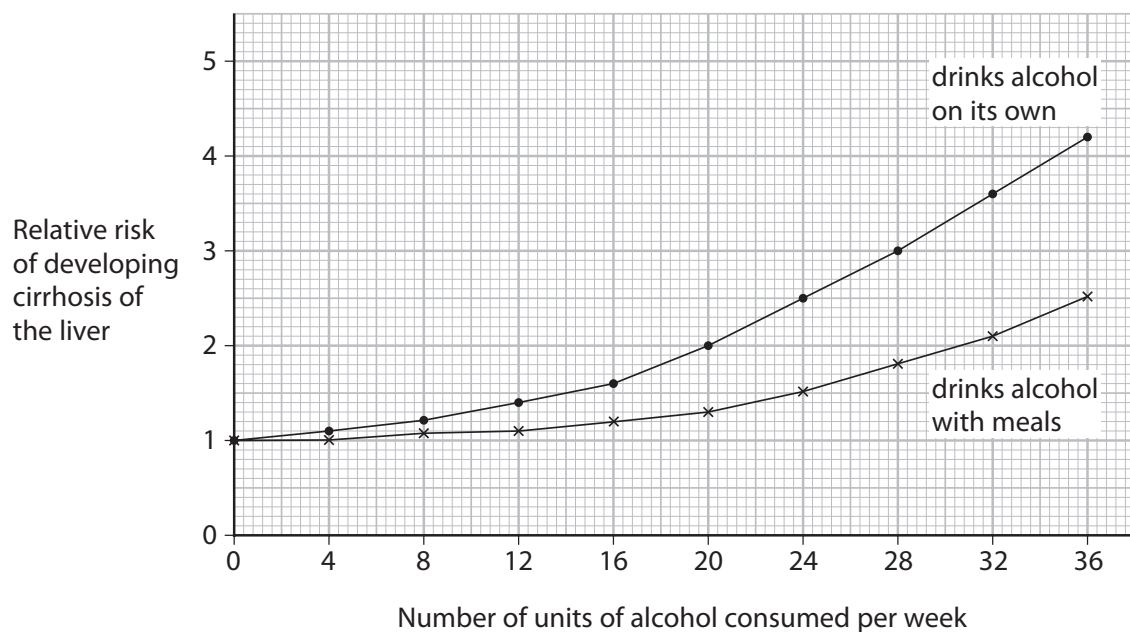


Figure 7

- (i) Person A drinks alcohol on its own.

Person B drinks alcohol with their meals.

Calculate the difference in risk for these two people when each one drinks 28 units of alcohol per week.

(3)

- (ii) Using evidence from Figure 7, state **two** pieces of health advice for people about drinking alcohol.

(2)

1.....

2.....



(c) Cystic fibrosis is a genetic condition that can also cause liver disease.

(i) State where genes are found in cells.

(1)

(ii) Figure 8 shows the inheritance of cystic fibrosis in a family.

F represents the dominant allele that does not cause cystic fibrosis.

f represents the recessive allele that causes cystic fibrosis.

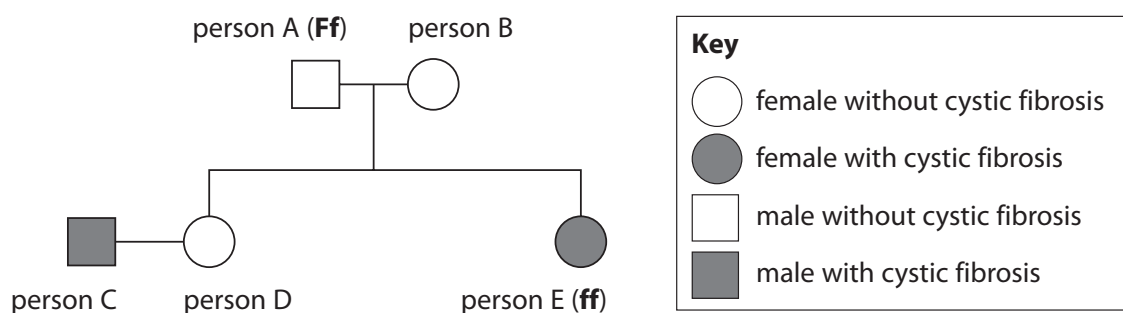


Figure 8

A scientist states that the genotype of person B is **Ff**.

Explain why the scientist is correct.

(2)

(iii) State the genotype of person C.

(1)

(Total for Question 4 = 10 marks)

4 (a) Which is the reason why obesity is a non-communicable disease?

(1)

- ☐ **A** it is spread from person to person
- ☐ **B** it is caused by a virus
- ☐ **C** it is not spread from person to person
- ☐ **D** it lasts for a short time

(b) Several factors affect the risk of developing cardiovascular disease.

Figure 7 shows different BMI ranges and their weight descriptions.

BMI range	weight description
18.5 to 24.9	healthy weight
25.0 to 29.9	overweight
30.0 to 39.9	obese
40 or more	severely obese

Figure 7

(i) A person has a BMI of 39.0

Explain the risk of this person developing cardiovascular disease.

(2)

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(ii) Changes in lifestyle can reduce the risk of cardiovascular disease.

State **two** other treatments for cardiovascular disease.

(2)

1

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2

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- (c) Figure 8 shows the percentage of people who smoked cigarettes in England from 2011 to 2019.

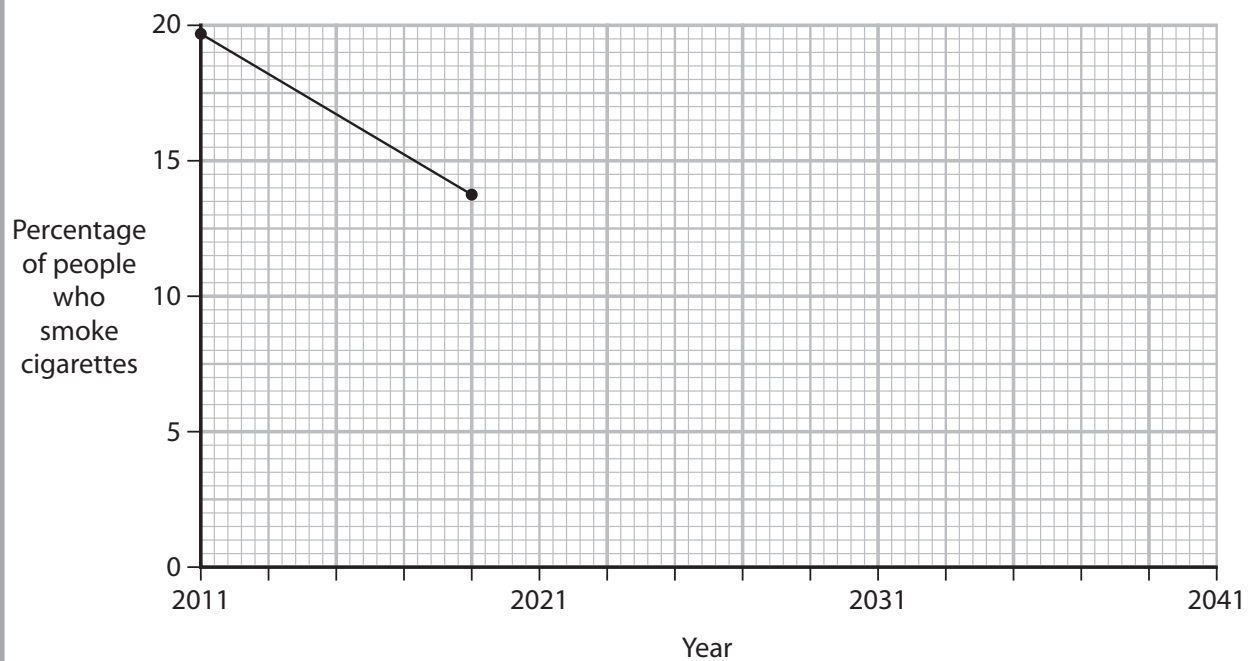


Figure 8

- (i) State the trend shown in the graph from 2011 to 2019.

(1)

.....

.....

- (ii) Give **two** reasons for this change in the number of people smoking cigarettes.

(2)

1

.....

2

.....

- (iii) Draw a line on Figure 8 to show the likely trend in the percentage of people smoking cigarettes from 2019 to 2041.

(1)

(iv) Smoking cigarettes can increase the risk of people developing cancer.

Which is the description of cancer?

(1)

- ☐ **A** uncontrolled organ division
- ☐ **B** uncontrolled cell division
- ☐ **C** controlled cell division
- ☐ **D** controlled organ division

(Total for Question 4 = 10 marks)



11-MARK QUESTIONS

5 questions in this booklet



8 (a) Cirrhosis is a disease caused by prolonged alcohol abuse.

(i) Prolonged alcohol abuse causes cirrhosis of the

(1)

☐ A brain

☐ B liver

☐ C heart

☐ D skin

(ii) Give **one** reason why cirrhosis is described as a non-communicable disease.

(1)

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(b) Obesity increases the risk of a person developing cardiovascular disease.

Losing weight can reduce the risk of this disease occurring.

Explain why exercise can cause weight loss.

(2)

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(c) Figure 8 shows a gastric band fitted to a stomach.

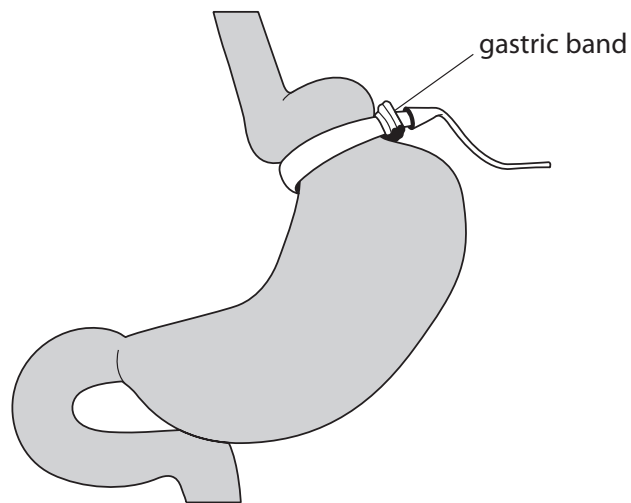


Figure 8

Explain how a gastric band helps a person to lose weight.

(2)

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(d) BMI and waist:hip ratio can be used to find out if a person is obese.

Figure 9 shows some data for two males.

male	BMI	waist:hip ratio
A	27.3	0.85
B	?	0.81

Figure 9

BMI is calculated using the equation:

$$\text{BMI} = \frac{\text{mass in kilograms}}{(\text{height in metres})^2}$$

(i) Male B has a mass of 72 kg and a height of 1.81 m.

Calculate the BMI of male B.

Give the answer to 3 significant figures.

(3)

BMI = ...



(ii) Figure 10 shows the interpretation of BMI values.

BMI range	interpretation
below 18.5	underweight
18.5 – 24.9	normal
25.0 – 29.9	overweight
30.0 and above	obese

Figure 10

Males with a waist:hip ratio above 0.90 are defined as abdominally obese.

Explain what the BMI and waist:hip ratio for male A shows about his weight distribution.

(2)

(Total for Question 8 = 11 marks)

8 (a) Measles is a communicable disease caused by a virus.

(i) What can a virus also be classified as?

(1)

☐ A a bacterium

☐ B a fungus

☐ C a pathogen

☐ D a protist

(ii) Give **one** reason why measles is described as a communicable disease.

(1)

.....

.....

.....

(b) The human immunodeficiency virus (HIV) can cause AIDS.

Which type of cell is destroyed by the HIV virus?

(1)

☐ A red blood cell

☐ B nerve cell

☐ C white blood cell

☐ D sperm cell

(c) Describe how the specific immune system defends the body against disease.

(3)

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.....

.....

(d) Figure 13 shows the number of people per million **of the population** in five European countries who were diagnosed with measles in one year.

country	number of people diagnosed with measles per million of the population
Belgium	21.00
France	15.63
Germany	8.42
Italy	20.06
Norway	0.05

Figure 13

- (i) The population of Belgium in that year was 11.18 million.
- Calculate the number of people in Belgium diagnosed with measles.
- Give your answer to three significant figures.

(3)

.....people

- (ii) Countries do not report the total number of people diagnosed with measles. Countries report the number of people diagnosed with measles per million of the population.

Give **one** reason why this is better.

(1)

- (iii) Give **one** reason why the number of people per million diagnosed with measles is different in these countries.

(1)

(Total for Question 8 = 11 marks)



10 *Streptococcus mutans* is one species of bacteria which causes tooth decay.

A scientist tested the effectiveness of toothpaste at killing this species of bacteria.

The scientist spread the bacteria *Streptococcus mutans* across an agar jelly plate.

(a) (i) Which word describes the techniques used to prevent contamination of the agar jelly plate?

(1)

- ☐ **A** clinical
- ☐ **B** diagnostic
- ☐ **C** aseptic
- ☐ **D** lysogenic

(ii) Give **two** precautions needed to prevent contamination of the agar jelly plate.

(2)

1

2

- (b) The scientist placed a filter paper disc soaked in toothpaste mixed with saliva (disc A) on one half of the agar jelly plate.

A filter paper disc soaked in only saliva (disc B) was placed on the other half of the agar jelly plate.

The agar jelly plate was kept at 37°C for 24 hours.

Figure 20 shows the results.

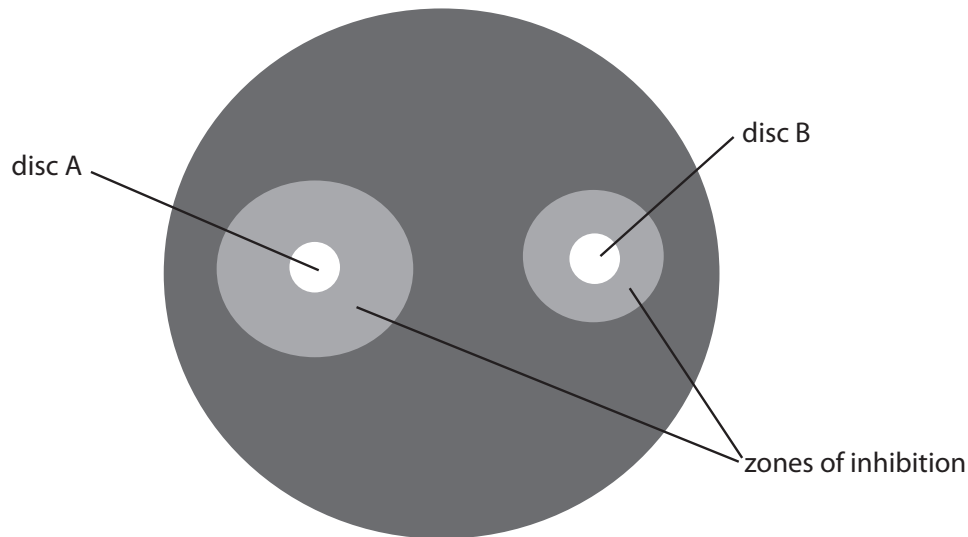


Figure 20

- (i) The diameter of the zone of inhibition around disc A is 9 mm.

Calculate the area of this zone of inhibition using the equation πr^2 .

Use a value of 3.14 for π .

Give your answer to 1 decimal place.

(3)

..... mm²

- (ii) Give a reason why disc B, soaked in only saliva, was included in this test.

(1)

.....

.....

(iii) Suggest **two** reasons why this test does not prove that toothpaste kills all bacteria on teeth.

(2)

1

2

(c) Before a new toothpaste can be sold, the toothpaste has to be tested on cultured human cells.

Cultured human cells were placed into four identical flasks.

Saliva was added to each flask and a different brand of toothpaste was added to each of three flasks.

The human cells were left for two hours and the percentage of cells that were healthy was recorded.

Figure 21 shows the results.

substance added to the human cells	percentage of healthy cells after 2 hours (%)
saliva only	85
toothpaste brand 1	84
toothpaste brand 2	86
toothpaste brand 3	85

Figure 21

Explain the conclusion that can be made from this data.

(2)

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.....

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.....

(Total for Question 10 = 11 marks)



- 8 (a) Figure 15 shows the number of new cases of chlamydia diagnosed in England from 2013 to 2022.

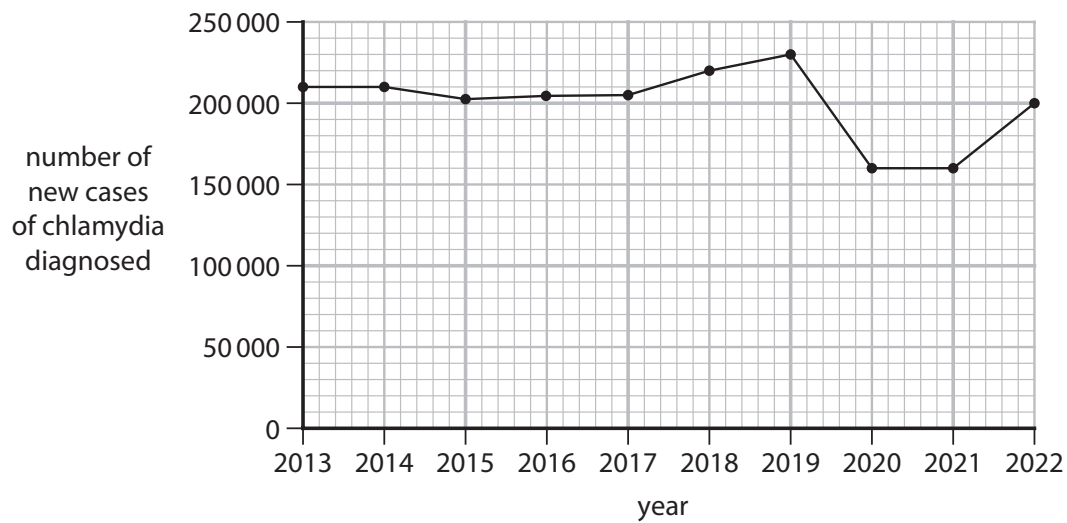


Figure 15

- (i) Which type of organism causes chlamydia?

(1)

- ☐ A bacteria
- ☐ B fungi
- ☐ C protists
- ☐ D viruses

- (ii) Calculate the increase in the number of new cases of chlamydia diagnosed from 2020 to 2022.

(1)

..... cases

(iii) Tuberculosis is a disease that is spread through airborne droplets.

Give **two** ways of reducing or preventing the spread of tuberculosis.

(2)

1

.....

2

.....

(b) Obesity is a risk factor for some non-communicable diseases.

(i) State why liver disease is a non-communicable disease.

(1)

.....

.....

(ii) The waist-to-hip ratio can be used to show if excess weight is a health risk.

An adult has a waist measurement of 80 cm and a hip measurement of 90 cm.

Calculate the waist-to-hip ratio for this adult, using the equation:

$$\text{waist-to-hip ratio} = \frac{\text{waist measurement}}{\text{hip measurement}}$$

Give your answer to **two** decimal places.

(2)

waist-to-hip ratio



(iii) Figure 16 shows the health risk of some waist-to-hip ratios.

health risk	waist-to-hip ratios	
	males	females
low	0.95 or less	0.80 or less
medium	0.96 to 1.0	0.81 to 0.85
high	1.1 or more	0.86 or more

Figure 16

Explain the health risk for a female with a waist-to-hip ratio of 0.75.

(2)

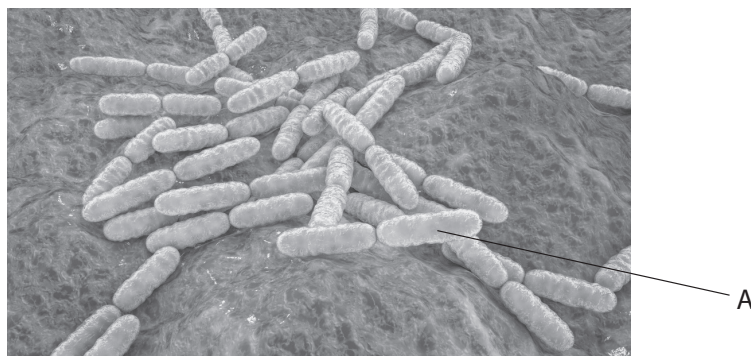
(c) Cancer occurs when cell division by mitosis is uncontrolled.

Describe the properties of cells produced by mitosis.

(2)

(Total for Question 8 = 11 marks)

- 10 (a) Figure 22 shows a type of bacteria (*Lactobacillus acidophilus*) that is found in cow's milk.



(Source: © Kateryna Kon/Shutterstock)

Figure 22

The magnification of this image is $\times 18\,000$.

Measure the length of the bacterium labelled A.

Use your measurement to calculate the actual length of this bacterium in millimetres.

Give your answer in standard form.

(3)

..... mm

(b) Figure 23 shows the growth rate of two species of bacteria at different pH values.

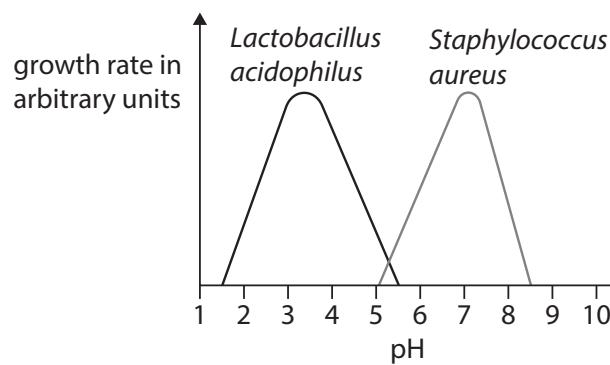


Figure 23

- (i) State a pH that allows the growth of both *Lactobacillus acidophilus* and *Staphylococcus aureus*.

(1)

- (ii) Describe the relationship between pH and the growth of *Staphylococcus aureus*, as shown in Figure 23.

(2)

(c) A student investigated the effect of temperature on the decay of milk.

Milk was placed in a beaker in a water bath at 5 °C for 72 hours.

The pH of the milk was measured every 24 hours using a pH probe.

The investigation was repeated at different temperatures.

Figure 24 shows the results of this investigation.

temperature in °C	pH			
	at 0 hours	at 24 hours	at 48 hours	at 72 hours
5	6.6	6.6	6.6	6.5
10	6.6	6.5	6.4	6.3
20	6.6	6.0	5.6	5.2
30	6.6	5.8	5.0	4.8

Figure 24

(i) Which is a variable that the student needs to control in this investigation?

(1)

- ☐ **A** pH of the milk
- ☐ **B** temperature of the milk
- ☐ **C** incubation time
- ☐ **D** volume of the milk

(ii) Describe the changes in the pH of the milk at 30 °C from 0 hours to 72 hours, as shown in Figure 24.

(2)

(iii) Calculate the rate of decay of the milk at 20°C for the 72 hours of this investigation.

Use the equation:

$$\text{rate of decay} = \frac{\text{change in pH}}{\text{time taken}}$$

(2)

..... change in pH per hour

(Total for Question 10 = 11 marks)



12-MARK QUESTIONS

2 questions in this booklet



6 (a) The common cold is caused by a virus.

(i) Give **one** reason why antibiotics are not used to treat the common cold.

(1)

(ii) The development of a new antibiotic has many stages.

Which is the last stage in the development of a new antibiotic?

(1)

- ☐ **A** preclinical testing
- ☐ **B** discovery
- ☐ **C** clinical testing
- ☐ **D** diagnosis

(b) Figure 11 shows the effect of adding an antibiotic to a culture of bacteria.

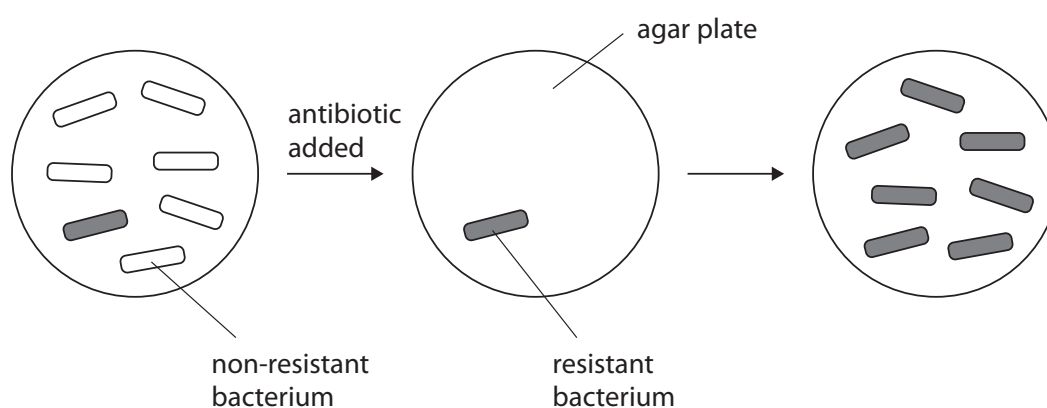


Figure 11

Explain how antibiotic-resistant bacteria have evolved.

Use information from Figure 11 in your answer.

(4)

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(c) One source of evidence for human evolution is from stone tools.

Give **one** other source of evidence for human evolution.

(1)

(d) Figure 12 shows two stone tools.



(Source: © John Kepchar/Shutterstock)



(Source: © Eduardo Estellez/Shutterstock)

tool A
approximately
4 000 years old

tool B
approximately
100 000 years old

Figure 12

(i) Explain how these tools provide evidence for human evolution.

(3)

(ii) Describe **two** methods that scientists use to date stone tools.

(2)

1

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2

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(Total for Question 6 = 12 marks)



7 (a) Bacteria cause many diseases in humans.

(i) Which term describes a pathogen?

(1)

- ☐ A a chemical that causes disease
- ☐ B an animal that eats another animal
- ☐ C a cell that engulfs micro-organisms
- ☐ D an organism that causes disease

(ii) In the UK, most children are immunised against serious infections such as measles.

Give **two** advantages of immunising children against measles.

(2)

1

2

(b) Humans have physical barriers to prevent bacterial infections.

(i) Name **two** of these physical barriers.

(2)

1

2

(ii) State the chemical in the stomach that destroys bacteria.

(1)

.....

.....

*(c) Many food crops are damaged by pests.

Some farmers use insects for the biological control of plant pests.

Figure 14 shows a ladybird which can be used for biological control.



(Source: © IanRedding/Shutterstock)

Figure 14

Explain the advantages and disadvantages of biological control.

(6)

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(Total for Question 7 = 12 marks)

13-MARK QUESTIONS

5 questions in this booklet



- 9 (a) Name the organisation which defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

(1)

- (b) Tuberculosis (TB) is a communicable disease.

- (i) State **two** ways that communicable diseases are different from non-communicable diseases.

(2)

1

2

- (ii) Explain **one** way that the spread of tuberculosis (TB) can be reduced or prevented.

(2)

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(iii) A student researched the number of people with TB in some countries.

Figure 19 shows the student's data.

	Belgium 1000	Portugal 2400
	UK 5400 people	
	Germany 6100	5800 in France

Figure 19

Complete the table to show the student's data.

(2)

* (c) Describe how the physical barriers and chemical defences of the human body provide protection from diseases.

(6)

(Total for Question 9 = 13 marks)

- 9 (a) Figure 18 shows ciliated epithelial cells from the airways of a human as seen using a light microscope.



(Source: © Jose Luis Calvo/Shutterstock)

Figure 18

- (i) Draw the cell labelled A in the box below.

Label **three** parts of this cell on your diagram.

(4)



- (ii) State the function of the ciliated epithelial cells in the airways of the human breathing system.

(1)

.....

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.....

(b) Figure 19 shows equipment used to investigate the rate of respiration in maggots.

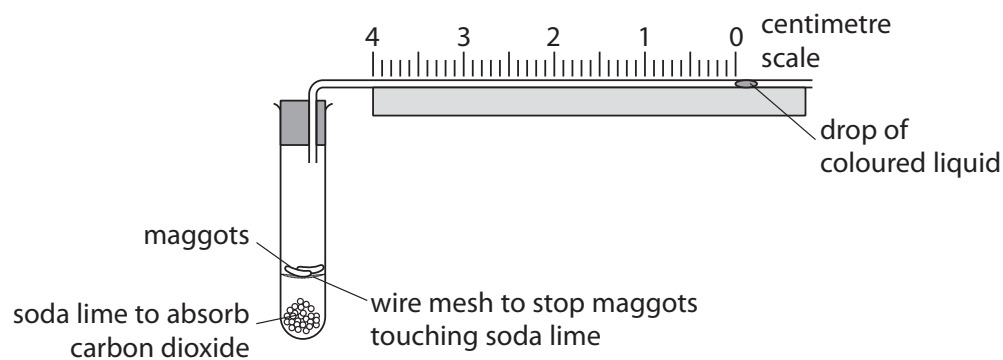


Figure 19

As the maggots respire, the drop of coloured liquid moves towards the test tube.

Figure 20 shows the position of the drop of coloured liquid after ten minutes.

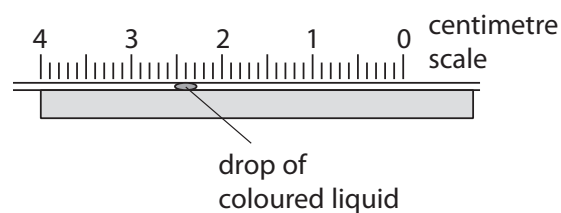


Figure 20

Use information from Figures 19 and 20 to calculate the mean rate of respiration of the maggots in mm per minute.

(2)

..... mm per minute

*(c) Explain how alveoli in human lungs are adapted for gas exchange.

Include the names of the gases that are being exchanged.

(6)

(Total for Question 9 = 13 marks)

- 9 (a) Figure 17 shows the number of people diagnosed with sexually transmitted infections (STIs) in the UK during 2017.

sexually transmitted infection (STI)	number of people diagnosed per 1000 of the population
chlamydia	3.7
gonorrhoea	0.8
genital herpes	0.6
genital warts	1.1
syphilis	0.1

Figure 17

- (i) State the sexually transmitted infection that has the median number of people diagnosed.

(1)

- (ii) The population of the UK in 2017 was 66 million people.

Calculate the total number of people diagnosed with chlamydia in the UK in 2017.

(2)

..... people

- (iii) State why chlamydia can be described as a communicable disease.

(1)

- (iv) Give **one** way the transmission of chlamydia can be prevented.

(1)



(v) Explain why chlamydia can be treated with antibiotics.

(2)

*(b) When a person is infected with a disease, the immune system will respond to protect their body.

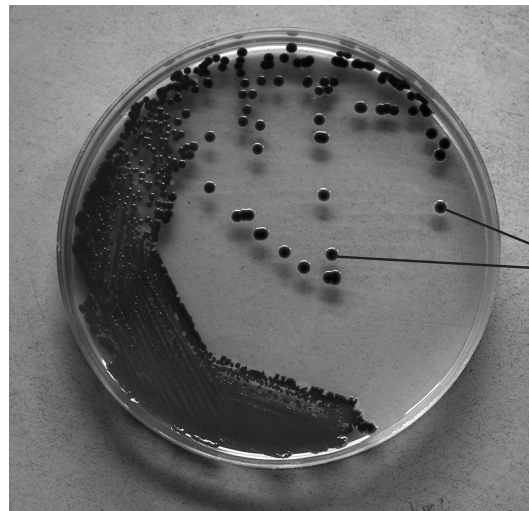
Explain how the immune system will respond to an infection caused by bacteria.

(6)

(Total for Question 9 = 13 marks)



9 Figure 17 shows colonies of bacteria growing on an agar plate.



colonies of
bacteria

(Source: © Chatchouliya/Shutterstock)

Figure 17

Each colony starts as one bacterium.

Every time bacteria reproduce, the number of bacteria in each colony doubles.

- (a) Calculate the number of bacteria in a colony after five hours, if each bacterium reproduces every 30 minutes.

(2)

..... bacteria

- (b) Some bacteria are pathogens.

- (i) State the meaning of the term pathogen.

(1)

.....

.....

(ii) Explain why antibiotics can be used to treat bacterial infections.

(2)

.....

.....

.....

.....

(iii) A rod-shaped bacterium is 0.005 mm long.

A student draws the rod-shaped bacterium.

The bacterium in the drawing is 80 mm long.

Calculate the magnification of this drawing.

(2)

magnification = ...



9 (a) Malaria is a disease that causes damage to the blood and liver.

(i) Which type of pathogen causes malaria?

(1)

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

(ii) State how the pathogen that causes malaria is spread.

(1)

(b) Measles is a disease caused by a virus.

Figure 17 shows the number of measles cases reported in England and Wales from 1985 to 2015.

year	number of measles cases reported
1985	97 408
1995	7 447
2005	2 089
2015	1 193

Figure 17

Explain **one** conclusion that can be made about the change in the number of measles cases reported from 1985 to 2015.

(2)

(c) Describe **two** ways the immune system will respond to an infection by a pathogen.

(2)

1

.....

2

.....

(d) (i) Beriberi is a disease caused by a lack of vitamin B1 in the diet.

Give **one** reason why beriberi is classed as a non-communicable disease.

(1)

.....

.....



(Total for Question 9 = 13 marks)

MARK SCHEMES

official Pearson Edexcel mark schemes



Question Number	Answer	Additional guidance	Mark
1(a)	<u>type</u> of pathogen <pre> graph LR subgraph Pathogen_Type [type of pathogen] F[fungus] V[virus] end subgraph Disease [disease] A[AIDS] M[malaria] T[tuberculosis] C[cholera] D[Chalara ash dieback] end F --- D V --- A </pre>	reject more than one line from each pathogen	(2) AO 1 1

Question Number	Answer	Mark
1(b)	C bacteria 1. The only correct answer is C <i>A is not correct because antibiotics do not kill antibodies</i> <i>B is not correct because antibiotics do not kill antigens</i> <i>D is not correct because antibiotics do not kill viruses</i>	(1) AO 1 1

Question Number	Answer	Additional guidance	Mark
1(c)	(patient Z) has a high(er) white blood cell count (1) - white blood cells kill bacteria / pathogens/microorganisms/produce antibodies / produce antitoxins (1)	accept more wbc/most wbc accept fight infection / destroy bacterial infection	(2) AO 2 1

Question Number	Answer	Additional guidance	Mark
1(d)	Any two from: • wear gloves/ goggles/cover wounds/cover cuts (1) • clean up spills/use tongs to handle sample (tubes) (1) • store samples in sealed containers (1) • dispose of samples safely (1)	accept store in fridge/cooler accept burn/incinerate/sterilise(1)	(2) AO 2 1

Total for Question 1 = 7 marks

Question number	Answer	Mark
1(a)	A Pathogen The only correct answer is A <i>B is incorrect because a culture does not cause disease.</i> <i>C is incorrect because antibiotics do not cause disease.</i> <i>D is incorrect because platelets do not cause disease.</i>	(1) AO1 1

Question number	Answer	Mark
1(b)	disease cholera malaria main way the disease is spread in the air by animal vectors in body fluids by a vaccination in water do not award mark if two lines are drawn from cholera box do not award mark if two lines are drawn from malaria box	(2) AO1 1

Question number	Answer	Additional guidance	Mark
1(c)(i)	all points plotted correctly $\pm$ one small square		(1) AO2 2

Question number	Answer	Additional guidance	Mark
1(c)(ii)	straight line of best fit going through all the plotted points $\pm$ two small squares.	ignore any extrapolation	(1) AO2 2

Question number	Answer	Additional guidance	Mark
1(c)(iii)	A description including two from: • 10 °C is slower (than growth at 20 °C) (1) • 10 °C is linear /straight (1) • 10 °C does not level off (1) • supported by manipulated data (1)	accept 10 °C is below / less (than the 20 °C line) differences must be in 1000s accept reverse arguments for 20 °C	(2) AO3 1a 1b

(Total marks for question 1 = 7 marks)

Question Number	Answer	Mark
1(a) (i)	D nucleus The only correct answer is D <i>A is not correct because mitochondria do not control the white blood cell</i> <i>B is not correct because ribosomes do not control the white blood cell</i> <i>C is not correct because chromosomes are only part of organelle X</i>	(1) AO1.1a

Question Number	Answer	Additional guidance	Mark
1(a) (ii)	haemoglobin (1) liquid (1)	answers must be in correct order	(2) AO2.1

Question Number	Answer	Additional guidance	Mark
1(a) (iii)	A description including two from: • make antibodies • {surround / engulf / digest} {pathogens / bacteria / viruses} • remembers pathogens / bacteria / viruses (so can react quickly to secondary infection)	accept produce memory cells	(2) AO1.1

Question Number	Answer	Mark
1(b)	10 (µm)	(1) AO2.2

Question Number	Answer	Additional guidance	Mark
1(c)	An explanation including any two from: • greater resolution (1) • so greater magnification is possible (1) • so smaller structures can be seen / identified (1)	accept more detail of cell structures can be seen accept electrons (with a shorter wavelength) are used (instead of light) (1)	(2) AO1.1

(Total for question 1 = 8 marks)

Question Number	Answer	Mark
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Question Number	Answer	Mark
5(a)(i)	bacteria are killed (by the garlic extract / antibiotic)	(1) A02 2

Question Number	Answer	Mark
5(a)(ii)	An explanation linking • C (is the 100 mg/cm³ concentration) (1) • (because C) has the largest area with no bacterial growth / A and B have smaller areas (with no bacterial growth) (1)	(2) A03 2ab

Question Number	Answer	Mark
5(a)(iii)	one from: • use a control (1) • use the same source of garlic extract (1) • incubate the agar plates at the same temperature (1) • ensure paper discs are the same size (1) • measure the diameter of the clear zone (1) • repeat (each concentration) (1)	(1) A03 3a

Question Number	Answer	Additional guidance	Mark
5(a)(iv)	3.14 x 5² / 3.14 x 25 (1) 78.5 (mm²)	award full marks for correct answer without working	(2) A02 1

Question Number	Answer	Mark
5(b)(i)	to sterilise it / to kill {bacteria / microorganisms} (on the spreader)	(1) AO1 2

Question Number	Answer	Mark
5(b)(ii)	two from: • disinfect the work surface / area (1) • work close to a Bunsen burner (flame) (1) • wear protective gloves / mask (1) • taking the lid off for the minimum amount of time possible (1) • aseptic techniques (1)	(2) AO1 2

(Total for question 5 = 9 marks)



Question number	Answer	Mark
5(a)(i)	D pancreas insulin The only correct answer is D pancreas insulin A is incorrect because the ovary does not produce a hormone that controls blood glucose concentration. B is incorrect because the ovary does not produce a hormone that controls blood glucose concentration. C is incorrect because oestrogen does not control blood glucose concentration.	(1)

Question number	Answer	Mark
5(a)(ii)	Liver / muscles / named muscle	(1)

Question number	Answer	Additional guidance	Mark
5(b)(i)	Substitution $110 \div 2.0^2$ (1) Evaluation $= 27.5$	accept 28 Award full marks for correct answer with no working.	(2)

Question number	Answer	Mark
5(b)(ii)	A description that includes two from: - lose weight (1) - control diet / eat less sugary food (1) - exercise more (1)	(2)

Question number	Answer	Mark
5(c)(i)	A aerobic respiration and anaerobic respiration. The only correct answer is A aerobic respiration and anaerobic respiration B is incorrect because anaerobic respiration uses glucose. C is incorrect because aerobic respiration uses glucose. D is incorrect because aerobic respiration and anaerobic respiration use glucose.	(1)

Question number	Answer	Mark
5(c)(ii)	An explanation linking three of: • as activity / speed increases, the respiration rate increases (1) • because respiration supplies energy (to muscles / cells) (1) • when sleeping you are not moving / using muscles very much (1) • the faster you run / the more you use muscles (1) • so more energy is required. (1)	(3)

Total for question 5 = 10 marks



Question Number	Answer	Additional guidance	Mark
5(a)	An explanation including two from:		(2) A02.1

Question Number	Answer	Mark
5(b)(i)	C 50% The only correct answer is C <i>A is not correct because 0% is too low</i> <i>B is not correct because 25% is too low</i> <i>C is not correct because 75% is too high.</i>	(1) A01.1

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	An answer including two from		(2) A03.1ab

Question Number	Answer	Additional guidance	Mark
5(b)(iii)	An explanation including two from: - enzymes don't work (at 60°C) / enzymes are denatured (1) - active site shape changed so can't fit with substrate (1) - so (biochemical) reactions won't {take place / occur quickly enough} (1)	accept mould is killed (1) accept the bread was too dry (for the mould to grow) (1)	(2) A03.2ab

Question Number	Answer	Mark
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Question Number	Answer	Additional guidance	Mark
5(d)	An explanation including two from: - too cold (1) (for) enzymes to work effectively (1) (biochemical) reactions occur too slowly (1)	accept respiration for reactions.	(2) A01.1

(Total for question 5 = 10 marks)

Question Number	Answer	Mark
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Question number	Answer	Mark
4(a)	A diffusion The only correct answer is A <i>B is incorrect because respiration is the release of energy from glucose.</i> <i>C is incorrect because osmosis is the movement of water, not alcohol.</i> <i>D is incorrect because protein synthesis is how proteins are made.</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
4(b)(i)	readings from graph 3.0 / 3 (1) 1.8 (1) Evaluation 3.0 – 1.8 = 1.2 (units higher of developing cirrhosis of the liver) (1)	award full marks for correct answer with no working ecf for (3 – 1.7 or 3 – 1.9)	(3) AO3 1a 1b

Question number	Answer	Additional guidance	Mark
4(b)(ii)	An answer including two of the following: • reduce alcohol intake / do not drink alcohol (1) • drink alcohol with meals / do not drink it on its own (1)	accept data from graph / manipulated data from graph reflecting a reduction in drink	(2) AO2 1

Question number	Answer	Additional guidance	Mark
4(c)(i)	in the nucleus / on a chromosome	accept on DNA / it is part of DNA accept in mitochondria	(1) AO1 1

Question number	Answer	Additional guidance	Mark
4(c)(ii)	An explanation including: - person B must have an F allele because she does not have cystic fibrosis (1) - person B must have an f allele because person E must have inherited an f allele from her (1)	accept because person E is ff / homozygous recessive	(2) AO2 2

Question number	Answer	Additional guidance	Mark
4(c)(iii)	ff both letters must be lower case	accept: homozygous recessive accept: double recessive accept: 'two small fs'	(1) AO2 1

(Total marks for question 4 = 10)

Question Number	Answer	Mark
4(a)	C it is not spread from person to person The only correct answer is C <i>A is not correct because obesity is not spread from person to person</i> <i>B is not correct because obesity is not caused by a virus</i> <i>D is not correct because obesity does not last for a short time</i>	(1) AO1 1

Question Number	Answer	Mark
4(b)(i)	An explanation linking - the risk is high (1) - because the person is obese (1)	(2) AO3 1ab

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	Any two from: - medication (1) - heart transplant (1) - stents (1) - bypass surgery (1)	accept named medicines	(2) AO1 1

Question Number	Answer	Mark
4(c)(i)	(the percentage of people who smoked cigarettes from 2011 to 2019) has decreased	(1) AO3 2a

Question Number	Answer	Mark
4(c)(ii)	Two from • more smokers die than non-smokers (and fewer people taking up smoking) (1) • people are more aware of the dangers of smoking / have followed health advice (1) • (there are) alternatives to smoking cigarettes / {nicotine gum / nicotine patches / vapes} available (1) • smoking cigarettes is expensive / unaffordable (1)	(2) AO3 2a

Question Number	Answer	Mark
4(c)(iii)	a line showing a continued downward trend to 2041	(1) AO3 2a

Question Number	Answer	Mark
4(c)(iv)	B uncontrolled cell division The only correct answer is B <i>A is not correct because cancer is not uncontrolled organ division</i> <i>C is not correct because cancer is not controlled cell division</i> <i>D is not correct because cancer is not controlled organ division</i>	(1) AO1 1

(Total for question 4 = 10 marks)



Question Number	Answer	Mark
8(a)(i)	B liver 1. The only correct answer is B <i>A is not correct because prolonged alcohol abuse does not cause cirrhosis of the brain</i> <i>C is not correct because prolonged alcohol abuse does not cause cirrhosis of the heart</i> <i>D is not correct because prolonged alcohol abuse does not cause cirrhosis of the skin</i>	(1) AO 1 1

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	(cirrhosis is) not caused by {pathogens/named micro-organisms}/cannot be {passed/spread} (from one person to another)	accept it is not contagious/infectious	(1) AO 2 1

Question Number	Answer	Additional guidance	Mark
8(b)	An explanation linking: • exercise {requires energy/ uses respiration} (1) • {obtained from/reducing} fat (1)	accept burns calories accept sweating causes water loss for 1 mark	(2) AO 1 1

Question Number	Answer	Additional guidance	Mark
Q8c	An explanation linking two of the following: • reduces the volume of the stomach (1) • so it reduces food intake (1) • so stored {fat/lipids} is used up (1)	accept restricts the amount of food entering the stomach	(2) AO 2 1

Question Number	Answer	Additional guidance	Mark
8(d)(i)	substitution (1) $72 \div 1.81^2$ evaluation (1) $= 21.977 / 21.98 / 22$ 3 s.f. (1) 22.0	accept $72 \div 3.2761$ award 2 marks for correct evaluation award full marks for correct numerical answer without working accept 21.9 for 2 marks	(3) AO 1 1

Question Number	Answer	Additional guidance	Mark
8(d)(ii)	- the BMI shows male A is overweight but his waist:hip ratio {shows he is not abdominally obese / is below 0.9/is healthy} (1) - male A's weight distribution is not around the {vital organs/abdomen} (1)	accept male A's weight is distributed evenly over the body accept more weight on the hips than the waist accept mass for weight	(2) AO 3 2a AO 3 2b

Total for Question 8 = 11 marks

Question number	Answer	Mark
8(a)(i)	C a pathogen The only correct answer is C A is not correct because a virus cannot also be classified as a bacterium B is not correct because a virus cannot also be classified as a fungus D is not correct because a virus cannot also be classified as a protist	(1)

Question number	Answer	Additional guidance	Mark
8(a)(ii)	(communicable disease) can be {passed / transferred / spread} (from person to person)	accept it is contagious / infectious	(1)

Question number	Answer	Mark
8(b)	C white blood cell The only correct answer is C A is not correct because the HIV virus does not destroy red blood cells B is not correct because the HIV virus does not destroy nerve cells D is not correct because the HIV virus does not destroy sperm cells	(1)

Question number	Answer	Additional guidance	Mark
8(c)	An answer linking three from: • (pathogens have) antigens (1) • (that trigger) antibodies to be produced (1) • by lymphocytes (1) • (leads to the) destruction of the pathogen (1) • memory {cells/ lymphocytes} produced (1) • cause a secondary response (in the event of infection by the same pathogen) (1)	accept bacteria/virus for pathogen ignore WBC accept engulf pathogen accept description of a secondary response e.g. before symptoms/before the person gets ill/can react quickly	(3)

Question number	Answer	Additional guidance	Mark
8(d)(i)	Substitution (1) 21.00 x 11.18 Evaluation (1) 234.78 3 significant figures 235	award full marks for correct numerical answer without working award 2 marks for correct evaluation ecf for the incorrect calculation correctly rounded to 3 s.f.	(3)

Question number	Answer	Additional guidance	Mark
8(d)(ii)	One from: • each country has a different size population (1) • allows comparisons to be made between countries (1)	ignore it is easier to read/easier to analyse	(1)

Question number	Answer	Additional Guidance	Mark
8(d)(iii)	One from: - vaccination (1) {reporting/diagnosis} systems (1) {access to/quality of} healthcare (1) - environmental factors (1)	accept examples of relevant environmental factors e.g. population density, proximity of country to others. (1) accept herd immunity (1)	(1)

(Total for question 8 = 11 marks)

Question Number	Answer	Mark
10 (ai)	C aseptic The only correct answer is C <i>A is not correct because clinical is not a technique</i> <i>B is not correct because diagnostic does not prevent contamination</i> <i>D is not correct because lysogenic describes a stage of the virus lifecycle</i>	(1) AO1 2

Question Number	Answer	Additional Guidance	Mark
10 (a)(ii)	Any two from: • keep the lid on at all possible times (1) • use sterile equipment (1) • autoclave agar (1) • wear gloves / mask (1) • work close to a Bunsen (burner) (1)	accept a method of sterilising equipment e.g. flaming loops / disinfect the working area accept use sterile growth medium	(2) AO1 2

Question Number	Answer	Additional Guidance	Mark
10 (b)(i)	radius 4.5 mm (1) calculation $(3.14 \times 4.5 \times 4.5 / 3.14 \times 4.5^2) = 63.585$ (1) evaluation 63.6 (mm²)	award full marks for correct answer with no working accept 63.617 ecf if diameter used 254.469 / 254.34 for one mark ecf if diameter used 254.5 / 254.3 (mm²) to 1 DP for two marks	(3) AO2 1

Question Number	Answer	Additional Guidance	Mark
10 (b)(ii)	as a control / to compare	accept to see the effect without using toothpaste / to see the effect of just saliva	(1) AO2 2

Question Number	Answer	Additional Guidance	Mark
10 (b)(iii)	Any two from: - the test only uses one species of bacteria (1) - there are still bacteria on the agar plate (1) - the test is not done on teeth (1) - the conditions in the mouth are different (1) - toothpaste is only used on teeth for a short time (1)	accept temperature in the mouth may not be 37°C accept the test only uses one type of toothpaste (1)	(2) AO2 2

Question Number	Answer	Additional Guidance	Mark
10(c)	An explanation linking: - the toothpastes were not harmful to the cells (1) - because the % of healthy cells after 2 hours was similar to saliva (1)	accept toothpaste has the same effect as saliva / accept toothpaste 2 is less harmful to cells accept a description of the data values to illustrate a similar effect	(2) AO3 2a +2b

(Total for question 10 = 11 marks)

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Question number	Answer	Mark
8(a)(i)	A bacteria The only correct answer is A B, C and D are incorrect as they do not cause chlamydia	(1) AO1 1

Question number	Answer	Additional guidance	Mark
8(a)(ii)	40 000 (cases)		(1) AO2 1

Question number	Answer	Additional guidance	Mark
8 (a)(iii)	Any two from: • take antibiotics (1) • vaccination / immunisation (1) • covering mouth when sneezing or coughing / wear a (face) mask (1) • isolation of (infected individuals) / avoid contact with infected people (1) • washing hands /disinfecting surfaces (1)	ignore take medicine / drugs ignore PPE accept avoid mixing in groups / more ventilation / air filters	(2) AO1 1

Question number	Answer	Additional guidance	Mark
8(b)(i)	(because) it cannot be passed from person to person / it is not caused by a pathogen	accept it is caused by consuming alcohol ignore it cannot be spread unqualified	(1) AO1 1

Question number	Answer	Additional guidance	Mark
8(b)(ii)	calculation (80 ÷ 90) = 0.8888 (1) 0.89	award full marks for the correct answer with no working accept 0.88 / 0.8 / 0.9 / 0.90 / 1.13 for one mark	(2) AO2 1

Question number	Answer	Additional guidance	Mark
8(b)(iii)	An explanation linking: - the risk to health is low (1) (because excess mass) is not around the {waist / vital organs}	ignore no risk accept because the {WHR / 0.75} is less than 0.8 (1)	(2) AO3 2a2b

Question number	Answer	Additional guidance	Mark
8(c)	An answer including two from: - two (cells produced) (1) - diploid / two sets of chromosomes (1) genetically identical (1) - body cells (1)	ignore they double / duplicate accept a full set of chromosomes reject haploid accept somatic cells	(2) AO1 1

Total for Question 8 = 11 marks



Question number	Answer	Additional guidance	Mark
10(a)	Measurement 15 mm (1) Substitution $15 \div 18\,000 = 0.00083$ (1) Standard form 8.3×10^{-4}	accept correct answer for full marks with no working. accept 14 mm – 16 mm accept reading in cm accept 0.00078 / 0.00086 / 0.00089 accept 8.9×10^{-4} 8.6×10^{-4} 7.8×10^{-4}	(3)

Question number	Answer	Mark
10(b)(i)	5 / 5.0 / 5.1 / 5.2 / 5.3 / 5.4	(1)

Question number	Answer	Mark
10(b)(ii)	A description including - from pH 5 to pH 7 the growth of the bacterium increased (1) - pH 7 is optimum (1) - from pH 7 to pH 8.5 the growth of the bacteria decreased (1)	(2)

Question number	Answer	Mark
10(c)(i)	The only correct answer is D volume of the milk A is incorrect as pH is a dependent variable B is incorrect as temperature is an independent variable C is incorrect as incubation time is set by the student	(1)

Question number	Answer	Additional guidance	Mark
10(c)(ii)	An answer including: - pH decreases (1) (from 6.6) to 4.8 / by 1.8 (1)	accept becomes more acidic	(2)

Question number	Answer	Additional guidance	Mark
10(c)(iii)	Substitution Change in pH = 1.4 (1) Evaluation: answer divided by 72 0.019	award full marks for correct answer with no working accept 0.0194 / 0.02	(2)

Total for Question 10 = 11 marks

6(a)(i)	antibiotics {do not kill / inhibit} viruses / (only) {kill / inhibit} bacteria	accept antibiotics are (only) used to treat bacterial infections / the common cold is not caused by bacteria ignore fight off / get rid of bacteria	(1) A02 1
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Question number	Answer	Additional guidance	Mark
6(b)	An explanation linking four from: • some bacteria have a mutation / resistant gene (1) • non-resistant bacteria are killed / the resistant bacteria survive (the antibiotic) (1) • reduces competition / resistant bacteria have more {resources / food} • the resistant bacteria reproduce (1) • pass on beneficial alleles • (eventually) all bacteria are the antibiotic-resistant / bacteria with the mutation (1)	accept allele for gene accept changes / variation in DNA ignore bacteria are immune / get rid of bacteria accept survival of the fittest accept named resources accept resistance gene accept the antibiotic will no longer be effective	(4) A03 1

Question number	Answer	Additional guidance	Mark
6(c)	fossils / (structure of) {skeletons / bones / skull / pentadactyl limb}	accept cave paintings / (stone) carvings / discovery of Ardi / Lucy ignore clothes / DNA	(1) AO1 1

Question number	Answer	Additional guidance	Mark
6(d)(i)	An explanation including: {tool A / newer tool} is more {refined / specialised} (1) so {more recent humans / humans that made tool A} had greater skill (1) because more recent humans were more intelligent (1)	 accept named skill accept had a larger brain	(3) AO2 1

Question number	Answer	Additional guidance	Mark
6(d)(ii)	compare with other finds (of a known age) / compare their shapes (1) depth in rock layer (1)	accept compare the way the tools were made	(2) AO1 1

	(radiometric) dating the surrounding rocks (1)	accept position in rock ignore place where they were found ignore carbon dating unless related to organic material found with tools	
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Total marks for question 6 = 12 marks

Question number	Answer	Additional guidance	Mark
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Question number	Answer	Mark
7(a)(i)	D an organism that causes disease The only correct answer is D A, B and C are incorrect because they are not organisms that cause disease	(1) AO1 1

Question number	Answer	Additional guidance	Mark
7(a)(ii)	Any two from: - less likely to become ill (with measles) / will have antibodies to protect them (from measles infections) (1) - less likely to need medication / hospital treatment (1) - disease less likely to spread through a population (1)	accept memory lymphocytes / cells are formed ignore children become immune accept herd immunity	(2) AO2 1

Question number	Answer	Additional guidance	Mark
7(b)(i)	Any two from: - mucus (1) - cilia (1) - skin / hair (1)	accept ear wax	(2) AO1 1

Question number	Answer	Mark
7(b)(ii)	(hydrochloric) acid	(1) AO1 1

Question number	Indicative content	Mark
7(c)*	Advantages of biological control • fewer pests • so a higher crop yield • no chemical pesticides used • so no chemical residues in the environment • pest does not develop resistance to the predator • generally cheaper method of pest control • predators can be selective / specific to a pest species • so beneficial species not affected • predator population size can respond to changes in pest population size Disadvantages of biological control • the predator may not find / eat all the pests • so pest population might increase • the predator could eat {useful species / the crop plants} • so food chains could be affected • the predators could move away from the area • so more have to be purchased / they have to be reapplied • predators may take longer to control the pest (than chemical control)	(6) AO2 1

Level	Mark	Descriptor
	0	No awardable content
Level 1	1–2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. • Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3–4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. • Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5–6	• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. • Lines of reasoning are supported by sustained application of relevant evidence. (AO2)



Level	Mark	Additional guidance	General additional guidance
	0	No rewardable material	The level is determined by the areas of indicative content covered within the response. The mark within the level is determined by the detail and/or use of biological terms within each explanation.
Level 1	1–2	Makes a simple statement about an advantage or a disadvantage of biological control. States a consequence of the advantage or disadvantage	<u>Possible candidate responses</u> • Ladybirds eat plant pests • Ladybirds eat plant pests and reduce crop damage
Level 2	3–4	Makes a statement about an advantage and a disadvantage of biological control. Explains a consequence of an advantage or a disadvantage	<u>Possible candidate responses</u> • Ladybirds will eat plant pests but ladybirds might also fly away from the crop. • Less pests to eat the crop so the yield will be higher.
Level 3	5–6	Makes statements about advantages and disadvantages of biological control. Explains a consequence of an advantage or a disadvantage	<u>Possible candidate responses</u> • Ladybirds will eat plant pests so no pesticides needed. Ladybirds might also fly away from the crop or eat the crops. • Less pests to eat the crop so the yield will be higher.

Total for Question 7 = 12 marks

Question Number	Answer	Mark
9(a)	World Health Organization / WHO	(1) AO1 1

Question Number	Answer	Additional guidance	Mark
9(b)(i)	An answer including two from: • (communicable) is passed from person to person (1) • (communicable) caused by {pathogens / example of pathogen} (1) • (communicable diseases) cannot be inherited (1)	accept reverse arguments for non-communicable diseases	(2) AO1 1

Question Number	Answer	Additional guidance	Mark
9(b)(ii)	An explanation including: • {cough / sneeze} into a tissue / avoid close contact with infected people / avoid cramped living conditions (1) • because spread of TB is airborne droplets / TB is spread through the air (1) OR • vaccination / immunisation (1) • to provide immunity / reduces the chance of a person getting infected (1) OR • treat infected people with antibiotics (1) • reduces the number of infected people (1)	accept regular hand washing / wear a mask / isolate an infected person accept spread by coughing / breathing it {in / out} accept reduces the chances of contact with an infected person	(2) AO2 1

Question Number	Answer	Additional guidance	Mark
9(b)(iii)	• suitable heading for each column, with country in left column (1) • all data entered accurately (1)	accept country / region / number of people / people with TB countries can be entered in any order	(2) AO2 1

Question Number	Indicative content	Mark
9(c)*	Physical barriers • mucus is produced by cells that line some surfaces of the body • mucus traps pathogens • cilia are found on epithelial / lining cells • ciliated cells line the inside of the respiratory system • cilia move mucus across the surface of cells • cilia move pathogens out of the body / into the throat • skin is a thick covering over the body • skin has dead cells on its surface • skin is waterproof • pathogens are unable to enter the body through the skin • tears wash pathogens away • ear wax traps pathogens • nasal hairs trap pathogens • blood clots / scabs cover wounds to prevent the entry of pathogens Chemical defences • skin has glands that secrete lysozymes • lysozymes are enzymes found in tears, saliva and mucus • lysozymes kill some bacteria • hydrochloric acid is in the stomach • hydrochloric acid has a low pH which kills many pathogens • antibodies are present on mucus linings	(6) AO1 1



Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	- Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. - Presents an explanation with some structure and coherence.
Level 2	3-4	- Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and /or developed. - Presents an explanation that has a structure which is mostly clear, coherent and logical.
Level 3	5-6	- Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. - Presents an explanation that has a well-developed structure which is clear, coherent and logical.

Level 1	1-2	- a physical barrier OR a chemical defence is identified - a function of the physical barrier OR a chemical defence is described
Level 2	3-4	- more than one physical barrier OR more than one chemical defence is identified - functions of the physical barriers OR chemical defences are described OR - a physical barrier AND a chemical defence are identified - a function of the physical barrier AND a function of the chemical defence are described
Level 3	5-6	- more than one physical barrier AND more than one chemical defence are identified - functions of most of these physical barriers AND chemical defences are described

(Total for question 9 = 13 marks)



Question Number	Answer	Additional guidance	Mark
9(a)(i)	- a diagram of the cell that reflects its shape and some of the structures (1) - with any three cell structures from {nucleus / cytoplasm / membrane / cilia} (3)	ignore a 'textbook' diagram that does not resemble cell A	(4) AO1 2

Question Number	Answer	Additional guidance	Mark
9(a)(ii)	to {move/waft} {mucus / bacteria / dust} (1)	ignore stop bacteria entering the body / trap bacteria	(1) AO1 1

Question Number	Answer	Additional guidance	Mark
9(b)	measurement (2.5 – 0 =) 2.5 (cm) (1) calculation (25 ÷ 10 =) 2.5 (mm per minute)	accept 25 (mm) ecf for incorrect reading divided by 10 (1) award full marks for correct answer with no working	(2) AO1 1

Question Number	Indicative content	Mark
9(c) *	AO1 General points about gas exchange • air is breathed in and out of the lungs • oxygen is absorbed (into blood) • carbon dioxide is released (from blood) • by diffusion Adaptations of alveoli for gas exchange • breathing maintains high concentration of oxygen in alveoli / lungs. • breathing maintains low concentration of carbon dioxide in alveoli / lungs. • many alveoli • large surface area • so that more oxygen is absorbed / more carbon dioxide is released • are moist • so oxygen /carbon dioxide can dissolve / is able to move across into the blood • surrounded by (network of) capillaries blood vessels • has a (good) blood supply / (many) red blood cells • keeps oxygen concentration low in blood • keeps carbon dioxide concentration high in blood • to absorb oxygen (quickly) • to remove carbon dioxide (quickly) • membranes / alveolar walls / cells are thin • membranes / alveolar walls / cells are permeable • allows oxygen / carbon dioxide to move through	(6) Exp AO1 1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. • Presents an explanation with some structure and coherence.
Level 2	3–4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. • Presents an explanation that has a structure which is mostly clear, coherent and logical.
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. • Presents an explanation that has a well-developed structure which is clear, coherent and logical.

Level	Mark	Additional Guidance
	0	No rewardable material.
Level 1	1–2	• Makes a simple reference to a feature of alveoli, oxygen or carbon dioxide • Linked to gas exchange
Level 2	3–4	• Explains an adaptation of alveoli • Linked to a reference to oxygen or carbon dioxide
Level 3	5–6	• explains more than one adaptation of alveoli • linked to oxygen and carbon dioxide

(Total for question 9 = 13 marks)

Question number	Answer	Mark
9(a)(i)	Gonorrhoea accept phonetic spellings	(1) A03 1a

Question number	Answer	Additional guidance	Mark
9(a)(ii)	$66\,000\,000 \div 1000 = 66\,000$ (1) $(66\,000) \times 3.7 = 244\,200$ (people) or $3.7 \div 1000 / 0.0037$ (1) $(0.0037) \times 66\,000\,000 = 244\,200$ (people) or $(66\,000\,000 \times 3.7) = 244\,200\,000$ (1) $(244\,200\,000 \div 1000) = 244\,200$ (people)	award full marks for correct answer no working accept answers in standard form accept 244 200 to any incorrect magnitude for one mark	(2) A02 1

Question number	Answer	Additional guidance	Mark
9(a)(iii)	Any one from: - it is {passed/spread} from person to person (1) - caused by bacteria (1)	accept it is spread by {sexual contact / body fluids} accept pathogen ignore caused by a virus	(1) A01 1



Question number	Answer	Additional guidance	Mark
9(a)(iv)	Any one from: • avoid sexual contact (1) • use a {condom / femidom} (1) • screen people for an infection (1) • treat the infection / give antibiotics (1)	accept use a barrier form of contraception ignore protection / contraception	(1) AO2 1

Question number	Answer	Additional guidance	Mark
9(a)(v)	An explanation including the following: • it is {killed / inhibited} by antibiotics (1) • because chlamydia is caused by bacteria (1)	accept disrupt cell processes (in bacteria) / prevent (bacteria) reproducing accept antibiotics are used to kill bacteria for 2 marks	(2) AO2 1



Question number	Indicative content	Mark
9(b)	AO2 Area A • antigens are on the bacteria • which are detected by WBCs / phagocytes • white blood / phagocytes engulf bacteria (phagocytosis) • swelling / inflammation of tissues / fever Area B • number of white blood cells increases • antibodies are produced • by lymphocytes / white blood cells • antibodies surround / cover / inactivate the antigens / pathogens Area C • memory lymphocytes / cells are produced • which remain in the blood • then if a secondary infection occurs • memory lymphocytes produce antibodies faster / in greater numbers • so the bacteria / pathogens are destroyed faster	(6) AO1 1



Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of biological understanding, some of which is accurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. • Presents a description which is not logically ordered and with significant gaps.
Level 2	3–4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. • Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing.
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. • Presents a description that has a well-developed structure which is clear, coherent and logical.



Level	Mark	Additional Guidance	General additional guidance
	0	No rewardable material	The level is determined by the areas of indicative content covered within the response. The mark within the level is determined by the detail and /or use of biological terms within each description.
Level 1	1–2	Makes a simple reference to a feature of the immune response	<u>Possible candidate responses</u> - White blood cells are involved - White blood cells engulf bacteria
Level 2	3–4	Refers to two areas of indicative content OR Gives an explanation of one area of indicative content	<u>Possible candidate responses</u> - Bacteria have antigens on them and white blood cells make antibodies - Infection by bacteria causes more white blood cells to be produced. Lymphocytes make antibodies which inactivate antigens on the pathogens
Level 3	5–6	Refers to three areas of indicative content OR Gives an explanation of two areas of indicative content	<u>Possible candidate responses</u> - There are antigens on bacteria which are detected by white blood cells. Lymphocytes make antibodies and then memory lymphocytes are produced for a faster secondary response - Phagocytes detect antigens on the bacteria and engulf them. This is called phagocytosis. People might also develop a fever. Memory lymphocytes are produced and these stay in the blood to produce specific antibodies very quickly if there is a secondary infection by the same bacteria

(Total for question 9 = 13 marks)

Question number	Answer	Additional guidance	Mark
9(a)	Calculation $300 \div 30 / 2^{10}$ / indication that there are 10 divisions (1) Evaluation 1024	award full marks for the correct answer with no working accept 512 for one mark	(2) A02 1

Question number	Answer	Additional guidance	Mark
9(b)(i)	(pathogens are organisms) that cause disease	ignore examples of pathogens unless linked to causing disease accept cause disease / illness / infections	(1) A01 1

Question number	Answer	Additional guidance	Mark
9(b)(ii)	An explanation including two from: - they inhibit processes (in bacteria) (1) - so bacteria {are destroyed / are killed / growth stops / reproduction stops} (1) - but antibiotics {do not affect/damage} the host cell (1)	accept named processes e.g. disrupt cell walls accept slows down for stopped	(2) AO1 1

Question number	Answer	Additional guidance	Mark
9(b)(iii)	substitution $80 \div 0.005$ (1) 16 000	award full marks for the correct answer with no working	(2) AO2 1

Question number	Indicative content	Mark
9(c)*	<u>similarities</u> • cell membrane • cell wall • ribosomes • cytoplasm • both have DNA <u>differences</u> • chromosomal DNA (bacteria) • plasmid DNA (bacteria) • flagella (bacteria) • smaller size (bacteria) • prokaryotic (bacteria) • nucleus containing DNA (plants) • chloroplasts (plants) • mitochondria (plants) • vacuole (plants) • eukaryotic (plants)	(6) AO1 1



Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	- Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. - Presents a description with some structure and coherence.
Level 2	3-4	- Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. - Presents a description that has a structure which is mostly clear, coherent and logical.
Level 3	5-6	- Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. - Presents a description that has a well-developed structure which is clear, coherent and logical.



Level	Mark	Additional Guidance	General additional guidance The level is determined by the number points of indicative content and the inclusion of similarities and differences in the response. The mark within the level is determined by the depth of detail, coherence and accuracy of the response.
	0	No rewardable material	
Level 1	1-2	Makes simple statements identifying either similarities or differences between bacterial cells and plant cells.	<u>Possible candidate responses</u> - Bacterial cells and plant cells have a cell wall. - Bacterial cells and plant cells have a cell wall for structural support.
Level 2	3-4	Makes simple statements to describe a similarity and a difference between bacterial cells and plant cells including some detail.	<u>Possible candidate responses</u> - Both cells have a cell membrane and a cell wall. Bacteria have flagella, but plant cells do not. - Both cells have a cell membrane and a cell wall for structural support. Bacteria have flagella, but plant cells do not.
Level 3	5-6	Gives an accurate, detailed description of similarities and differences between bacterial cells and plant cells.	<u>Possible candidate responses</u> - Both cells have a cell membrane and a cell wall. Bacteria have flagella and plasmids but plant cells do not. - Both cells have a cell membrane and a cell wall for structural support. Bacteria have flagella for movement, and a plasmid, but plant cells do not.

(Total for question 9 = 13 marks)

Question number	Answer	Mark
9(a)(i) overlap	C a protist The only correct answer is C <i>A is incorrect because malaria is not caused by a bacterium</i> <i>B is incorrect because malaria is not caused by a fungus</i> <i>D is incorrect because malaria is not caused by a virus</i>	(1) AO1 1

Question number	Answer	Additional guidance	Mark
9(a)(ii)	by vectors / mosquitoes	accept blood transfusions / through blood / sharing contaminated needles ignore insects / animals	(1) AO1 1

Question number	Answer	Additional guidance	Mark
9(b)	An explanation linking: • (the number of measles cases reported) has decreased (1)	accept herd	(2) A02 1

Question number	Answer	Additional guidance	Mark
9(c)	Any two from: - white blood cells {kill / destroy} pathogens (1) (WBC) produce {antibodies / antitoxins} (1) - memory lymphocytes (are produced) (1)	accept phagocytosis accept WBCs engulf pathogens reject antigens accept memory cells accept rise in body temperature / inflammation / more mucus produced / more WBC are produced / WBC move to site of infection (1)	(2) A01 1

Question number	Answer	Additional guidance	Mark
9(d)(i)	(beriberi) is not spread from person to person / is not caused by a {pathogen / named pathogen}	accept organisms for people	(1) A02 1

Question number	Indicative content	Mark
9(d)(ii)*	A02 path - electrical impulses travel from the skin → - neurone X → neurone Y → → neurone Z → muscle in the arm reflex arc detail - pricking the skin is a stimulus (the stimulus is) detected by receptors - neurone Y / relay neurone is in the spinal cord /CNS - there are synapses between neurones - chemical transmitters are released at synapses - the muscle is the effector - the muscle contracts - this is the response - electrical impulses do not travel to the brain - the response is very fast neurones - X - sensory neurone - Y - relay neurone - Z - motor neurone	(6) A02 1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	- The description attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. - Lines of reasoning are unsupported or unclear.
Level 2	3-4	- The description is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. - Lines of reasoning mostly supported through the application of relevant evidence.
Level 3	5-6	- The description is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. - Lines of reasoning are supported by sustained application of relevant evidence.

Level	Mark	Additional Guidance	General additional guidance The level is determined by the quality of the description of the path taken by electrical impulses in a reflex arc The mark within the level is determined by additional detail of the path and reflex
Level 1	1-2	- The answer refers to part of the path taken by electrical impulses - The response includes an additional point of detail of the path	<u>Possible candidate response</u> - Impulses go from the skin through X - Impulses from the skin through X to the spinal cord
Level 2	3-4	- The description of the path includes X to Y to Z - The response includes an additional point of detail of the path AND a named neurone	<u>Possible candidate response</u> - Impulses go through X to Y then to Z - Impulses go from the skin, through the sensory neurone to Y, which is in the spinal cord. Impulses then go to Z and on to the muscle.
Level 3	5-6	- The description of the path includes X to Y to Z and includes the names of at least two neurones OR one named neurone and reference to synapses - The response includes an additional point of detail	<u>Possible candidate responses</u> - Impulses go through the sensory neurone, to Y then to Z, which is a motor neurone. - Impulses go from the skin, through X, the sensory neurone. Y is a relay neurone, which is in the spinal cord. Impulses then go to Z which is a motor neurone.

Total for question 9 = 13 marks