

1 Some infections are caused by bacteria.

- (a) The genetic material is arranged differently in the cells of bacteria compared with animal and plant cells.

Describe **two** differences.

(2)

- (b) Tuberculosis (TB) is an infection caused by bacteria.

The table below shows the number of cases of TB in different regions of southern England from 2000–2011.

Number of cases of TB per 100 000 people

Year	London	South East	South West
2000	37	5	3
2001	36	6	4
2002	42	6	6
2003	42	7	4
2004	42	7	5
2005	49	8	5
2006	44	8	3
2007	43	8	5
2008	44	8	5
2009	44	9	6
2010	42	9	5
2011	45	10	5

(i) How does the number of cases of TB for London compare with the rest of southern England?

(1)

(ii) Describe the pattern in the data for cases of TB in the South East.

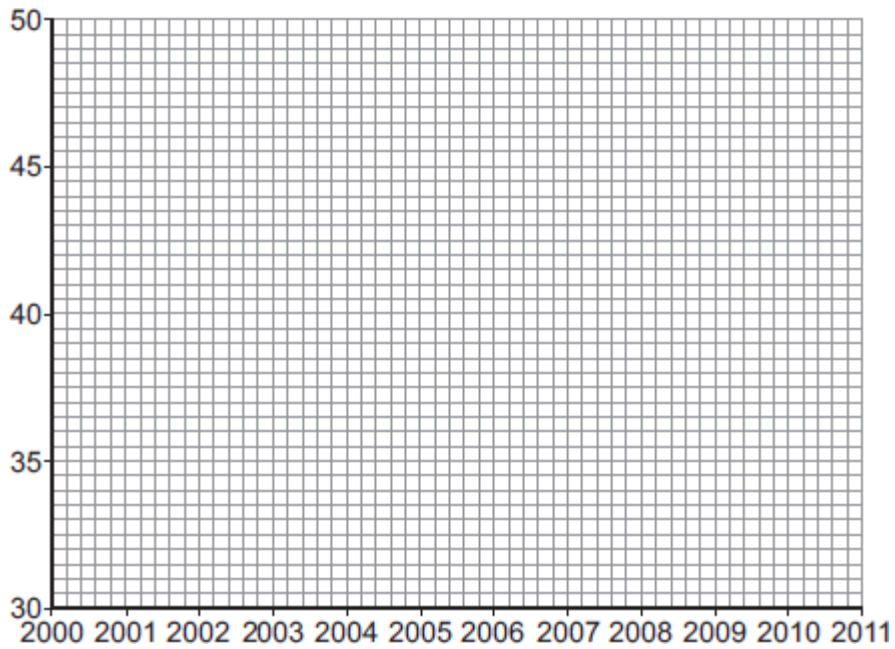
(1)

(iii) Describe the pattern in the data for cases of TB in the South West.

(2)

(c) (i) On the graph paper below:

- plot the number of cases of TB in **London**
- label both the axes on the graph
- draw a line of best fit.



(4)

(ii) Suggest why a student thought the value for 2005 in London was anomalous.

(1)

(d) People can be vaccinated against TB.

Suggest how a vaccination programme would reduce the number of people with TB.

Details of how a vaccine works are **not** required.

(2)

(Total 13 marks)

2

Microorganisms cause infections.

The human body has many ways of defending itself against microorganisms.

(a) Describe **two** ways the body prevents the entry of microorganisms.

1. _____

2. _____

(2)

(b) In 2014 the Ebola virus killed almost 8000 people in Africa.

Drug companies have developed a new drug to treat Ebola.

Explain what testing must be done before this new drug can be used to treat people.

(6)

(Total 8 marks)

3

Antibiotics can be used to protect our bodies from pathogens.

(a) What is a pathogen?

(1)

- (b) Bacteria may become resistant to antibiotics.

How can doctors reduce the number of bacteria that become resistant to antibiotics?

(2)

- (c) Scientists grow microorganisms in industrial conditions at a higher temperature than is used in school laboratories.

- (i) Which temperature would be most suitable for growing bacteria in industrial conditions?

Draw a ring around the correct answer.

25 °C

40 °C

100 °C

(1)

- (ii) What is the advantage of using the temperature you gave in part (c)(i)?

(1)

(Total 5 marks)

4

The MMR vaccine is used to protect against measles.

- (a) Apart from measles, which **two** other diseases does the MMR vaccine protect against?

_____ and _____

(1)

- (b) Read the information.

Measles is a dangerous disease caused by a virus.
Normally, MMR vaccinations are given at 1 year old and again at 4 years old.
Each vaccination is 90% effective in protecting against the measles virus.

In April 2013, there were 630 cases of measles in children aged 4 and over in a small area of the UK. Of these cases, 504 children had not been vaccinated against MMR at all and only a few had been given a second vaccination.

- (i) Calculate the percentage of the children who caught measles in April 2013 who had **not** been vaccinated against MMR.

Percentage = _____

(2)

- (ii) Suggest **one** advantage to the population as a whole of children having the second MMR vaccination.

(1)

- (c) (i) What does a vaccine contain?

(1)

- (ii) Explain how a vaccination prevents infection.

(3)

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

Explain why antibiotics **cannot** be used to treat measles.

(2)

- (ii) Why do antibiotics become less useful at treating an infection if the antibiotic is overused?

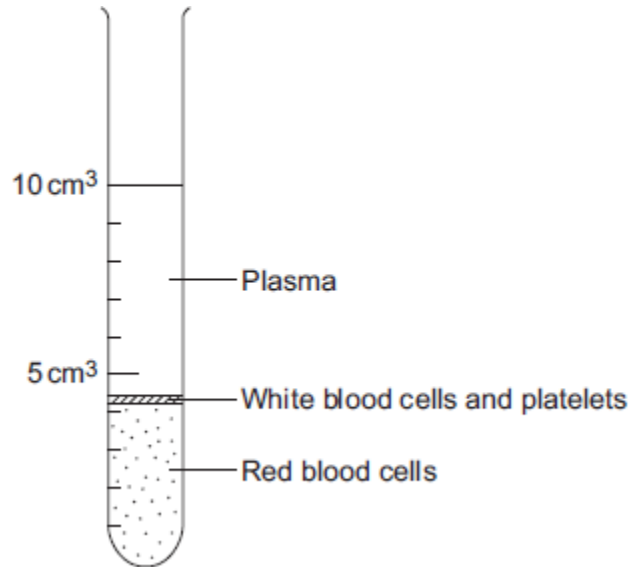
(1)

(Total 11 marks)

5

The parts of the blood can be separated from each other by spinning the blood in a centrifuge.

The image below shows the separated parts of a 10 cm³ blood sample.



- (a) Calculate the percentage of the blood that is made up of plasma.

Answer = _____%

(2)

- (b) Name **three** chemical substances transported by the plasma.

1. _____

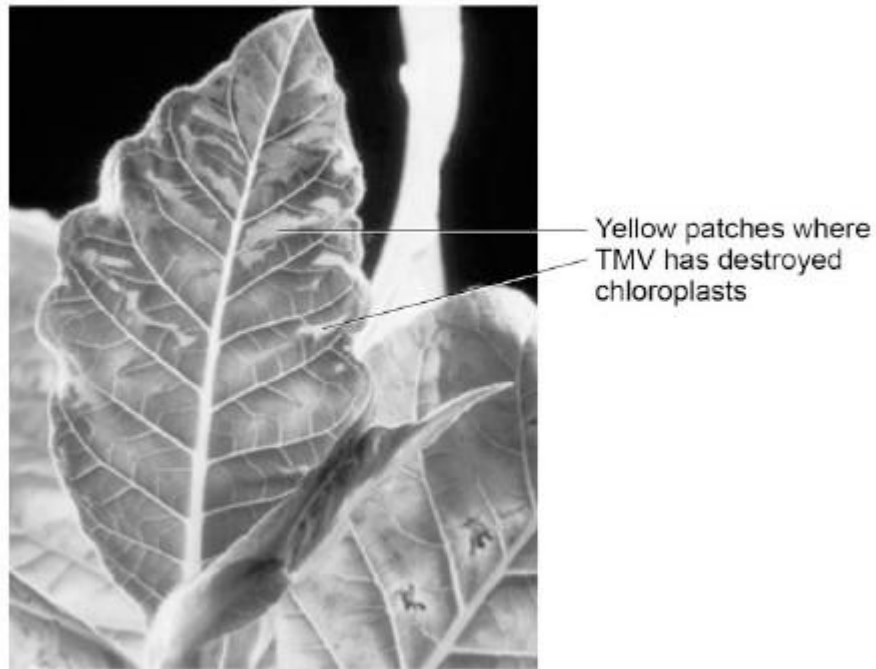
2. _____

3. _____

(3)

6 Tobacco mosaic virus (TMV) is a disease affecting plants.

The diagram below shows a leaf infected with TMV.



© Nigel Cattlin/Visuals Unlimited/Getty Images

(a) All tools should be washed in disinfectant after using them on plants infected with TMV.

Suggest why.

(1)

(b) Scientists produced a single plant that contained a TMV-resistant gene.

Suggest how scientists can use this plant to produce **many** plants with the TMV-resistant gene.

(1)

(c) Some plants produce fruits which contain glucose.

Describe how you would test for the presence of glucose in fruit.

(2)

(d) TMV can cause plants to produce less chlorophyll.

This causes leaf discoloration.

Explain why plants with TMV have stunted growth.

(4)

(Total 8 marks)

Mark schemes

- 1** (a) any **two** from:
- only one 'chromosome'
allow one strand of DNA
 - circular
allow loop
 - may have plasmids
 - not in a nucleus / no nucleus
- 2
- (b) (i) any **one** from:
- London is much higher
or converse
 - more variable / wider range
allow 'on average it is 5 / 6 times greater'
- 1
- (ii) increases
Included figures must be correct
- 1
- (iii) overall slight increase
accept 'doesn't change much'
- 1
- variable / goes up and down
- 1
- (c) (i) both axes correctly labelled
- x = Year
- y = Number of cases
- 1
- correct points
all correct = 2 marks
1-2 errors = 1 mark
> 2 errors = 0 marks
- 2
- suitable line of best fit
accept straight line or smooth curve
- 1
- (ii) doesn't fit the pattern / line of best fit
- 1

- (d) provides immunity / protection (to TB)
ignore 'stops people catching it'
ignore 'resistance'

1

prevents TB spreading
accept ref to herd immunity

1

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2

- (a) any **two** from:
- acid in the stomach kills pathogens in food
 - skin forms a barrier / produces antimicrobial secretions
 - hairs in the nose trap (particles which may contain) pathogens
 - trachea / bronchi has mucus which traps pathogens
- or**
- bronchi have cilia which waft mucus to throat to be swallowed

2

- (b) **Level 3 (5–6 marks):**
 A clear, logical and coherent answer, with no significant redundancy. The student understands the process and links this to reasons for clinical trials.

Level 2 (3–4 marks):
 A partial answer with errors and ineffective reasoning or linkage.

Level 1 (1–2 marks):
 One or two relevant points but little linkage of points or logical reasoning.

0 marks:
 No relevant content.

Indicative content

- pre-clinical trials of the new drug on cells / tissues / live animals
- to test toxicity, dosage and efficacy
- clinical trials / test on healthy volunteers and Ebola patients at very low doses
- so that you can monitor for safety / side effects
- and only then do trials to find the optimum dosage and test for efficacy
- double blind trial / use of placebo
- which does not contain the new drug
- random allocation of Ebola patients to groups
- so no one knows who has placebo / the new drug
- peer review of data
- to help prevent false claims

6

[8]

3

- (a) microorganism / bacteria / virus / fungus that causes (infectious) disease

1

- (b) reduce / stop use of (current) antibiotics

1

(reduce / stop use) for non-serious / mild / viral infections

allow ensure course is completed

allow use of variety of antibiotics

1

(c) (i) 40 °C

1

(ii) any **one** from:

- microorganisms grow / reproduce / work / act faster
- results / product acquired sooner

1

[5]

4

(a) mumps

in either order rubella / German measles

both needed for the mark

ignore measles unqualified

1

(b) (i) 80(.0)

allow 1 mark for $\frac{504}{630}$ or 0.8

2

(ii) less chance of epidemic / pandemic

or

less chance of spread of disease / measles / mumps / rubella

allow idea of herd immunity (increased protection for those who are not vaccinated)

ignore less chance of getting the disease or to eradicate the disease

1

(c) (i) dead / inactive pathogens / viruses / bacteria

allow antigens / proteins from pathogens / viruses / bacteria

ignore microorganisms

1

(ii) white blood cells produce antibodies

1

antibodies produced rapidly (on re-infection) **or** response rapid (on re-infection)

allow ecf if antibodies incorrectly identified in first marking point

1

these antibodies kill pathogens / viruses / bacteria

*do **not** accept idea that original antibodies remain in blood and kill pathogens*

1

(d) (i) antibiotics don't kill viruses
allow antibiotics only kill bacteria

1

(because measles) virus / pathogen lives inside cells
allow antibiotics do not work inside cells or killing virus / pathogen would kill / damage cell

1

(ii) (bacteria / pathogens) develop resistance (to antibiotic)
ignore reference to immunity
ignore viruses develop resistance

1

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5

(a) 55%

2 marks for correct answer alone
accept 54 – 56
5.5 / 10 × 100 alone gains 1 mark

2

(b) any **three** from:

- amino acids
- antibodies
- antitoxins
- carbon dioxide
- cholesterol
- enzymes
- fatty acid
- glucose
- glycerol
- hormones / named hormones
- ions / named ions
- proteins
- urea
- vitamins
- water.

ignore blood cells and platelets
ignore oxygen
max 1 named example of each for ions and hormones
allow minerals

3

- (c) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

There is a description of pathogens with errors or roles confused.

or

the immune response with errors or roles confused.

Level 2 (3 – 4 marks)

There is a description of pathogens **and** the immune response with some errors or confusion

or

a clear description of either pathogens **or** the immune response with few errors or little confusion.

Level 3 (5 – 6 marks)

There is a good description of pathogens **and** the immune response with very few errors or omissions.

Examples of biology points made in the response:

- bacteria and viruses are pathogens
credit any ref to bacteria and viruses
- they reproduce rapidly inside the body
- bacteria may produce poisons / toxins (that make us feel ill)
- viruses live (and reproduce) inside cells (causing damage).

white blood cells help to defend against pathogens by:

- ingesting pathogens / bacteria / (cells containing) viruses
credit engulf / digest / phagocytosis
- to destroy (particular) pathogen / bacteria / viruses
- producing antibodies
- to destroy particular / specific pathogens
- producing antitoxins
- to counteract toxins (released by pathogens)
credit memory cells / correct description
- this leads to immunity from that pathogen.

6

[11]

6

- (a) to kill virus
or
to prevent virus spreading

1

- (b) take (stem) cells from meristem
or
tissue culture
allow take cuttings

1

- (c) use Benedict's solution

1

glucoses turns solution blue to orange

1

- (d) **Level 2 (3–4 marks):**

A detailed and coherent explanation is provided. The student makes logical links between clearly identified, relevant points that explain why plants with TMV have stunted growth.

Level 1 (1–2 marks):

Simple statements are made, but not precisely. The logic is unclear.

0 marks:

No relevant content.

Indicative content

- less photosynthesis because of lack of chlorophyll
- therefore less glucose made
so
- less energy released for growth
- because glucose is needed for respiration
and / or
- therefore less amino acids / proteins / cellulose for growth
- because glucose is needed for making amino acids / proteins / cellulose

4

[8]