Infection and Response 1

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Name: _____

Class: _____

Date: _____

Time: **73 minutes**

Marks: **67 marks**

Comments:

Q1.

This question is about disease.

Gonorrhoea is a sexually transmitted disease.

(a) Which is a symptom of gonorrhoea?

Tick (✓) **one** box.

Damaged immune system ☐

Pain when urinating ☐

Reduced body temperature ☐

(1)

The table below shows the number of reported cases of gonorrhoea for 5 cities.

City	Number of reported cases of gonorrhoea per 100 000 of the population
A	124
B	118
C	40
D	130
E	40

(b) The number of cases of gonorrhoea in each city might **not** be accurate.

Suggest **one** reason why.

_____

_____

(1)

(c) Which is the best way to present the data from the table above?

Tick (✓) **one** box.

Bar chart ☐

Line graph ☐

Scatter diagram ☐

(1)

(d) The data is given as per 100 000 of the population and **not** as the total number of people with gonorrhoea.

Suggest why.

_____

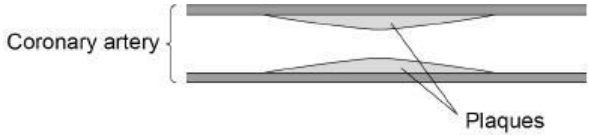
(1)

Deposits can form in coronary arteries.

The deposits are called plaques.

Plaques cause damage to the arteries.

The figure below shows plaques in a coronary artery.



(e) Which **two** factors **increase** the risk of plaques forming in the coronary artery?

Tick (✓) **two** boxes.

High fat diet ☐

Low blood glucose ☐

Regular exercise ☐

Smoking ☐

Taking statins ☐

(2)

(f) Which treatment can be used for the plaques in the above figure?

Tick (✓) **one** box.

A placebo ☐

A stent ☐

An antibiotic ☐

(1)

(g) A heart attack can happen when plaques block a coronary artery.

During a heart attack muscle cells in the heart die.

Explain how the blockage can lead to the death of muscle cells in the heart.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

Q2.

This question is about communicable diseases.

Measles is a communicable disease caused by a pathogen.

(a) What type of microorganism causes measles?

_____

(1)

Vaccinations help reduce the spread of measles.

(b) Suggest **two** ways the spread of measles can be reduced.

Do **not** refer to vaccination in your answer.

1 _____

_____

2 _____

_____

(2)

(c) Describe how the measles vaccine helps a person to become immune to the measles pathogen.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

Norovirus is a type of virus.

(d) Explain how viruses cause illness.

_____

_____

_____

_____

(2)

(e) Drugs can help to reduce the symptoms of the norovirus infection.

New drugs must go through clinical trials before being licensed for use.

Give **three** reasons why clinical trials are needed.

1 _____
_

_____

2 _____
_

_____

3 _____
_

_____

(3)

(Total 12 marks)

Q3.

Antibiotics are drugs used to treat bacterial infections.

Mutations in bacteria produce new strains.

Some strains of bacteria are resistant to antibiotics.

(a) Where do mutations happen in a **bacterial** cell?

_____

(1)

A scientist investigated which antibiotics (**A**, **B**, **C**, **D** and **E**) killed *Staphylococcus aureus* (*S. aureus*) bacteria.

This is the method used.

1. Grow *S. aureus* bacteria in a Petri dish.

2. Cut five small discs of paper.

3. Soak each paper disc in a different antibiotic solution.

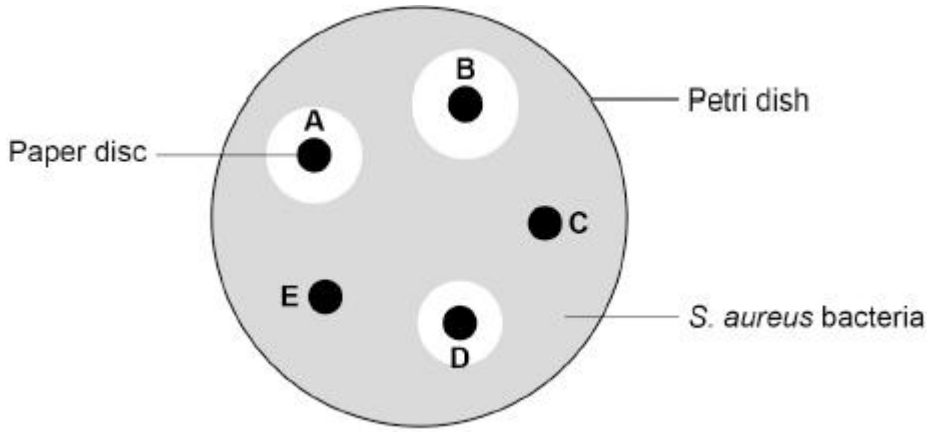
4. Put the five paper discs into the Petri dish.

5. Keep the Petri dish at 37 °C for 24 hours.

Figure 1 shows the results.

A clear area around a disc shows where the bacteria have been killed.

Figure 1



(b) The scientist concluded:

'*S. aureus* is resistant to antibiotics **C** and **E**'.

Explain the evidence for this conclusion.

Use **Figure 1**.

_____

_____

_____

_____

(2)

(c) The scientist later discovered that *S. aureus* is **not** resistant to antibiotic **E**.

Suggest how the method was developed and showed that *S. aureus* is **not** resistant to antibiotic **E**.

_____

_____

_____

_____

(2)

Broken bones are sometimes repaired using a metal implant.

The area around an implant can become infected with *S. aureus* bacteria. The infection is usually treated with a long-term course of antibiotics.

Long-term use of antibiotics has led to the development of antibiotic resistant bacteria. Research is being carried out into alternative treatments.

Stem cells from bone marrow and from fat tissue have antimicrobial properties.

A scientist investigated the effect of four treatments on the area of infection around metal implants. Each treatment was injected into the area around the implant.

The four treatments were:

- unreactive solution
- antibiotic solution
- stem cells from fat tissue
- stem cells from fat tissue containing antibiotic.

Each treatment was tested on 5 patients where an infection had developed around their metal implant.

After 7 days of treatment, the scientist calculated the ratio:

area of infection **:** total tissue area

(d) What was the independent variable in this investigation?

Tick (✓) **one** box.

The ratio of area of infection **:** total tissue area	☐
The treatment injected around the implant	☐
The type of antibiotic used	☐
The type of bacterial infection	☐

(1)

(e) Suggest **one** advantage of using stem cells from fat tissue, rather than using stem cells from bone marrow.

_____

_____

(1)

(f) Stem cells containing antibiotic were produced by growing the cells for 24 hours in a solution containing the antibiotic.

How did the antibiotic enter the stem cells from the solution?

Give a reason for your answer.

Tick (✓) **one** box.

By active transport ☐

By diffusion ☐

By osmosis ☐

By translocation ☐

Reason _____

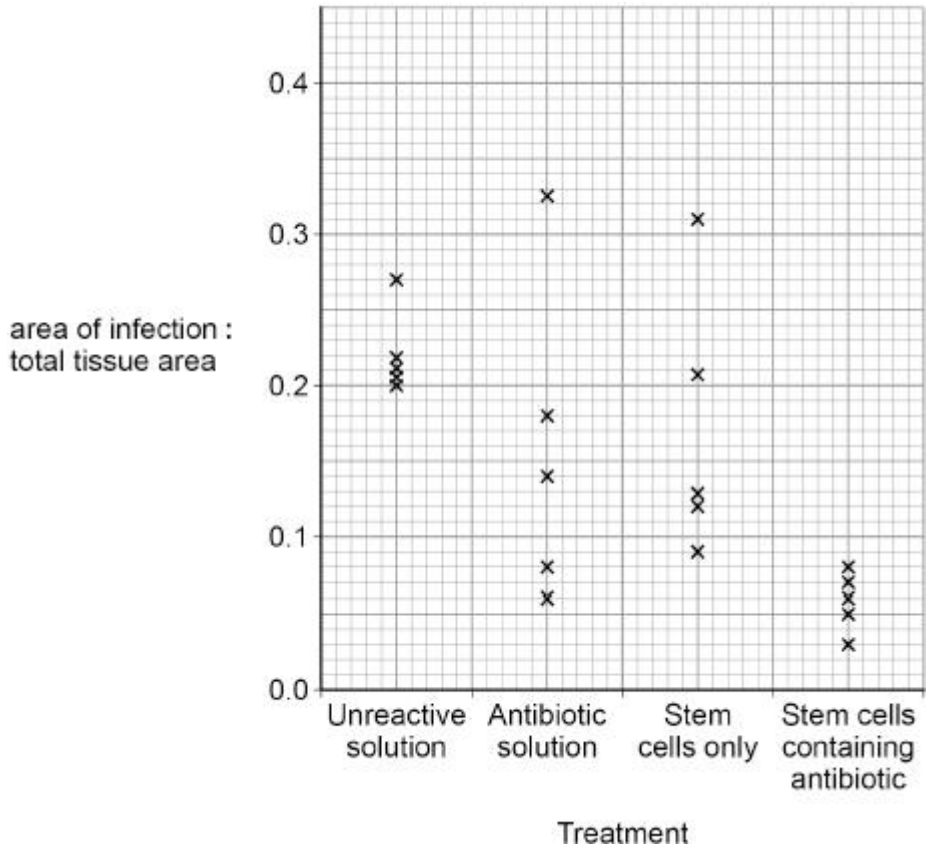
_

_____

(2)

Figure 2 shows the results.

Figure 2



(g) What is the range of results for the treatment with stem cells only?

From _____ to _____

(1)

(h) A student looked at the results and concluded:

'Injections of stem cells containing antibiotic should be used to treat **all** implant-related infections'.

Evaluate the student's conclusion.

Use **Figure 2**.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

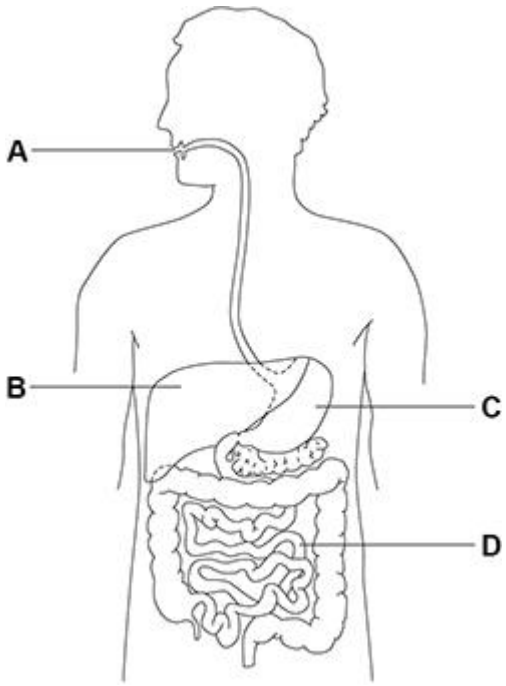
(4)

(Total 14 marks)

Q4.

Foods are digested before they are absorbed into the blood.

The diagram below shows organs in the human digestive system.



(a) Which organ is the stomach?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(b) What type of enzyme is produced in the stomach?

Tick (✓) **one** box.

Carbohydrase ☐

Lipase ☐

Protease ☐

(1)

(c) Which term describes the pH in the stomach?

Give **one** reason why the stomach is this pH.

Tick (✓) **one** box.

Acidic ☐

Alkaline ☐

Neutral ☐

Reason _____

_

_____

(2)

(d) Which organ produces bile?

Tick (✓) **one** box.

Large intestine ☐

Liver ☐

Mouth ☐

Pancreas ☐

(1)

(e) How does bile help in the digestion of foods?

Tick (✓) **one** box.

It increases the surface area of fats. ☐

It is an enzyme that digests protein. ☐

It makes the pH in the small intestine acidic. ☐

(1)

A student tested different foods for the presence of protein, starch and sugar.

(f) Draw **one** line from each food molecule to the reagent used to test for the food molecule.

Food molecule	**Reagent**
Protein	Benedict's solution
Starch	Biuret reagent
Sugar	Iodine solution

(2)

(g) Give **one** safety precaution a student should take when using Benedict's solution.

_____

_____

(1)

(h) The table below shows the results for one food sample.

Test	**Benedict's test**	**Biuret test**	**Iodine test**
Colour after test	Red	Blue	Black

Which of the tests show positive results?

Tick (✓) **one** box.

All three tests ☐

Benedict's and Biuret tests only ☐

Benedict's and iodine tests only ☐

Biuret and iodine tests only ☐

(1)

(i) Starch molecules are **not** absorbed into the blood from the digestive system.

Give **one** reason why.

_____

_____

(1)

(Total 11 marks)

Q5.

Bacteria can cause a variety of diseases in humans.

(a) What are **two** similarities between a bacterial cell and an animal cell?

Tick (✓) **two** boxes.

Both have a cell membrane.	☐
Both have a cell wall.	☐
Both have a nucleus.	☐
Both have cytoplasm.	☐
Both have plasmids.	☐

(2)

(b) Salmonella food poisoning is caused by bacteria in food.

Give **one** symptom of salmonella food poisoning.

Do **not** refer to vomiting or diarrhoea in your answer.

_____

_____

(1)

(c) What is the name of the first antibiotic developed?

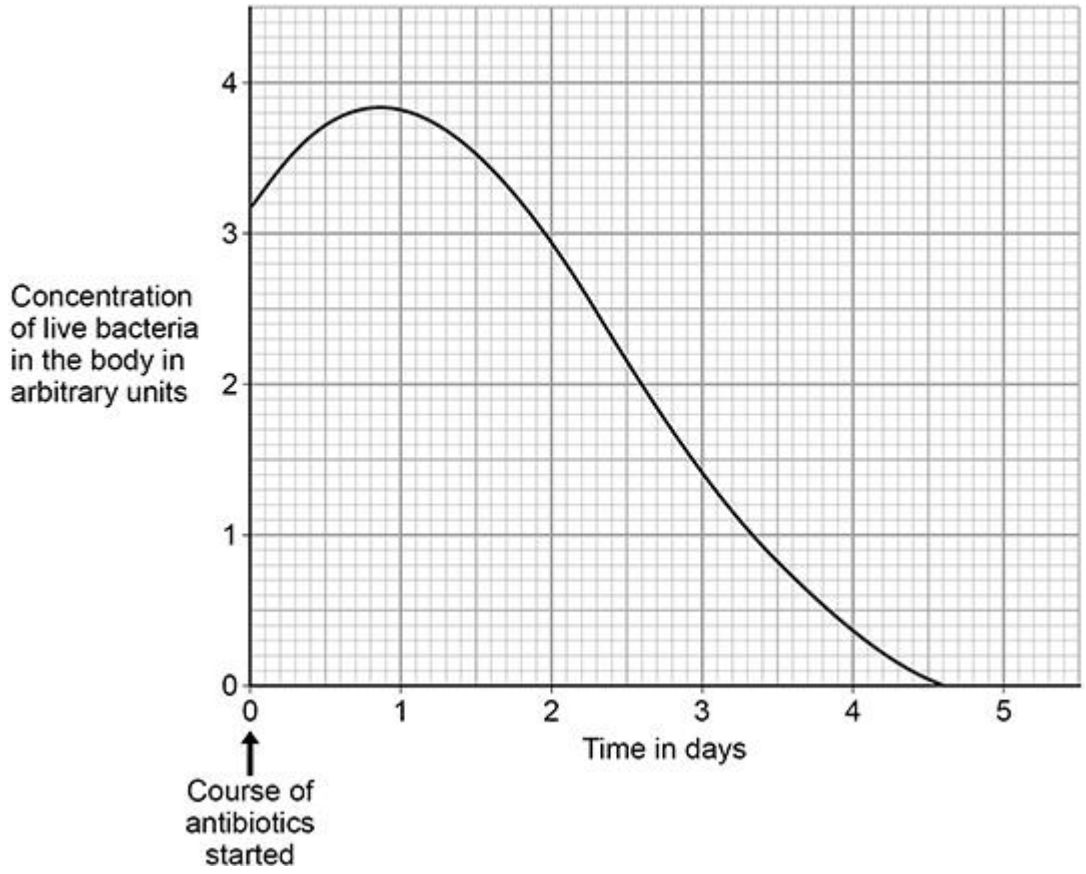
_____

(1)

A child with a severe bacterial infection was given a course of antibiotics.

Figure 1 shows how the concentration of live bacteria in the child's body changed when taking the course of antibiotics.

Figure 1



(d) The concentration of live bacteria in the body continued to increase after starting the course of antibiotics.

Suggest **one** reason why.

_____

_____

(1)

(e) After 3 days of taking the antibiotic:

- the child felt better
- there were still bacteria in the child's body.

Why did the child feel better?

Tick (✓) **one** box.

Bacteria had become immune to the antibiotic. ☐

The child had become resistant to the bacteria. ☐

There were fewer toxins in the body than at day 0 ☐

(1)

(f) Suggest why doctors do **not** give antibiotics to patients with minor infections.

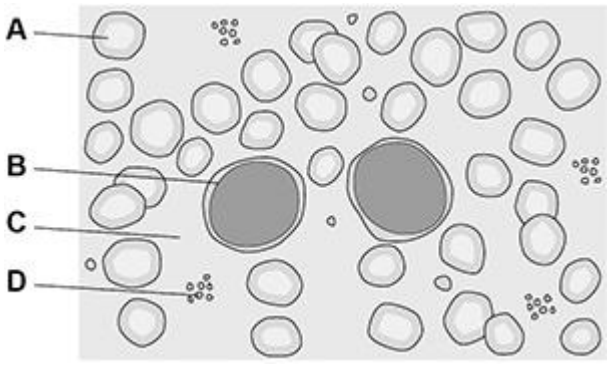
_____

_____

(1)

Figure 2 shows blood viewed using a microscope.

Figure 2



Blood viewed using a microscope © jarun011 / iStock

(g) A vaccine will stimulate the production of antibodies.

Which part of the blood in **Figure 2** produces antibodies?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(h) Which part of the blood in **Figure 2** starts the clotting process?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

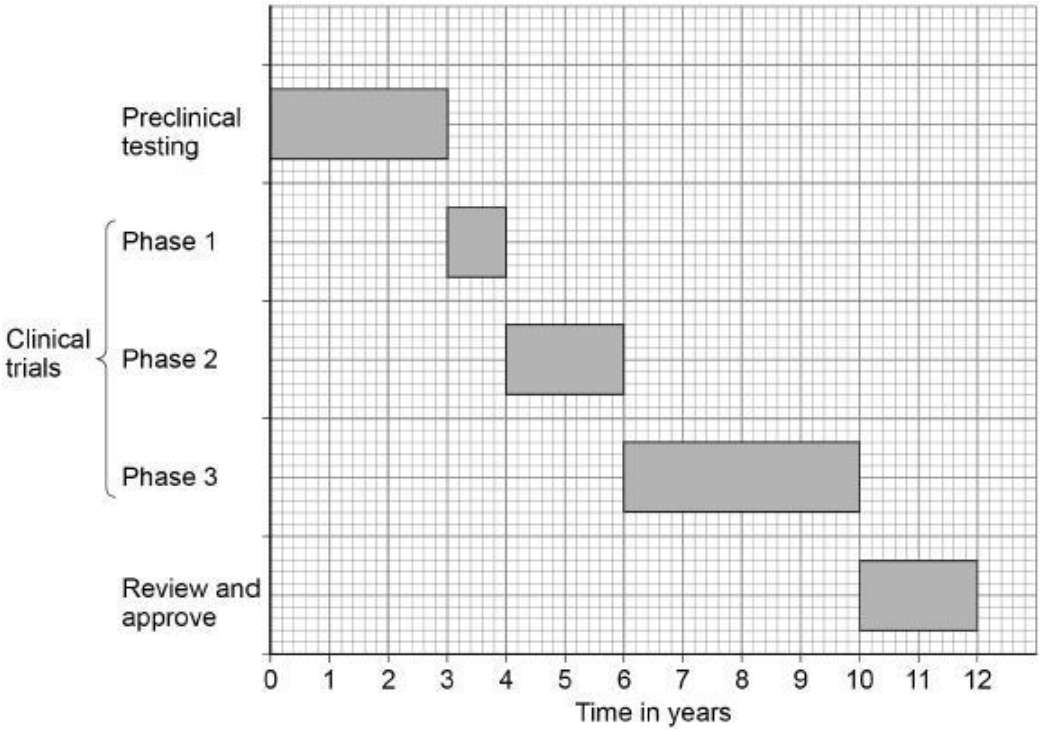
(Total 9 marks)

Q6.

New drugs are tested before they can be licensed for use with patients.

Figure 1 shows how much time the different stages of testing took for one new drug.

Figure 1



(a) Preclinical testing is done in a laboratory.

What is the drug tested on in a laboratory?

Give **one** example.

_____

(1)

(b) How many years did the clinical trials take for the drug in **Figure 1**?

_____

_____

Time for clinical trials = _____ years

(1)

(c) During Phase 1 clinical trials, the drug is tested on **healthy** volunteers using **low** doses.

What is the main purpose of Phase 1 testing?

Tick (✓) **one** box.

To find the best dose to use. ☐

To see if the drug is safe to use. ☐

To see if the drug works. ☐

(1)

During clinical trials, half of the patients are given a placebo in a double blind trial.

(d) What is a placebo?

_____

_____

(1)

(e) Who knows which patients are given the placebo and which patients are given the drug in a double blind trial?

Tick (✓) **one** box.

Not the patients or the doctors ☐

The patients and the doctors ☐

The patients but not the doctors ☐

(1)

Paracetamol and ibuprofen are two medicines used to reduce a high body temperature.

Doctors investigated which medicine was more effective at reducing high body temperature in 200 children who were ill.

The children were put into two groups, which were matched for:
- age
- gender
- body mass.

Each group had 100 children.

This is the method used.

1. Measure the body temperature of each child before any medicine is given.
2. Give children in Group 1 paracetamol.
3. Give children in Group 2 ibuprofen.
4. Measure the body temperature of each child every hour after the medicine is given.

(f) Give **two** control variables in this investigation.

1. _____

2. _____

(2)

(g) None of the children was given a placebo.

Suggest **one** reason why.

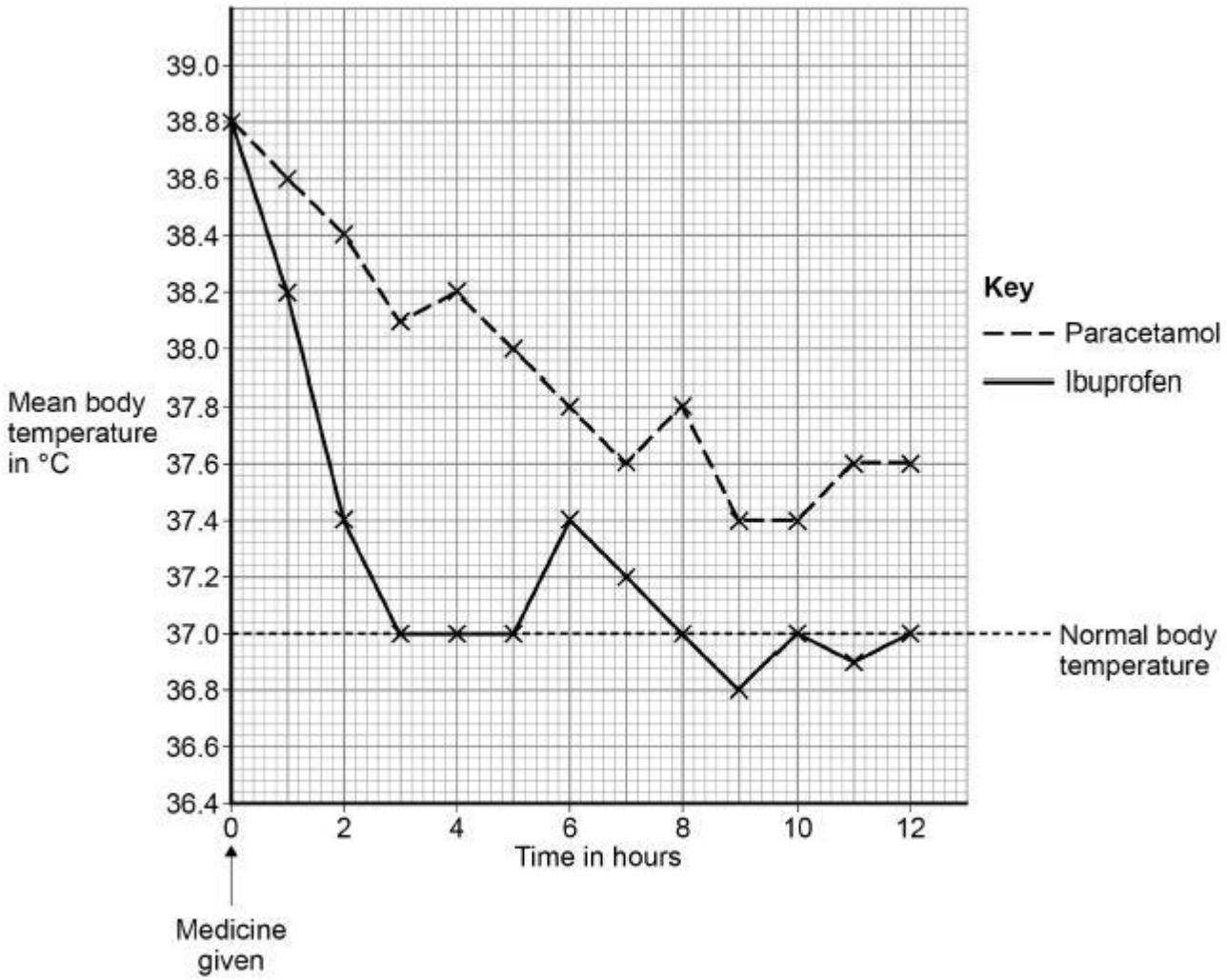
_____

_____

(1)

Figure 2 shows the results.

Figure 2



(h) What was the mean body temperature after 6 hours for the children given ibuprofen?

Mean body temperature = _____ °C

(1)

(i) The doctors concluded that children with a high body temperature should be given ibuprofen and not paracetamol.

Give **two** reasons for the doctors' conclusion.

Use **Figure 2**.

1. _____

_____

2. _____

_____

(2)

(Total 11 marks)

Q1.

(a) pain when urinating

1

(b) any **one** from:

- not all cases are reported / recorded
  allow people may not know they have it
- (there may be) false positives / negatives
  allow idea of misdiagnosis
- references to population numbers only being estimates

1

(c) bar chart

1

(d) to compare

or

different cities have different population sizes
allow cities are different sizes

1

(e) high fat diet

1

smoking

1

(f) a stent

1

(g) less / no blood (flow)

1

(so) less / no oxygen (to heart muscle / cells)

1

(so) less / no respiration
allow less energy available ignore reference to lactic acid

1

[10]

Q2.

(a) virus(es)

1

(b) any **two** from:

- isolation (of people with measles)
- cover your nose / mouth when you cough / sneeze
  allow wear face coverings

- frequent handwashing / sanitiser

  allow frequent cleaning of surfaces

  ignore PPE unqualified
  ignore public health education programmes unqualified
  ignore social distancing unqualified

2

(c) any **four** from:

- (vaccine / injection) contains dead / inactive (measles) pathogen / virus

  allow vaccine / injection contains weakened / attenuated pathogen / virus
  allow vaccine / injection contains (measles) antigens
  ignore vaccine contains dead measles

- white blood cells produce antibodies

  allow leucocytes / lymphocytes produce antibodies
  *do **not** accept phagocytes produce antibodies*

- the antibodies produced are specific / correct (for the measles virus / pathogen)

- reference to memory cells made

  allow description of memory cells

- on secondary exposure antibodies are produced faster

  allow on secondary exposure larger quantities of antibodies are produced

  ignore herd immunity
  ignore antitoxins

  *if no other marks awarded allow **1** mark for antibodies are produced*

4

(d) viruses enter cells

allow viruses exist / reproduce inside cells
allow viruses inject genetic material into cells

1

(so) cells are damaged / killed

allow cells burst open

1

(e) to check the drugs are not toxic / poisonous

allow to check for side-effects
allow to check the drugs are not harmful
ignore dangerous

1

to check efficacy
or to see if the drugs work
or check if the drugs treat the disease

1

to determine dosage
or to find out how much is needed

allow to check interaction with other drugs

1

[12]

Q3.

(a) any **one** from:

- plasmid

  *do **not** accept nucleus*
- chromosome
- DNA / genes

  allow alleles

  allow genetic material

1

(b) no clear area (around C and E)

1

(so) no bacteria killed (by antibiotic)

allow (so) antibiotic did not work

1

if no letters are given assume they are referring to antibiotics C and E

(c) increased the concentration of antibiotic

allow increased the dose of antibiotic

ignore increased the volume of antibiotic

ignore left it longer

ignore used a different temperature

ignore used a different sized disc

1

clear area seen (around disc)
or
bacteria (around disc) killed

mark dependent on describing a change to the method

1

(d) the treatment injected around the implant

1

(e) any **one** from:

ignore reference to cost

(stem cells from fat tissue)

- easier to obtain

  allow quicker to obtain
- less invasive

  allow fewer side effects

  allow less painful

  ignore reference to rejection

1

(f) by diffusion

no marks if incorrect process selected

1

concentration of antibiotic lower inside cells than in solution
or
concentration of antibiotic higher in solution than inside cells

allow 'it' for antibiotic

allow correct reference to concentration gradient

1

(g) 0.09 to 0.31

allow 0.31 to 0.09

1

(h) any **two** from:
Pros:
stem cells containing antibiotic had:

- smallest area of infection (**:** total tissue area)
- small(est) range of results
- no overlap with unreactive solution (suggesting significant effect)

2

any **two** from:
Cons:

- only tested on 5 patients

  allow small sample size
- some results for antibiotic treatment similar to stem cells containing antibiotic
- some results for stem cell treatment similar to stem cells containing antibiotic
- age / health of patients not controlled
- only tested on one type of bacterium

  ignore only tested on one infection
- only tested on one type of implant
- only collected results after 7 days
- may lead to antibiotic resistance (in *S. aureus* bacteria)
- rejection of stem cells
- need donors for stem cells
- allergic reaction to antibiotic

ignore cost

ignore religion

ignore use of embryonic stem cells

ignore references to viruses

ignore side effects unqualified

2

[14]

Q4.

(a) C

1

(b) **Mark with (c)**

protease

1

(c) **Mark with (b)**

acidic

1

reason:
any **one** from:

- produces (hydrochloric) acid

  allow contains (hydrochloric) acid

- optimum / best conditions for enzyme / protease to act

  allow optimum / best condition to digest food / protein

  allow ecf from (b)

  allow to kill microorganisms / bacteria / pathogens

1

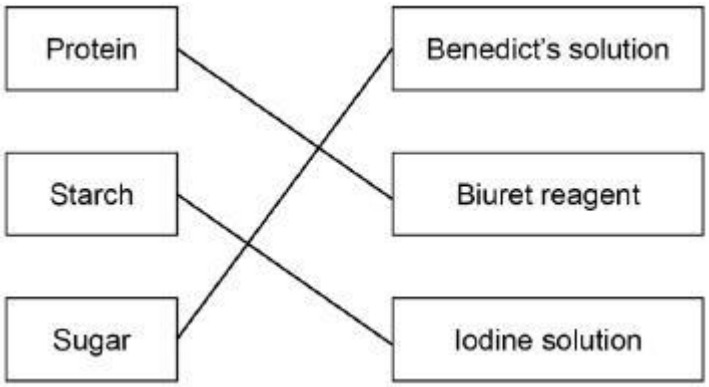
(d) liver

1

(e) it increases the surface area of fats

1

(f)



*all three correct for **2** marks*
*one or two correct for **1** mark*
extra line from a box negates that box

2

(g) any **one** from:

- wear goggles
- use a water bath to heat the solution / mixture
- wash spills from bench / skin

  allow wash hands

  allow wear gloves

  ignore examples such as tie hair back or move bags under bench

1

(h) Benedict's and iodine tests only

1

(i) any **one** from:

- starch (molecule) is (too) large

  allow idea that starch needs to be broken down into small / soluble molecules

- starch (molecule) is insoluble

1

[11]

Q5.

(a) both have a cell membrane

1

both have cytoplasm

1

(b) any **one** from:

- fever

  allow high temperature

  allow sweating / chills

- abdominal / stomach cramps

  ignore vomiting / sickness / diarrhoea

  ignore feel unwell unqualified

  ignore rashes

1

(c) penicillin

allow phonetic spelling

1

(d) any **one** from:

- only a few bacteria killed so live bacteria continued to reproduce

  allow bacteria reproducing when course started

- time delay before antibiotic reached bacteria

  allow takes time (for antibiotic) to travel through the body

- time delay before antibiotic could kill bacteria

  allow takes time (for antibiotic) to work

1

(e) there were fewer toxins in the body than at day 0

1

(f) to reduce / prevent resistant strains / bacteria developing

ignore references to bacteria becoming immune

or

to reduce / prevent antibiotic resistance (in bacteria)

allow because they will get better without taking any antibiotics

ignore body will fight the infection unqualified

allow some infections are caused by viruses

allow because they have been told not to by NHS / NICE

1

(g) B

1

(h) D

1

[9]

Q6.

(a) any **one** from:
- (live) cells
- (live) tissues
- (live) animals

allow examples , eg mice / rats

1

(b) 7 / seven (years)

1

(c) to see if the drug is safe to use

1

(d) tablet that does not contain the drug / active ingredient

allow a sugar pill
allow a fake drug

1

(e) not the patients or the doctors

1

(f) any **two** from:
- age
- gender
- body mass
- number of children (in group)
  or
  100 in group
- time (after taking medicine) when temperature was measured

allow all (children had a) high body temperature (at the start)

allow dose of drug / medicine

ignore temperature unqualified

2

(g) any **one** from:
- unethical not to treat ill children
- children were ill so had to be treated
- children may become more ill if no drug given

1

(h) 37.4 (°C)

1

(i) any **two** from:

- reduced (body) temperature faster

allow converse arguments

- decreased (body) temperature more

- reduced (body) temperature to normal / 37 °C

  *allow paracetamol did **not** reduce (body) temperature to normal*

- maintained normal (body) temperature / 37 °C for longer **or** for several hours

2

[11]