Mark schemes

Q1.

(a) penicillin

allow other named antibiotics ignore penicillium

1

(b) the bacterium is killed (by antibiotic **C**)

*allow there is a zone of inhibition (around antibiotic **C**)*

1

if the bacterium was resistant, bacteria would be right up to the (edge of the) antibiotic disc

allow resistance means that the bacterium is not killed (by antibiotic(s))

allow if the bacterium was resistant there would be no zone of inhibition

ignore no white area

1

(c) any **two** from:

- current / available antibiotics do not kill (certain) bacteria

  allow current / available antibiotics have no effect on (certain) bacteria

- diseases become more common
  or
  there will be some diseases that cannot be cured / treated

  ignore more people become ill

- new antibiotics need to be developed which takes time / money

  allow some diseases become more difficult to treat

2

(d) viruses **only** exist / reproduce inside (living) cells

*allow viruses **need** (living) cells to exist / reproduce*

*allow viruses exist / reproduce inside (living) cells **and** agar is not made of cells*

ignore names of cell types

1

(e) (these) drugs (can) damage (body) cells / tissues
or
it is hard to get (these) drugs into (living) cells

allow viruses often / frequently mutate (giving resistance to these drugs)

1

(f) AIDS

1

[8]

Q2.

(a) (bacteria) release / produce toxins

allow (bacteria) release / produce poisons

ignore toxins unqualified

1

(b) **Level 2**: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

3–4

Level 1: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

1–2

No relevant content

0

Indicative content:

Vaccination of animal

- (animal's) white blood cells / lymphocytes produce antibodies (against *Salmonella* / vaccine / antigens)
- antibodies are specific / complementary / correct to *Salmonella* / antigens
- (specific) antibodies bind to *Salmonella* / antigens

Secondary response in animal

- if infected (specific) antibodies are produced quickly **or** in large numbers
- (so) white blood cells **or** antibodies would kill (live) *Salmonella*
- (so) fewer / no bacteria / pathogens / *Salmonella* in animals **or** in animal products (meat / milk / eggs)

Prevention of food poisoning in humans

- (so) fewer / no bacteria / pathogens / *Salmonella* eaten **or** in (named) food
- (so) number of bacteria never reaches a high enough level for infection to develop
- (so) fewer toxins produced (in humans).

For **Level 2** students must link immune response in animals to prevention of an outbreak in humans.

(c) any **two** from:

allow alternative descriptions of sterilising equipment such as UV light

ignore clean / wash surfaces / hands / equipment

- disinfect hands / work surface
- sterilise Petri dish **or** culture medium (before use)
- pass inoculating loop / forceps through a flame (before use)

  allow sterilise agar (before use)

  ignore sterilise equipment
- work near a flame
  or
  work in a fume cupboard
- tilt lid (of Petri dish) when placing discs on agar (to minimise contact with air / breath)

  allow example of other method to minimise contact with air / breath
- secure lid of Petri dish with adhesive tape

  ignore store dish upside-down

2

(d) (37 °C)

37 °C is human / body temperature

1

Salmonella / bacteria grows best / better at 37 °C

allow (so) bacteria grow best / better at human body temperature

1

(25 °C)

25 °C reduces / prevents the growth of bacteria that are harmful to humans / students

allow because it is too low for growth of human pathogens

1

(e) (acts as a) control

allow for comparison

allow to show that the results are not due to the paper disc

allow to show that the results are due to the antibiotic

ignore to show the effect / effectiveness of the antibiotic

*do **not** accept as a control variable*

1

(f) (they) killed the most bacteria

allow prevented most bacteria growing / replicating

allow largest zone of inhibition (of bacteria)

ignore largest clear area unqualified

*ignore antibiotic **B** killed the most bacteria*

1

(g) measure the diameter / radius of each clear area

allow measure the diameter / radius of each region where the bacteria are killed

or

calculate / measure the area of each clear area

allow calculate the area of each region where the bacteria are killed

1

(h) bacteria must be resistant (to antibiotic **B**)

*do **not** accept bacteria must be immune*

1

(i) water enters the (bacterial) cell

1

(water enters) by osmosis

allow (water enters) by diffusion through a partially / selectively / semi permeable membrane

*do **not** accept if description of concentrations is incorrect*

1

(so) damaged / incomplete / no cell wall cannot withstand pressure (of water)

allow (so remaining) cell membrane cannot stretch further

1

[17]

Q3.

(a) vector

1

(b) any **three** from:

allow converse for prokaryotic cells

allow eukaryotic for protist

- protist / it has mitochondria
- protist / it has (a) nucleus **or** protist DNA / genetic material is not free in the cytoplasm

*if neither mark awarded, allow **1** mark for protist has membrane-bound structures*

ignore genetic information

- protist / it does not have a single loop of DNA / genetic material

ignore genetic information

- protist / it does not have plasmids
- protist / it does not have a cell wall

*do **not** accept eukaryotic cell does not have a cell wall*

allow protist / it does not have a slime capsule

ignore cilia / flagellae / ribosomes

ignore size / shape

3

(c) less oxygen carried (in blood)

allow less oxygen carried (to cells)

ignore reference to number of red blood cells unqualified

*do **not** accept no oxygen carried*

1

less energy released from respiration

*do **not** accept energy produced / made / created*

1

(d) any **three** pairs from:

Sexual reproduction	Asexual reproduction
involves two parents	involves one parent
involves gametes joining / fusing **or** involves fertilisation	involves no (fusion of) gametes **or** does not involve fertilisation
there is mixing of genetic material / information **or** there is genetic variation **or** offspring are genetically different	there is no mixing of genetic material / information **or** there is no genetic variation **or** offspring are genetically identical ignore reference to clones
involves (only) meiosis	involves mitosis **or** does not involve meiosis
more energy required	less energy required
slower	faster

*if no other mark awarded allow **1** mark for asexual reproduction produces many offspring*

pairs of answers can be in any order

3

(e) (no bases so) DNA replication cannot occur

allow copying / duplicating / doubling for replication

ignore cannot make DNA unqualified

1

(f) (after DNA replication) one set of chromosomes is pulled to each end of the cell

allow one (member) of each pair of chromosomes is pulled to each end of the cell

ignore (half the) chromosomes are pulled to each end of the cell

1

nucleus divides

allow two (new) nuclei form

1

cytoplasm **or** cell membrane divides to form two cells

allow cytokinesis

1

(g) having disorder **S** reduces incidence / percentage of malaria

*allow having disorder **S** reduces chance of getting malaria*

*allow having disorder **S** protects against malaria*

1

as age increases a lower percentage of children with disorder **S** get malaria until age 10, then the percentage increases

allow protection against malaria increases with (increasing) age until age 10, then it decreases

1

[15]

Q4.

(a) any **one** from:

- sexual contact / intercourse

  allow intercourse unqualified

  ignore kissing

- exchange of body fluids

  *allow example of exchange such as (drug) users sharing needles **or** blood transfusion **or** passage from mother to foetus in uterus*

1

(b) (number of cases) in women decreases then increases, then decreases

1

(number of cases) in men increases then decreases

1

*allow **total** numbers (of men and women together) increase then decrease*

ignore reference to differences between men and women

*if no other marks awarded allow overall trend decreases in **both** for **1** mark*

ignore use of figures

(c) any **one** from:

- better education (into prevention of spread of HIV)

  allow increased awareness about HIV

- condoms more widely available **or** condoms easier to source **or** condoms cheaper

  ignore contraception / protection unqualified

- new / better drugs (to prevent HIV infection / spread)

  allow PrEP / anti-retrovirals stop the virus being passed on

  ignore new treatments

  *do **not** accept antibiotics*

- better / more testing / identification (of people with HIV)

  allow less promiscuity

  ignore vaccination

1

(d) $\frac{242}{1288}$

1

0.1878…

allow a rounded answer

1

0.188 (:1)

allow a correctly rounded answer from student's incorrect division using numbers from the table

*do **not** accept if a unit is given*

1

(e) any **one** from:

- calculate as a percentage
- give the numbers per 100 000 people

ignore calculate as a proportion allow any standard number eg 10 000 / 1000

1

(f) inactive HIV / virus is injected (into bloodstream / muscle / body)

allow dead HIV / virus is injected (into bloodstream / muscle / body)

allow (named) part of HIV / virus is injected (into bloodstream / muscle / body)

1

white bloods cells produce antibodies (against inactive virus)

allow lymphocytes produce antibodies (against inactive virus)

*do **not** accept phagocytes produce antibodies (against inactive virus)*

1

(if infected with HIV) correct / specific antibodies are produced quickly

1

antibodies destroy the (active) virus / HIV

allow antibodies 'kill' the (active) virus / HIV

1

ignore reference to WBC unqualified

(g) HIV / antigen / protein injected into mouse

1

extract / collect (mouse) lymphocytes that make a specific antibody to HIV / antigen / protein

1

allow other correct small mammals eg rat

*allow extract specific lymphocytes from someone with HIV for **2** marks*

lymphocytes are combined with tumour cell to create a hybridoma

allow lymphocytes are combined with a myeloma / cancer cell to create a hybridoma

1

(hybridoma) cloned to create many cells that produce the antibody

1

alternative route

HIV / antigen / protein injected into mouse (1)

lymphocytes from mouse are combined with a tumour cell to create a hybridoma (1)

the hybridoma that makes the specific / correct antibody is isolated (1)

(hybridoma) cloned to create many cells that produce the antibody (1)

(h) monoclonal antibody is complementary / specific to HIV antigen

allow correct description of complementarity

1

monoclonal antibodies attaches to (all the) HIV antigens

1

(so) HIV cannot bind to (human) cell
or
(so) HIV genetic material cannot enter (human) cell

*allow white blood cells **or** phagocytes identify (monoclonal) antibodies and engulf / destroy (antibody bound) HIV*

1

alternative route

monoclonal antibody is complementary / specific to HIV antigen (1)

monoclonal antibody with (anti-retroviral) drug attached attaches to the HIV antigens (1)

*drug destroys the virus **or** drug destroys genetic material (1)*

allow 'the virus' for HIV throughout

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