AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.3.1 COMMUNICABLE DISEASES (PACK 4)

SCORE	PERCENTAGE
/328	%

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Q1.

(a) cell membrane

extra ticks negates marks

1

(b) engulf pathogens

1

produce antibodies

1

produce antitoxins

1

extra ticks negates marks

(c) 2050 − 100

1

= 1950

*allow **1** mark for a correct subtraction of incorrect values*

1

*an answer of 1950 scores **2** marks*

(d) any **one** from:

- (more) people vaccinated

  ignore injections / treatments / medicines unqualified
  allow vaccine produced
  allow (more people given) MMR (vaccine)
  *do **not** allow antibiotics*
  ignore less people infected

- (more) people immune
- no new measles strain

1

(e) any **one** from:

- measles is (caused by) a virus

  allow measles is not caused by a bacterium

- viruses cannot be killed / destroyed by antibiotics

  *allow antibiotics **only** kill / destroy bacteria*
  ignore harmed / treated

1

(f) any **one** from:

- use of a barrier method of contraception

  ignore use of diaphragm

- use of a condom

  ignore use protection / safe sex

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- vaccination / immunisation
- avoid sexual intercourse / contact

*do **not** accept less sexual intercourse / contact*

1

(g) any **one** from:

- size / shape/ type of paper disc

ignore paper disc unqualified

- concentration of antibiotic

allow strength / dosage of antibiotic

- volume / amount of antibiotic
- (incubation) time

allow 3 days

- (incubation) temperature

ignore size of petri dish

1

(h) to check that the disc / water did not have an effect
or
to make sure it was the antibiotic that had an effect

allow for comparison with the antibiotics

allow as a (experimental) control

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

1

(i) (antibiotic) **A**

no marks if wrong antibiotic given

1

any **one** from:

- (antibiotic **A**) had the larg**est** clear area around it
- (antibiotic **A**) killed the **most** bacteria

1

[13]

Q2.

(a) is not caused by a pathogen / infective organism

allow not caused by a microorganism / microbe
ignore not caused by infection

ignore named pathogen unless bacteria, virus and fungus all mentioned

1

(so) is not passed / spread (from person to person)

allow cannot be spread / caught
allow is not infectious / contagious

1

(b) reduced / restricted / stopped blood flow

it does not matter where blood flow is restricted to − heart / body

1

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(so) less oxygen reaches heart (muscle / cells)

must reference heart / it
allow no oxygen reaches the heart (muscle / cells)

1

(so heart muscle / cells) cannot respire (enough)

or
(so heart muscle / cells) do not release (enough) energy

*do **not** accept do not make / produce / create energy*
ignore references to breathing / suffocation
ignore blood clots / blockages

1

allow 'it' for heart

(c) **Level 3:** Relevant points (factors / effects) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (factors / effects) are identified and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

medical risk factors:
- high blood pressure
- high cholesterol
- diabetes
- genetic factors
- medications

lifestyle risk factors:
- smoking
- obesity
- lack of exercise
- high fat / energy diet
- eating insufficient fruit / vegetables
- alcohol
- high salt intake
- exposure to air pollution
- certain drugs / correct named drug

examples of links:
- smoking − high bp / cholesterol / fatty deposition
- obesity − lack of exercise / high bp / cholesterol / fatty deposition / diabetes
- exercise − obesity / bp /diabetes

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- diet − obesity / cholesterol / diabetes
- alcohol − bp / cholesterol
- high salt intake − high blood pressure
- genetic factors − bp / cholesterol / diabetes / obesity
- medication − can affect blood / blood vessels / metabolism

the main discriminator is the quality of linking
both lifestyle and medical factors are required for **level 3**

[11]

Q3.

(a) any **one** from:

- not everyone would go to the doctor

  allow not all cases recorded
  allow only medically confirmed cases recorded
  ignore some cases are unknown

- sample will not always be sent for analysis
- some cases not tested / diagnosed / confirmed

  allow idea that doctor may make a judgemental error or mis-diagnosis

1

(b) $\frac{1939}{2030} \times 100$

*allow for **1** mark:*

$\left(\frac{91}{2030} \times 100 =\right) 4.5\%$

1

96 / 95.5

*allow **2** marks for correct rounding of 95.51724138*

*allow **1** mark for correct calculation using incorrect subtraction **only** if working shown*

1

*an answer of 96 / 95.5 scores **2** marks*
*allow **1** mark only for 95 or other incorrect rounding*

(c) most people are **immune** so do **not become ill** (from infection)

allow herd / community immunity so do not become ill (from infection)

allow most people are immune so do not become infected

ignore most people are immune so don't get / catch it

1

less chance of **non-immune** / **unvaccinated** individuals being exposed to pathogen / measles / virus

reference to an organism is needed

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allow 'it' for the measles virus

allow fewer people to pass it on to non-immune people

1

(d) **Level 3:** Relevant points (comparisons / reasons) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (comparisons / reasons) are identified and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

differences (after exposure to measles virus):

- greater number / higher concentration of antibodies produced
- quantitative statement, e.g. 9 times higher **or** 0.8 to 7.2
- antibodies produced sooner − idea of immediate response
- antibodies produced quicker
- antibodies stay (in higher concentration) for longer

explanation

- white blood cells / leucocytes / lymphocytes / B cells
  ignore phagocytes / macrophages
- reference to previous exposure (of white blood cells) to pathogen / virus
- (white blood cells) recognise pathogen / virus / antigen
- memory cells
- production of specific / correct antibodies

[11]

Q4.

Level 3: Relevant points (advice / reasons) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (advice / reasons) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

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precautions with reasons

- do not prescribe fluroquinolone / antibiotics for mild infections
- because they will get better due to the body's normal immune system

- do not prescribe fluroquinolone / antibiotics for viral infections / colds / flu
- because antibiotics do not kill viruses

- if you do prescribe fluroquinolone / antibiotics make sure the patient finishes the course
- because any bacteria left may develop resistance, survive and reproduce rapidly (due to lack of competition)

- only prescribe fluroquinolone if the patient has the new strain
- because routine use would lead to an increase in resistant bacteria

other relevant content

- doctors and nurses in the practice / hospital should be using antibacterial / alcohol hand wash between each patient **and / or** disinfectant to clean wards
- to kill (resistant) bacteria

- doctors should isolate patients with this strain of bacteria
- to prevent other patients getting the resistant infection

[6]

Q5.

(a) a type of electromagnetic radiation

1

(b) a thick sheet of lead

1

(c) to decrease the rate of decay of the food

1

to prevent food poisoning

1

(d) gamma rays cause mutations

1

(e) decrease the distance between the food and the radioactive source

1

increase the time for which the food is close to the radioactive source

1

(f) (because) the source of radiation is not in the food

allow source of radiation is / remains outside food

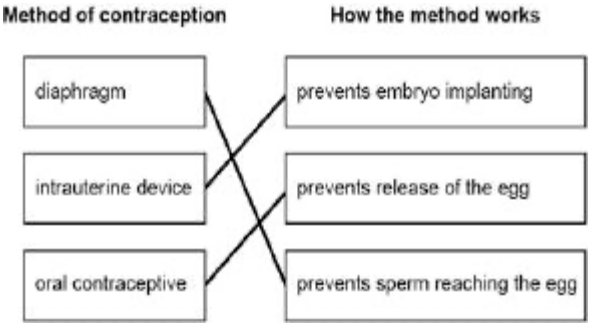
1

[8]

Q6.

(a)

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2

***2** marks for all 3 correct*
*allow **1** mark for 1 or 2 correct*

(b) to test for safety / toxicity
or
to test for dangerous / harmful side effects

ignore to test for side effects unqualified

1

(c) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5–6

Level 2: Some logically linked reasons are given. There may also be a simple judgement.

3–4

Level 1: Relevant points are made. They are not logically linked.

1–2

No relevant content

0

Indicative content

allow converse where applicable
- condom effectiveness is lower than oral contraceptive and patch
- hormone patch slightly more effective than oral contraceptive
- all are highly effective
- condoms more easily accessible
- condoms have no serious side effects, oral contraceptive and patch have possible side effects
- only condoms protect against STIs / STDs or named STIs / STDs
- side effects don't affect all women
- could forget to take oral contraceptive, but patch is applied for long time
- could forget to replace patch
- patch is visible

ignore costs
ignore how the contraceptive works

[9]

Q7.

(a) (gamma emission) does not change the number of protons

1

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(because gamma emission) is not a particle

allow (gamma emission) is an (electromagnetic) wave

1

(b) prevents food poisoning

1

(by) killing the bacteria / microorganisms / moulds

1

that produce toxins

ignore references to decay

1

(c) (only) gamma rays can pass (all the way) through packaging (to reach the food / bacteria)

allow converse

1

(and also) gamma rays pass all the way through the food without damaging / ionising the food

allow converse

1

ignore contamination
ignore no damage to food unqualified

(d) radioactive food contains a source of radiation
or
radioactive food is emitting radiation

1

(whereas)
irradiated food has been exposed to (an external source of nuclear) radiation

1

[9]

Q8.

(a) virus

allow viral

ignore communicable / airborne / microorganism / microbe

*do **not** accept bacteria / bacterial / fungus / fungal / protist*

1

(b) white blood cells

1

(c) 57

allow any answer in range 55−59

1

(d) 85

allow any answer in range 84−86

1

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(e) children are less likely to come into contact with someone with the disease

1

more people will have the correct antibodies

1

(f) any **two** from:

- cost (to the NHS / government)
- money saved through not treating people with chickenpox
- how effective the vaccine is
- severity of the disease
- less effect of disease on people with weaker immune systems / elderly / HIV or on unborn babies

2

[8]

Q9.

(a) ionising radiation

allow UV / X-rays / gamma (radiation)
allow environmental factors qualified e.g. carcinogenic chemicals

1

(b) enzymes

1

vectors

1

(c) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

- pre-clinical trials of the new drug on cells / tissues / live animals
- to test for toxicity / dosage / efficacy

- clinical trials / tests on healthy volunteers
- clinical trials / tests on children with Dravet syndrome at very low doses
- so you can monitor for safety / side effects
- and only after these stages trial to find optimum dosage / test for efficacy

- trial could be double blind / use a placebo
- which does not contain the new drug
- children with Dravet syndrome would be randomly allocated to the test groups
- so no one knows who has the drug / placebo
- comparison to existing drugs

- peer review of data

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- to help prevent false claims
- approval by NICE

to access **level 2** the key ideas of testing on healthy volunteers followed by testing on patients must be given

[9]

Q10.

(a) antigen (in vaccine) stimulates white blood cells

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

1

to produce specific antibodies

1

(so) if the person ingests salmonella

allow idea of secondary exposure

1

(so on secondary exposure to antigen / bacteria white blood cells) produce the (correct) antibodies faster or in larger quantities

allow idea of memory cells produced

1

(so) toxins (produced by the bacteria) don't reach high enough concentrations / levels (to make the person have symptoms)

1

(b) (random) mutations (in the population of bacteria)

*do **not** accept bacteria deliberately mutate*

1

(so that) resistant salmonella / bacteria are not killed by the antibiotic / nalidixic acid

allow those bacteria without the mutation are killed by antibiotic / nalidixic acid
*do **not** accept immune bacteria*

1

(so) these bacteria reproduce to pass on the gene for resistance (to their offspring)

1

[8]

Q11.

(a) (number of deaths =) 91 **and**
(number of cases =) 3.4×10^3

allow readings in range 90 to 92
allow readings in range 3.3×10^3 to 3.5×10^3

1

$$\frac{91}{3.4 \times 10^3} (\times 100)$$

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allow correct substitution of incorrect readings from 2004

1

(=) 2.68

allow correct calculation using incorrect readings from 2004

1

2.7 (%)

1

*an answer of 2.7 (%) scores **4** marks*

(b) the number of deaths peaked (to 120 in 2008)
the percentage deaths peaked (to 3.2%)

1

(but) the number of reported cases fell / did not rise

1

ignore numbers

(c) we don't know what the data was before 2002

1

(d) any **two** from:

- poor sanitation
  or idea of poor toilet hygiene
  ignore overcrowding
- drinking contaminated water
- eating contaminated food
  or using contaminated water to grow crops

2

(e) air / water under the sheet is warmed by the Sun

1

(so) water evaporates (from the ground / contaminated water)

1

(then water) condenses on (the underside of) the plastic sheet

1

the weight causes a drip point in the centre of the plastic sheet

1

(so clean) water drips into the can (continuously ready for drinking through the plastic tubing)

1

(f) UV (light)
ignore ionising radiation

1

causes mutations in the DNA
causes breakage(s) in the DNA

1

(so) bacteria cannot replicate (and so die out)

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(so) cellular processes stop

1

[17]

Q12.

(a) any **two** adaptations with linked descriptions from:

- many alveoli to provide a large surface area
- good blood supply to maintain steep diffusion / concentration gradient
- thin walls so gases do not have far to diffuse / travel
- well ventilated to maintain steep diffusion / concentration gradient

__1__ mark for adaptation and __1__ mark for linked description
allow to collect oxygen __or__ to bring carbon dioxide to lungs

4

(b) an allergy

1

(c) any **one** from:

- narrow(er) / small(er) (air) passages / bronchioles
- less air / oxygen can pass through

1

(d) 3.3 (dm^3)

1

(e) any **one** from:

- fake drug
- inactive form of drug

1

(f) neither the volunteers nor the scientists

1

(g) to avoid / reduce bias

1

(h) any **two** from:

- drug only works for severe asthma attacks
  or
  drug only increased lung capacity in severe asthma attacks
- drug had little effect **or** slight reduction in healthy people
- drug had no effect in mild asthma attacks
- drug does not alleviate the problem entirely

2

[12]

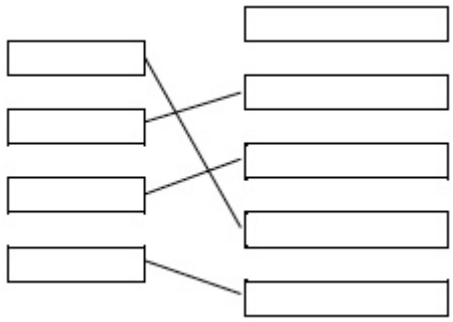
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Q13.

(a) salmonella

1

(b)



1
1
1
1

(c) lower concentration of antibiotic / chemical further from the fungus

allow less antibiotic / chemical further from the fungus

1

(d) lead to mass production of antibiotics

or

lead to development of other antibiotics

1

reduced infection by bacteria

or

antibiotics have saved many lives

1

[8]

Q14.

(a) (1 572 189 × 3 467) / 100 000

1

54 507.79263 or any correct rounding

1

54 508

*an answer of 54 508 scores **3** marks*

1

(b) to control for the different (group) population sizes

allow so the different groups can be compared

1

(c) thick yellow / green discharge from penis / vagina

and

pain on urinating

*allow any **two** correct symptoms*

1

(d) diameter of clear area

1

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(e) 3.14 × 8.5 × 8.5

1

227

*allow 226.865 or any correct rounding for max **1** mark*

*an answer 227 scores **2** marks*

1

(f) comment relating to data, eg higher concentrations did not show much improvement

or

5 mg/dm^3 was much more successful at killing bacteria than at lower concentrations

1

comment relating to patient safety eg much less likely to cause toxic / side effects than at higher concentrations

1

(g)

Level 3: Relevant points (correct stages / reasons) are identified, given in detail and linked logically to form a clear account.	5-6
Level 2: Relevant points (correct stages / reasons) are identified and there are attempts at logical thinking. The resulting account is not fully clear.	3-4
Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical thinking.	1-2
No relevant content	0
Indicative content names of stages are not required, but a logical progression through stages of testing is required for Levels 2 and 3. **phase 1 clinical testing:** • tested on healthy volunteers • low doses used **reason:** • to test for side effects / toxicity / safety **phase 2 clinical testing:** • tested on patients • patients given placebo or drug • double blind trial **reason:** • to test for side effects / toxicity / safety	

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• to test its efficacy / effectiveness **phase 3 clinical testing:** • larger numbers of patients used • patients given placebo or drug • double blind trial **reason:** • to verify efficacy / effectiveness • to determine correct dose **prior to licensing:** • analysis of results • peer review **reason:** • to check results are valid • to avoid bias	

6

[16]

Q15.

(a) any **one** from (bacterial cell):
- has a cell wall
- has plasmids

allow converse
- has a single DNA loop
- has no nucleus
- is much smaller

1

(b) 14.50 × 3 = 43.5

1

43.5 + 14.50 = 58
or
14.50 × 4 = 58

*allow 58 for **2** marks*

1

(58 / 100000 =)

0.00058 or 0.058%

*an answer of 0.00058 or 0.058% scores **3** marks*

1

(c) decreased (from 2006 to 2014)

1

(d) improved hygiene (for food preparation)

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allow stricter food hygiene regulations

1

vaccination of poultry

1

(e) any **one** from:
- warmer weather so number of bacteria increases faster
- more cold / precooked food (rather than hot food) being eaten
- food not cooked properly on barbeques

1

[8]

Q16.

(a) xylem / phloem

allow translocation / transpiration

1

(b) any **one** from:
- through tools or hands (after touching infected plants)
- in the soil
- infected plants in contact with healthy plants

1

(c) GM is faster

1

GM is less dependent on chance at fertilisation

1

(d) any **four** from:
- gene for resistance is cut out with enzymes
- placed into a vector (virus or plasmid)
- inserted into early stage of young plants
- that grow by mitosis
- plants grow with gene in most cells

points must be in correct order to gain credit

4

(e) any **two** from:
- a species is less likely to survive in changing conditions

allow named change such as new disease
- less links in food webs **or** populations become smaller and have less variation
- less likely have suitably adapted individuals

2

(f) any **one** from:
- habitat for predators of pests
- natural barrier against disease transmission / herbivores
- reduce wind damage

ignore references to cost

1

[11]

Q17.

(a) blood enters the heart twice on each journey around the body

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allow blood circulates once to the lungs (for oxygen) and then around the body

1

(b) **D**

1

(c) **C**

1

(d) coronary artery / arteries

1

(e) right atrium

1

(f) electrical

1

(g) any **two** from:

- rest of diet

  allow an example such as fibre or <u>saturated</u> fat or alcohol intake
- weight

  allow obesity
- age
- type of activity
- gender
- blood pressure

2

(h)

Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5-6
Level 2: A conclusion, supported by some relevant reasons is given.	3-4
Level 1: Relevant points are made. If there is a conclusion, this is asserted, but not logically linked to the points made.	1-2
No relevant content	0
Indicative content **for** • as hours of activity increase, number of cases of heart disease decrease • increasing hours of exercise from low numbers to slightly higher (groups **W-X**) seems to reduce cases more than increasing activity from groups **Y-Z** • cholesterol and family history do not correlate with heart disease	

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against • other factors also increase / decrease / correlate with changing hours of exercise • smoking correlates with changing hours of exercise • smoking correlates with heart disease • % fat in diet also correlates with lack of exercise and heart disease • limitations such as only studied men, not women / children • unknown how many people are in each category or what percentage (of each group) had heart disease	

6

[14]

Q18.

(a) a disease that can be spread from one person to another

1

(b) gonorrhoea

1

(c) antibiotics

1

(d) painkillers

allow aspirin, paracetamol, ibuprofen and other correct brand names

1

(e)

Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3-4
Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1-2
No relevant content	0
Indicative content • skin stops the bacterium (entering the body) • blood clots to stop bacteria entering (through cuts) • stomach acid will kill the bacterium (if it is in food)	

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• nose / trachea have mucus to trap the (tuberculosis) bacteria • nose / trachea have cilia / hair to move mucus out • white blood cells destroy the bacteria if infected • by phagocytosis • by antibodies • by antitoxins	

4

[8]

Q19.

(a) gene for the malarial protein is removed from the malarial pathogen

allow gene for the malarial protein is removed from the malarial protist

1

goat DNA / chromosome is cut open

1

using an enzyme

1

goat and malarial DNA are combined (and put back into the goat cell)

1

(b) only females produce milk

allow males don't produce milk

1

(c) ensure all the offspring are female (to produce milk)

1

ensure all goats will have the malarial protein gene

or

all will produce the malarial protein / vaccine

1

(d) any **two** from:

- everyone who drinks milk will get the vaccine
- no need for storage / refrigeration of the vaccine
- cheaper production of the vaccine
- less risk of infection from injections
- no needles which some people are scared of

2

(e) pathogens are engulfed (destroyed) via phagocytosis

1

antibodies are produced to kill the pathogens

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1

(and) antitoxins are made (to stop the symptoms of malaria)

1

[12]

Q20.

(a) 8 (micrometres)

1

(b) red blood cell(s)

1

white blood cell(s)

accept named cell

eg phagocyte / lymphocyte

1

(plasma)
transports proteins / dissolved substances / food (molecules) / urea / hormones / blood
cells

1

(c) any **one** from:

- you could lose a lot of blood
- bleed internally

allow bleeding would not stop

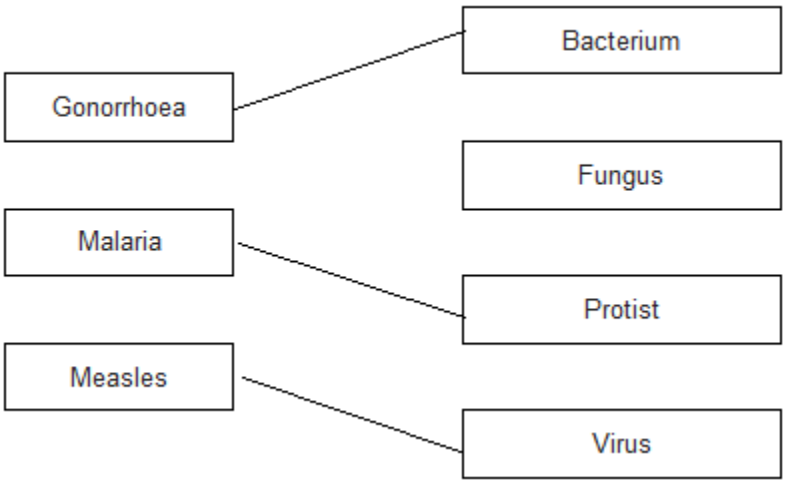
allow could bleed to death

1

[5]

Q21.

(a)



3

(b) (trachea) has mucus

1

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to trap pathogens

1

(trachea) has cilia

1

to move mucus out of trachea

1

(c) **dependent variable:**
number of times mosquitoes landed on socks

1

control variable:
any **one** from:

- number of mosquitoes in each container
- length of time socks worn
- dampness of socks
- same type of socks
- size of container
- time
- temperature
- species of mosquito
- age of mosquito

1

(d) use worn socks
or
use chemical from worn socks

1

to attract / trap infected mosquitoes

1

or accept:
wear clean socks / change socks regularly (1)
to reduce the chance of attracting mosquitoes (1)

(e) less chlorophyll present

1

(so) less light absorbed

1

(so) reduced photosynthesis
or
(so) less sugar / food made

1

[14]

Q22.

(a) any **one** from:

- not all deaths recorded
- not all causes of deaths recorded

allow cause may not be known

1

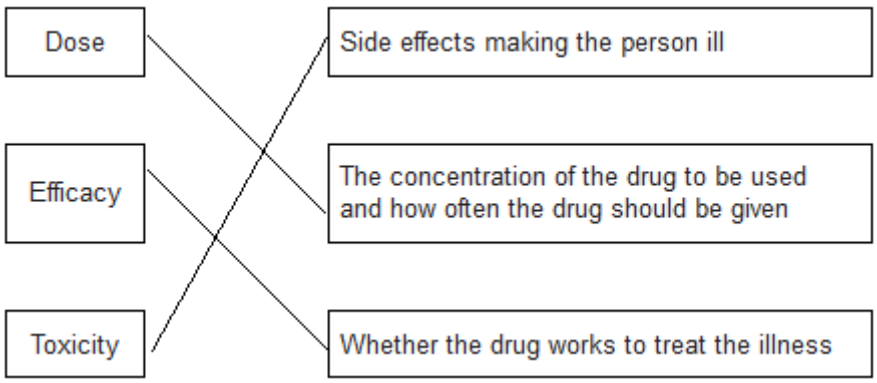
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(b) antibiotics do not kill viruses

allow antibiotics <u>only</u> kill bacteria

1

(c)



*all correct for **2** marks*

*1 or 2 correct for **1** mark*

2

(d) any **one** from:

- to prevent false claims
- to make sure the conclusions are correct / valid
- to avoid bias

1

[5]

Q23.

(a) any **one** from:

- not all deaths recorded
- not all causes of deaths recorded

allow cause may not be known

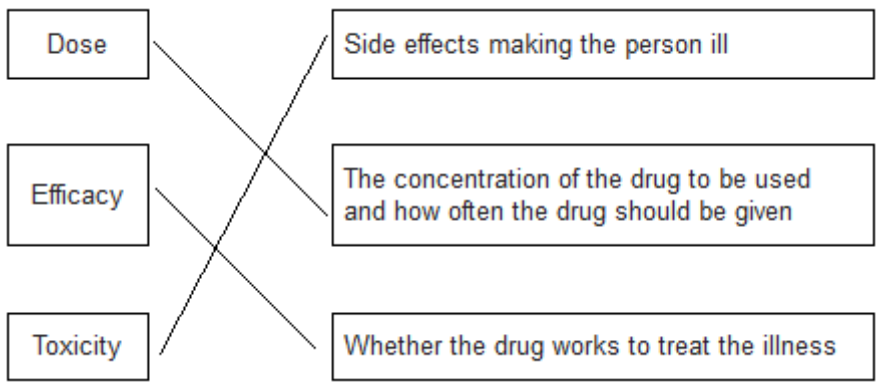
1

(b) antibiotics do not kill viruses

allow antibiotics <u>only</u> kill bacteria

1

(c)



*all correct for **2** marks*

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*1 or 2 correct for **1** mark*

2

(d) any **one** from:

- to prevent false claims
- to make sure the conclusions are correct / valid
- to avoid bias

1

(e) some people would be immune to EVD

allow those vaccinated would not contract the disease

1

if less people (in a population) have EVD less chance of it being passed on

1

(f) **Level 3 (5–6 marks):**
A detailed and coherent evaluation is provided which considers a range of arguments for and against the use of unlicensed drugs and comes to a conclusion consistent with the reasoning.

Level 2 (3–4 marks):
An attempt to give arguments for and against the use of unlicensed drugs is made. The logic may be inconsistent at times but builds towards a coherent argument.

Level 1 (1–2 marks):
Discrete relevant points made. The logic may be unclear and the conclusion, if present,
may not be consistent with the reasoning.

0 marks:
No relevant content

Indicative content

pros

- might save some lives
- vaccine could reduce chance of future outbreaks
- patient made aware of risk and agreed to use of drug
- sharing of results could speed up development of effective vaccines / drugs
- used mainly for health workers who were risking their lives to help

cons

- could be dangerous

or

vaccine could harm a healthy person

- goes against legislation / laws governing drug development
- might set a precedent for other drugs not to be fully tested
- unfair as not available to the African people

a justified conclusion

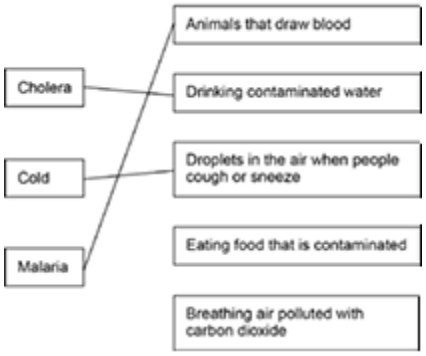
6

[13]

Q24.

(a) **Disease** **Way the disease is spread**

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extra lines from left cancel the mark

3

(b) any **two** from:

- skin acts as a barrier
- blood clots (over cuts)
- nose (hairs) catch particles (breathed in)
- mucus (in trachea / bronchi) traps microorganisms
- acid in stomach kills microorganisms

2

(c) because measles is a virus

1

(d) 28 / twenty eight

± 0.5 small square tolerance

1

(e) 2.5

1

(f) number will decrease

1

less likely to come into contact with someone with measles / the disease

1

[10]

Q79.

(a) antibiotics do not kill viruses

allow antibiotics only kill bacteria

allow flu is not caused by a bacterium

or

antibiotics are not effective against viruses

allow antibiotics cannot reach viruses inside cells

1

(b) Inactive viruses

1

(c) Conclusion:

people 65 years and older had the highest percentage vaccinated.

ignore references to figures unless qualified

1

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Reason:
more worried about becoming ill
or
had more time to go to the doctor.
OR
Conclusion:
children aged 3-years had the lowest percentage vaccinated.

Reason:
parents didn't have time to take them to the doctor
or
they had been vaccinated when 2-years old.

1

[4]

Q80.

(a) viruses live / reproduce inside cells

1

(so) the drug cannot reach the virus

allow (so) cell also damaged

1

(b) develop new antibiotics

1

not prescribe antibiotics for viral infections / non-serious infections

allow antibiotics should not be prescribed / used inappropriately

or

allow (patients) should take the complete course of antibiotics

1

[4]

Q81.

(a) toxins

1

(b) (i) bacteria

1

(ii) mutate

1

(iii) new / different antibiotic

allow new / different drug

*do **not** allow vaccine*

1

[4]

Q82.

(a) (i) any **one** from:

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- age
- gender
- body mass
- number in group / 50

allow number of children

- high body temperature

allow starting temperature

allow dose / amount of drug given

1

(ii) any **one** from:

- tablet that does not contain a drug / anything

allow sugar pill

*do **not** allow a different drug*

- fake drug

1

(b) (i) 38.2 (°C)

1

(ii) ibuprofen

no mark for drug
no marks if wrong drug selected

any **two** from:

- reduced body temperature fast(er)

allow acts fast(er)

- maintained temperature in normal range / around 37 °C (longer / for several hours)
- paracetamol did not reduce temperature to normal / 37 °C

accept ibuprofen did reduce temperature to normal / 37 °C

- ibuprofen given less frequently

allow less drug needed

ignore cheaper unless qualified

2

[5]

Q83.

(a) (bacteria and viruses produce) toxins

allow poisons
allow damage body cells

1

(b) (i) body mass

allow weight
allow ethnicity

ignore height / size

1

(ii) placebo / fake drug

allow sugar pill

allow no treatment

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1

(iii) any **one** from:

- as a control group
- for comparison
- to see if the drugs worked
- to take account of psychological effect

accept placebo effect
allow to avoid bias

1

(c) (i) 1.2 (°C)

1

(ii) 3 (hours)

1

(d) (i) (Paracetamol)

any **two** from:

- ibuprofen reduces body temperature faster
- ibuprofen reduces temperature more
- ibuprofen doesn't need to be taken as often
- ibuprofen keeps body temperature lower / normal / 37 °C for longer

allow works faster

2

(ii) (Paracetamol + ibuprofen)

any **two** from:

- body temperature decreases at a similar rate

allow ibuprofen works (almost) as fast

- ibuprofen maintained body temperature close to normal / 37 °C

allow ibuprofen maintained normal body temperature almost as long
allow doesn't make temperature drop below normal as long

- (better to) take fewer drugs

allow less chance of overdose / giving too much
allow (better to) take drugs less frequently

- easier to administer

allow less chance of missing doses / taking at the wrong time

2

[10]

Q84.

(a) any **one** from:

- <u>amount / concentration</u> of antibiotic

*do **not** allow type of antibiotic ignore number of antibiotics*
allow type of paper

- size of discs

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ignore number / position of discs

- (incubation) temperature
- incubated for same time / 3 days
  allow left / kept for same time
- type of agar
  ignore references to bacteria or petri dishes

1

(b) (i) D

1

(ii) C

1

(iii) B
no marks if wrong antibiotic

1

both had a large clear area around the disc
allow a description of this, eg B had the 2nd largest clear area with E.coli and the largest clear area on S.aureus

or

killed a lot of both bacteria

1

(c) resistant

1

[6]

Q85.

(MRSA is) resistant to / not killed by antibiotics
ignore references to viruses
ignore immune
ignore not treated by antibiotics

1

(as is a) new / different strain / type of bacterium
ignore has mutated
ignore new species

1

(therefore) people are not immune to it
accept can't produce the correct antibodies
ignore resistant

1

(many) patients more susceptible to infection / weaker immune system
ignore references to hygiene

1

[4]

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Q86.

(a) (i) 4 / four (years)

1

(ii) any **one** from:

- animals
  allow suitable examples eg rats
  *do **not** allow humans / plants*
- (living) cells
  allow human cells
  *do **not** allow plant cells*
- (living) tissues
  allow human tissues
  *do **not** allow plant tissues*

1

(b) (i) 9 (years)
*allow **1** mark for 13 – 4*
or
2 + 3 + 4

2

(ii) see if the drug has side effects

1

(iii) neither the volunteers nor the doctors

1

[6]

Q87.

(a) more (mothers) died if doctors delivered their babies (rather than midwives)
answer must be comparative
allow more deaths on Ward 1
ignore descriptions of trends

1

doctors spread bacteria / viruses / pathogens / microbes from dead bodies / other patients
allow disease / infection childbed fever
ignore germs
allow doctors did not wash their hands / midwives washed their hands

1

(b) (i) hand-washing

1

before / after examining patients
ignore between wards

or

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between patients

or

after examining dead bodies

1

(ii) removed / killed bacteria / viruses / pathogens / microbes (from hands)
ignore disease / infection / germs / childbed fever

or

reduced transfer of bacteria / viruses / pathogens / microbes (from hands)

1

[5]

Q88.

(a) (i) 5 (years)

1

(ii) lab tests on cells / tissues / animals **and** clinical trials in humans
*allow 1 block of lab tests **and** 3 blocks of clinical trials*
or
number of phases

1

(b) (i) (healthy volunteers)

any **one** from:

- too great a risk for ill person / patient
- patient might be taking another drug
- side effects <u>easier to see</u>
ignore references to the immune system

1

(low dose)

any **one** from:

- to reduce any risk
- to look for side effects
allow to avoid harm

1

(ii) placebo and drug tested
allow fake drugs / sugar pills

1

neither patients nor doctors know (who has taken placebo or drug)
*this full statement would gain **2** marks*

1

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(so) avoids bias

or

(therefore) controls for psychological effects

or

(so) can tell if drug works rather than placebo effect

1

[7]

Q89.

(a) ingest pathogens

1

produce antibodies

1

produce antitoxins

1

*deduct **1** mark for each extra box ticked*

(b) are not killed / affected (by antibiotic)

allow antibiotic does not work / does not cure
allow bacteria immune (to antibiotic)
allow infection not killed
ignore bacteria mutated

1

(c) (i) (antibiotic) Y

1

(ii) 8

*allow 54 − 46 for **1** mark*

2

(iii) any **two** from:

- overuse / widespread use/ over prescription
  OWTTE
- inappropriate use / use for eg sore throats / viral infections
- mutation / change to DNA (in bacteria)
- natural selection /description
  ignore people not finishing course of antibiotics
  ignore wrong antibiotic given

2

[9]

Q90.

(a) dead / inactive form of pathogen / microorganism / bacterium / virus

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ignore disease (for organism)
ignore toxins / antibodies

1

(b) (i) any **three** from:

(after exposure):

- greater number of antibodies produced / higher concentration
- antibodies stay (in higher concentration) for longer
- antibodies produced quicker
- quantitative, eg 9 times higher / 0.8 to 7.2
  *scores **2** marks for increased to 9 times higher / from 0.8 to 7.2*

3

(ii) white cells

allow lymphocytes / leucocytes
*do **not** accept phagocytes / macrophage*

1

have had previous exposure to pathogen / recognise pathogen on re-entry / familiar with pathogen / reference to memory cells

ignore knows how to kill pathogen
ignore live pathogen introduced on exposure

1

<u>therefore</u> antibodies produced (more) rapidly

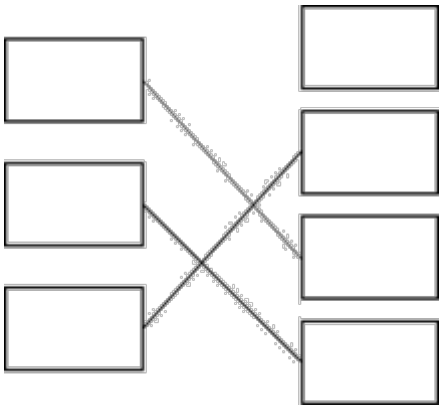
this marking point dependent on previous marking point

1

[7]

Q91.

(a)



one mark for each correct line
extra line from drug negates mark

3

(b) stop the trial

1

second mark scores only if first mark correct

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side effects too severe

allow people might die / get ill / harmed

or

(too) many people had side effects

allow use of numbers from table

ignore itchy skin

1

[5]

Q92.

(a) dead / inactive form of virus introduced into body

1

white blood cells stimulated to produce antibodies

1

correct antibodies rapidly made if the body is infected with the virus

1

(b) the percentage of children vaccinated fell to zero in 1995

1

but the number of children developing autism rose and fell during the period when % vaccinations was falling

1

number of children developing autism peaked after MMR vaccination had ceased

1

which suggests that something other than MMR vaccination was causing autism

1

[7]

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Q1.

(a) 51% of students identified A as being the cell membrane. Almost as many thought it was the cell wall.

(b) 39% of students achieved full marks for identifying the three ways that white blood cells defend the body. Almost a third of students had not read the instruction to tick three boxes, and only ticked one box instead of three. The majority of students knew that white blood cells produce antibodies.

(c) 60% the students achieved two marks. 195 of students achieved one mark. This was usually for a correct subtraction of incorrect graph readings. Some students attempted to subtract the values for 2013, 2014 and 2015 from that for 2012.

(d) 38% of students suggested a correct reason for the decrease in the number of cases of measles. They usually said it was due to the use of vaccines or vaccinations. Some referred to the MMR vaccine.

Vague responses such as new cures, improved medical knowledge, new medical technology or new treatments were insufficient. The use of antibiotics was seen quite often, which was incorrect.

(e) 43% of students knew that measles is caused by a virus so cannot be treated with antibiotics. Some said antibiotics would not treat measles because they were not strong enough. Others said measles is not a disease, or is not caused by a pathogen.

(f) 34% of students gave a correct method to control the spread of gonorrhoea. The majority of these said use a condom. Safe sex, use protection, or contraception unqualified were insufficient. Others achieved the mark for saying ‘vaccinate people’.

Some students said use antibiotics, which was given in the question and was therefore ignored. Others did not realise gonorrhoea is a sexually transmitted infection and said wash your hands or cover your mouth when coughing.

(g) 62% of students gave a correct control variable. The concentration of the antibiotic or size of the disc was often given. Just saying paper disc unqualified was ignored; the size, shape or type of paper disc was required. Many said the type of antibiotic, which was the independent variable.

(h) 27% of students understood why one disc was soaked in water. They usually said it was for a comparison with the antibiotics.

Most responses were not clearly expressed. There were some confused ideas about the water affecting the antibiotics or the agar.

(i) Many students identified antibiotic A as being the most effective in treating gonorrhoea. 67% of students also included a correct reason for their choice to achieve full marks.

Q2.

Foundation

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(a) Few students scored the first marking point for saying that a non-communicable disease is not caused by a pathogen. Some students gave examples of non-communicable diseases, such as CHD, diabetes and cancer. Others gave a cause, such as genetics, lifestyle or diet. These were ignored.

61% of students achieved one mark, usually for saying a non-communicable disease cannot be caught or is not passed from person to person. 1% of students achieved full marks.

(b) 56% students gained the first marking point for stating that blood flow is reduced in people with CHD. 7% of students scored more than one mark.

For the second marking point it had to be clear that reduced blood flow would result in less oxygen reaching the cells of the heart, as the question asked how CHD can cause a heart attack. Many students talked about less oxygen reaching other parts of the body.

The last marking point needed a link to less respiration or insufficient energy release. Students often incorrectly referred to less energy being made, created or produced.

(c) This was a 'level marked', 'extended response' question. The command word was 'Explain', so the main discriminator between the three different levels was the quality of linking ideas. Students were asked to explain how lifestyle and medical risk factors increase the chance of developing CHD. Therefore examples of both types of factor had to be included, with several examples of logical linking of ideas, in order to enter level 3. 46% of students achieved three or more marks.

Many students phrased their response in terms of how to reduce the chance of developing CHD, which could achieve full credit, if explanations were included. References to doing exercise and not eating too many fatty foods were often seen, but if these were not linked to explanations the answer was limited to level 1. References to bad or unhealthy diets were too vague without going on to mention high levels of fat, sugar or salt.

An answer such as a fatty diet and not enough exercise can lead to obesity, which increases the chance of CHD, achieved three marks as there is an attempt to link ideas. To be awarded four marks better links had to be made, or more factors referred to. Smoking and alcohol consumption were sometimes mentioned. With reference to smoking, a number of students were under the impression that smoking leads to the build-up of tar in the coronary arteries.

Many responses were limited to level 2 because there was no reference to any medical risk factors. Where medical factors were included it was often in relation to diabetes or genetic factors. A family history of heart problems was sufficient for this idea. High blood cholesterol was sometimes given as a medical risk factor.

Higher

(a) Few students scored the first marking point for saying that a non-communicable disease is not caused by a pathogen. Some students gave examples of non-communicable diseases, such as CHD, diabetes and cancer. Others gave a cause, such as genetics, lifestyle or diet. These were ignored.

89% of students achieved one mark, usually for saying a non-communicable disease cannot be caught or is not infectious. 5% of students achieved full marks.

(b) The majority of students gained the first marking point for stating that blood flow is

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reduced in people with CHD.

For the second marking point it had to be clear that this would result in less oxygen reaching the cells of the heart, as the question asked how CHD can cause a heart attack. Many students wrote about less oxygen reaching other parts of the body.

The last marking point needed a link to less respiration or insufficient energy release. Students often incorrectly referred to less energy being made, created or produced.

There were very few three-mark answers seen (2%). Of these, some gave a complete story linking reduced respiration to there being insufficient energy released for the heart muscle to contract.

(c) This was a 'level marked', 'extended response question'. The command word was 'Explain', so the main discriminator between the three different levels was the quality of linking ideas. Students were asked to explain how lifestyle and medical risk factors increase the chance of developing CHD. Therefore examples of both types of factor had to be included, with several examples of logical linking of ideas, in order to enter level 3. 77% of students achieved a minimum of three marks. 41% of students gave a level 3 response.

Many students phrased their response in terms of how to reduce the chance of developing CHD, which could achieve full credit if explanations were included. References to doing exercise and not eating too many fatty foods were often seen, but if these were not linked to explanations the answer was limited to level 1. References to bad or unhealthy diets were too vague without going on to mention high levels of fat, sugar or salt.

An answer such as a fatty diet and not enough exercise can lead to obesity, which increases the chance of CHD, gained 3 marks as there is an attempt to link ideas. To be awarded 4 marks better links had to be made, or more factors referred to. Smoking and alcohol consumption were sometimes mentioned. With reference to smoking, a number of students were under the impression that smoking leads to the build-up of tar in the coronary arteries.

Many responses were limited to level 2 because there was no reference to any medical risk factors. Where medical factors were included it was often in relation to diabetes or genetic factors. A family history of heart problems was sufficient for this idea. High blood cholesterol was sometimes given as a medical risk factor.

Q3.

(a) 76% of students achieved this mark. Common correct responses included not all cases of measles being recorded or diagnosed, or people not going to see the doctor. There were some confused ideas that deaths would not be recorded.

(b) 34% of students were awarded both marks. The most common error was in rounding the final answer, for example an answer of 95 gained one mark only.

Quite a lot of students used the alternative method given on the right hand side of the mark scheme. Many gave an answer of 4.5% for one mark. Only a few continued and subtracted this value from 100 to give the correct final answer.

(c) This was a demanding question targeting the highest-attaining students. 8% of students achieved at least one mark. The question asked for an explanation of why vaccinating a large proportion of a population reduced the spread of the measles

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virus.

The first marking point required a reference to most people being immune and linking this to the fact that they would not become ill. Students usually missed this mark because they said they would not catch the virus, which is incorrect. Many were familiar with the term ‘herd immunity’, but few could clearly explain it.

The second marking point was for the idea that there would then be fewer people with the disease to pass the virus on to unvaccinated people. This mark did need a reference to the chance of an organism being passed on, disease was insufficient.

Many responses included correct biological facts, but they were not relevant to the question being asked. For example, many students gave a description of what a vaccine is, or described the immune response in general terms.

(d) This was a ‘level marked’, ‘extended response’ question. The command word was ‘Explain’, so the main discriminator between the three different levels was the quality of linking ideas. Students were asked to explain the differences between antibody production after the injection of a vaccine and after exposure to the measles virus. Therefore comparisons between the two exposures and clear explanations in terms of the immune response were needed for level 3.

Students who only gave simple statements or a description of the graph, without comparisons or explanations, could only attain level 1. 53% of students gave a level 1 response.

Some students only gave comparisons. These could achieve three marks, if sufficient comparisons were made. The most common comparisons given were that more antibodies were produced at a faster rate after exposure. On their own these comparisons achieved two marks. If a correct quantitative statement was also given this was sufficient for three marks.

To achieve four marks explanations for the differences were required. 34% of students achieved three or more marks. Very few students gave a level 3 response, but this was targeted at grades 8−9.

Many responses showed a misunderstanding of antibodies, antigens, antitoxins and phagocytosis. Incorrect graph readings were often seen.

Q4.

Foundation

This ‘level response’ question asked for advice that doctors should be given in order to prevent the spread of a new strain of bacteria. Many students answered it in terms of advice that patients should be given by doctors and this was acceptable if relevant points were given. The majority of lower-attaining students responded in terms of general hygiene and separation. In the case of the former, washing hands was commonly seen with the additional reference to antibacterial hand washes or similar less frequent. The reason for the precaution which is to kill bacteria was rarely seen. Isolation was described in a great variety of ways and a lot of the time there was a correct reason given for it. There were also frequent additional comments about face masks, gloves and various other types of protective clothing. Some students also gave descriptions of how to stop the spread of STDs.

Of the more scientific / biological reasons completing the course of antibiotics was the most common and this frequently had a weak link with references to immune rather than

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resistance. There were a few very good scientific explanations for this precaution.

Lots of students described in various ways that doctors should not overuse the antibiotic and in some cases, there were appropriate weak links. Some students also referred to not using them for viral infections or mild infections but on these occasions there were rarely any relevant attempted links.

A lot of students decided the whole population needed to take the antibiotic so large stocks had to be available at pharmacies, so they could get them. Again many were under the assumption that if they were given the antibiotic in advance, it would prevent them from getting the infection rather than treating the infection once they got it.

Also a significant number thought mass vaccinations were the answer. In some cases these were accompanied by very good scientific explanations about how vaccines work, but more often they suggested the fluoroquinolone should be used as the vaccine. Another common incorrect response was to describe drug trials and although some used appropriate science this was irrelevant and did not gain marks.

Overall students found this question difficult with 18% achieving level 2 or 3.

Higher

This was an 'extended response' question, marked using a holistic 'levels of response' mark scheme. Students were asked to explain the advice that doctors should be given to prevent the spread of a new strain of *Pseudomonas*

.

They were told that infections caused by the strain occurred in hospitals and that they could only be treated with one antibiotic, fluoroquinolone.

Most students who took this paper showed good appreciation of how best to prevent the spread of such an infection and achieved at least a level 2 mark (47% of students). There were some excellent answers which easily accessed the highest award within level 3 (2% of students).

Many students failed to supply good biological explanations for the precautions they gave and so restricted themselves to the level 2 criteria of attempted logical linking and a not fully clear account. Common examples of this were references to bacteria becoming 'immune' to the antibiotic, or even the patient becoming immune to the antibiotic and the bacteria becoming 'stronger' if they were not all killed. Basic hygiene rules to 'stop the spread' as given in the stem were restricted to level 1. Many students gave no relevant content (0 marks) because they suggested that all hospital patients, or everyone in the world, should be given the new antibiotic. Many thought that it should be used as a vaccine to immunise everyone.

There were several misunderstandings:

- The question asked for advice that should be given to doctors. Answers based on advice to patients rarely gained above level 1. Doctors are not responsible for developing vaccines, so answers that focused on this alone could not be given credit.

- Answers that suggested that 'everyone should be given antibiotics' because they are a protective, preventative measure were inappropriate.

- Bacteria may develop resistance to an antibiotic but not 'immunity'. Some students also implied that that any bacteria remaining after use of antibiotics might simply be

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'stronger'.

- Some students believed that the 'patient' developed resistance to the antibiotic or that the 'antibiotic became resistant to the bacteria', as opposed to the resistance being developed 'by the bacteria' and 'against the antibiotic'.

- Some students thought that antibiotic resistance only developed 'over time' and, therefore, suggested that antibiotics should only be administered for short periods. Others believed that dosage was significant and argued for either small or large doses of antibiotics to be given.

Q5.

(a) 77% of students knew gamma rays are a type of electromagnetic radiation.

(b) 66% of students knew that a thick sheet of lead would be the best absorber of gamma radiation.

(c) Over half of students knew that bacteria on food are killed to decrease the rate of decay of food. Fewer knew that this helps prevent food poisoning, with many believing it removes dirt from food.

(d) 19% of students knew that gamma rays kill bacteria by causing mutations. Most students responded that gamma rays decrease the size of bacterial cells.

(e) 34% of students could select both choices describing how food producers could increase the level of radiation that the food is exposed to.

(f) 3% of students understand that for food to be radioactive, the source needs to be within the food itself. Common misconceptions and incorrect answers seen include:

- bacteria / viruses / pathogens are affected by the gamma radiation, but the food itself isn't
- irradiation is the opposite of radioactivity
- it is impossible for food to be radioactive
- the food was not exposed to the gamma rays for long enough to become radioactive.

Q6.

Foundation

(a) 80% of students could link one or two methods of contraception to how it works, but few could correctly link all three methods.

(b) 32% of students could describe that a low dose of a new drug would be given because there may be harmful side effects.

(c) This was an 'extended response' question, asking students to evaluate the use of three contraceptive methods. Students should know that marks will not be awarded for repeating information given in the question. Evaluate means students should use the information supplied, as well as their knowledge and understanding, to consider evidence for and against. Guidance regarding command words can be obtained from the AQA website.

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Some students misinterpreted the percentages in the table as referring to the percentage use of each method of contraception. The strongest answers evaluated aspects from the table, and students' own knowledge, such as prevention of sexually transmitted infections.

60% of students were able to give level 2 or level 3 answers.

Higher

(a) 44% of students could correctly link three methods of contraception to how the method works.

(b) 44% of students could describe that a low dose of a new drug would be given because there may be harmful side effects.

(c) This was an 'extended response question', asking students to evaluate the use of three contraceptive methods. Students should know that marks will not be awarded for repeating information given in the question. Evaluate means students should use the information supplied, as well as their knowledge and understanding, to consider evidence for and against. Guidance regarding command words can be obtained from the AQA website.

Some students misinterpreted the percentages in the table as referring to the percentage use of each method of contraception. The strongest answers evaluated aspects from the table, and students' own knowledge, such as prevention of sexually transmitted infections.

91% of students were able to give level 2 or level 3 answers. 5% of students achieved full marks.

Q7.

(a) 26% of students could identify that gamma emission is an electromagnetic wave. 2% of students could explain that gamma emission does not change the number of protons.

(b) The most common mark awarded was for the idea that irradiating food kills microorganisms. Answers were often too vague regarding preventing food poisoning, with more students referring to best before dates, which was insufficient.

Misconceptions referring to the half-life of the food being extended were seen. There were also misconceptions regarding food that has been irradiated becoming radioactive.

(c) Some students could relate their knowledge of properties of gamma radiation to being able to pass through packaging. Recall of penetration properties needed to be applied to the situation given in the question.

(d) Some students could state that irradiated food has been exposed to a source of radiation, or that radioactive food emits radiation, however, 6% of students did both to give a full answer. The most common misconception was that the term irradiated means removing a source of radiation from food.

Q8.

(a) 39% of students were able to answer this question assessing knowledge direct from the specification.

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(b) 65% of students knew that white blood cells produce antibodies.

(c) 61% of students were able correctly to identify the points as those where the level of antibodies started to rise for the second time. Misinterpreting the scale on the *x*-axis, meant that some students gave values outside the acceptable range.

(d) 64% of students were able to identify point of peak concentration. As with part **(c)**, misinterpretation of the *x*-axis resulted in incorrect answers.

(e) 70% of students achieved both marks for selecting reasons for the decrease in the number of children contracting measles.

(f) Many students misinterpreted this question and wrote 'cost to the parents' rather than the NHS. Some students realised that the effectiveness of the vaccine and the severity of chicken pox would be a factor. Marking points two and five were rarely seen. 5% of students achieved both marks.

Q9.

Foundation

(a) 4% of students were able to give a correct answer. Some students who were on the right track just wrote 'radiation' which was insufficient. Other common answers were 'extra chromosomes', 'Down's syndrome' or specific genetic disorders which may be the result of a mutation but do not cause a mutation.

(b) Enzymes were commonly identified as used in genetic engineering, but vectors less often. Placebos were often given instead. 74% of students achieved at least one mark.

(c) This 'extended response' question was challenging to students and discriminated well. Only the highest-attaining students were able to access level 3 (3%). 18% of students were able to access level 2 by giving the key ideas of testing on healthy volunteers followed by testing on patients. Most students in level 2 achieved three marks.

Few students appear to have a completely clear grasp of the sequence of drug testing. Many students missed the testing on healthy volunteers and / or those with Dravet syndrome. Those who gained credit seemed to be familiar with the use of a placebo and / or a double blind trial with some students describing it in detail.

Higher

(a) This question required a specific answer, 'ionising radiation', or an example. Many students gave 'radiation' which was insufficient at this level. A few students correctly suggested mutagenic chemical. 14% of students achieved this mark.

(b) 52% of students achieved one mark here, with 33% of students achieving two marks. 'Enzymes' was the most common one mark answer, with 'white blood cells' being the most common incorrect answer.

(c) 'The quality of answers seen would suggest that a significant number of students struggled with this 'extended response' question. Answers were generally poorly structured, with points not in a logical sequence. It was often difficult to interpret student's meaning because of weak knowledge and understanding of the topic, and limited powers of expression.

However, the question did discriminate between students well. 7% of students were

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able to access level 3, 32% of students were able to access level 2, and 50% of students accessed level 1.

Q10.

(a) 68% of students were unable to achieve any marks in this question. Most students did not seem to be aware of:

- antigens on bacteria
- specific antibody production by lymphocytes
- rapid response by white blood cells on second exposure which prevents the production of sufficient bacterial toxins to cause illness.

Common misconceptions included:

- antibodies engulfing pathogens
- antigens (in common with enzymes) are not alive so cannot be killed
- antigens engulfing bacteria.

Many responses were not accurate and precise enough to gain credit. The body 'making stuff to kill bacteria' is not sufficient for 'white blood cells produce specific antibodies against salmonella antigens'. And 'the vaccine teaches the body to fight off disease' without further amplification is not enough either.

(b) 74% of students were unable to achieve any marks in this question.

A creditworthy answer follows the sequence of:

- **random** mutation
- survival of the organism with mutation
- reproduction by survivors to pass on the resistance gene.

Students must take care not to imply that the mutation was a conscious act. 'A mutation caused the bacteria to become resistant', not, 'the bacteria mutated to become resistant'.

Many students inaccurately wrote about bacteria becoming **immune** to antibiotics.

Q11.

(a) 23% of students achieved all four marks in this calculation, while 50% of students did not receive any credit. Common errors included:

- calculating cases ÷ deaths
- reading the wrong scale
- not using 103 correctly
- not giving the answer correct to two significant figures
- not rounding correctly.

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(b) An epidemic is characterised by a sudden increase rising to a peak. A high number of deaths is not necessarily a peak and a low number of cases is not necessarily a fall. 42% of students gained no marks while 22% achieved both marks.

(c) 60% of students achieved this mark for identifying the lack of data before 2002.

(d) Cholera is identified in the specification as an area of study, but 67% of students were unable to give a creditworthy answer. The essential point is that cholera must be ingested in drinking water or on contaminated food and therefore 'through water' was insufficient. Many students thought that cholera is contagious or spread by a vector.

(e) A significant number of students described filtration systems using the parts in the diagram instead of describing the ideas of distillation in this context. Many students suggested that the plastic was to collect rainwater. 27% of students achieved three or more marks. 16% of students did not attempt this question and 37% gave responses that were awarded zero marks.

(f) The stem of the question was designed to point the students in the right direction by stating 'the steriliser emits light'. However, a significant number of students suggested that a chemical was released. Very few of those who gave UV light were able to gain the other two marks. 17% of students achieved any marks in this high demand question (most of which were rewarded one mark).

Q79.

(a) The most common correct response was that antibiotics do not kill viruses. A common misconception was that viruses are immune or resistant to antibiotics. Quite a lot of students said 'antibiotics should not be prescribed for flu because it will go away on its own in a few days', or that 'the body will fight it off'. These ideas were not creditworthy.

(b) Just under half the entry gained the mark for saying that a flu vaccine contains inactive viruses.

(c) Quite a lot of students misinterpreted the information given in the table. Some thought it showed the percentage of each age group who had flu, and others thought it was a percentage of the whole population. Some said 'as you get older a higher percentage of people get vaccinated', which is incorrect as the data does not show a pattern. The most common reasons given were that older people had weaker immune systems, or were more likely to catch flu, both of which were ignored.

Q80.

(a) Just over a third of the students gained a mark, usually for saying that viruses live inside cells. When the second mark was awarded it tended to be for saying that the antibiotic would damage the cell. Few said that the antibiotic would not be able to reach the virus. There was quite a lot of irrelevant information given by students, for example, about viruses mutating, or references to antigens and antibodies.

(b) Less than half of the students gained a mark. Many of these said new antibiotics would have to be developed. Quite a lot said that better or stronger antibiotics were needed, which was ignored. Many said that new vaccines were needed, but the question was about treating, rather than preventing, bacterial infections. Similarly, many students referred to improved hygiene. Poor use of language meant that some students lost marks. Saying that antibiotics should be used less was ignored. Some

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mention of not using them for viral infections, or not using them inappropriately, was required. Quite a lot of students said that patients should complete the course of antibiotics, and often went on to explain antibiotic resistance.

Q81.

(a) Three quarters of the students correctly stated that toxins produced by bacteria and viruses make us feel ill.

(b) (i) Only just over half of the students knew that antibiotics only kill bacteria; many thought they killed both bacteria and viruses.

(ii) Just under two thirds of the students said that new strains are produced when pathogens mutate.

(iii) The question asked what scientists will have to develop to kill new, resistant strains of bacteria. The most common error was to mention an antibiotic or a drug without any indication of it being new or different. A stronger antibiotic or new treatment was insufficient. Other incorrect responses included antitoxins and antiviruses. Many thought that a new vaccine was needed, but as this would not directly kill the bacterium it was not allowed. Responses highlighted a misunderstanding of immunity and resistance, and once again, some students thought that antibiotics could be used to kill viruses.

Q82.

(a) (i) Students answered this question well, stating the number of children, amount of drug, age or body mass as control variables. The most common incorrect response was the type of drug given, which was the independent variable.

(ii) Fake drug and sugar pill were the most common correct responses. Some students did not answer the question asked, but instead described a double-blind trial. Common incorrect answers included a vaccine, or a small or very weak dose of the drug.

(b) (i) Just over half of the students gained the mark here. 37.0 (°C) was a very common incorrect response. Students were unable to use the key, so gave the answer for ibuprofen rather than for paracetamol.

(ii) Most students selected ibuprofen as being the drug of choice, but many struggled to explain why they had selected it. A lot of students identified that ibuprofen reduced body temperature faster, or that it did reduce body temperature to normal whereas paracetamol did not. The mark scheme was fairly generous and, although a comparison was not essential, students who did phrase their responses giving comparisons gave clearer answers which were more likely to gain marks. Several students quoted temperatures, but did not go on to state an advantage of ibuprofen. Unqualified responses such as ibuprofen is cheaper or more effective were insufficient.

Q83.

(a) Only just over a third of the students knew that bacteria and viruses make us feel ill because they produce toxins. Many students said that bacteria produce toxins, but went on to give a different reason for viruses, for example, viruses reproduce inside cells or make the cells burst. These students gained the mark as long as they had not given an incorrect statement about viruses. Several incorrect responses referred

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to the immune system or used poor terminology saying that the organisms attacked body cells.

(b) (i) Only a fifth of the students gained this mark. The question stated that the children in the groups were matched for age and gender; therefore a different factor that should be controlled was needed. The most common correct answers were mass or weight. Height or size did not gain the mark. Several students said “Previous illness” or “Severity of illness”, and many references to temperature were given. Very few students mentioned ethnicity.

(ii) The majority of students answered this question correctly with many mentioning the word “placebo”. Most of the other correct answers said “nothing”. Students who did not gain the mark generally said give them a different drug, for example, Calpol, or an antibiotic. Some said give them a larger dose of the drugs mentioned in the question.

(iii) There were some good responses relating to taking account of a psychological effect. Many gained the mark for saying that a placebo was used in order to see if the drug worked, but this was expressed in many different ways. Some said it was used for comparison or as a control. Only a few referred to accuracy, fair testing or to improve reliability, all of which were ignored.

(c) (i) Most students interpreted the graph correctly to gain the mark.

(ii) Only just over a fifth of students gained this mark, showing they had some difficulty in counting how many hours the body temperature was normal or below for the two groups.

(d) (i) Many students lost marks because they did not write comparative statements. Saying that ibuprofen reduced the temperature quickly was insufficient. It was necessary to say that ibuprofen reduced the temperature faster, more or for longer. Many said that ibuprofen worked better or more effectively, but this was too vague to be awarded a mark. A few students attempted to compare all three groups, rather than ibuprofen (alone) with paracetamol (alone).

(ii) Over half of the students gained 1 mark for saying that ibuprofen maintained body temperature close to normal. There was a lack of understanding that there is a range for normal body temperature, and many students thought that lowering the body temperature below 37 °C was harmful. A vague statement such as“Ibuprofen is almost as good” or “almost as effective” was not creditworthy; students had to give an example of this, for example, it decreased the temperature at a similar rate.

Q84.

(a) Some students did not understand what a controlled variable was and either described what the scientist was trying to find out, or explained the results. The most common correct answers were amount or concentration of antibiotic, size of the discs or temperature

(b) (i) Students interpreted the information well and the majority gained full marks for these questions. They were obviously familiar with this type of investigation.

(ii) Students interpreted the information well and the majority gained full marks

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for these questions. They were obviously familiar with this type of investigation.

(iii) Some responses were expressed well, explaining that antibiotic B killed a lot of bacteria in both dishes. Other students gained 1 mark for identifying the correct antibiotic but did not gain the second marking point if they just said killed both bacteria, as three of the other antibiotics also killed both bacteria. Reference to a lot being killed, or a large clear area, in both dishes was required.

(c) Almost equal numbers of students opted for immune or resistant as their answer, highlighting the confusion they have with these two terms.

Q85.

Quite a lot of students gained 1 mark for stating that MRSA is resistant to antibiotics, but then failed to develop their answer to score further marks. Many others said the bacteria were immune to antibiotics, or talked about drugs, treatments or medicines when the word antibiotic had to be used. The point that there will not be immunity in the population to a new strain of bacterium was not understood by the vast majority of candidates. Many answers merely described poor hygiene practices in hospitals and made vague references to bacteria spreading. A few realised that patients in hospitals would be more susceptible to infection due to a weakened immune system.

Q86.

(a) (i) This question was well answered and most students interpreted the bar chart correctly.

(ii) More than half of the students gained the mark, usually for giving animals, or a named animal, as their answer. Incorrect responses included volunteers, young people, smokers and pregnant women. Some students had not read the question properly and tried to explain why laboratory testing was carried out.

(b) (i) Although many students gained full marks for this question, very few included their working out. Students should be encouraged to show their working for all calculations.

(ii) More than half of the students knew that the purpose of Phase 1 clinical trials was to see if the drug had side effects. The most common incorrect answer was to see if the drug works.

(iii) Just under half of the students correctly said that neither the volunteers nor the doctors knew who was given the drug and who was given a placebo. However, almost as many thought that the doctors but not the volunteers knew.

Q87.

(a) For the first marking point a conclusion was required which compared the death rates on the two wards. Some students just gave a description of the graph, which did not gain a mark. Many of these students had described the changes in death rates between 1840 and 1854. Some students who did attempt a conclusion said midwives were more successful or better, but did not gain the mark unless they referred to the death rates. There were many who thought the graph was showing the number of babies delivered by doctors and midwives, rather than the percentage

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of mothers who died. Students should be encouraged to read the axes titles and to use this language in their responses.

For the second marking point an explanation in terms of the spread of pathogens was needed. As this was a common question at standard demand reference to disease or infection was allowed. Germs were often mentioned, which did not gain the mark. Many students picked up a mark for stating that doctors did not wash their hands. Some students focussed their explanation on the fact that doctors worked in different wards and others said midwives were more experienced or more gentle, none of which was sufficient to gain the mark. The cleanliness of hospitals or mothers being ill were also given as reasons, which were ignored.

(b) (i) The first mark was for mentioning hand washing. Some students talked about hygiene and keeping the ward clean, which was insufficient. Some referred to the use of antiseptic hand washes or wearing gloves, both of which were ignored. Some thought Semmelweis introduced a policy of only allowing midwives to deliver babies, introducing more training for doctors or only allowing healthy women to have babies. The second mark was for stating when hand washing had to be done, and had to link to patients or dead bodies. Most students phrased it as ….before delivering babies, which was allowed.

(ii) Many students did not gain the mark because they used loose terms like germs, disease or infection, rather than a pathogen.

Q88.

(a) (i) Just over half of the students interpreted the chart correctly and gave an answer of 5 years. 9 or 10 years were often given.

(ii) The expected response was that laboratory testing is carried out on animals or cells and clinical testing is carried out on humans. However, most responses that gained credit simply said that there were more phases of testing in the clinical trials. Those who said that there were three phases of clinical trials were not credited, as a comparative statement was needed. Students should be taught to give comparative statements when two or more things are being compared.

(b) (i) Students ran into problems because they did not set their answer out clearly. To be sure to gain both marking points they needed to make it clear whether they were referring to using only healthy volunteers, or low doses.

(ii) Approximately two thirds of the students gained at least 1 mark. Most of these mentioned that a drug and a placebo were tested. There was some confusion about who did not know who had taken the drug – some just said the patients didn't know and others said only the doctors didn't know. To gain this mark they had to state that neither patients nor doctors knew. The third marking point was phrased in various ways to gain credit for avoiding bias. However, if they just said that it was to see if the drug worked, this was insufficient; a reference to the placebo was also needed.

Q89.

(a) Most students were able to gain at least two marks for this question. A common incorrect response was 'stop pathogens entering the body'. Some students

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confused antibodies and antibiotics.

(b) Many students answered in terms of bacteria fighting the antibiotic or being stronger than the antibiotic. Others thought the body was resistant or rejected the antibiotic.

(c) (i) About half of all students gained a mark for this question. Some students shaded the box as indicated by the key, rather than giving the letter. These answers gained credit.

(ii) A lot of responses gave values greater than 100%. A common mistake was to use figures from the wrong years or to misread the scale. Some students thought they had to calculate a percentage rather than just do a simple subtraction. They appeared not to understand the term 'difference' or had not read the label on the y-axis. Some wrote down 54–46 but did not get the correct answer. Students who have poor maths skills should be encouraged to check all their answers using a calculator.

(ii) A wide range of incorrect responses was given and less than a fifth of students were able to score at least one mark. Many thought the bacteria got used to the antibiotic, could fight it or got stronger. Others said the wrong antibiotic or dose had been given or that a new antibiotic was used instead. Once again, many students thought the body became immune to the drug. Some thought it was related to more or less people catching pneumonia. Antibiotic resistance and immunity are misunderstood and often confused.

Q90.

(a) Most students knew that a dead or inactive form of a pathogen is used in a vaccine. However, some students gave weak answers which gave 'disease' or 'germ' rather than pathogen. A surprising number gave 'antibody' or 'antigen'.

(b) Students continue to confuse the command terms 'describe' and 'explain'. Significant numbers repeated themselves in part (b)(i) and (b)(ii).

(i) A surprisingly large number of students could not describe the differences shown in the graph. Many students obviously did not use the graph at all and gave descriptions of the immune response, rather than the differences between antibody production after vaccination and exposure to pathogen. To gain credit, comparisons should have been given. Some students attempted a comparative response but in terms of the pathogen being killed quicker rather than producing antibodies quicker.

(ii) Many students stated that the smaller and slower response to the vaccine is because the vaccine is at a lower concentration or volume than later exposure to the pathogen. There were frequent references to white blood cells or antibodies knowing how to kill the pathogen. Many students stated that more antibodies were produced after exposure because the pathogen was more dangerous and had to be killed, whereas the vaccine was not dangerous so did not warrant a response.

Q91.

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(a) A general lack of knowledge about the three drugs was demonstrated. The most common correct answer was for anabolic steroids stimulating muscle growth.

(b) The majority of students realised that the trial should be stopped because the majority of volunteers in the small sample had adverse effects, so scored the first mark. Not all were able to express in terms of side effects why the trial should be stopped giving general answers such as ‘people might die / be harmed’

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