AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.2.2 ANIMAL TISSUES, ORGANS AND ORGAN SYSTEMS (PACK 7)

SCORE	PERCENTAGE
/352	%

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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) breathing rate when walking is twice that at rest

allow breathing rate when walking is 12 (breaths / minute) more than at rest

1

breathing rate when jogging is 5 times that at rest

allow breathing rate when jogging is 48 (breaths / minute) more than at rest

1

breathing rate when jogging is 2.5 times that when walking

allow breathing rate when jogging is 36 (breaths / minute) more than when walking

1

*allow for **1** mark if no other marks gained:*
breathing rate at rest is 12 (breaths per minute),
breathing rate when walking is 24 (breaths per

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minute) and breathing rate when jogging is 60 (breaths per minute)
or
breathing rate increases with increasing activity
***max 2** marks if written in terms of heart rate*

(b) (breathing rate increases)

to supply more oxygen / O_2
or
to supply oxygen / O_2 faster
allow to remove more carbon dioxide / CO_2
or
to remove carbon dioxide / CO_2 faster
*do **not** accept incorrectly written formulae*

1

for (aerobic) respiration
or
to reduce anaerobic respiration
or
to reduce lactic acid build up

1

(so) that more energy is transferred / released
or
(because) more energy is required
*do **not** accept used / produced / created or energy made*

1

reference to more / faster required at least once for full marks

(c) right ventricle / side of the heart pumps (blood) to the lungs

1

left ventricle / side of the heart pumps (blood) to the body

1

*if no other marks scored allow **1** mark for one side pumps blood to the lungs and the other side pumps blood to the body*

(d) any **one** from:

- (the left ventricle) has to pump blood further (than the right ventricle)
  allow (the left ventricle) has to pump blood all around the body

- (the left ventricle) has to pump blood with a greater force (than the right ventricle)
  allow (left ventricle) has to pump blood harder

- (the left ventricle) has to pump blood at a higher pressure (than the right ventricle)

1

there must be a comparative statement

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(e) any **one** from:

- strengthens heart (muscle)
- reduces chance of another heart attack

  ignore prevents / no heart attacks

- reduces / controls weight
- improves circulation

  allow decreases chance of fatty deposits
  ***or** fat building up (in arteries / blood vessels)*
  allow reduces resting heart rate

1

[10]

Q3.

(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

(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

allow 'it' for heart

1

(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.

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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
- 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]

Q4.

(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

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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

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):

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- 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]

Q5.

(a) any **one** from:
- temperature
- water

allow ions / salt / pH

allow oxygen / carbon dioxide

1

(b) 7 ($mmol/dm^3$)

allow 6.75 to 7.25 ($mmol/dm^3$)

1

(c) 1 (pm)

allow 12.30 to 1.10 (pm)

1

(d) insulin

1

(e) glucose moved from blood into (liver / muscle) cells

allow insulin transported in the blood and glucose moved into (liver / muscle) cells

1

to be stored as glycogen

allow to be converted into glycogen

1

(f) the person injected too much hormone

1

(g) decrease

1

(because) glucose is used in respiration

*allow increase only if linked to glucagon released for **2** marks*

1

(h) (blood glucose concentration would) not increase as much

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allow (blood glucose concentration would) return to normal faster

1

[10]

Q6.

(a) (wear safety) goggles

allow (wear) safety glasses
allow (wear) eye protection
allow keep ethanol away from flame or in a water bath
allow use tweezers or a glass rod to remove leaf from ethanol / water
ignore gloves

1

(b) iodine solution

1

(c) blue-black

1

(d) separate

1

mobile

1

in this order only

(e) $\frac{17}{110}$

allow 0.154545 or correctly rounded answer

1

= 0.15

allow an answer from an incorrect calculation correctly given to 2 significant figures

1

*an answer of 0.15 scores **2** marks*

(f) carotene

1

[8]

Q7.

(a) any **two** from:

- amino acids
- glycerol
- fatty acids

*do **not** accept fat*
allow salt / minerals
allow vitamins

2

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(b) 11.79 (g)

allow 11.8 (g) ***or*** *12 (g)*

1

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

5–6

Level 2: Relevant points (reasons / causes) 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

- carbon dioxide enters the leaf through stomata
- glucose / sugars produced by photosynthesis (in leaves)
- some detail of photosynthesis
- transport / translocation (of glucose / sugars)
- in phloem
- glucose is converted to starch
- (starch is a) long chain of glucose / sugar molecules
- starch as storage (of glucose / sugars)

[9]

Q8.

(a) (boil ethanol) in a water bath

1

(b) (test) add iodine (solution)

1

(result) blue-black

allow black
allow blue / black
allow dark blue
ignore purple unqualified

1

(c) solvent moves through paper

1

different pigments have different solubilities in solvent
or
different pigments have different attractions for the paper

1

(and so) are carried different distances

1

allow references to solvent as the mobile phase and paper as the stationary phase

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(d) any **one** from:

- R_f values overlap
  or
  0.20 is within range for two pigments
- R_f ranges overlap
- could be chlorophyll b or xanthophyll
- there may be other pigments (that are not in table 2)

1

(e) $$(R_f \text{ value}) = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

1

$$0.89 = \frac{\text{distance moved by substance}}{140}$$

or

$$0.98 = \frac{\text{distance moved by substance}}{140}$$

1

(distance moved by substance)
= 0.89 × 140
or
= 0.98 × 140

1

= 125 / 124.6 **or** 137 / 137.2

1

(from) 125 / 124.6 (mm to) 137 / 137.2 (mm)

1

*an answer of (from) 125 / 124.6 (mm to) 137 / 137.2 (mm) scores **5** marks*

*calculation using an incorrect distance moved by solvent scores a maximum of **4** marks*

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

5–6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logically 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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- variation arising from mutations
- mutations occurring randomly
- produce a different protein / pigment / enzyme responsible for pigment production
- produce if more likely to survive
- will pass on favourable genes
- idea of timescale
- if more light captured, faster rate of photosynthesis
- increased photosynthesis causes faster growth
- outcompete neighbouring plants
- different colours of light have different wavelengths
- absorbing wider range of wavelengths means more light is absorbed
- more likely to survive in changing conditions

[18]

Q9.

(a) all points plotted accurately

allow ± 0.5 small square tolerance
*allow **1** mark for 3 or 4 points plotted accurately*

2

line of best fit drawn

1

(b) extrapolation on graph

1

9.5 (%)

allow value in range 9.4−9.6
allow correct reading from incorrect extrapolation

1

(c) any **one** from:

- eating habits may change
- people are more informed about the causes of diabetes
- change in exercise patterns

allow new cure

1

(d) any **two** from:

- diabetes (in the world) is increasing

allow low / high income countries are increasing

- diabetes in low-income countries is rising faster (than high-income / world)
- high-income countries and low-income countries were the same in 2010
- high-income countries have been higher than low-income but now / 2018 the situation is reversed
- diabetes in high-income countries was higher than the world total (from 1986 − 1993) but is now lower

allow correct use of data

2

(e) people are becoming more obese

1

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people are eating more sugar

1

[10]

Q10.

(a) trachea

1

(b) any **one** from:

- can see more detail in lungs

  ignore gives clearer image

- you can see the bronchus / bronchioles / soft tissues

  ignore bones

  allow it doesn't use ionising radiation
  allow X-rays can cause cancer / mutation

1

(c) you can see the ribs / bones

  allow cheaper
  allow takes less time

1

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

- uses / needs / requires oxygen (and anaerobic does not)
- transfers more energy (than anaerobic)

  allow releases more energy (than anaerobic)
  *do **not** accept energy is created / produced / made*

- produces carbon dioxide / water (anaerobic does not)
- does not produce lactic acid (anaerobic does)
- does not cause an oxygen debt (anaerobic does)

  *allow aerobic takes place in mitochondria **and** anaerobic takes place in cytoplasm*

  allow converse in terms of anaerobic

3

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

5–6

Level 2: Relevant points (reasons / causes) 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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(stopping smoking will improve health because):
- smoking is a risk factor for cardiovascular disease
- raises blood pressure
- increases cholesterol and / or lowers HDL
- increases atherosclerosis **or** thickened artery walls
- increases the risk of blood clots forming
- increases risk of stroke

- smoking is a risk factor for lung cancer
- as it can cause mutations
- caused by carcinogenic chemicals in smoke (tar)
- leading to uncontrolled growth of cells

- smoking damages alveoli
- causing the surface area of the alveoli to decrease
- causes emphysema / COPD
- causes shortness of breath **or** reduces gas exchange

- chemicals / tar / nicotine in the smoke irritate / inflame the bronchi / lung / bronchioles
- which damage the cilia
- causes goblet cells to secrete more mucus
- causes shortness of breath **or** reduces gas exchange
- causing chronic bronchitis **or** increases risk of infections

- carbon monoxide is produced
- which is toxic / poisonous
- binds / attaches to haemoglobin / Hb
- so oxygen carrying capacity of blood is decreased

[12]

Q11.

(a) **C**

1

(b) **B**

1

(c) **E**

1

(d) any **one** from:

- they are too big
- they are insoluble

1

(e) (pH) 7.5

allow answers in range 7.4 to 7.6

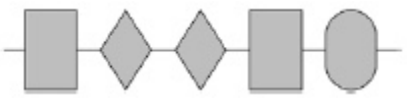
1

(f) (enzyme **X**) stomach

(enzyme **Y**) small intestine

1

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(g) 

1

(h) lock and key

1

(i) (some pH values):

change the shape of the active site

allow some pH values denature enzymes

1

(so) so substrate will no longer fit / bind to the active site

1

[10]

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

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(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]

Q13.

(a) 36 000 (cm^3)

1

(b) 11600 / 1200

1

9.66666r

allow any number of decimals

1

(c) muscles need more energy (for contraction)

1

(so) more oxygen / glucose needed

need at least one reference to 'more' for full marks

allow so more carbon dioxide / thermal energy needs to be removed

1

(for) increased respiration

1

(d)

Level 3: Relevant points (differences / functions) are identified, given in detail and linked logically to form a clear account.	5-6
Level 2: Relevant points (differences / functions) 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 • artery has a thicker wall • (because) artery has to withstand higher	

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pressure • artery has thicker layer of elastic tissue / fibres • (so) it can stretch • (so) artery returns to original size / shape • artery has thicker layer of muscle • to maintain a force on the blood • vein has valves • (valves) prevent backflow of blood • artery carries blood away from the heart • vein carries blood towards the heart ignore references to oxygenated / deoxygenated blood	

6

[12]

Q14.

(a) stomach and pancreas

1

(b) all points plotted correctly

*allow **1** mark for 3 points correctly plotted*

2

smooth curve drawn through all the points

1

(c) as concentration of protein increases the percentage of light passing through decreases

1

(because) mixture more cloudy

allow idea of more particles in suspension

1

(d) use protein concentrations between 2 and 10 g/dm^3

1

(e) any one from:

- to allow them to reach 37 °C

  to allow them to reach body temperature

- so they would be at the optimum temperature

  allow so they would be at the same temperature

- so reaction temperature controlled

  allow temperature affects enzyme activity

1

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(f) correctly read concentration at 57% from their graph

1

(g) their value given in part (f) – 0.5

allow use of different values over straight line portion of graph

1

answer for their value given in

$$\frac{\mathbf{03.6} - 0.5}{12}$$

1

(h) (protease from organ **B**) is inactive **or** rate of digestion is zero **and** protease from organ **A** is active

*allow <u>only</u> protease from organ **B** is inactive*

1

any **one** from:

- enzyme denatured by pH
- at the wrong pH
- enzyme not specific for this protein

allow active site damaged / changed by pH

1

[13]

Q15.

(a) **A**

1

(b) **F**

1

(c) **B**

1

(d) **D**

1

(e) nucleus

1

(f) (makes reactions) faster

allow to reduce risk of damage / burns

allow for protection / safety

1

(g) alcohol

1

tiredness

1

[8]

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Q16.

(a) (LHS)
glucose

1

(RHS)
carbon dioxide

1

(RHS)
water

either order on RHS

1

(b) any **one** from:
- ache
- bum
- hurt
- fatigue(d)
- tired
- cramp
- painful

1

(c) any **three** from:
- temperature (of room)
- time running / 10 minutes running
- recovery before increasing speed
- same person
- incline of treadmill

allow normal lactic acid concentration at start

3

(d) (as speed increases) blood lactic acid concentration increases

ignore (directly) proportional

1

increase is greater at higher speeds

allow converse

allow linear relationship at higher speeds

1

(e) 7.5 – 1.2

1

6.3 (arbitrary units)

*an answer of 6.3 scores **2** marks*

1

(f) increased blood flow

1

delivers more oxygen

1

therefore less anaerobic respiration
or
therefore more respiration is aerobic

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1

(g) after anaerobic respiration, oxygen debt must be repaid.

1

oxygen is needed to remove lactic acid from muscles.

1

[16]

Q17.

(a) 46

1

(b) mitosis

1

(c) 3

1

(d) differentiation

1

(e) cell membrane

1

cytoplasm

1

(f) (stem cells from embryos) can become more types of cell

allow converse

allow (stem cells from embryos) are pluripotent

1

(g) less risk of rejection of umbilical cord stem cells

1

(h) could cause cancer

1

(i) any **one** from:

- embryos are created (for this purpose)
- embryos are destroyed
- the embryos do not develop into a foetus / child

ignore religious objections

1

[10]

Q18.

(a) platelets

1

white blood cells

1

plasma

this order only

1

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(b) 5500 000

1

(55 000 000 × 1000 000 =) 5500 000 000 000

1

5.5×10^{12}

1

(c) ($5.5 \times 10^{12} \times 5.2$ =) 2.86×10^{13}

allow ecf from part (b)

allow 28 600 000 000 000

1

(d) it is recessive

allow it is not dominant

1

(e)

Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5-6
Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logically 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 • red blood cells carry oxygen • rbc contain haemoglobin • haemoglobin carries / binds to oxygen • sickle cells are smaller or have smaller volume • sickle cells contain less haemoglobin • less oxygen carried • smaller SA:volume ratio • oxygen enters rbc by diffusion • slower / decreased diffusion • less oxygen delivered per minute or slower rate of delivery • blood vessels blocked (due to cell shape)	

6

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(f) any **one** from:

- breathlessness
- tiredness
- less able to do exercise
- pain (in muscles)
- muscle fatigue
- anaemia

1

[15]

Q19.

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

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 saturated 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

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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 **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]

Q20.

(a) biuret

1

(b) purple

1

(c) 1:1.6

1

(d) provides amino acids to make new muscle

1

(e) it has a large surface area

1

it has a thin surface

1

(f) **C**

1

lowest sugar (content)

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1

[8]

Q21.

(a) pulmonary artery

1

(b) **D**

1

(c) $\frac{8}{7} \times 60$

1

69

1

(d) **Y**

1

(the heart rate) is regular

1

(e) any **two** from:
- higher carbon dioxide (concentration)
- lower glucose (concentration)
- lower oxygen (concentration)

2

(f) capillaries

1

(g) (artery has) thicker wall

1

(artery has) narrower / smaller lumen

allow vein has valves

1

[11]

Q22.

(a) scales drawn

should use more than50% of the graph paper

1

all five points plotted

allow ±0.5 small square tolerance

*allow **1** mark for 3 or 4 points plotted accurately*

2

line of best fit drawn

1

(b) the higher the concentration of glucose the darker the blue compound that is formed

1

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the blue compound absorbs the light

1

(c) 0.13

allow 0.12

allow ecf from graph drawn in part (a)

1

(d) increase in blood glucose detected by the pancreas

1

insulin is released from the pancreas

1

glucose would move into cells

1

glucose converted to glycogen (for storage) in the liver

1

(e) glycogen isn't converted to glucose

1

therefore more glucose isn't released into the bloodstream

1

(f) pancreas

or

bone marrow

*do **not** accept embryo*

allow other correct sources of stem cells

1

(g) any **three** from:

- would not need to inject insulin
- continuous control
- would not need to test blood glucose levels (via blood tests)
- won't need to monitor carbohydrate intake
- no risk of forgetting to inject insulin

3

(h) any **two** from:

- fear that the cells could become cancerous
- possible transmission of other disease
- may form other types of cell

2

[19]

Q23.

(a) 8 (micrometres)

1

(b) red blood cell(s)

1

white blood cell(s)

accept named cell

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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]

Q24.

(a) mitosis

extra box ticked negates mark

1

(b) cell division is uncontrolled

extra box ticked negates mark

1

(c) any **one** from:

- smoking / tar
- alcohol
- carcinogens
  allow named chemical
- viruses (living in cells)
- (ionising) radiation
  accept UV / X-rays / gamma waves

1

(d) bar plotted at 78%

ignore width of bar

1

(e) testicular

extra box ticked negates mark

1

(f) prostate

extra box ticked negates mark

1

(g) any **two** from:

- improved treatment / drugs
- earlier diagnosis
- more cancer screening
- improved patient knowledge (of risk factors)

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allow improved patient diet / lifestyle

2

[8]

Q25.

(a) any **two** from:

- same result at pH 7 and 7.5
  or
  could be any pH between 7 and 7.5
  or
  not tested at pH 7.25
  or
  need to test at smaller pH intervals (between 7 and 7.5)
- accuracy of result only to nearest 0.5 minutes
- no repeats
- difficult to determine end point (colour)

2

(b) 2.7 / 5

1

0.54 (units per minute)

*allow 0.52 with no working shown for **2** marks*

1

*allow **1** mark for 0.52 **or** 0.56*

(c) (after 10 minutes) solution goes black

1

(after 60 minutes) solution stays the same
or
does not go black
or
goes slightly orange

1

(d) steeper curve

1

levels off at 11.8 units **and** before 45 minutes

1

[8]

Q26.

(a) cells can break off

allow cells invade other tissues

1

travel in blood

accept travel in lymph (fluid)

1

(b) $\frac{(89 - 48)}{48} \times 100 = 85.416\dot{6}$

1

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85.4 (%)

*allow 85.4 (%) with no working shown for **2** marks)*

1

(c) any **two** from:

- similar survival rates for diagnosis in 1961
- survival rate (for diagnosis in 2011) is 1.5 times greater for prostate cancer compared to bowel cancer
- (survival rates) have improved for both cancers
- (survival rate) for prostate cancer has improved more

*accept survival rate for bowel cancer has increased 2.4 times **but** for prostate cancer 3.4 / 3.36 times*

2

plus **two** from:

- earlier diagnosis
- improved screening programmes
- improved drugs
- difference in level of aggression of cancers
- difference in ease of removing tumours

reason must be correctly linked to comparison

2

[8]

Q27.

(a) plasma transports proteins / dissolved substances / food (molecules) / urea / hormones
or
blood cells are suspended in the plasma

1

platelets are involved in blood clotting

1

(b) the right side of the heart pumps blood to the lungs
and
the left side of the heart pumps blood around (the rest of) the body

1

(c) **Level 3 (5–6 marks):**
A detailed and coherent evaluation is provided which considers a range of relevant points and comes to a conclusion consistent with the reasoning.

Level 2 (3–4 marks):
An attempt to relate relevant points and come to a conclusion. 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

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Indicative content

pros of statins:

- decreases blood cholesterol
- slows down build-up of fatty material in arteries
- (so) blood can flow to heart muscle cells

cons of statins:

- drug has to be taken regularly **or** may forget to take drug
- drug will need to be taken long-term
- side-effects of taking the drug
- effects of drug will take time to happen

pros of stents:

- blocked artery is held open
- (so) blood can flow to heart muscle cells
- will remain in place / work for a long time
- rapid recovery time

cons of stents:

- risk of infection from procedure
- risk of surgery eg heart attack
- risk of thrombosis **or** blood clot

a justified conclusion

6

[9]

Q28.

(a) (**A**) right atrium

1

(**B**) right ventricle

1

(b) To take blood from the lungs to the heart

1

(c) keeps the (coronary) artery open / wide

1

so the blood can carry glucose and oxygen

1

to the heart (muscle)

1

for respiration

1

*if marking points 2, 3 and 4 not awarded allow **1** mark for 'keep a (constant) flow of blood to the heart (muscle)'*

(d) bar **D** correctly plotted

1

bar **E** correctly plotted

1

± 0.5 small squares

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(e) twice / two times (more likely)

1

(f) **Level 3 (5–6 marks):**
A detailed and coherent evaluation is provided that considers a range of relevant points
about how well the data correlates with the statement, quoting relevant comparisons and
comes to a conclusion consistent with the reasoning.

Level 2 (3–4 marks):
An attempt to relate relevant points within the data and come to a conclusion. The logic may be inconsistent at times but builds towards a coherent argument.

Level 1 (1–2 marks):
Discrete, relevant points made, attempting to apply understanding of the factors involved in development of CHD to the data in the table. The logic may be unclear and the conclusion, if present, may not be consistent with the reasoning.

0 marks:
No relevant content

Indicative content

data that supports statement:

- country A has the highest death rate at 285 deaths per 1000 and the lowest consumption at only 180 kg per person
- death rate in country E is less than half that in country A (125 compared with 285) and consumption is higher (244 compared with 180)
- other countries with lower death rates than A have higher consumption (eg country B 250 deaths per 1000 but consumption of 320 kg per person)

arguments against statement:

- but most of the data on the graph does not show clear correlation between death rates and consumption of data
- eg death rate in country B is second highest at 250 deaths per 1000 but consumption is highest at 320 kg per person, nearly double that in A where death rate is only 35 per 1000 more
- differences show no clear pattern – eg in countries where death rate is much lower the consumption is not a similar proportion higher (cf country D death
rate just under half that in A but consumption not double that in A)
- there may be other factors affecting death rate that are not reported, such as smoking, obesity, exercise, stress

6

[16]

Q29.

(a) any **two** from:

- to work out the correct dose to be given
- to check that the drug is working correctly
- to check for toxic effects.

2

(b) patients are randomly allocated to receive statin or a placebo

1

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so neither patient nor doctor knows who has received which

1

*answer in terms of only the drug company knows who is taking the statin or the placebo gains **2** marks*

(c) To prevent false claims

1

(d) drug **A** reduced the blood cholesterol level more than drug **B**

1

drug **A** reduced the thickness of the artery **or** drug **B** increased the thickness of the artery

*allow drug **A** made the artery thinner **or** drug **B** made the artery thicker*

1

ignore side effects

(e) differences in number of patients reporting side effects are very similar

1

we don't know what the patients died of

1

[9]

Q30.

(a) (lack of) exercise

allow description of type or amount of exercise

1

allow other risk factors not mentioned in table, eg high cholesterol levels, blood pressure, levels of obesity, diabetes

(b) the second highest death rate has the highest fruit and vegetable consumption

the lowest death rates don't have high fruit and vegetable consumption

lowest death rates have a low percentage of the population that smokes.

3

(c) (it builds up) inside the coronary arteries

1

(causing) them to narrow

1

(this) reduces blood flow

1

so less oxygen gets to the heart muscle

1

(d) (statins) reduce cholesterol in the blood

1

so there is less build up of fatty material (in coronary arteries)

allow slows the rate of fat deposit

1

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[10]

Q31.

(a) in the blood(stream)

allow plasma

ignore dissolved or in solution

1

(b) all three plots correct

*accept two correct plots for **1** mark*

2

suitable line drawn

1

(c) 1 hour

1

(d) 230−185

identification of steepest part of graph and correct readings taken

1

= 45

1

(e) line on graph showing extrapolation for person **B**

correct value read from graph (at 130 mg per 100 cm^3)

*allow **1** mark for a value of 4.5–5 hours if no extrapolation shown*

2

[9]

Q163.

(a) (i) dependent (variable)

allow continuous (variable)

allow discrete (variable)

1

(ii) any **one** from:

- lemon juice contained the most vitamin C
- apple juice contained the least vitamin C.

allow a correct comparison of two or more juices

1

(b) (i) 62.5 (%)

allow 63 (%)

*do **not** allow 62 (%)*

*do **not** allow 63.0*

1

(ii) different people need different amounts

allow examples, eg pregnant women may need more

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1

[4]

Q164.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.
Examiners should also refer to the information on the marking guidance (see Reference Material), and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1-2 marks)
There is a brief description of the evidence for or against the newspaper's claim, including either evidence for or evidence against.

Level 2 (3-4 marks)
There is a description of some of the evidence for and evidence against the newspaper's claim, with at least one example of evidence for and one example of evidence against. There is an attempt at a conclusion.

Level 3 (5-6 marks)
There is a clear and detailed description of the evidence for and evidence against the newspaper's claim, with at least one example for and at least two examples against. A reasoned conclusion is given. The description must include reference to polyphenols.

Examples of the chemistry points made in the response

Evidence supporting the newspaper claim:

- the study included a control group / one group given a placebo
- all participants ate the same amount of chocolate each day
- results showed a decrease in total cholesterol / an increase in 'good' cholesterol / a decrease in 'bad' cholesterol in the group that ate the dark chocolate

  allow (dark) chocolate worked / reduced (risk of) heart disease

Evidence against the newspaper claim:

- no results given for (dark) chocolate without polyphenols
- only type 2 diabetes patients tested
- small sample tested / only 12 tested
- unequal numbers of males and females
- other health issues / age not controlled
- rest of diet not controlled
- chocolate contains high levels of fat / sugar / could cause other health issues eg weight gain
- long term effects not known / trial only 16 weeks

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Argued conclusion made with an attempted justification

[6]

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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.

(a) This question was set at standard demand. 50% students achieved one mark. This

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was usually for giving three correct graph readings, without comparisons. 11% of students achieved more than one mark.

(b) 62% of students achieved at least one mark. This was usually for saying breathing rate increased in order to supply more oxygen. Some students referred to changes in heart rate, rather than breathing rate. Only a few mentioned that more energy would be required during increased activity.

Some who did refer to energy used poor terminology, for example to produce more energy, which was not allowed.

(c) 16% of students achieved a mark for this question. Students confused which side of the heart pumped blood to the lungs or to the body. Others thought the lungs pumped the blood. Quite a few students referred to oxygenated and deoxygenated blood but did not include sufficient detail to gain marks.

(d) The question asked why the wall of the left ventricle is thicker than that of the right ventricle. Therefore a comparison had to be implied. 19% of students achieved this mark. A common incorrect idea was that the left ventricle pumped more blood than the right ventricle.

(e) 27% of students achieved this mark, usually for saying that exercise would strengthen the heart muscle. Saying that exercise would prevent a heart attack was ignored. The idea of reducing the chance of another heart attack was needed.

Q3.

Foundation

(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.

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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 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.

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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.

Q4.

(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 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

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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.

Q5.

(a) 75% of students could not give an example of an internal condition controlled by homeostasis. Many repeated the example given in the stem of the question.

(b) This question was answered well with 60% of students achieving credit. There were instances of students reading from the scale of the graph incorrectly.

(c) 45% of students could interpret the graph to suggest at what time the person ate lunch.

(d) 52% of students could identify the hormone injected by the person with diabetes as insulin. A variety of reproductive hormones were incorrectly stated for this question.

(e) Students found this very difficult with 10% answering correctly. Most students gave incorrect statements regarding insulin, glucose and glycogen. Many referred to glucagon in incorrect contexts.

(f) 51% of students could apply their knowledge to the graph to suggest the person injected too much hormone.

(g) Many students stated that blood glucose concentration would increase during a run. This was allowed if it was linked to glucagon release. Few students made that link. Many students stated that exercise gives us energy, so glucose increases, highlighting several misconceptions. The usual misconceptions of glucose making or producing energy were also seen. 54% of students achieved any credit for this question.

(h) 26% of students suggested how the graph would differ for a person who does not have diabetes.

Q6.

(a) 50% of students gave one safety precaution the students should take. Most of these students gave the idea of safety goggles. Gloves was an insufficient answer, as were general safety measures such as wearing safety clothing, lab coats, or keeping away from fire.

(b) 50% of students knew that iodine solution is used to test for starch.

(c) 61% of students knew the positive result of a test for starch.

(d) 32% of students could correctly select both words from the box add to the sentences to describe chromatography.

(e) This question discriminated between students well. 24% of students achieved a mark for showing the correct working, but then incorrectly rounded, or could not give

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their answer to two significant figures. 45% of students achieved full marks.

(f) 81% of students could identify carotene from the R_f value and Table 2.

Q7.

Foundation

(a) 83% of students gave the incorrect answers of fat, protein or fibre, demonstrating a lack of understanding of digestion. Glucose, sugars and carbohydrates were also frequently seen, which did not score a mark, given the way the question was phrased.

(b) 28% of students could calculate the mass of sugars in 180 g of sweet potato, when given the mass of sugars in 100 g of sweet potato.

(c) 'Level descriptors' are used to mark 'extended response' questions such as this. Level 2 and level 3 answers require students to make unprompted links between aspects of an explanation. For example, responses that only referred to processes in the leaf rarely contained relevant links to answer the question. 3% of students were able to answer sufficiently to enter level 2 or level 3.

Many students incorrectly refer to carbon dioxide mixing with water in an attempt to describe photosynthesis. Major misconceptions were frequent, such as carbon dioxide being taken into the roots from the soil, and photosynthesis occurring in the roots.

Higher

(a) 86% of students gave the incorrect answers of fat, protein or fibre, demonstrating a lack of understanding of digestion. Glucose, sugars and carbohydrates were also frequently seen, which did not score a mark, given the way the question was phrased.

(b) 65% of students could calculate the mass of sugars in 180 g of sweet potato, when given the mass of sugars in 100 g of sweet potato.

(c) 'Level descriptors' are used to mark 'extended response' questions such as this. Level 2 and level 3 answers require students to make unprompted links between aspects of an explanation. For example, responses that only referred to processes in the leaf rarely contained relevant links to answer the question. 18% of students were able to answer sufficiently to enter level 2 or level 3.

Many misconceptions regarding photosynthesis were seen, such as roots absorbing carbon dioxide for photosynthesis and carbon dioxide being used in respiration.

Q8.

(a) 65% of students could not describe how to safely boil ethanol. Some referred to safety glasses, despite being directed not to in the question. Others thought that using a beaker above a Bunsen burner is sufficient, or suggested mixing the ethanol with water.

(b) This question tested knowledge of a Required Practical Activity and generally, this was answered well with 51% of students achieving some credit.

Students should be reminded not to describe the positive result of a test for starch

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as purple, as this could be confused with the Biuret test for protein.

(c) Students were asked to explain how chromatography causes different pigments to separate. It was clear that most students had good understanding of chromatography and detailed descriptions of methods were seen. Students must ensure they take notice of the command word in the question. 'Explain' questions require students to make something clear, or state the reasons for something happening. Descriptions of detailed methods often failed to answer the question.

The best answers referred to solvent moving through the paper, rather than assuming the solvent was water. Most students could explain that different pigments have different solubilities in the solvent and therefore are carried different distances.

Responses using the terms from the specification: stationary and mobile phase, often achieved all three marks, but there were some misconceptions regarding these terms. Some students incorrectly describe the pigment as the stationary phase.

12% of students achieved either two or three marks.

(d) This high demand question required application of knowledge of Rf values to a novel context. 14% of students answered correctly. Many of these students could identify that the pigment could be xanthophyll or chlorophyll b, or describe that the Rf value ranges overlap.

A significant number thought the pigment could be chlorophyll a or chlorophyll b, which was incorrect. It's possible these students used the distance moved (24 mm) and interpreted this as an R_f value of 0.24.

(e) 26% of students demonstrated an excellent understanding of Rf values in a difficult context. Those who did not achieve full marks often recalled the equation incorrectly. If the equation was recalled correctly and then rearranged incorrectly, the first marking point could be awarded. Again, this demonstrates that students should show every stage of their calculations.

Usually, when a mark is awarded for recall of an equation, the full equation should be given. In this instance, because the question was phrased in terms of R_f value, the whole equation was not required.

(f) This 'extended response' high demand question was not answered well. Students often simply repeated the stem of the question, which will never gain marks.

- Level 1 responses included aspects of the indicative content, but with no attempts at linking, or developing simple statements to give a complete answer to the question.
- Level 2 responses included ideas from the indicative content, with some attempt at logical linking, but were not fully clear.
- Level 3 responses require relevant points to be given in detail and linked to give a clear account. Few students were awarded level three marks.

8% of students gave level 2 or 3 answers. To award level 2 or 3, the answer had to apply to the situation given, rather than straight recall of the process of evolution, without application to the context given.

Weaker answers frequently gave confused accounts of photosynthesis, often confused with respiration. Some responses stated all the student could remember

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regarding photosynthesis, without engaging with the command word of the question.

Misconceptions regarding mutations, adaptation and evolution were common. Incorrect references to plant camouflage, plant breeding and genetic modification were seen.

Q9.

(a) Students answered this question well with 48% achieving full marks. A large number of students did not work out the correct scale, therefore two or more points were plotted incorrectly. Lines of best fit were generally well drawn unless the student had decided to join the points with straight lines. 18% of students gained no marks here.

(b) Quite a few students extrapolated the wrong line. Some didn't extrapolate at all but still got the right answer, therefore, they lost the mark for extrapolation but gained one mark for the final correct answer. Many also gained the second mark for correctly reading off an answer for 2020 after having extrapolated the wrong line. 56% of students achieved one or two marks.

(c) Correct answers most commonly related to a change in eating habits. 'Sugar tax' was only credited if students went on to say that people would thus eat less sugar in their diets.

(d) 63% of students achieved at least one mark. The first marking point for rising cases of diabetes was seen most often. If an answer was made in terms of income or population increase no credit was gained.

(e) 73% of students were able to identify why the percentage of people in the world with diabetes has changed (gone up) from the graph.

Q10.

Foundation

(a) 57% of students correctly identified the trachea.

(b) Many students answered in terms of the x-ray 'only showing bones' which was ignored as a clear advantage was required. Those students who did look for an advantage generally stated 'it was clearer' which was insufficient. However, 18% of students did recognise that the image was either more detailed or gave a specific example of tissues that could be seen.

(c) This was well answered particularly with reference to ribs. Many students seem to be familiar with the problem of a punctured lung due to broken ribs. Very few students mentioned it being cheaper.

(d) 30% of students had the depth of understanding of respiration required to achieve any credit for this question. Many referred to the idea of energy being produced which negated the second marking point.

Most answers that achieved a mark were about the need for oxygen in aerobic respiration or the production of carbon dioxide. There were some good responses referencing the location of each: mitochondria and cytoplasm.

(e) This 'extended response' question discriminated well. 57% of students were able to access level 1, and 21% of students spread across levels 2 and 3 by provided there was logical linking. The most common were tar causing breathing problems or

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smoking having something to do with cancer. Some mentioned the reduced oxygen carrying capacity of blood in smokers but did not know what caused it.

There were many vague level 1 answers seen. There did seem to be a lack of understanding and knowledge about the components of cigarettes and consequently how these affect the human body. Although most students answered the question in terms of the dangers of smoking, as opposed to how giving up smoking would benefit an individual, this was acceptable.

Higher

(a) 79% of students correctly identified 'trachea' here, with 'bronchus' the most common incorrect alternative.

(b) Both the scan and the X-ray show clear images so 'clear' was insufficient. The scan shows more detail. Answers in terms of not using X-rays or avoiding problems associated with ionising radiation were also allowed. 29% of students achieved this mark.

(c) 59% of students were able to answer this question correctly.

(d) 18% of students achieved all three marks in this question. Common misconceptions included:

- anaerobic respiration **needs** carbon dioxide / lactic acid
- anaerobic respiration only happens in plants
- confusion between respiration and breathing
- the idea that aerobic respiration **needs** carbon dioxide and anaerobic **needs** lactic acid
- aerobic respiration **produces** oxygen / glucose
- energy is made, created or produced.

(e) 5% of students were able to construct a clearly sequenced, correct account in this 'extended response' question. Much of what was seen was colloquial, e.g. 'smoking rots the lungs', 'tar clogs lungs'.

Smoking is indirectly linked to a considerable range of health problems which students are taught or research for themselves. It is important however that they are aware of the clear-cut examples given in the specification.

93% of students were able to achieve at least one mark, and 32% of students gave level 2 responses.

Q163.

(a) (i) Students still get confused between the dependent and independent variables. The dependent variable depends on what the independent variable is, so is therefore the result. Some students gave 'continuous variable' for their answer, which is also correct.

(ii) Many students struggled to give a conclusion. The stem of the question made clear that the investigation was about the vitamin C content of the juices. Many students simply described the data in the table, in relation to the

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number of drops of DCPIP solution added, and did not add any value. An interpretation of what the number of drops indicated was required. A comparative statement was needed, so saying 'lemon juice contained a lot of vitamin C' was insufficient for this standard demand question. Quite a lot of students misinterpreted the results and thought that apple juice contained the most vitamin C.

(b) (i) Just under half the students correctly calculated the percentage of the recommended daily amount of vitamin C in the serving of grapefruit juice.

(ii) Most students realised that different people would require different amounts of vitamins, with many giving examples of factors that could affect the amount needed. However, some students misinterpreted the meaning of Recommended Daily Amount, and related their answer to the type of fruit used having different amounts of vitamin C, or the tests used to determine the amount of vitamin C in a fruit juice being inaccurate.

Q164.

In this question students were assessed on their ability to evaluate an investigation. They were also assessed on QWC - their ability to use good English, organise information and use appropriate specialist terms. Significant numbers of students lost at least one mark by not observing the QWC criteria.

To attain level 3 (5-6 marks), students needed to include evidence supporting the newspaper's claim, evidence that did not support the claim and to give a reasoned conclusion. They were also required to make an appropriate reference to the presence or absence of polyphenols in the chocolate. A few Foundation Tier students did give Level 3 responses.

Most Foundation Tier students gave Level 1 or 2 responses. Many responses included at least one piece of evidence supporting the claim and one piece of evidence not supporting the claim, with many also attempting to give a conclusion. However, many students only argued their case from one side so were limited to Level 1.

Generally the question was well attempted, but simply copying the text did not gain credit.

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