Mark schemes

Q1.

(a) $C_6H_{12}O_6$

1

(b) carbohydrase

1

(c) beaker

allow water bath

1

(d) so that both solutions could reach 10 °C

1

(e) 10 / ten (minutes)

1

(f) test the mixture with iodine solution every 30 seconds

1

(g) 35 °C

1

(h) enzyme / amylase is denatured
or
enzyme / amylase stops working

allow active site / enzyme has changed shape

*do **not** accept enzyme / amylase has died*

1

(so) starch is not broken down
or
starch is still present

1

[9]

Q2.

(a) less blood flows through **or** less blood flows to the heart (muscle / cells / tissue)

1

less oxygen (reaches the heart muscle)

allow less respiration

allow less energy released

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

1

(b) D

1

(c) B

1

(d) is more likely to get a blockage (with high cholesterol)
or
blockage could be biggest

ignore has the highest blood cholesterol concentration

1

(e) 4 **and** 5.6

1

$\left(\frac{5.6}{4}\right) = 1.4$

allow correct division using either 5.3 or 5.8 (for person D)

1

(f) opens / widens (artery)

allow pushes blockage to the side

1

so (more) blood can flow through

allow (more) oxygen(ated blood) can flow through

1

(g) platelets

1

(h) **Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

3–4

Level 1: Relevant points are made. They are not logically linked. 1–2

1–2

No relevant content

0

Indicative content:

Advantages:

- **only** have to take the tablet once a day
- **only** a tablet so easy to take **or only** a tablet so not painful to take
- (drugs are effective so) less likely to get a blood clot
- drugs are cheap so less cost to NHS **or** drugs are cheap so

(more) people can afford them

- drugs have been used for a long time so must be safe / trusted

Disadvantages:

- patients have to make sure they always have a supply of drugs
- patients could forget to take the drugs (every day)
- patients could still get a blood clot in the first week
- restrictions on lifestyle because patients have to have a blood test every few weeks
- restrictions on lifestyle because patient can't eat certain foods
- patients may get a blood clot if they eat the wrong food
- risks associated with puncturing skin / infection
- patient may have a fear of needles
- higher risk of bleeding / bruising

For **Level 2** students must evaluate, including consideration of, the advantage and disadvantage of anti-clotting drugs.

[14]

Q3.

(a) amino acid(s)

ignore monomers

1

(b) salivary gland

in any order

ignore mouth

pancreas

small intestine

*allow duodenum / ileum do **not** accept large intestine ignore intestine unqualified*

*all three correct for **2** marks two correct for **1** mark*

2

(c) starch / substrate binds to <u>active site</u> (of enzyme)

ignore starch / substrate fits <u>active site</u> (of enzyme)

1

(because) shape of <u>active site</u> and substrate are complementary

allow shape of starch / substrate and <u>active site</u> allow them to fit together

1

a chemical reaction occurs to produce smaller molecules
or
bonds between the (starch) molecules are broken to produce smaller molecules

allow maltose / sugars for smaller molecules

1

(d) any **two** from:

- time before mixing (starch and amylase) solutions

  ignore time unqualified
- volume / 5 cm^3 of starch (solution)
- volume / 1 cm^3 of amylase (solution)
- volume / 1 drop of mixture added to spotting tile
- volume / 2 drops of iodine (solution)

allow amount as an alternative to volume once only

*do **not** accept temperature*

2

(e) to allow the solutions to reach the same temperature as the water
or
to allow both solutions to reach 5 °C

allow so the solutions can equilibrate with the temperature of the water

1

(f) as temperature increases, (amylase / enzyme) activity increases, to 35 °C after which activity decreases

ignore reference to time

1

(g) (iodine is not yellow-brown because) starch is still present **or** starch has not been broken down

allow enzyme for amylase and substrate for starch throughout

1

at 5 °C amylase / starch / molecules have low (kinetic) energy

1

(therefore) there are fewer (enzyme-substrate) collisions

allow fewer enzyme-substrate complexes are formed

1

at 80 °C the amylase has been denatured

*do **not** accept the amylase is killed / has died*

allow the shape of the amylase / active site changes

1

(so) the starch can no longer fit

allow the bonds holding the amylase in its (3D) shape have broken

1

(h) keep temperature constant

1

(but) change named factor **and** test a range of values of named factor

*named factor e.g. pH **or** enzyme concentration **or** substrate concentration **or** inhibitor concentration*

1

[17]

Q4.

(a) cells grow / divide abnormally / uncontrollably

ignore mutation

1

(b) has spread to other parts / organs of the body
or
has spread to the liver / lung
or
has formed a secondary tumour

allow tumour has metastasised

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:

Tiredness

- fewer red blood cells
- so less haemoglobin
- so less oxygen transported around the body

- so less (aerobic) respiration can take place
- so more anaerobic respiration takes place
- less energy released for metabolic processes **or** less energy released so organs cannot function as well
- lactic acid produced (during anaerobic respiration) causes muscle fatigue

Frequent infections
- fewer white blood cells / phagocytes / lymphocytes
- so fewer antibodies produced **or** less phagocytosis
- so fewer pathogens / bacteria / viruses killed

Bleeding
- fewer platelets
- so blood does not clot as easily

For **Level 3**, reference to all three symptoms must be made.

(d) anti-B antibodies in patient / receiver / recipient will bind to type B antigens on person's / donor's red blood cells

1

(so) red blood cells clump together and are wider than capillaries
or
(so) red blood cells clump together and block capillaries

allow (so) red blood cells clump together and capillaries burst

1

(so) cells have reduced supply of oxygen / glucose
or
(so) cells can't respire

ignore references to energy

*if no other mark awarded allow antibodies from patient and antigens from donor are matching / complementary shapes for **1** mark*

1

(e) no antigens (on type O red blood cells)

1

(so) antibodies cannot bind (to the antigens / red blood cells)

allow no clumping (of red blood cells)

1

(f) hepatitis C infection

1

(g) no / less bile reaches the small intestine

ignore less / no bile produced

1

(so) less / no emulsification of fat

allow correct description of

emulsification

*do **not** accept reference to chemical digestion*

1

(so) smaller surface area for lipase to break down fat

1

pH of small intestine is not neutralised / alkaline

allow pH of small intestine is acid / low

1

(so) lipase is not at its optimum pH to break down fat

pH (of small intestine) is not suitable for lipase to break down fat

1

[19]

Q5.

(a) increased (at first)

1

until 4 minutes **or** 50 breaths per minute

1

(then) stayed constant (from 4 minutes **or** at 50 breaths per minute)

1

(b) 175 (beats per minute)

1

(c) 140 (beats per minute)

1

(d) because his rate is lower than the maximum safe rate

allow ecf for incorrect values in question (b) and question (c)

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 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

- heart rate increased
  - to increase blood flowing to muscles / lungs
  - to provide more oxygen (to muscles)
  - to provide more glucose (to muscles)
  - to remove carbon dioxide more quickly (from the muscles / blood)
  - to remove lactic acid more quickly (from the muscles)

- breathing rate increased
  - supplies more oxygen / air to lungs
  - so more oxygen to blood
  - more carbon dioxide removed

- more oxygen to muscles
  - needed for (increased) respiration
  - to release / provide energy
  - for muscle contraction

- anaerobic respiration occurs
  - due to lack of oxygen
  - which causes a build-up of lactic acid
  - oxygen debt
  - muscle fatigue / pain

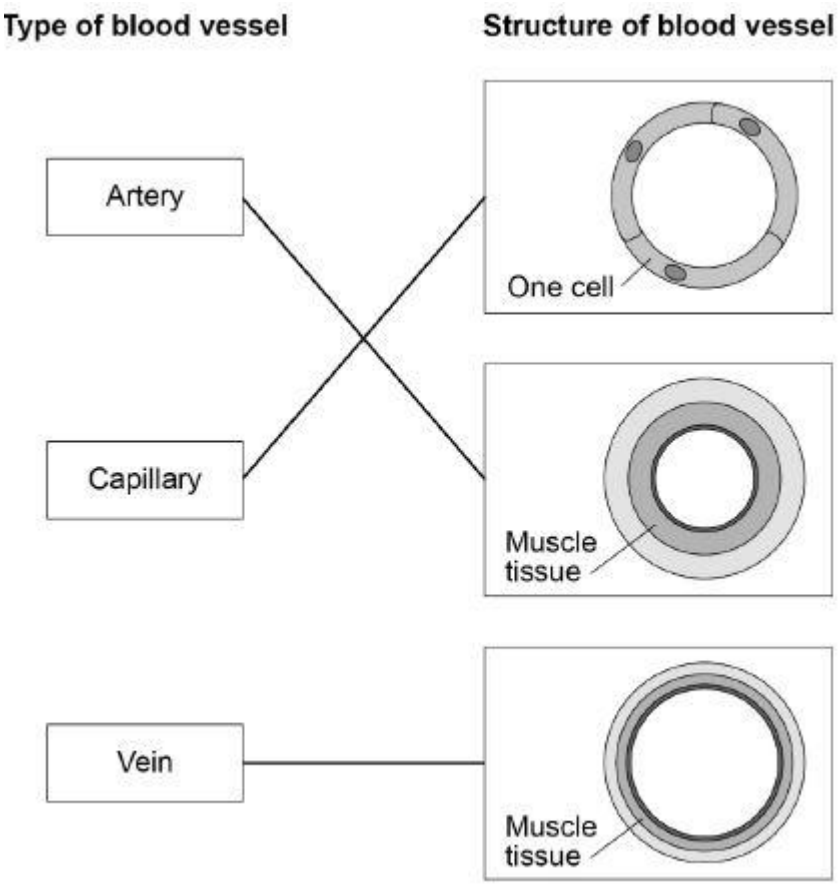
To reach **Level 3**, there must be reference to heart rate, breathing rate and respiration

[12]

Q6.

(a) all lines correct = **2** marks

1 **or** 2 lines correct = **1** mark



additional line from a box on the left negates the credit for that box

2

(b) any **one** from:

- thick(er) (muscle) walls / tissue (1)

  to push blood (all) around the body (1)

  allow to withstand high (blood) pressure

  *do **not** accept to pump blood (all) around the body*

or

- thick(er) elastic walls / tissue (1)

  to maintain / withstand high (blood) pressure **or** to retain / regain shape (1)

or

- narrow lumen (1)

  to maintain high (blood) pressure (1)

2

(c) (A) – white (blood) cell(s)

allow any named white (blood) cell(s)

1

(B) – platelet(s)

1

(d) (no nucleus) more space for haemoglobin / oxygen

allow to carry more oxygen

1

(has haemoglobin) to bind / carry oxygen

ignore carries carbon dioxide

1

(e) plasma

1

(f) platelets

1

(g) any **one** from:

- (continued) bleeding

  allow described

  allow blood does not clot (at cuts)

- (more) bruising

  *allow ecf from answer to question **(f)***

1

[11]

Q7.

(a) movement / spreading out of molecules / particles

allow movement / spreading out of (named)

substances / chemicals / gases / liquids

ignore reference to membranes / cells

1

from (an area of) high(er) concentration to (an area of) low(er) concentration

allow down / with the concentration gradient

ignore along / across the concentration gradient

*do **not** accept movement from / to a concentration gradient*

1

(b) increased carbon dioxide concentration in the air

1

increased number of stomata that are open

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

- (many) alveoli
  - provide a large(r) surface area (**:** volume)
- capillaries are thin
  - **or** alveoli / capillary walls are thin **or** one cell thick
  - **or** capillaries are close to the alveoli
  - which provides short diffusion path (for oxygen / carbon dioxide)
- breathing (mechanism) moves air in and out **or** lungs are ventilated
  - to bring in (fresh) oxygen
  - to remove carbon dioxide
  - to maintain a concentration / diffusion gradient
- large capillary network (around alveoli) **or** good blood supply
  - to remove oxygen(ated blood) quickly
  - to bring carbon dioxide to the lungs quickly
  - to maintain a concentration / diffusion gradient

(d) Osmosis

allow diffusion

1

(e) active transport

1

(because) energy is needed

1

(to move nitrate ions) from a low(er) concentration (in the soil) to a high(er) concentration (in the root / cell)

allow (to move nitrate ions) against / up the concentration gradient

allow (because) there is a lower concentration (of nitrate ions) in the soil ***or*** *(because) there is a higher concentration (of nitrate ions) in the root*

/ cell

ignore reference to amount / number of nitrate ions

ignore along / across the concentration gradient

*do **not** accept if reference to molecules / atoms moving*

1

[14]

Q8.

(a) fatty acids

1

glycerol

1

(b) enzyme binds to the substrate because they are complementary (shapes)

allow enzyme joins to the substrate because they fit together exactly

allow enzyme joins to the substrate because the substrate fits the active site

*ignore reference to specificity do **not** accept same shape*

1

(so) substrate is broken down (into products)

allow (so) substrate splits (into products)

ignore products are formed, unqualified

1

(so) products are released **or** enzyme is not changed

allow enzyme is not used up

*allow reference to activation energy for either marking point 2 **or** marking point 3*

1

(c) each <u>active site</u> has a specific shape (so only fits one type of lipid molecule)

allow each <u>active site</u> is a different shape

*do **not** accept reference to the substrate having an active site*

1

(d) add Benedict's (solution / reagent to the liquid)

1

boil / heat

allow any temperature of 65 °C or

above

1

(if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick) red

1

(e) add iodine solution / reagent (to the liquid)

allow add a drop of iodine

ignore iodine unqualified

1

(if starch is present) it changes colour to blue / black (from yellow / orange / brown)

1

(f) glucose from photosynthesis

*do **not** accept starch made in photosynthesis*

1

(excess) glucose converted to starch

allow (excess) glucose is stored as starch

1

(g) starch (stores) have been converted to glucose

ignore reference to residual glucose from previous photosynthesis

1

(so the glucose can be) used for respiration / (named) metabolic reactions
or (so the glucose can be) used to release energy

*do **not** accept idea of energy being produced / created / made*

1

(because) there is no light to make (new / more) glucose by photosynthesis

1

(h) any **one** from:

- test roots / stems of plants (in the light and dark)

  *do **not** accept reference to changing the independent variable*

  allow test other parts of the plants
- test other species of plant

  allow test other types of plant
- measure the concentrations of glucose **and** starch

  ignore mass / amount
- vary the time in the dark / light
- test variegated leaves

  allow any other valid extension ignore

repeats

1

[17]

Q9.

(a) any **two** from:

ignore genetic factors

- BMI / morphology / obesity level
  *allow mass / weight **and** height*
- smoking habits
- diet
  allow previous drinking habits
- medication
  allow medical conditions
  allow drug use
- family history of liver disease
- fitness levels
  allow level of exercise
- ethnicity
  allow race
- area of UK they live in

2

(b) 2.55 – 1.60 (= 0.95)

allow 1.60 − 2.55 (= −0.95)

allow value for with meals in range 1.60 to 1.65 (for 1.60)

1

$\left(\frac{0.95}{2.55} \times 100 = \right)$

37 (.2549019608…) (%)

allow answer correctly calculated from values in ranges 1.60 to 1.65 and 2.50 to 2.60

allow – 37(.2549019608...)(%)

1

(c) 12 × 2 × 7 = 168 (g/week)

1

1.8

allow in range 1.8-1.9

*allow correct reading from a calculation that omits the 2 **or** the 7*

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

1

(d) any **two** from:

- consuming alcohol increases the RR (with / without meals) **and** supporting data

  allow risk for RR throughout

  allow data in terms of number of glasses of wine

  allow increasing alcohol consumption increases the RR at an increasing rate

- consuming less than 50 g/week of alcohol with meals does not increase the RR

  allow any value between 35 and 60 g / week

- even (small amounts of alcohol at) 25 g / week increases the RR if not with meals

2

(e) any **two** from:

- large number in survey
- long term / 15 year survey

  allow 800 000 in survey

  if neither mark awarded allow large study
- well controlled

  allow many controls

2

(f) any **one** from:

- people underestimate / overestimate alcohol consumption

  allow people lie about alcohol consumption
  ***or** people lie about other named control variables*
- people may change (lifestyle / drinking) habits over time
- some people may drink all their weekly alcohol at once

  ignore survey only tested women

1

(g) **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

Responses may refer to either total or partial liver failure

- no bile made (in the liver)

- fats / lipids are not emulsified
- surface area of fats / lipids not increased
- pH of small intestine will not be alkaline / neutralised
- enzymes (in small intestine) will not work effectively **or** (named) food not digested / absorbed
- so may lose weight

- lactic acid not broken down / oxidised
  - accumulation of lactic acid in blood / body
  - lactic acid is toxic **or** body will be poisoned
  - oxygen debt higher / prolonged
  - so muscle pain / fatigue

- proteins / amino acids will not be broken down (in liver)
  - (amino acids) not deaminated
  - amino acids not made into urea **or** will not form ammonia
  - (however) any ammonia formed is toxic
  - so accumulation of amino acids in blood / body

- liver does not break down / remove other toxins (like alcohol)
  - toxins accumulate in blood / body
  - body will be poisoned
  - so pain **or** jaundice **or** swollen liver **or** portal hypertension occurs

- glycogen stores will not be formed
  - cannot control blood glucose
  - so hyperglycaemia / hypoglycaemia / diabetes / coma may occur

[15]

Q10.

(a) rice

1

(b) 25 (%)

allow an answer between 23 and 27 (%)
ignore ¼ / 0.25

1

(c) (beans) contain all (four) food groups

allow converse for chicken
*allow chicken contains no / less carbohydrate **or** beans contain carbohydrate*
allow beans contain more nutrients
ignore references to water / fat / protein

1

(d) amylase

1

(e) Benedict's reagent

1

(f) (brick) red / green / yellow / orange / brown

1

(g) C

1

(h) small intestine

allow ileum

ignore intestine unqualified

*do **not** accept large intestine / duodenum*

1

(i) active transport

1

osmosis

1

[10]

Q11.

(a) circulatory / circulation (system)

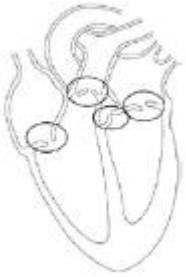
allow cardiovascular (system)

ignore blood (system)

ignore cardiorespiratory system

1

(b) any valve ringed



allow more than one valve separately ringed

1

(c) prevent backflow (of blood)

allow correct description of backflow

or

ensure one-way flow

allow maintains (correct) direction of blood

1

(d) vein

allow correctly named veins

1

(e) any **two** from:

(referring to mechanical valves)

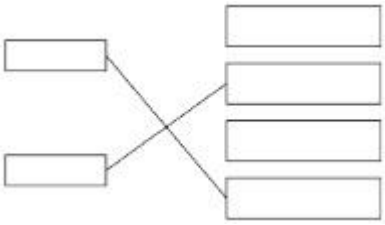
- long lasting
  or
  durable
  or
  does not break / tear
  or
  does not wear out
  allow reliable
  allow less likely to need a replacement (after 5 years)
  ignore no need for a replacement
- do not need to go into hospital / surgery again
- no ethical issues (surrounding use of living / animal tissue)
- no risk of rejection
- no need for anti-rejection / immunosuppressant drugs
- no risk of transmission of disease

2

(f) no need to take anti-clotting medication
allow can't hear a pig valve
allow can get a better fit with a pig valve
allow less leaky with a pig valve
allow less likely to get a heart attack / stroke
ignore will not get blood clots (around the valve)

1

(g)



an additional line from a medical condition negates the mark

2

[9]

Q12.

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

3–4

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

1–2

No relevant content

0

Indicative content:

- backflow can occur **or** some blood flows backwards
- less blood leaves the heart **or** less blood is pumped around the body **or** some blood stays in the heart (instead of being pumped out) **or** reduced blood pressure **or** reduced flow rate
- less oxygen supplied to muscles / cells
- (so) less aerobic respiration
- (so) less energy released
- (so) less (efficient) muscle contraction
- anaerobic respiration takes place
- less (efficient) removal of lactic acid **or** lactic acid builds up **or** oxygen debt occurs
- (lactic acid building up) causes muscle fatigue
- less (efficient) removal of carbon dioxide (from blood)

a **level 2** response should refer to both respiration **and** the effects on exercise

(b)

ignore raw numbers from the table

(deaths mechanical valve =) 6% / 6.31136%

allow correctly rounded value

1

(deaths biological valve =) 10% / 10.14823%

allow correctly rounded value

1

(therefore a) higher proportion / percentage of patients die with biological valve

or

patients are more likely to die with biological valve

*do **not** accept more patients die with a biological valve*

*allow **2** marks for ratio mechanical : biological = 1:1.6 **or** 1:1.7 **or** correctly calculated value*

*allow **3** marks for deaths with biological valves = 4% / 3.83687% higher **or** correctly rounded value*

or

patients are 1.6 / 1.7 times more likely to die with biological valves

*if **no** other marks awarded, allow for **1** mark*

*chance of death after a valve replacement is 8% / 7.77247% **or** correctly rounded value*

1

(c) platelets

allow thrombocytes

1

(d) **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:

mechanical valves
- longer lasting **or** more durable **or** don't wear out as easily **or** less likely to need replacing (within 6 years)
- blood clots (on the brain) are more likely (after surgery)
- patient has to take anti-clotting medication (for the rest of their lives)
- if medication not taken (correctly), clots can lead to blood clots on brain / heart attack
- medication can lead to excessive bleeding (after injury)
- some patients say they can hear the valves opening and closing
- survival rate at 5 years is slightly higher for mechanical valve
- lower percentage of deaths due to heart-related problems

biological valves
- no additional medication required
- ethical issues surrounding use of animal tissue
- valve may harden
- more likely to need further operation **or** another new valve
- more likely to be rejected
- more likely to need (immuno-suppressant) medication

both valves
- both are readily available
- little wait time

a **level 2** response should contain comparisons of both valves **and** some reference to own knowledge

[14]

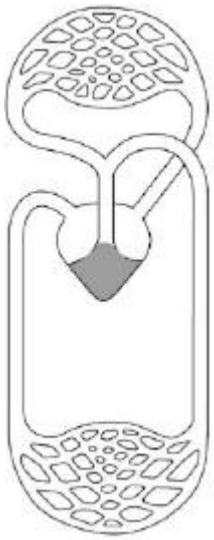
Q13.

(a) blood is pumped to the lungs by one / right side of the heart
and
blood is pumped to the body by the other / left side of the heart

allow blood enters the heart twice for every (one) circuit around the body

1

(b) ventricle correctly identified as any part of grey area below:



1

(c) oxygenated and deoxygenated blood mixes

allow some deoxygenated blood is sent to the body / tissues / cells

1

(so) less oxygen reaches the body / tissues / cells

allow named tissues / organs

1

(d) concentration gradient (of oxygen) is shallow(er) / less steep

1

(therefore) less oxygen diffuses into blood / cells / gills

1

allow idea that concentration gradient is negative (i.e. out of axolotl) (1)
so oxygen diffuses out of axolotl's blood / cells / gills (1)

(so) less (aerobic) respiration occurs so less energy is released / available
or
(so more) anaerobic respiration occurs so less energy is released / available

*do **not** accept no respiration occurs*

*do **not** accept energy production*

1

(so) less metabolism

ignore reduced living processes unqualified

*allow reduction of building larger molecules **or** movement / muscle*

*contraction **or** keeping warm **or** urea formation **or** chemical reactions*

or

(so when) anaerobic respiration occurs, lactic acid is produced (and is toxic)

1

(e) stem (cells)

*do **not** accept embryonic stem cell*

1

(f) any **one** from:

- paralysis
- diabetes

allow other examples such as Parkinson's / heart disease / stroke / cystic fibrosis / cancer / burns

*do **not** accept infectious diseases*

1

(g) any **one** from:

- easy to breed

allow reproduce quickly

- easy / cheap to keep / rear (as are small)
- don't take up much space

allow reference to not being dangerous (to the scientist)
allow they are not endangered
allow removal of gill will not kill the axolotl

1

(h) any **one** from:

- it's not a mammal **or** it is an amphibian
- regeneration in gills may be different to that in other organs
- metabolism / body processes are too different to humans

allow humans do not have gills

*allow it's an endangered species **or** species need to be protected from extinction*

*ignore reference to genetic differences **or** ethics*

1

[12]

Q14.

(a) any **one** from:

- (chemical which) catalyses / speeds up reactions in living organisms

allow biological catalyst
allow reduces activation energy (of reactions) in living organisms

- (chemical which) catalyses / speeds up biological reactions

1

idea of specificity
or
(is a) protein
allow made of amino acids

1

(b) salivary gland
ignore mouth
ignore liver

1

small intestine
allow duodenum / ileum
ignore intestine unqualified
*do **not** accept large intestine*

1

(c) reduced / no enzyme production / release (from pancreas)
allow named example of enzymes
ignore reference to hormones

1

food is not broken down fully **or** food is not digested fully
allow no food is broken down / digested
allow example

1

plus any **one** of the following routes for max **2** marks:
mark as pairs

less glucose / sugar absorbed **or** less glucose / sugar passes into the blood(stream)

1

(so) less glucose available for respiration so more (body / stored) fat used up in metabolism / respiration

1

or

fewer amino acids absorbed **or** fewer amino acids pass into the blood(stream) (1)

(so) fewer amino acids are available for making new protein for repair / replacement (1)

or

fewer fatty acids absorbed **or** fewer fatty acids pass into the blood(stream) (1)
ignore glycerol

(so) fewer fatty acids available so less fat is stored in the body (1)
ignore glycerol

or

chemotherapy / radiotherapy causes nausea / loss of appetite (1)

(so) less intake of food (1)

(d) (cancer) cells cannot divide
or
(cancer) cells are destroyed / killed

*do **not** accept reference to the drug killing (cancer) cells*

1

(so) tumour doesn't grow / get bigger **or** tumour less likely to spread **or** tumour less likely to form secondary tumours

allow cancer cells less likely to spread / metastasise

1

(because) enzymes **A** and **B** are not working / active / effective / present
or
(because) enzymes **A** and **B** are inhibited

allow reference to both enzymes

ignore enzymes unqualified

1

(e) (functional) enzyme **B** would still be made / present

allow enzyme B is not inhibited

1

(therefore cancer) cells would still divide uncontrollably
or
(therefore cancer) cells would not be destroyed
or
(therefore) the tumour will (continue to) grow / get bigger / spread **or** the tumour will form secondary tumours

1

(f)

ignore to make it more valid unqualified

any **two** from:

- to avoid the patients thinking they feel better with the drug
  or
  to take into account a psychological effect
- as a control / comparison

  ignore to provide an independent variable

- to avoid bias(ed results)

2

(g) testing on volunteers with the disease

1

(h) monoclonal antibody is attached to radioactive substance / toxin / drug / chemical

1

monoclonal antibody will (only) attach to / target (antigen on) cancer cells / tumour

1

(so) radioactive substance / toxin / drug / chemical will (bind to cancer cells and) stop them growing / dividing

allow radioactive substance / toxin / drug / chemical will kill / destroy the cancer cells

OR

monoclonal antibody interrupts the cell cycle ***or*** *monoclonal antibody aids immune response (1)*

monoclonal antibody will (only) target cancer cells / tumour (1)

(so) action of monoclonal antibody stops cancer cells growing / dividing ***or*** *(so) action of monoclonal antibodies helps immune system kill / destroy cancer cells (1)*

1

[19]

Q15.

(a) (A) stomach

1

(B) small intestine

allow ileum
ignore intestine unqualified

1

(C) liver

1

(b) soluble

1

catalyse

1

denatured

1

this order only

(c) amino acids

1

(d) any **one** from:

- for growth

  allow for enzymes / hormones / antibodies
- for repair / replacement (of cells / tissues / organs)

allow to strengthen bones
ignore for energy

1

(e) stomach

1

(f) **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

- grinding up the food
- add Biuret reagent (allow $CuSO_4$ and NaOH) to food (sample)
- protein turns solution (from blue) to purple / lilac
- wear goggles to protect eyes
- clean up spills immediately
- Biuret / NaOH is an irritant / corrosive / poisonous

for **level 2** a reference to Biuret, a positive result and reason for a safety precaution is required

(g) fat

1

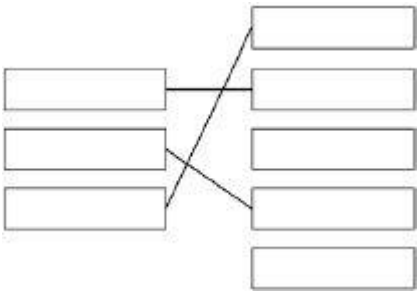
(h) type 2 diabetes

1

[15]

Q16.

(a)



additional line from a blood component negates the mark for that component

1
1
1

(b) C

1

(c) (vessel) B

thick walls **or** thick muscle / elastic tissue

*do **not** accept ref to 'cell walls'*

1

or

lumen is small / narrow

allow description of 'lumen'

1

(d) 95

1

(e) (because coronary) arteries / they are narrower

allow (because the coronary) arteries are blocked / clogged (with fat)

1

(f) 250 × 60 (= 15 000)

or

15 000

allow 0.25 × 60

1

15

$$\text{allow } \frac{\text{answer to marking point 1}}{1000}$$

an incorrect conversion to dm^3 in calculation does not negate marking point 1

1

*an answer of 15 scores **2** marks*

(g) any **two** from:

- no need to stay as long in hospital (after procedure) **or** can go home sooner / same day

  allow only need to stay 2–3 hours in hospital (after procedure)
  allow less scarring
  allow less chance of infection
  allow only a small cut needed

- not as / less invasive **or** no need for a major operation **or** no need for general anaesthetic
- shorter recovery time **or** can get back to normal lifestyle quicker **or** less time needed off work

  allow only 7 days recovery

- lower risk of a heart attack (during procedure)

  ignore reference to cost
  ignore idea that it takes less time overall

2

(h) lower chance of failure (within one year)

allow only a 5% chance of failure

1

only need one operation to treat multiple blockages **or** can treat multiple blockages at one time

ignore ref to anaesthetic or CABG being a long-term treatment

1

[14]

Q17.

(a) (for calcium)

$$\frac{500}{605} \times 1000 = 826.446281\,(cm^3)$$

allow any correct rounding to minimum 3 significant figures
allow alternative route with correct rounding

1

(for vitamin B-12)

$$\frac{500}{4.5} \times 2.4 = 266.67\,(cm^3)$$

allow alternative route with correct rounding

1

560 / 559.8 / 559.78 / 559 (cm^3)

allow only correct answer based on values given for vitamin B-12 and calcium

1

*an answer of 560 / 559.8 / 559.78 / 559 (cm^3) scores **3** marks*

an incorrect answer for one step does not prevent allocation of marks for subsequent steps

(b) **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

- Biuret reagent (allow $CuSO_4$ and NaOH) tests for protein
- add Biuret reagent to milk
- solution will turn (from blue) to lilac if positive

- iodine solution tests for starch (ignore iodine unqualified)
- add iodine solution to milk
- solution will turn (from orange / brown) to blue / black if positive

- Benedict's reagent tests for sugars
- add Benedict's reagent to milk and boil / heat (allow any temperature above 60 °C)
- solution will turn (from blue) to (brick) red / brown / orange / yellow / green if positive

for **level 2**, reference to all three food tests is required

(c) lipase breaks down fat into fatty acids (and glycerol)

*do **not** accept if 'glycerol' is contradicted*

1

(and) fatty acids lower the pH

1

(and when) fatty acids cause the pH to be below 10 (the indicator becomes colourless)

1

(d) observation of colour change is subjective / based on opinion

ignore human error unqualified
ignore experimental error or examples of this

1

(e) bile emulsifies fats

allow a correct description of emulsification (i.e. breaks fat from large droplets into smaller droplets)

*do **not** accept a description of chemical breakdown*

1

creates a larger surface area (of fat)

1

(so) lipase can break down fat (to produce fatty acids) more quickly / effectively

allow fatty acids produced by action of lipase more quickly

1

[16]

Q18.

(a) (**A**) bronchus

allow bronchi
allow bronchiole

1

(**B**) trachea

allow windpipe

1

(**C**) alveolus

allow alveoli
ignore air sac

1

(b) circulatory system

1

(c) **Q**

1

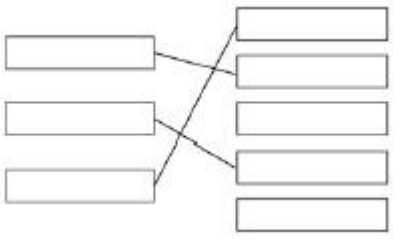
(d) guard cell

1

(e) a group of cells with a similar structure / function

1

(f)



1 *mark for each correct line*
extra line from a tissue negates the mark for that tissue

3

[10]

Q19.

(a) vena cava

1

(b) 0.5 mm = 0.05 cm

1

time = $\frac{10.00 - 0.05}{0.4}$

allow alternative correct substitution

1

24.875

1

25 (s)

*an answer of 25 (s) scores **4** marks*

*allow 24 for **3** marks (no conversion of mm to cm)*

*allow 23.8 / 23.75 for **2** marks (no conversion of mm to cm and incorrect sf)*

1

(c) (blood) travels through (the) pulmonary vein

1

(blood) enters left atrium

1

(blood) enters (the) left ventricle

1

(blood) leaves the heart via / through (the) aorta

allow blood travels through arterioles

allow blood (travels round the body and) reaches the cells / tissues via / in capillaries

1

ignore ref to valves / systole / diastole throughout

(d) **Level 3 (5-6 marks):**
Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

Level 2 (3-4 marks):
Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

Level 1 (1-2 marks):
Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

No relevant content (0 marks)

Indicative content

S = structural F = functional

- (S) both have a large surface area
- (S) villi have many microvilli
- (S) alveolar walls are not flat / are folded

- (F) to maximise diffusion (of gases) / absorption of (food) molecules

- (S) both have many capillaries / good blood supply / capillaries near the surface
- (F) to maintain concentration / diffusion gradient

- (S) both have thin walls / walls that are one cell thick / one cell thick surface
- (F) to provide a short diffusion distance (for molecules to travel)

- (S) villi have many mitochondria
- (F) to provide energy for active transport (of food molecules)

- (S) cells of the villi have microvilli / more projections

- (F) to further increase the surface area / increase the number of proteins in the membrane / to allow more active transport to take place

[15]

Q20.

(a) salivary glands and pancreas

1

(b) starch / substrate fits into active site (of enzyme)

1

shape of active site is unique / complementary to substrate

allow converse

or

substrate is specific to active site / enzyme

allow enzyme has a high specificity for substrate

1

bonds (within starch / substrate

or

between sugar molecules) are broken

1

(c) converted to new carbohydrates / glycogen / named organic compound (e.g. protein / fat)

1

(d) to allow (the starch and amylase / solutions) to equilibrate (to the temperature of the water bath)

or

to get the starch and amylase / solutions to the same temperature / 20 °C

or

to get the starch and amylase / solutions to the (same) temperature of the water bath

1

(e) **40 °C**

all wells contain a symbol

and

must contain at least two crossed (×) wells at the end

allow final three wells crossed

(×)

1

60 °C

all wells contain a symbol

and

must have fewer crossed (×) wells at the end than at 40 °C

allow all wells ticked (✓)

*for either mp do **not** allow a crossed well followed by a ticked well*

1

(f) more accurate

allow (so) closer to (the) true value

1

(because) it is a quantitative measure

allow (it's) an actual value as opposed to an opinion

or

less / not subjective

allow colour is only qualitative

1

(g) 0.07 (%)

1

(h) starch is broken down less quickly (at 20 °C)

allow converse

1

because, at 20 °C, substrates / enzymes / molecules have less (kinetic) energy

1

(i) 1.08 (arbitrary units)

1

at 80 °C, enzyme / amylase has denatured

allow description of denaturation

*do **not** allow enzyme is killed*

1

so starch is not broken down (at all)

allow the concentration of starch is still 0.5%

1

[16]

Q21.

(a) ventricle

1

(b) lungs

1

(c) valve circled on heart

1

(d) no fatty deposit

1

healthy artery is wider / bigger hole / has more blood flow

1

(e) statins

1

stent

1

(f) any **two** from:
- smoking
- high-fat diet
- lack of exercise

allow:
- *overweight / obese*
- *having high blood pressure*
- *having high cholesterol*

2

(g) 8 (%)

1

(h) more males have coronary heart disease than females

1

[11]

Q22.

(a) to show the experiment was more repeatable

1

(b) (circle) 0.0 at 20 °C

1

(c) ignored it / did not use it

ignore repeated it

1

(d) increases the rate of reaction up to 30 °C

1

(e) 60 °C

1

(f) do the experiment at 30 °C, 35 °C and 40 °C

1

(g) **Level 2 (3–4 marks):**
A detailed and coherent plan covering all the major steps is provided. The method is set out logically taking into account control variable and appropriate measurements. The plan could be repeated by another person to determine the effect of pH on breakdown of starch by amylase.

Level 1 (1–2 marks):
Simple statements relating to relevant apparatus or steps are made but they may not be in a logical order. The plan would not allow another person to determine the effect of pH on breakdown of starch by amylase.

0 marks:

No relevant content.

Indicative content

- range of at least 3 pH values / use of buffer solutions
- control variables / keep amount or concentration of starch and amylase the same
- keep temperature the same using water bath / electric heater
- use iodine test to make qualitative observations
- observe colour changes at different temperatures
- do repeats at each pH

4

[10]

Q23.

(a) 300

1

(b) suitable scale on *y*-axis

1

label *y*-axis

1

4 bars drawn correctly

*allow **1** mark for 3 correct bars*

2

(c) increases from 50 to 500

1

then decreases from 500 to 0

1

(d) carbohydrates broken down / digested into sugars

1

broken down by carbohydrase or amylase

1

(e) absorption of glucose

1

into blood

1

by active transport

allow diffusion

1

[12]

Q24.

Level 3 (5–6 marks):
A detailed and coherent explanation is provided with most of the relevant content, which demonstrates a comprehensive understanding of the human

circulatory system . The response makes logical links between content points.

Level 2 (3–4 marks):
The response is mostly relevant and with some logical explanation. Gives a broad understanding of the human circulatory system. The response makes some logical links between the content points.

Level 1 (1–2 marks):
Simple descriptions are made of the roles of some of the following: heart function, gas exchange, named blood vessels, named blood cells. The response demonstrates limited logical linking of points.

0 marks:
No relevant content.

Indicative content

- dual / double circulatory system which means that it has higher blood pressure and a greater flow of blood to the tissues
- heart made of specialised (cardiac) muscle cells which have long protein filaments that can slide past each other to shorten the cell to bring about contraction for pumping blood
- heart pumps blood to lungs in pulmonary artery so that oxygen can diffuse into blood from air in alveoli
- blood returns to heart via pulmonary vein where muscles pump blood to the body via aorta
- oxygen carried by specialised cells / RBCs which contain haemoglobin to bind oxygen and have no nucleus so there is more space available to carry oxygen
- arteries carry oxygenated blood to tissues where capillaries deliver oxygen to cells for respiration and energy release
- thin walls allow for easy diffusion to cells
- large surface area of capillaries to maximise exchange
- waste products removed eg CO_2 diffuse from cells into the blood plasma
- blood goes back to the heart in veins which have valves to prevent backflow
- cardiac output can vary according to demand / is affected by adrenaline

accept annotated diagrams

[6]

Q25.

(a) (i) large intestine = **E**

1

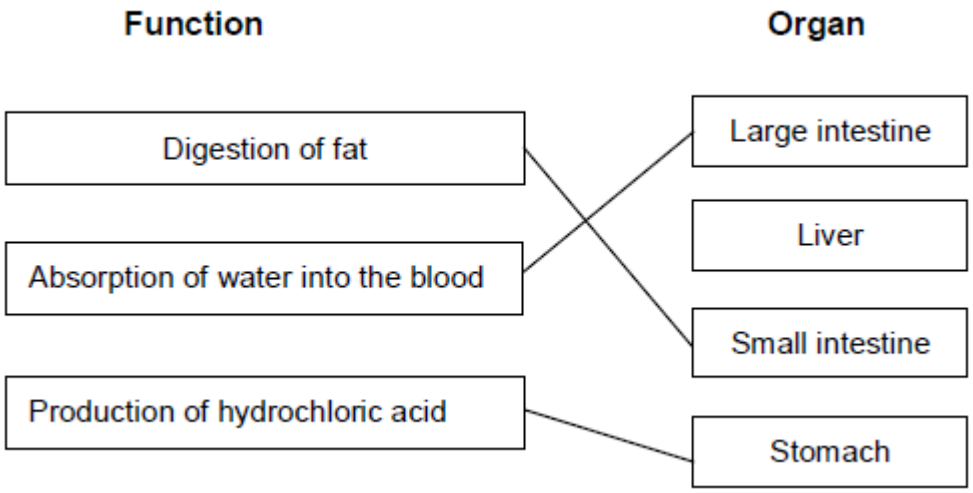
small intestine = **D**

1

stomach = **B**

1

(ii)



extra lines cancel

3

(b) The concentration in the blood is lower.

1

[7]

Q26.

(a) a catalyst / speeds up a reaction

ignore it is not used up

1

it is a protein **or** it is specific / described **or** it has an active site

allow it only acts on one molecule

1

(b) cytoplasm

1

(c) **Advantage:**

any **one** from:
- heat would denature proteins in milk
- heat alters texture or flavour of milk
- catalase / enzyme is specific **or** only affects hydrogen peroxide
- less energy / fuel / lower temperature used so less expensive **or** less pollution

1

Disadvantage:

any **one** from:
- (some pathogens may survive) causing illness
- catalase / enzyme left in milk **or** may cause allergies **or** may alter taste

1

[5]

Q27.

(a) (i) any **one** from:
- glucose
- oxygen
- carbon dioxide
- urea
- water

allow hormones

allow named example of a product of digestion

1

(ii) (cardiac) muscle

allow muscular

1

(b) (i) **B**

1

(ii) **D** atrium / atria

ignore references to left or right

1

E ventricle(s)

ignore references to left or right

1

(c) (i) a vein

1

(ii) an artery

1

(iii) keeps artery open / wider

allow ecf from part cii

1

(so) blood / oxygen can pass through (to the heart muscle)

1

[9]

Q28.

(a) (i) doesn't have valves

allow veins have valves

1

has a thicker wall **or** thicker layer of muscle

allow has a smaller lumen

ignore references to elastic (in walls)

1

(ii) any **two** from:
- (artery has) more oxygen
- (artery has) more glucose

allow (artery has) more amino acids / fatty acids

- (artery has) less carbon dioxide
- (artery has) less lactic acid

ignore urea

ignore reference to pressure

accept converse for veins if veins is clearly stated

2

(b) any **two** from:

- no rejection

  allow no tissue matching required
- abundant supply
- low risk of infection

  allow named example ie HIV, CJD
- longer shelf life

  allow less space needed for storage

  ignore side effects

2

[6]