

Mark schemes

| | | |
|----------|---|-------------|
| 1 | (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 | |
| | <i>allow:</i> | |
| | • <i>overweight / obese</i> | |
| | • <i>having high blood pressure</i> | |
| | • <i>having high cholesterol</i> | 2 |
| | (g) 8 (%) | 1 |
| | (h) more males have coronary heart disease than females | 1 |
| | | [11] |
| 2 | (a) to show the experiment was more repeatable | 1 |
| | (b) (circle) 0.0 at 20 °C | 1 |
| | (c) ignored it / did not use it | |
| | <i>ignore repeated it</i> | 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]**3**

- (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]

4

(a) **A**

1

(b) **D**

1

(c) use the same type of plant
or
give equal amount of water to each plant

ignore size of pot

1

(d) (advantage) more minerals

1

(disadvantage) cost / not free

1

[5]

5

(a) active transport

1

(b) by transpiration stream / pull

1

in xylem

1

(c) any **three** in the correct order from:

- mount epidermis on a slide
- count stomata in one area
- repeat in four more areas
- repeat method on other surface of leaf
- calculate mean

allow nail varnish film

3

(d) 1

allow numbers written out in a line with middle number circled

1

(e) $(44 + 41 + 40 + 42 + 39) / 5 = 41.2$

1

41

allow 41 with no working shown for 2 marks

1

allow 41.2 for 1 mark

- (f) less water lost 1
- so it does not wilt 1
- [11]

6

- (a) to kill virus
or
to prevent virus spreading 1
- (b) take (stem) cells from meristem
or
tissue culture
allow take cuttings 1
- (c) use Benedict's solution 1
- glucoses turns solution blue to orange 1

- (d) **Level 2 (3–4 marks):**
A detailed and coherent explanation is provided. The student makes logical links between clearly identified, relevant points that explain why plants with TMV have stunted growth.

Level 1 (1–2 marks):

Simple statements are made, but not precisely. The logic is unclear.

0 marks:

No relevant content.

Indicative content

- less photosynthesis because of lack of chlorophyll
- therefore less glucose made
so
- less energy released for growth
- because glucose is needed for respiration
and / or
- therefore less amino acids / proteins / cellulose for growth
- because glucose is needed for making amino acids / proteins / cellulose

4
[8]

7

- (a) stomach and pancreas correctly labelled 1
- (b) bacteria not killed (by stomach acid / HCl) and so they damage mucus lining 1

so acid / HCl damages stomach tissue / causes an ulcer

allow bacteria infect stomach tissue

1

(c) if the cancer is malignant

1

(cancer) cells can spread to other organs

1

via the blood forming a secondary tumour

do not award marking points 2 or 3 without marking point 1

1

(d) add Biuret reagent to food sample

allow sodium / potassium hydroxide (solution) + copper sulfate(solution)

1

mauve / purple colour shows protein present

1

(e) damaged villi reduce surface area for absorption (of food molecules)

1

(therefore) fewer amino acids and glucose absorbed

1

with less glucose transfer of energy from respiration is reduced

1

and fewer amino acids available to build new proteins

1

[12]

8

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 CO₂ 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]

9

(a) tissue → organ → organ system

one right for 1 mark

three right for 2 marks

2

(b) **Epithelial tissue** → covers the outside and the inside of the stomach

more than one line from a tissue = no mark

1

Glandular tissue → produces digestive juices

1

Muscular tissue → allows food to be churned around the stomach

1

(c) (i) light

ignore dark

1

(ii) moving (to the dark)

1

(iii) any **two** from:

- use more woodlice
- repeat the experiment
- run for a longer time

2

[9]**10**

(a) 55%

*2 marks for correct answer alone**accept 54 – 56**5.5 / 10 × 100 alone gains 1 mark*

2

(b) any **three** from:

- amino acids
- antibodies
- antitoxins
- carbon dioxide
- cholesterol
- enzymes
- fatty acid
- glucose
- glycerol
- hormones / named hormones
- ions / named ions
- proteins
- urea
- vitamins
- water.

*ignore blood cells and platelets**ignore oxygen**max 1 named example of each for ions and hormones**allow minerals*

3

- (c) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

There is a description of pathogens with errors or roles confused.

or

the immune response with errors or roles confused.

Level 2 (3 – 4 marks)

There is a description of pathogens **and** the immune response with some errors or confusion

or

a clear description of either pathogens **or** the immune response with few errors or little confusion.

Level 3 (5 – 6 marks)

There is a good description of pathogens **and** the immune response with very few errors or omissions.

Examples of biology points made in the response:

- bacteria and viruses are pathogens
credit any ref to bacteria and viruses
- they reproduce rapidly inside the body
- bacteria may produce poisons / toxins (that make us feel ill)
- viruses live (and reproduce) inside cells (causing damage).

white blood cells help to defend against pathogens by:

- ingesting pathogens / bacteria / (cells containing) viruses
credit engulf / digest / phagocytosis
- to destroy (particular) pathogen / bacteria / viruses
- producing antibodies
- to destroy particular / specific pathogens
- producing antitoxins
- to counteract toxins (released by pathogens)
credit memory cells / correct description
- this leads to immunity from that pathogen.

6
[11]

| | | |
|-----------|--|-------------|
| 11 | (a) (i) 5.0 | 1 |
| | (5 × 0.8) or 4 <i>allow ecf from distance</i> | 1 |
| | 0.4 <i>allow ecf from 10-min volume</i> | 1 |
| | (ii) increased (rate of uptake) | 1 |
| | more transpiration / evaporation | 1 |
| | (b) correct scales <i>allow reversed axes</i> | 1 |
| | correctly labelled axes with units | 1 |
| | correct points <i>one plot error = max 1 mark</i> | 2 |
| | curved line of best fit <i>allow correct straight line</i> | 1 |
| | (c) leaves <u>wilt</u> | 1 |
| | because plants lose too much water (by evaporation) | 1 |
| | through the <u>stomata</u> or because cells become <u>plasmolysed</u> or <u>stomata</u> close controlled by <u>guard cells</u> to prevent <u>wilting</u> | 1 |
| | | [13] |

12

- (a) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1–2 marks)

The method described is weak and could not be used to collect valid results, however does show some understanding of the sequence of an investigation.

Level 2 (3–4 marks)

The method described could be followed and would enable some valid results to be collected, but lacks detail.

Level 3 (5–6 marks)

The method described could be easily followed and would enable valid results to be collected.

Examples of the points made in the response:

- bean seedlings of same age
- cut material from same part of each organ (for repeats) e.g. top 1 cm of stem / a whole cotyledon / seed
- equal mass of each organ
accept weight for mass
- grind / homogenise
- in equal amounts of water / buffer
- equal volumes of hydrogen peroxide solution
- equal concentrations of hydrogen peroxide solution
- same temperature
- temperature maintained in water bath
- quantitative measure of gas production eg height of foam in mm / collect gas in graduated syringe in cm³
- for same time period
- repetitions (3+ times)
- calculate mean for each.

(b) (i) correct answer: 40

1 mark for 45 as the anomalous result has been included in the calculation

or

1 mark for $\frac{(38 + 41 + 42 + 39)}{4}$

or $\frac{160}{4}$

2

(ii) vertical axis correctly labelled:
'Enzyme activity in arbitrary units'

allow ecf from (b)(i)

1

points plotted correctly ± 1 mm

deduct 1 mark for each incorrect plot

2

suitable line of best fit

not feathery, not point to point

1

(iii) 6.0 / 6

allow ± 0.1

if 6.0 not given, allow correct for candidate's graph ± 0.1

1

(iv) in range 0 to 14 units

allow correct for candidate's graph

1

(v) enzyme denatured / enzyme (active site) shape changed

allow substrate no longer fits (active site)

ignore reference to temperature

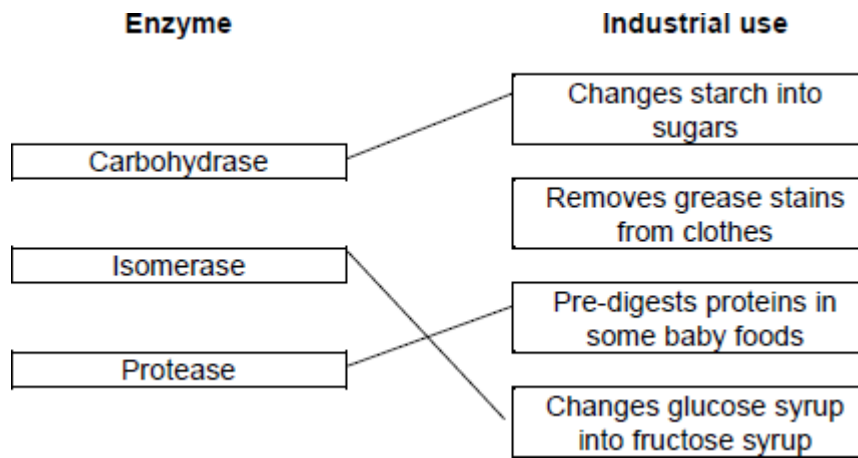
do not allow enzyme dies

1

[15]

- 13** (a) (i) 64 1
- (ii) 36
allow e.c.f from (i) i.e. 100 – answer given in (a)(i) 1
- (iii) any **one** from:
 - only considers 16-year-olds
ignore lack of evidence
allow does not refer to all ages
 - only about some / 5 countries
allow does not refer to all countries. 1
- (b) the more exercise done the healthier a person is
allow the more exercise done the higher the health rating
allow the less exercise done the lower the health rating 1
- (c) having a high cholesterol level 1
- (d) (i) antibodies 1
- (ii) antibiotics 1
- [7]**
- 14** (a) (i) a catalyst 1
- (ii) protein 1
- (iii) salivary glands 1

(b)



extra lines from any enzyme cancels that mark

3

[6]

15

(a)

| Structure | Organ | Organ system | Tissue |
|--|-------|--------------|--------|
| Stomach | ✓ | | |
| Cells lining the stomach | | | ✓ |
| Mouth, oesophagus, stomach, liver, pancreas, small and large intestine | | ✓ | |

all 3 correct = 2 marks
 2 correct = 1 mark
 1 or 0 correct = 0 marks

2

(b) (i) diffusion

allow phonetic spelling

1

(ii) glucose

1

(iii) mitochondria

1

[5]

16

(a) (i) glycerol

1

(ii) pancreas / small intestine*accept duodenum / ileum**ignore intestine unqualified*

1

(b) any **two** from:

- type of milk
- volume / amount of milk
- vol. bile equals vol. water
- volume of lipase
- concentration of lipase
- temperature

*ignore time interval**ignore solution unqualified**do **not** allow pH**ignore starting pH**ignore volume / amount of bile / water**ignore concentration of bile**accept amount of lipase if neither volume nor concentration given*

2

(c) (i) fatty acid (production)

1

(ii) faster reaction / digestion (with bile)**or**pH decreases faster (with bile)**or**

takes less time (with bile)

or

steeper fall / line (with bile)

*allow use of data**ignore easier*

1

(iii) all fat / milk digested

or

same amount of fatty acids present

or

(lower pH) denatures the enzyme / lipase

*allow all reactants used up**ignore reference to neutralisation**allow enzyme won't work at low pH**do **not** allow enzyme killed*

1

[7]

17

(a) 5624

allow 2 marks for:

- correct HR = 148 **and** correct SV = 38 plus wrong answer / no answer

or

- only one value correct **and** ecf for answer

allow 1 mark for:

- incorrect values **and** ecf for answer

or

- only one value correct

3

- (b) (i) **Person 2** has low(er) stroke volume / SV / described
eg **Person 2** pumps out smaller volume each beat
do **not** allow **Person 2** has lower heart rate

1

- (ii) **Person 1** sends more blood (to muscles / body / lungs)

1

(which) supplies (more) oxygen

1

(and) supplies (more) glucose

1

(faster rate of) respiration **or** transfers (more) energy for use

ignore aerobic / anaerobic

allow (more) energy release

allow aerobic respiration transfers / releases more energy (than anaerobic)

*do **not** allow makes (more) energy*

1

removes (more) CO₂ / lactic acid / heat

allow less oxygen debt

or less lactic acid made

or (more) muscle contraction / less muscle fatigue

if no other mark awarded,

allow person 1 is fitter (than person 2) for max 1 mark

1

[9]

| | | | |
|-----------|---|---|------------|
| 18 | (a) (i) alveoli / alveolus <i>allow air sacs</i> <i>allow phonetic spelling</i> | 1 | |
| | (ii) any one from: • protection (of lungs / heart) • help you breathe / inflate lungs. | 1 | |
| | (b) (i) diffusion | 1 | |
| | (ii) capillaries | 1 | |
| | (iii) any two from: • (have many) alveoli <i>allow air sacs</i> • large surface / area • thin (exchange) surface or short diffusion pathway <i>accept only one / two cell(s) thick</i> • good blood supply / many capillaries <i>allow (kept) ventilated or maintained concentration gradient.</i> | 2 | [6] |
| 19 | (a) Lung | 1 | |
| | (b) Filtering the blood | 1 | |
| | (c) They will take in water and burst | 1 | |
| | (d) (i) 6 | 1 | |
| | (ii) less than 28 | 1 | |
| | (iii) urea not reabsorbed or dialysis (fluid) has removed urea | 1 | |
| | (e) (i) antibodies | 1 | |
| | (ii) Tissue typing the donor kidney | 1 | [8] |

- 20** (a) (i) water / H₂O
accept oxygen
allow H₂O
*do **not** allow H²O or H2O* 1
- (ii) the mineral ions are absorbed by active transport 1
the absorption of mineral ions needs energy 1
- (iii) have (many root) hairs 1
(which) give a large surface area (for absorption) 1
- (b) carbon dioxide in
or
oxygen out
or
control water loss
accept gas exchange
ignore gases in and out
ignore gain / lose water 1
- (c) (i) guard cells 1
- (ii) (stomata are) closed
allow there is no gap / space 1
- (iii) plant will wilt / droop
ignore die 1
- [9]

21

(a) any **two** from:

- carbon dioxide / CO₂
- urea
- protein
- water / H₂O
- hormones / insulin.

*ignore food / waste / alcohol / drugs / enzymes**ignore glucose and oxygen**allow **two** correct hormones for 2 marks**allow **two** correct food components for 2 marks**allow antibodies**allow antitoxins*

2

(b) (i) plasma

1

platelets

1

(ii) (cardiac) muscle

allow muscular

1

(c) 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 in the Marking Guidance and apply a 'best-fit' approach to the marking.

0 marks

No relevant content

Level 1 (1–2 marks)

There is a description of at least one advantage of the cow tissue valve

or

a description of at least one disadvantage of the cow tissue valve.

Level 2 (3–4 marks)

There is a description of at least one advantage of the cow tissue valve

and

at least one disadvantage of the cow tissue valve.

Level 3 (5–6 marks)

There is a description of the advantages and disadvantages of the cow tissue valve

or

a description of several advantages of the cow tissue valve and at least one disadvantage.

Examples of the points made in the response**Advantages of cow tissue valve:**

- abundant supply of cows
- so shorter waiting time
ignore can take many years to find a suitable human donor
- no need for tissue typing
- quicker operation
- less invasive **or** shorter recovery time
- cheaper operation costs
- less operation / anaesthetic risks.

Disadvantages of cow tissue valve:

- made from cow so possible objections on religious grounds
ignore ethical arguments
- new procedure so could be unknown risks
allow possible transfer of disease from cow
- risks of using a stent eg. blood clots, stent breaking or valve tearing
- not proven as a long term treatment
- may be rejected
ignore information copied directly from the table without value added.

6
[11]

22

- (a) (i) has the least amount of glucose
*allow least amount of fat **or** no fat*

1

- (to) transfer energy (for the run)
allow (to) release energy (for the run)
*do **not** allow produces energy*
*do **not** allow 'energy for respiration'*

1

- (ii) any **one** from:
- cells will work inefficiently
 - absorb too much water / swell / overhydrate
 - lose too much water / shrink / dehydrate
- ignore turgid / flaccid*
cells burst is insufficient
allow cramp in muscle.

1

- (b) any **three** from:
- thermoregulatory centre
 - (has temperature) receptors
 - (which) monitor blood temperature (as it flows through the brain)
 - (temperature) receptors in the skin
 - (receptors) send impulses to the brain

ignore vasoconstriction / vasodilation / sweating

allow hypothalamus

impulses sent to the thermoregulatory centre = 2 marks.

3

- (c) (i) (sports drinks) contain a lot of glucose

1

(a person with diabetes) does not produce insulin **or** does not produce enough insulin

allow (person with diabetes) has cells which do not respond to insulin

*do **not** allow insulin produced by liver*

1

so blood glucose / sugar levels will rise too high **or** to a dangerous level

1

- (ii) inject insulin

or

have an insulin pump (fitted)

*do **not** allow swallow insulin*

accept exercise

accept inhale insulin

*accept take metformin **or** other correctly named drug*

allow pancreatic transplant

1

[10]

23

- (a) (i) diaphragm

accept phonetic spelling

1

- (ii) (because) the volume (inside the jar) increases

*maximum **two** marks if no reference to correct part of model*

1

(causing) the pressure to decrease

1

(and) air enters the balloon

allow oxygen

1

- (b) (i) (so it moves by) diffusion
do **not** allow osmosis or active transport

1

from a high concentration (of oxygen) to a low concentration

allow down its / oxygen concentration gradient from the air **or** to the blood

or

(because) there is a high(er) concentration (of oxygen) in the air **or** there is a low(er) concentration of oxygen in the blood

ignore reference to amount of oxygen

1

- (ii) many gill filaments
must be in the correct pairs to gain 2 marks

1

(give a) large surface / area

do **not** allow surface area to volume ratio

or

thin

(so) short diffusion pathway

or

good blood supply

(to) maintain the concentration gradient

or

water continually flows over them / continually ventilated

(to) maintain the concentration gradient

1

[8]

24

- (a) (i) diffusion

1

- (ii) carbon dioxide
accept CO_2 / CO_2
do **not** accept CO^2

1

- (iii) red blood cells

1

- (b) 70

if no / incorrect answer then

70 000 000

or

280 x 0.25 gains 1 mark

ignore doubling the answer

2

- (c) allows more gas / oxygen / CO₂
(exchange)

do not accept air

1

[6]

25

- (a) any **three** from:

- parts of organisms have not decayed
accept in amber / resin
allow bones are preserved
- conditions needed for decay are absent
accept appropriate examples, eg acidic in bogs / lack of oxygen
- parts of the organism are replaced by other materials as they decay
accept mineralised
- or other preserved traces of organisms, eg footprints, burrows and rootlet traces
allow imprint or marking of organism

3

- (b) (i) teeth for biting (prey)

must give structure + explanation

1

claws to grip (prey)

accept sensible uses

1

wing / tail for flight to find (prey)

1

- (ii) any **two** from:

- new predators
- new diseases
- better competitors
- catastrophe eg volcanic eruption, meteor
- changes to environment over geological time
accept climate change
allow change in weather
- prey dies out **or** lack of food
allow hunted to extinction

2

[8]

26

- (a) A - atrium

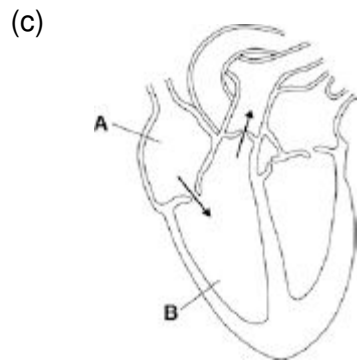
ignore references to right / left

1

B - ventricle

1

- (b) (i) muscular 1
- (ii) push blood
accept pump / force 1



arrows approx as indicated

arrow(s) showing flow from A to B
from B out / up / to artery

- (d) (i) male 1
- 65 and over 1
- (ii) fatty deposits / material in (coronary) arteries
allow correct points made about heart attacks 1
- narrows / blocks / reduces flow 1
- decreases oxygen supply (to heart muscle) 1

[11]

27

- (a) (i) sucrose 1
- (ii) fructose is sweeter than sucrose 1
- can use less fructose (for same sweetness) 1
- cheaper / can use in slimming food
allow 'less calories'
accept 'better for diabetics' 1

- (b) (i) carbohydrases 1
- (ii) denatured / shape changed
ignore 'inactivated'
allow 'enzyme / shape destroyed' 1
- (iii) faster reaction 1
- so more product made / product made in shorter time
allow '60 °C will kill microorganisms' 1
- (c) any **two** from:
- enzyme can be re-used / not wasted
 - constant-flow system
 - can be automated
 - product (= food) not contaminated by enzyme / enzyme may give allergic reaction / no need to separate P from E
allow 'people do not want to eat enzymes' 2
- (d) any **three** from:
- volume is smaller so costs less to heat / to maintain temperature / to build
 - temperature is cooler so costs less to heat / to maintain temperature / loses less heat to surroundings
 - reaction time is shorter so reduces running costs (re. heating / stirring) or can make more product in time
 - 1-stage product refining c.f. 4 stages, leading to reduced labour / time cost
need to qualify each point with respect to how it lowers costs 3
- (e) (i) 4500
correct answer = 2 marks
allow 1 mark for: 1500 x 3 2
- (ii) enzyme used for longer / less enzyme needed 1
- less money spent on enzyme 1
- [17]**
- (a) (i) capillaries 1
- (ii) platelets 1

(iii) fibrinogen changes to fibrin

1

(b)

| | | | |
|---|---|---|---|
| ✓ | x | x | ✓ |
| x | ✓ | x | ✓ |
| ✓ | ✓ | ✓ | ✓ |
| x | x | x | ✓ |

*1 mark per correct row***or***1 mark per correct column**whichever is greater*

3

(c) (i) antibody / antigen has specific shape

ignore active site

1

antibody fits antigen / has shape complementary to antigen

1

(ii) group A has anti-B antibodies which bind to B-antigens

1

join / clump RBCs together so too big to pass through capillary / block capillary

1

any **one** consequence: lack of O₂ / food / blood supply to body cells or cells can't respire*ignore 'cells die' / 'person dies' - look for cause*

1

[11]**29**

(a) (i) stomach

1

(ii) small intestine

1

(b)

| | salivary glands | stomach | pancreas | small intestine |
|----------|-----------------|---------|----------|-----------------|
| amylase | ✓ | ✗ | ✓ | ✓ |
| lipase | ✗ | ✗ | ✓ | ✓ |
| protease | ✗ | ✓ | ✓ | ✓ |

1 mark per correct row

or

if no correct row max 1 mark for any one correct column

2

(c) enzyme / protease / pepsin most effective in acid conditions / low pH

accept optimum / correct pH

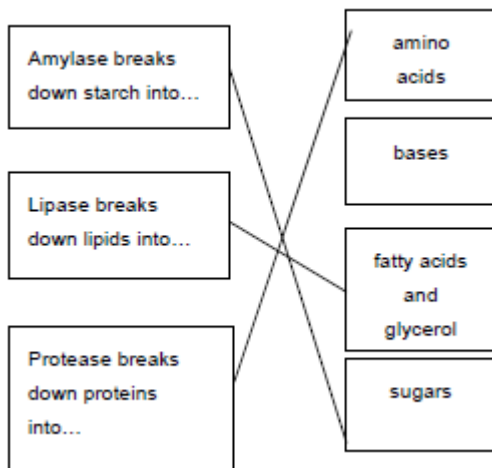
do not accept ref to incorrectly named enzymes

ignore killing bacteria

ignore acid breaks down food

1

(d) **Enzyme** **Breakdown products**



3

[8]

30

(a) guard cells

1

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

- species / plant
- length of time

ignore temperature and size of leaves

1

(ii) 20

*correct answer = 2 marks**accept $\frac{1.6 - 1.28}{1.6} \times 100$* *or $\frac{0.32}{1.6} \times 100$* *for 1 mark*

2

(c) less water loss / transpiration / evaporation

1

(d) hot

1

ignore bright / sunny conditions

dry / low humidity

1

wind(y)

1

[8]**31**

(a) (i) xylem

1

(ii) water

1

minerals / ions / named example(s)

ignore nutrients

1

(b) (i) movement of (dissolved) sugar

*allow additional substances, eg amino acids / correct named sugar
(allow sucrose / glucose)**allow nutrients / substances / food molecules if sufficiently qualified**ignore food alone*

1

(ii) sugars are made in the leaves

1

so they need to be moved to other parts of the plant for respiration / growth / storage

1

(c) (i) mitochondria

1

(ii) for movement of minerals / ions

Do not accept 'water'

1

against their concentration gradient

1
[9]

32

- (a) (i) muscular 1
- (ii) 7 1
- (iii) an electrical device 1
- (b) (i) in sequence: 1
- 5 1
- 7 1
- 2 1
- (ii) 3 1
- (c) (i) prevent backflow (of blood) / allow flow in only one direction / in the correct direction 1
- (ii) **A**
no mark, but max 2 marks if incorrect
2 / atrium contracts / pressure in 2 increases 1
- blood pushes ball (down / towards ventricle / towards 5)
allow this point even if valve in wrong part of heart 1
- (opens valve which) allows blood into 5 / ventricle
or converse points re closing the valve 1
- (d) (i) involvement of platelets / eg platelets 'trigger' clotting process / release enzyme(s) / release 'clotting factors' 1
- fibrinogen to fibrin
or
meshwork formed (which traps blood cells) 1

- (ii) any **four** from:
*to gain 4 marks candidates should include at least:
 one advantage and one disadvantage*

Advantages

(improved circulation / O₂ supply) provides:

- more cell respiration
- more energy released
- (more) active life / not so tired / more physical activity

Disadvantages

- danger of surgery / operation
- infection from surgery / operation
- valve may need replacing
- clots may form and block blood vessels
may need to take anti-coagulants – eg warfarin
- clots may cause heart attacks / strokes

4
[17]

33

- (a) (i) traps light (energy)
allow uses light / converts light energy to chemical energy

1

for photosynthesis / for making sugar / starch / carbohydrates
*ignore food
 allow organic molecules*

1

- (ii) dodder takes sugar / glucose / sucrose from phloem / dodder cannot make its own glucose / carbohydrate

or

phloem has sugar / glucose / sucrose
*accept amino acids / fatty acids / other small organic molecule
 ignore takes food / minerals / water / nutrients*

1

- (iii) any **one** from:

- not enough sugar / nutrients to grow / respire
accept not enough food to grow / respire
- might strangle / restrict growth by squeezing stem tightly
- may damage stem tissues by growing into it
- may smother leaves / block light **so** less photosynthesis / less growth

1

- (b) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

Description and explanation of an adaptation which only involves hooks **and** / **or** suckers.

Level 2 (3 – 4 marks)

Description and explanation of adaptations including hooks **and** / **or** suckers with any other adaptation **or** explanation.

Level 3 (5 – 6 marks)

Description of most correct adaptations **and** explanations.

Examples of biology points made in the response:

- hooks – for holding on / not being detached
 - suckers – for holding on / not being detached
 - flattened / large surface area – absorption of (large amounts of) food
 - no gut – not needed as host digests food
 - thick cuticle – protection from host's enzymes / so not digested
 - large number of eggs – increased chance of infecting new host
- allow hermaphrodite and self-fertilising – likely to be just one worm per host*
- internal fertilisation – gametes not digested*

6

[10]

34

- (a) (Type 2) diabetes / heart disease / deficiency disease / named
allow a relevant health problem
*ignore obesity **or** over / under weight / anorexia*

1

- (b) (i) provides more (energy / sugar) than is used
idea of sugar being high in / having a lot of energy eg contains a lot of calories
*allow it is turned to fat **or** stored (as fat)*

1

- (ii) fat

1

- (c) (i) C

1

- (ii) no health problems
allow as others (may) have (possible) health problems
ignore reference to sweetness

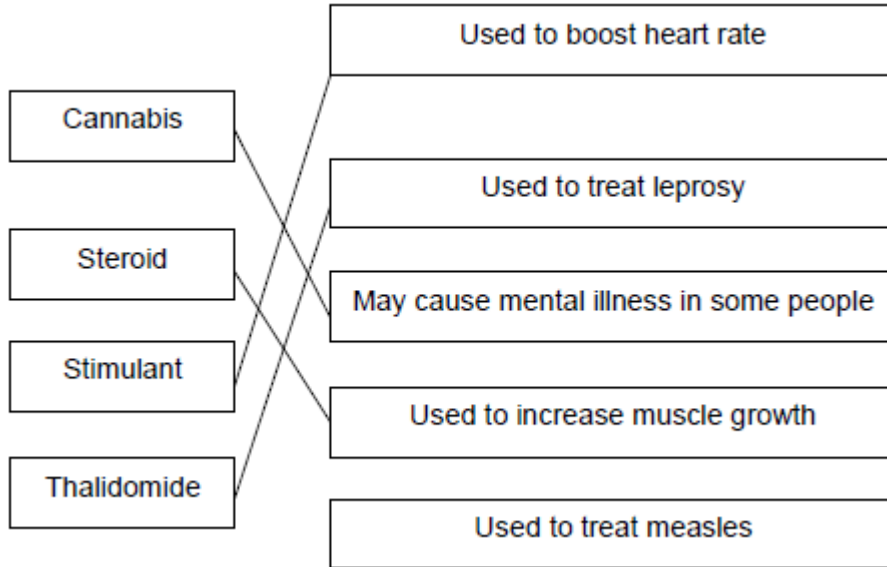
1

- (iii) idea of informed choice
eg in case you have health problems / allergies
allow legal requirement
ignore diabetes

1
[6]

35

(a)



extra line from any drug cancels that mark

4

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

- (live) animals
accept named examples, eg mice
ignore people / volunteers
- cells
- tissues
*do **not** allow plants*

1

(ii) to check that the drug works

1

to find the best dose to use

1

(iii) only scientists at the drug company

1

(c) (i) 420

1

(ii) statin(s)

1

(iii) any **one** from:

- side effects
allow cost
- other medication
allow patient choice
- other (medical) conditions
*allow family history **or** age*

1
[11]

36

(a) (i) A = (cell) membrane

B = cytoplasm

*do **not** accept cytoplast*

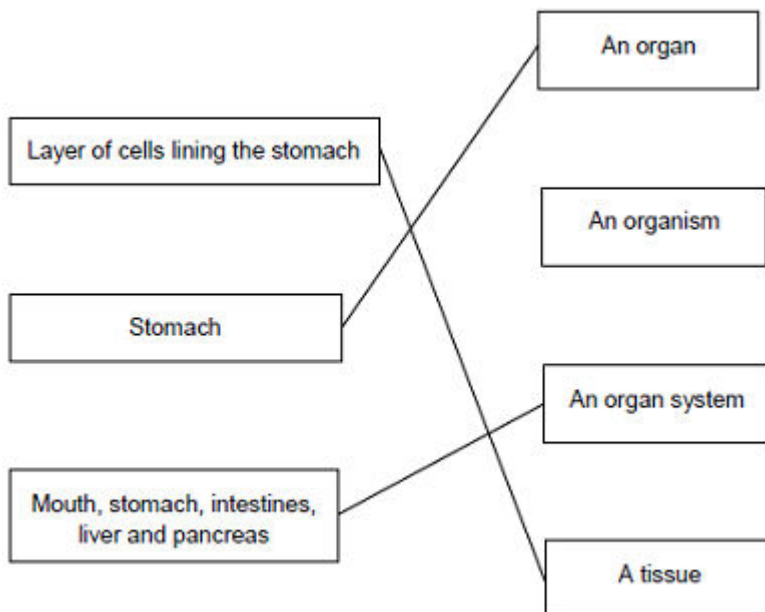
1

(ii) To control the activities of the cell

1

1

(b)



extra lines cancel

3
[6]

37

(a) (i) amino acid(s)

accept peptide(s)

*do **not** allow polypeptide(s)*

1

(ii) protease

1

(b) (i) 2

1

(ii) repeat

do not allow other enzyme / substrate

1

using smaller pH intervals between pH1 and pH3

allow smaller intervals on both sides of / around pH2

allow smaller intervals on both sides of / around answer to (b)(i)

1

(iii) enzyme / pepsin denatured / shape changed

*do **not** allow enzyme killed*

allow enzyme 'destroyed'

1

enzyme / pepsin no longer fits (substrate)

allow enzyme / pepsin does not work

1

(c) hydrochloric (acid)

allow phonetic spelling

accept HCl

allow HCL

ignore hcl

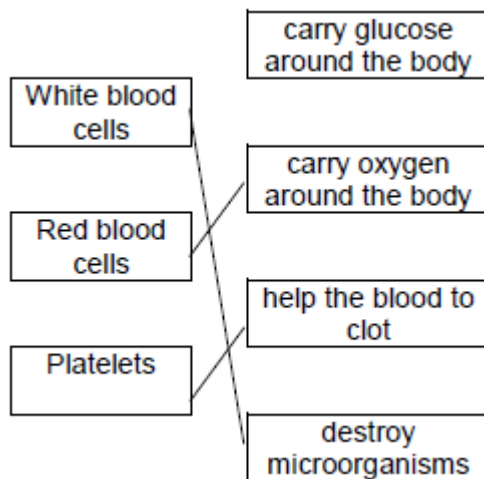
*do **not** allow incorrect formula –e.g. H₂Cl / HCl₂*

1

[8]

38

(a) (i)



one mark for each line

extra line negates a mark

3

(ii) any **one** from:

- carbon dioxide / CO₂
 - urea
- do not allow urine*
ignore water
ignore ions

1

(b) (i) B

1

(ii) D

1

(iii) vein

accept correct named
examples

1

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

- keeps artery / blood vessel open **or** widens artery / blood vessel
- allows (more) blood to heart / cardiac muscle
- (allows) blood to flow more easily
- allows (more) oxygen to heart / cardiac muscle

1

(ii) any **two** from:

- bleeding
- allow blood clots*
- infection
 - damaging blood vessels
 - damaging the heart
 - risk from anaesthetic

2

[10]**39**

(a) (i) xylem

1

(ii) phloem

1

(iii) transpiration

1

(iv) stomata

1

- (b) (i) any **one** from:
- reduce / prevent evaporation of water from flask
 - holds plant shoot in place
 - prevent damage to the plant
- 1
- (ii) same surface area **or** number of leaves
*(because if they used larger / smaller size shoots) there would be a larger / smaller surface area **or** a larger/ smaller number of leaves allow same number of stomata*
- 1
- from which (the same amount of) water evaporates
(and therefore) more / less water would escape allow from which water escapes
- 1
- (iii) 4.5
look for answer written in table
- 1
- (iv) increasing temperature / heat increases (rate of) water loss / evaporation
- 1
- (v) having moving air / a fan increases (rate of) water loss / evaporation
- 1
- (c) (i) 0.3 g
- 1
- (ii) plastic bag reduces air flow across leaves
or
 air is humid around the leaves
*allow plastic bag stops water (vapour) leaving
 allow air (in plastic bag) becomes saturated (with water)*
- 1

[12]

40

- (a) any **three** from:
- (water through a) partially permeable
accept 'semi permeable' / selectively permeable
 - membrane
 - from dilute to (more) concentrated solution
*allow 'from a high concentration of water to a lower concentration (of water)'
 allow 'from high water potential to low water potential'
 allow 'down a concentration gradient of water'
 do **not** accept 'along a concentration gradient of water'*
 - (it's a) passive (process)
allow requires no energy

3

(b) (there are) many hairs **or** thin hairs **or** hairs are one cell thick

1

(which gives) large / increased surface area **or** short diffusion pathway

1

(so there is) more diffusion / osmosis (of water into the root)

ignore absorption

1

[6]**41**

(a) (i) defence against **or** destroy pathogens / bacteria / viruses / microorganisms

*do **not** allow 'destroy disease'*

accept engulf pathogen / bacteria / viruses / microorganism

accept phagocytosis

accept produce antibodies / antitoxins

allow immune response

1

(ii) they are small fragments of cells

1

(b) liver

in this order only

1

kidney(s)

1

(c) any **two** from:

- that it doesn't cause an immune response **or** isn't rejected / damaged by white blood cells
- whether it is a long lasting material / doesn't decompose / corrode / inert
- if it is strong (to withstand pressure)
- it will open at the right pressure
- that it doesn't cause clotting
- that it doesn't leak **or** it prevents backflow
- non toxic

ignore correct size

2

[6]**42**

(a) (i) guard (cells)

allow phonetic spelling

1

(ii) any **one** from:

ignore reference to cells

- allow carbon dioxide to enter
*allow control loss / evaporation of water **or** control transpiration rate*
- allow oxygen to leave.
allow 'gaseous exchange'

1

(b) (i) 200

correct answer gains 2 marks with or without working

allow 1 mark for $0.1 \times 0.1 = 0.01$ (mm²)

2

(ii) more / a lot of / increased water loss

allow plant more likely to wilt (in hot / dry conditions)

1

(c) (i) 0.12

1

(ii) the lower surface has most stomata

1

stomata are now covered / blocked (by grease)

1

so water cannot escape / evaporate from the stomata

ignore waterproof

to gain credit stomata must be mentioned at least once

1

[9]

43

A + B most effective (treatment)

ignore descriptions of LDL levels

1

D is (the most) effective (treatment)

D is the best single (treatment)

1

neither A nor B (alone) are effective

allow increase risk of heart disease instead of not effective

1

can't tell if C is effective

OR

A + C is not effective

1

[4]

44

(a) any **two** from:*or allow converse for outdoors*

- constant speed
 - *variable speed*
 - constant effort
 - *variable terrain*
 - constant temperature
 - *traffic conditions*
 - *variable temperature*
 - *wind (resistance)*
 - *rain / snow*
- } allow weather

allow pollution only if qualified by effect on body function but ignore pollution unqualified

if no other marks obtained allow variable conditions outdoors

2

(b) Brain

1

(c) (i) 20 800

correct answer with or without working gains 2 marks

if answer incorrect, allow 1 mark for use of 1200 and 22 000 only

2

(ii) oxygen

apply list principle

1

*do **not** accept other named substances eg CO₂ water*

glucose / sugar

allow glycogen

ignore food / carbohydrate

1

(iii) respire aerobically

1

(iv) carbon dioxide

1

lactic acid

1

- (d) increased heart rate
ignore adrenaline / drugs
accept heart beats more but not heart pumps more

1
 [11]

45

- (a) any **one** from:
ignore 'check temperature'

- add a water bath
- heat screen
- use LED
- low energy bulb / described

1

- (b) (i) rate / number of bubbles decreases
*accept converse with reference to increasing light **or** shorter distance*

or

less oxygen / gas released
ignore reference to rate of photosynthesis

1

- (ii) temperature / CO₂ (concentration)
*accept 'it was too cool' **or** not enough CO₂*
accept number of chloroplasts / amount of chlorophyll
allow heat
allow CO₂
*do **not** allow CO²*

1

- (c) 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 in the [Marking guidance](#), 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 at least 1 tissue **or** at least 1 function of an indicated part of the leaf.

The account lacks clarity or detail.

Level 2 (3-4 marks)

There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf.

Level 3 (5-6 marks)

There is a detailed description of most of the structures and their functions.

Examples of responses:

- epidermis
- cover the plant
- mesophyll / palisade
- photosynthesises
- phloem
- xylem
- transport.

The following points are all acceptable but beyond the scope of the specification:

- (waxy) cuticle – reduce water loss
- epidermis – no chloroplasts so allows light to penetrate
- stomata / guard cells – allow CO₂ in (and O₂ out) **or** controls water loss
- palisade (mesophyll) – many chloroplasts to trap light
– near top of leaf for receiving more light
- spongy (mesophyll) – air spaces for rapid movement of gases

6

[9]

46

- (a) (i) directly proportional
gains full marks

or

0.1 rise in rate for 1% rise in concentration

*accept increased concentration: increased rate **or** positive correlation **or** proportional for 1 mark*

2

- (ii) 0.6
allow ± 0.01

1

- (b) (0.5% trypsin) cheaper
ignore more profit 1
- (35°C) faster reaction
allow (35°C) optimum / best temperature 1
- so takes less time to make product 1
- extra heating cost outweighed by savings on enzyme cost 1
- (c) (i) any **two** from:
- breaks down / digests food
allow pre-digests protein / food
allow easier for baby to digest
 - from protein into amino acids / peptides
 - makes soft(er) / runni(er)
allow description of texture change
allow make (more) soluble 2
- (ii) correct named enzyme 1
- correct function
to gain 2 marks function must relate to correctly named enzyme
- Eg
- carbohydrase
accept amylase / maltase / lactase 1
- starch → sugar **or** lactose → glucose **or** making sugar syrup
- or**
- isomerase
- glucose → fructose **or** making slimming foods
- or**
- lipase
- fats / oils → fatty acids **or** removal of grease stains
accept other correct example

| | | |
|-----------|--|---------------------|
| 47 | (a) (i) mitochondrion / mitochondria <i>must be phonetically correct</i> | 1 |
| | (ii) carbon dioxide / CO ₂ water / H ₂ O <i>in either order</i> <i>accept CO₂ but not CO²</i> <i>accept H₂O or HOH but not H²O</i> | 1 1 |
| | (iii) diffusion high to low concentration <i>allow down a concentration gradient</i> through (cell) membrane or through cytoplasm <i>do not accept cell wall</i> | 1 1 1 |
| | (b) ribosomes make proteins / enzymes using amino acids part A / mitochondria provide the energy for the process <i>allow ATP</i> <i>do not accept produce or make energy</i> | 1 1 1 |
| | | [9] |
| 48 | (a) genes chromosomes | 1 1 |
| | (b) (i) higher yield less use of pesticides | 1 1 |

- (ii) any **two** from:
- uncertain about effects on health
 - fewer bees
 - might breed with wild plant
 - seeds only from one manufacturer

2

[6]

49

- (a) pancreas

apply list principle

1

- (b) (i) protein

apply list principle

1

- (ii) any **one** from:

- (controlling / changing) diet
*accept sugar(y foods) / named eg
ignore references to starch / fat / protein / fibre*
- exercise
accept example, eg go for a run
- pancreas transplant
accept named drug eg metformin

1

- (c) (i) increase

ignore reference to women

1

then fall

1

relevant data quote (for male)

*eg max at ages 65–74 **or** starts at 10 (per thousand) **or** max at 130
(per thousand) **or** ends at 120 (per thousand)
accept a difference between any pairs of numbers in data set
accept quotes from scale eg '130' or '130 per thousand' but **not**
'130 thousand'; to within accuracy of +/- 2 (per thousand)*

1

- (ii) (between 0 and 64) more females (than males) **or** less males (than females)

ignore numbers

allow eg females more diabetic than males

1

(over 65) more males (than females) or less females (than males)

allow eg males more diabetic than females

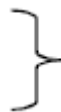
1

[8]

50

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

- fibres not damaged
- machines last longer / machines not damaged by stones
- shorter time or quickerer
- lower temperature



uses less energy or cheaper for energy as an alternative to shorter time / lower temperature, if neither of these given

no mark for cheaper unqualified

2

(ii) any **two** from:

- different enzymes (for different dyes)
- enzymes expensive
no mark for expensive alone
- enzymes have to be removed (from denim material) (after washing / treatment)

2

(b) protease

apply list principle

1

[5]

51

(a) **B**

*no mark for "B" alone, the mark is for B **and** the explanation.*

large(r) surface / area **or** large(r) membrane

accept reference to microvilli

ignore villi / hairs / cilia

accept reasonable descriptions of the surface eg folded membrane / surface

*do **not** accept wall / cell wall*

1

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

- (salivary) amylase
- carbohydrase

1

- (ii) many ribosomes
do **not** mix routes. If both routes given award marks for the greater.

1

ribosomes produce protein
accept amylase / enzyme / carbohydrase is made of protein

or

(allow)

many mitochondria (1)

mitochondria provide energy to build / make protein (1)
accept ATP instead of energy

1

[4]

52

- (a) stomach is acidic / has low pH
allow any pH below 7
ignore stomach is not alkaline

1

lactase works best / well in alkali / high pH / neutral / non-acidic conditions
allow any pH of 7 and above
accept works slowly in acid conditions
allow figures from table with a **comparison**
ignore reference to temperature

1

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

- (below 40(°C)) increase in temperature increases rate / speed of reaction
- reference to molecules moving faster / colliding faster / harder / more collisions
- enzyme optimum / works best at 40°C
allow value(s) in range 36 – 44
ignore body temperature unless qualified
- high temperatures (above 40°C) / 45°C / 50°C enzyme denatured
allow synonyms for denaturation, but do **not** allow 'killed'
denaturation at high and low temperature does **not** gain this mark
ignore references to time / pH

3

(c) any **two** from:

- acid neutralised or conditions made neutral / alkali
accept bile is alkaline
- (allow) emulsification / greater surface area (of lipid / fat)
allow description of emulsification eg fat broken down / broken up into droplets
*do **not** accept idea of chemical breakdown*
- lipase / enzymes (in small intestine) work more effectively / better
allow better for enzymes
ignore reference to other named enzymes

2

[7]

53

(a) (i) capillary

1

(ii) diffusion

1

(b) (i) Z

ignore any names

1

(ii) large / increased surface / area

allow all food absorbed

or to absorb more food

or improved diffusion

1

[4]

54

(a) (i) wind

answers in either order

1

temperature

ignore weather

1

(ii) different plants have different sizes

ignore reference to validity

/ different numbers of leaves

/ different sizes of leaves

/ different plants take up different amounts of water

/ different number of stomata

/ different surface area

allow different plants need different amounts of water

1

(b) in table, in sequence:

C
B
A

all 3 correct = 2 marks
2 correct = 1 mark
0 or 1 correct = 0 marks

max 2

(c) transpiration

1

[6]

55

(a) A

no mark - can be specified in reason part
if B given - no marks throughout
if unspecified + 2 good reasons = 1 mark

high(er) pressure in A

allow opposite for B
*do **not** accept 'zero pressure' for B*

pulse / described in A

accept fluctuates / 'changes'
allow reference to beats / beating
ignore reference to artery pumping

2

(b) (i) 17

1

(ii) 68

accept correct answer from student's (b)(i) × 4

1

(c) oxygen / oxygenated blood

allow adrenaline
ignore air

glucose / sugar

*extra wrong answer cancels - eg sucrose / starch / glycogen /
glucagon / water*
allow fructose
ignore energy
ignore food

2

[6]