



## Mark schemes

- 1** (a) (i) A = (cell) wall  
*ignore cellulose* 1
- B = cytoplasm 1
- (ii) any **one** from:  
*accept has DNA instead of a nucleus, but not just has DNA*
- bacterial cell / it has no nucleus  
*allow no mitochondria*
  - DNA free in cytoplasm  
*ignore size*
  - has no vacuole / no vesicles  
*ignore strands of DNA* 1
- (b) (i) yeast grows best / better / well **or** optimum temperature for yeast / more yeast present  
*allow yeast works best / better / well* 1
- (yeast) makes CO<sub>2</sub> **or** respire / respiration  
*allow fermentation* 1
- (ii) bacterium grows best / better / well / more bacteria present **or** optimum temperature for bacterium  
*ignore microorganisms / microbes*  
*allow works / respire best / better / well* 1
- (bacterium) makes (lactic) acid  
*do not allow wrong acid* 1
- [7]**
- 2** (a) guard cell  
*ignore stoma / stomata* 1
- (b) Species A :  
*allow converse points for species B*
- stomata open in dark / at night **or** close in light / in day 1

stomata closed during warm(est) period **or** open when cool(er)

1

heat (energy) /warmth increases evaporation / transpiration

*must give explicit link between heat and transpiration*

1

reduces water loss / evaporation / transpiration

*ignore photosynthesis*

1

**[5]****3**

(a) **A** – saliva(ry) gland

1

**B** – liver

1

**C** – duodenum

*ignore small intestine*

1

**D** – pancreas

*accept phonetic spellings*

1

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

- chewing / muscle contraction / mechanical digestion

*allow churning*

- protease enzymes

*allow pepsin / trypsin*

- in stomach / small intestine / duodenum / from pancreas

- (break down protein) into amino acids

*allow (poly)peptides*

3

(ii) neutralises acid pH / makes conditions alkaline

1

so lipase can work

1

emulsifies fat

1

to give large(r) surface area for lipase / enzyme action

1

(c) (i) starch

*ignore carbohydrate*

1

- (ii) breakdown stops  
*allow slows down* 1
- because stomach produces / contains acid / has low pH 1
- and amylase cannot work in acid / low pH  
*accept amylase is denatured / changes shape* 1

[15]

4

- (a) (i) (as a result of) uncontrolled / abnormal growth / division of cells  
*ignore mutation*  
*allow cells dividing with no contact inhibition* 1
- (ii) benign tumours do not invade / spread to other tissues / do not form secondary tumours  
*accept converse for malignant*  
*accept benign tumours do not metastasise* 1
- (b) via the blood / circulatory system  
*accept via lymphatic system* 1
- (c) (i) incidence is increasing 1
- more rapidly (over the years)  
*ignore figures* 1
- difference between rich and poor areas is getting less
- or**
- the incidence is rising fastest in people from poor areas  
*accept converse for people from rich areas* 1

- (ii) risk factor is UV from sunlight  
*ignore ionising radiation*

1

more UK citizens going abroad or taking holidays in the Sun

**or**

poorer people can afford holidays in the Sun

**or**

more poorer people are taking holidays in the Sun

1

[8]

5

- (a) (i) **A** lung

1

**B** rib

1

**C** diaphragm

1

**D** alveolus / alveoli

1

- (ii) (**B** moves) up(wards) / out / up and out

1

(**C** moves) down(wards) / flattens

*do **not** allow inwards*

*ignore outwards*

*if neither mark gained allow **1** mark for correct reference to muscle contraction*

1

- (b) (i) 1640

1

1440

1

1720

*allow max **1** for 3 correct values using of bottom of piston:*

*1380 + 1180 + 1480 to 1485*

1

(ii) 1600

*correct answer gains 2 marks**if answer incorrect allow 1 mark for evidence of*

$$(1640 + 1440 + 1720) \div 3$$

*allow ecf from (b)(i)**allow use of two numbers divided by two if one is considered anomalous:*

$$\frac{(1640 + 1720)}{2} = 1680$$

*for 2 marks*

2

(c) two groups of students – one group sports activity participants, other not

*allow students as a group*

1

fair test eg groups same height / same mass / same sex

1

measure air breathed in by each student / repeat previous experiment then calculate mean for group

1

(d) pointer remains still after breathing / cylinder will move down after breathing (in)

1

error reading volume less likely

*allow more accurate / reliable*

1

(e) (i) operator squeezes bag

1

air forced / pushed into lungs

**or**

positive pressure ventilator

1

(ii) any **two** from:

- air pressure / volume not regulated
- operator will tire / must be present at all times / variable intervals
- too much / too little air

*allow may 'overbreathe' the patient*

2

**[20]**

6

- (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 on page 5, 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 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 biology points made in the response:**

- (use of measuring cylinder to) measure equal volumes of detergent solution
- (use of dropping bottle to) apply same number of drops / amount of stain to each piece of cloth
- include stainless cloth as control
- use of forceps to transfer cloths
- use of test tubes as containers for detergent solution + stained cloth
- use water bath to provide a range of temperatures
- cloths left in detergent solution at each temperature
- for same length of time or measure time taken to remove stain
- repetition
- assessing the stain removal

6

- (b) (i) y axis: labelled 'Time (taken to remove stain in) minutes' plus suitable scale  
*data spread greater than half of grid*

1

points or bars plotted correctly to within  $\pm 1$  mm

*deduct 1 mark for each incorrect plot up to a maximum of 2*

2

one suitable line of best fit drawn on graph

*not feathery*

*not extrapolated to (0,0)*

*not point to point as on this occasion it is inappropriate*

1

- (ii)  $6 \pm 0.1$

*accept ecf from student graph*

1

- (c) activity of enzyme still very high / 84% / over 80%  
**or**  
 only lost 15% / 16% activity  
*allow above 60 °C marked decrease in activity*  
*allow 85%*

1

any **two** from:

- rate of reaction high at 60 °C / higher than at lower temperatures  
*allow in terms of reaction kinetics / collisions*
- higher temperatures would increase (energy) costs  
**or**  
 might damage cloth  
*ignore enzyme denaturation*
- higher temperatures / 60 °C is better (than lower temperatures) to remove other stains / named stains  
**or**  
 better for killing bacteria / infection control  
*eg grease*

2

[14]

7

(a) any **six** from:

- hormone(s) / named produced by pancreas
- if blood glucose levels are too high, insulin is produced / released
- allowing glucose to move from the blood into the cells / named eg liver
- glucose is converted to glycogen
- if blood glucose levels fall, glucagon is produced / released
- glycogen is converted to glucose
- causing glucose to be released into the blood

6

(b) diabetes that occurs when the body (cells) do not respond / are less responsive to insulin

1

(c) (i) higher BMIs due to increase in mass / weight (relative to height) / obesity

1

obesity / being overweight / being fat is a (significant) risk factor for Type 2 diabetes

*allow causes Type 2 diabetes*

1



(ii) any **three** from:

- related to described change in diet eg fast foods
- and less exercise
- which increases the chance of obesity / increases BMI
- increased awareness has helped to slow the increase

3

[12]

8

(a) (i) idea of 'normal' food / diet

*e.g. 'the same as usual' or 'the same as before'*

*allow balanced diet*

*allow none of the slimming programmes*

*ignore healthy diet*

1

(ii) for comparison

*accept to show the test is valid*

*allow to show the effect of the slimming programmes*

*allow to see if the slimming programmes work*

*ignore idea of fair test / reliable*

*do **not** allow accurate / precise*

1

(b) (i) (at first) large / rapid (loss / change of body mass)

1

then small (loss / change) / levelling off

*accept 'loss of mass decreased' for **2** marks*

1

(ii) all lost body mass (compared to the control group)

1

[5]

9

(a) (i) rate of chemical reactions (in the body)

1

(ii) any **two** from:

- heredity / inheritance / genetics

- proportion of muscle to fat **or** (body) mass

*allow (body) weight / BMI*

- age / growth rate

- gender

*accept hormone balance or environmental temperature*

*ignore exercise / activity*

2

(b) (i) 77

*correct answer with or without working gains 2 marks*

*allow 1 mark for 70 / 56 or 1.25 or 5*

2

(ii) increase exercise

*accept a way of increasing exercise*

1

reduce food intake

*accept examples such as eat less fat / sugar*

*allow go on a diet or take in fewer calories*

*ignore lose weight*

*ignore medical treatments such as gastric band / liposuction*

1

[7]

10

(a) (substance / chemical) that affects body chemistry / chemical reactions in the body

1

(b) statin / aspirin / neither recommended

*no mark, may be implied. If no recommendation or implication, max 4 marks*

*answers should be comparative*

any **five** from:

- argued evaluation in favour of aspirin or statin or neither

answers could include reference to

*accept converse for statins / aspirin but **not** as advantage of one **and** disadvantage of other*

for statins:

- more people in studies
- so data / findings more repeatable  
*accept reliable for repeatable*  
*ignore accurate / precise*
- reduces cholesterol but aspirin doesn't  
*allow reduces cholesterol but no evidence about aspirin*
- aspirin (may) causes bleeding / poor clotting but statins do not  
*allow aspirin causes bleeding / poor clotting but no evidence about statins*
- smaller (total) percentage suffer side-effects
- monitored by doctor, aspirins not

for aspirin:

- cheaper
- can be bought over the counter rather than prescribed
- statins cause serious damage / muscle damage / kidney failure but aspirins do not

similarities:

- both have similar effect on reducing (non-fatal) heart attacks
- incidence of side-effects low in both  
*allow (for aspirin) higher reduction of risk of heart attack*

- 11** (a) xylem **and** phloem  
*either order*  
*allow words ringed in box*  
*allow mis-spelling if unambiguous* 1
- (b) (i) movement / spreading out of particles / molecules / ions / atoms  
*ignore names of substances / 'gases'* 1
- from high to low concentration  
*accept down concentration gradient*  
*ignore 'along' / 'across' gradient*  
*ignore 'with' gradient* 1
- (ii) oxygen / water (vapour)  
*allow O<sub>2</sub> / O2*  
*ignore O<sup>2</sup> / O*  
*allow H<sub>2</sub>O / H2O*  
*ignore H<sup>2</sup>O* 1
- [4]**

- 12** (a) (i) 8.6  
*accept value in range 8.5 to 8.7* 1
- (ii) hydrochloric acid / HCl  
*accept HCL*  
*accept hydrogen chloride*  
*ignore hcl / etc.* 1
- (iii) X 1

- (b) 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](#).

**0 marks**

No relevant content.

**Level 1 (1-2 marks)**

There is a simple description of part of a process or a reference to at least one of: mechanical digestion, lipase, product of enzyme action, bile, site of production or site of digestion

**Level 2 (3-4 marks)**

There is a description of at least one process linking ideas

**Level 3 (5-6 marks)**

There is a clear description of the process including reference to the majority of: mechanical digestion, lipase, bile, where they are produced, products, function of bile and site of digestion / absorption

**Examples of biological points made in the response:**

- mechanical breakdown in mouth / stomach
- fats → fatty acids and / or glycerol
- by lipase
- (produced by) pancreas
- and small intestine
- fat digestion occurs in small intestine
- bile
- produced by liver
- neutralises acid from stomach
- produces alkaline conditions in intestine
- refs. to increased surface area related to emulsification or chewing
- products are small molecules / water-soluble
- products absorbed by small intestine

6  
[9]

13

- (a) (i) root hairs  
*if clear which word then allow*
- (ii) xylem  
*if clear which word then allow*
- (iii) stomata  
*if clear which word then allow*

1

1

1

- (iv) storage organs  
*in this order* 1
- phloem 1
- (b) (i) 23.2 1
- (ii) loss of water (from flask with plant) from leaves / plant 1
- via transpiration / via evaporation  
*if no other marks allow used in  
photosynthesis for one mark* 1

**[8]****14**

- (a) (i) kidney 1
- (ii) bladder 1
- (iii) liver 1
- (iv) lung(s) 1
- (v) skin 1
- (b) (i) 3000  
*allow 2970 to 3030  
correct answer gains 2 marks with or without working  
if answer incorrect allow 1 mark for evidence of 1550 + 450 + 1000  
(allow tolerance of + or - 1/2 square on each)* 2
- (ii) 1600  
*allow 1570 to 1630* 1
- (iii) 1400  
*allow (b)(i) - (b)(ii)* 1
- (iv) correct plot from (b)(iii)  
*tolerance 1/2 square ignore width* 1

- (v) cells swell / overhydrated /  
damaged  
*accept poisoned (by urea)*

1  
[11]

15

- (a) **A** artery

*allow aorta*

1

- B** ventricle

*ignore references to left and right*

1

- C** atrium

*ignore references to left and right*  
*allow atria*

1

- D** vein

*allow vena cava*

1

- (b) (i) stent

1

- (ii) keeps (artery) open

1

so (more) blood can flow through  
*allow blood can flow (more) easily*  
*ignore ref to blood clots*

1

[7]

16

- (a) **A** aorta

*ignore left and right*

1

- B** ventricle

1

- C** atrium

*allow atria*

1

- D** vena cava

1

- (b) (i) (coronary) artery

*allow arteriole*

1

- (ii) stent / description  
*accept (coronary) by-pass operation*  
*allow statins*  
*allow diets low in cholesterol*  
*allow balloon (angioplasty)*

1

- (iii) (stent) keeps artery open  
*must relate to (b)(ii)*

1

**or***ignore reference to capillary / vein*

(by-pass) new blood vessel / vein connecting around narrowed region;

**or**

(statins / low cholesterol diet) remove some of the cholesterol blockage

**or**

(balloon) widens / opens the blood vessel

1

which allows (more) blood through or allows blood to go around the blockage

- (c) (i) F artery  
*accept arteriole / branch of pulmonary artery*

1

G capillary

1

H vein

*H accept venule / branch of pulmonary vein;*

1

- (ii) F (Pulmonary artery) has less oxygen / more carbon dioxide / more glucose / sugar

*accept F (Pulmonary artery) is deoxygenated**accept converse for H (Pulmonary vein)**'It' refers to F*

1

**[12]****17**

- (a) solution in soil is more dilute (than in root cells)  
*concentration of water higher in the soil (than in root cells)*

1



so water moves from the dilute to the more concentrated region

*so water moves down (its) concentration gradient **or** water moves from a high concentration of water to a lower concentration*

1

concentration of ions in soil less (than that in root cells)

1

so energy needed to move ions

**or**

ions are moved against concentration gradient

*the direction of the concentration gradient must be expressed clearly*

*accept correct reference to water potential or to concentrations of water*

1

(b) any **three** from:

- movement of water from roots / root hairs (up stem)
- via xylem
- to the leaves
- (water) evaporates
- via stomata

3

(c) (i) 0.67/0.7

*accept 0.66, 0.6666666... or  $\frac{2}{3}$  or 0.6*

*correct answer gains **2** marks with or without working*

*if answer incorrect allow evidence of  $\frac{100}{150}$  for **1** mark*

*do **not** accept 0.6 or 0.70*

2

(ii) during the first 30 minutes

any **one** from:

- it was warmer
- it was windier
- it was less humid
- there was more water (vapour) in the leaves

1

so there was more evaporation

*ignore 'water loss'*

**or**

stomata open during first 30 minutes **or** closed after 30 minutes (1)

so faster (rate of) evaporation in first 30 min **or** reducing (rate of) evaporation after 30 min (1)

1

[11]

18

- (a) (concentration high) in the hepatic portal vein is blood with glucose absorbed from the intestine

1

concentration is lower in the hepatic vein because insulin

1

(has caused) glucose to be converted into glycogen

1

**or**

allows glucose into liver cells

- (b) (i) (after 6 hours) most of the glucose has been absorbed from the intestine **or** from food into the blood

1

- (ii) because glucagon (made in the pancreas) causes

*if biological terms incorrectly spelt they must be phonetically accurate*

*do **not** accept glucagon made / produced by the liver*

1

glycogen to be converted into glucose

1

glucose released into blood

*allow the liver maintains the correct / constant level of glucose in the blood*

1

[7]

19

- (a) (i) 251.2

*award 2 marks for correct answer, irrespective of working.*

*if incorrect or no answer  $62.8 \times 4$  or equivalent gains 1 mark*

2

- (ii) 31.2

*allow ecf from (a)(i); answer to (a)(i) – 220*

1

(b) any **two** from:

- overweight / obesity **or** increased BMI  
*allow get fat*  
*ignore get heavier*
- (Type 2) diabetes  
*allow high blood sugar*
- high blood pressure
- cardiovascular / heart disease **or** heart problems **or** disease of blood vessels **or** clogged arteries
- high cholesterol
- arthritis / worn joints
- tooth decay

2

[5]

20

(a) (i) addictive

*allow addicting / addict / addicted / addiction or similar*  
*allow phonetic spelling*  
*do **not** accept / additive / addition*

1

(ii) junction / gap / space between neurones

*allow nerve cells / nerves for neurones*  
*allow idea where neurones /*  
*nerve cells / nerves meet / join*

1

(b) (i) tablet with no drug

*accept answers that convey this idea eg fake / dummy / sugar pill*  
*allow injection with no drug*  
*ignore drugs that don't work.*

1

(ii) for comparison

*accept to see if drug / it works*  
*allow to see psychological effect **or** make sure, it is not all in the*  
*mind*  
*allow as a control*  
*ignore 'to make test fair / unbiased'*

1

(iii) Neither doctors nor volunteers

1

(iv) any **two** from:

- age (range)
- sex / gender (mix)
- previous smoking habits **or** eg number smoked (before trial)  
**or** length of time smoked
- number in the group
- other drugs being taken **or** general health **or** height / weight /  
BMI / lifestyle / fitness  
*ignore factors already controlled*  
*ignore reference to all smokers **or** all want to give up*

2

(c) higher percentage / number of smokers who had stopped smoking (than Drug B)

*answers must refer to data and be comparative*  
*allow best results / most effective*  
*ignore best drug unqualified*  
*ignore references to 12 weeks / 1 year*

1

[8]

21

(a) any **two** from:

- diet  
*ignore exercise*  
*accept any reasonable reference to diet*  
*do **not** accept salt / blood pressure*  
*ignore age / gender / HDL / LDL*
- heredity / genes / genetic makeup
- reference to cholesterol production by liver

2

(b) (i) Blood cholesterol concentration is only one of several factors  
affecting death from all causes

1

(ii) 170 – 210

*accept 210 - 170*

1

[4]

22

(a) any **one** from:

*ignore control variables that are not given in the method, such as 'equally crushed' or same time*

*do **not** accept volume of apple juice*

- 20 g (of apple) **or** (same) mass / amount / weight of apple  
*ignore volume / size*
- crushed (apple)
- 10 drops (of solution) **or** (same) number / amount / volume of drops  
*do **not** accept 10 drops of amylase alone*
- apple **or** type of fruit  
*ignore type of apple*

1

(b) (may) have different volume / amount / sizes

*ignore reference to human error*

*ignore don't know / can't measure size of drop*

1

(c) amylase has no / little effect on cell / walls / apple

*accept ideas that refer to shape of enzyme being 'incorrect'*

**or** amylase does not breakdown / digest cell / walls / apple

*accept amylase only breaks down / digests starch*

1

pectinase breaks down cell / walls / apple

*allow digest for breakdown*

*allow shape of pectinase fits cell / walls / apple*

1

boiling breaks down cell / walls / apple

1

(d) 11.6

1

enzyme / pectinase destroyed / denatured / damaged / broken down

*do **not** allow kill*

1

only effect of boiling (relevant)

1

**[8]**

23

(a) (i) capillary

1

(ii) diffusion

1

(iii)	Carbon dioxide	low(er)	high(er)
-------	----------------	---------	----------

1

Oxygen	high(er)	low(er)
--------	----------	---------

*1 mark for each correct row*

1

(b) (i) red blood cells

1

(ii) haemoglobin

1

**[6]****24**

(a) transpiration

1

(b) (i) 200

*correct answer with or without working**if answer incorrect:**allow 1 mark for  $8 \times 25$  or**allow 1 mark for answer from candidate's count  $\times 25$* 

2

(ii) **R***allow **P** or **Q** if candidate's answer to (b)(i) nearer to value for one of those**do **not** allow **R** if the answer to (b)(i) would give an answer of **P** or **Q****allow R if (b)(i) is blank*

1

(iii) few stomat

*allow no stomata on upper surface / all stomata on lower surface*

1

little / less transpiration **or** little / less water (vapour) loss / enable water to be retained

*allow no water loss from upper surface*

1

[6]

25

- (a) (i) water loss  
*extra substance(s) cancel*  
*if transpiration stream described max 1 mark*
- as a vapour / by evaporation  
*ignore stomata*
- (ii) stomata / stoma / guard cells  
*ignore epidermis*
- (b) (i) 2.8  
*correct answer with or without working gains 2 marks*  
*if answer incorrect:*  
*allow 1 mark for  $(8.6 - 0.2) \div 3$  **or**  $8.4 \div 3$*
- (ii) warmer at 16:00 / gets cooler  
**or** reverse argument for 19.00

1

1

1

2

1

faster diffusion / evaporation

*accept sun setting as equivalent to heat or light marking points*

**or**

lighter at 16:00 / gets darker (1)

*if no environmental factor still allow reason mark*

stomata open / more open (1)

*eg 'stomata close later in the day'*

**or**

(more) windy at 16:00 / gets less windy (1)

removal of (more) water vapour / steeper gradient (1)

**or**

air is less humid at 16.00 (1)

*allow rain at 19.00*

faster diffusion or steeper gradient (1)

1

[7]

26

(a) (i) 7500

*ignore units*

1



- (ii) any **two** from  
*if examples given they must be correct*

(differences in)

- age
- gender / sex
- activity / amount of exercise  
*allow job / lifestyle*  
*ignore fitness / health / medication*
- metabolism / metabolic rate  
*allow BMR*
- genetic differences
- body weight / mass / size / physique  
*allow BMI*
- pregnancy
- proportion of muscle to fat

2

- (b) **A**

*if box empty, allow in explanation*

1

more energy taken in than used

*accept more food taken in than used*

*allow correct numbers if comparative*

*ignore incorrect numbers if comparison correct*

1

- (c) eat less (food / carbohydrates / fat / calories)

*accept a medical treatment such as gastric band / slimming pills / liposuction*

*ignore balanced / healthy / diet*

*allow go to weight watchers etc.*

*ignore burn off more*

1

exercise (more) **or** go to the gym

1

[7]

27

- (a) (i) any **one** from:
- ignore cancer / AIDS*
  - as a sleeping pill  
*do **not** accept morning sickness*
  - treating leprosy
- 1
- (ii) thalidomide causes birth defects / abnormalities / described  
*in this order*  
*ignore kill / harm / damage baby*
- 1
- to be (more) sure of not getting pregnant  
*allow to be certain there is no baby **or** in case one doesn't work*
- 1
- (b) (i) oestrogen
- 1
- progesterone
- 1
- (ii) any **two** from:
- reduce chances of ovarian cancer
  - more effective (in preventing pregnancy)
  - no pills (to remember) for 7 days (out of every 28)  
*allow only taken for 21 days (out of 28)*
  - doesn't have to be taken at the same time every day
- 2
- (iii) less chance of headaches  
*ignore won't get headaches*
- or**  
less chance of forgetting  
*allow lower dose of hormone*  
*allow fewer side effects*  
*ignore only contains one hormone*
- 1

[8]

28

- (a) don't kill pathogens / bacteria / viruses / microbes / microorganisms

*allow don't contain antibiotics*

*ignore antibodies / attack / fight*

*allow only treat symptoms / pain*

*ignore kill disease / germs*

1

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

- age
- gender
- extent / severity of pain  
**or** how long had pain before trial
- type of pain / illness / site of pain  
*accept 'the pain' for 1 mark, if neither extent or type given*  
*ignore pain threshold*
- (body) mass / weight / height  
*allow body size / physique*
- other medical issues / drugs taken / health / fitness
- ethnicity

2

- (c) (i) 75

*ignore calculations / %*

1

- (ii) faster pain relief / decrease

*allow pain relief sooner*

**or** *it works quicker*

**or** *more pain relief at start / in first  $1 / 1\frac{3}{4}$  hours*

1

- (iii) decrease of pain higher / more

*ignore more effective unless qualified by time  $> 1\frac{3}{4}$  hours*  
*allow effect lasts longer*

1

decrease of pain is longer lasting

1

(d) any **three** from:

*ignore yes or no*

**(Yes because)**

- rapid pain relief (from A)
- long lasting pain relief (from B)
- and it costs less
- the sum of the pain relief (from A + B) is greater (than X)

**(No because)**

- drug X gives more pain relief
- (A + B / they ) might interact with each other
- could result in overdose
- could be more / new side effects

*if neither points gained  
allow (more) dangerous*

3

[10]

29

(a) in sequence:

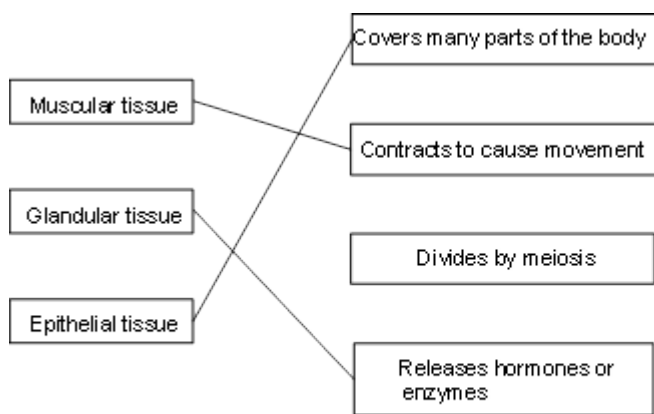
2 = tissue(s)

3 = organ(s)

4 = system(s)

1

(b)



*1 mark for each correct line  
extra line(s) from one tissue cancel*

3

[4]

30

(a) (i) A

1

(ii) hydrochloric (acid) / HCl

1

(iii) alkali / suitable named example

*accept sodium hydrogen*

*carbonate / sodium bicarbonate / milk of magnesia /*

*other brand names*

*allow bile (salts)*

*ignore antacid*

1

(b) • amylase breaks down starch

1

• (broken down) into sugars / glucose

1

• digestion of starch in the mouth

1

• (also) starch broken down in small intestine

1

• amylase produced in salivary glands / small intestine / pancreas

1

- (c) small intestine  
 allow ileum / duodenum  
 do **not** accept large intestine

1

[9]

31

- (a) LHS: carbon dioxide **AND** water  
 in either order  
 accept  $\text{CO}_2$  **and**  $\text{H}_2\text{O}$   
 allow  $\text{CO}_2$  and  $\text{H}_2\text{O}$   
 if names given ignore symbols  
 do **not** accept  $\text{CO}^2$  /  $\text{H}^2\text{O}$  /  $\text{Co}$  /  $\text{CO}$   
 ignore balancing

1

- RHS: sugar(s) / glucose / starch / carbohydrate(s)  
 accept  $\text{C}_6\text{H}_{12}\text{O}_6$   
 allow  $\text{C}_6\text{H}_{12}\text{O}_6$   
 do **not** accept  $\text{C}^6\text{H}^{12}\text{O}^6$

1

- (b) (i) light is needed for photosynthesis

**or**

no photosynthesis occurred (so no oxygen produced)

1

- (ii) oxygen is needed / used for (aerobic) respiration  
 full statement  
 respiration occurs **or** oxygen is needed for anaerobic respiration  
 gains **1** mark

2

- (c) (i) (with increasing temperature) rise then fall in rate

1

use of figures, ie

max. production at  $40^\circ\text{C}$ **or** maximum rate of 37.5 to 38

1

- (ii)  $25 - 35^\circ\text{C}$

**either** faster movement of particles / molecules / more collisions**or** particles have more energy / enzymes have more energy

1

**or** temperature is a limiting factor over this range

40 – 50 °C

denaturation of proteins / enzymes

*ignore denaturation of cells*

*ignore stomata*

1

- (d) above 35 °C (to 40 °C) – little increase in rate  
**or** > 40 °C – causes decrease in rate

1

so waste of money **or** less profit / expensive

1

because respiration rate is higher at > 35 °C

**or**

respiration reduces the effect of photosynthesis

1

[12]

32

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

*ignore eating disorder*

*ignore cancer*

- arthritis  
*accept worn joints*
- diabetes  
*accept high blood sugar*
- high blood pressure  
*ignore cholesterol*
- heart disease / heart condition / heart attack / blood vessel disease  
*allow blood clots / strokes*

2

- (b) (i)  $\frac{1}{4}$  **or** 0.25 **or** 25%

*correct answer gains 2 marks*

*if answer incorrect, evidence of  $1500 \div 6000$  gains 1 mark*

*25 without % gains 1 mark*

2

(ii) majority / most / high proportion of people in trial lost mass / weight  
*ignore good results / it worked*

1

[5]

33

(a) (i) 129

1

(ii) 9

*accept calculated difference between answer to (a)(i) and 120*

1

(b) less energy / power used

*allow less fuel / named fuel used*

*ignore cost*

1

less pollution / carbon dioxide

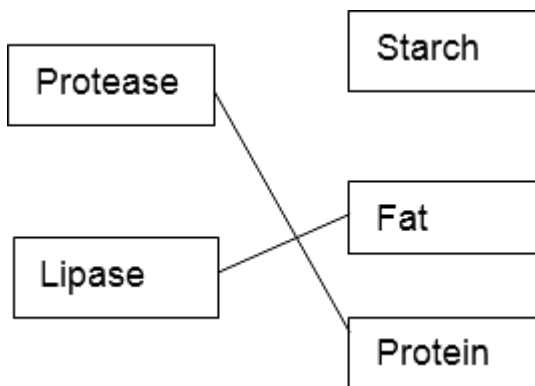
**or** less hot water / less heat released

*allow less global warming / carbon emissions or reduced carbon footprints*

*do **not** accept secondary effects alone, eg less melting of ice caps*

1

(c) (i)



*1 mark for each correct line*

*do **not** accept two lines from an enzyme*

2

(ii) denatured

*if no answer on the line accept a clear indication of correct answer in the box*

1

[7]



34

(a) protease

*allow trypsin / peptidase**do **not** allow pepsin*

1

carbohydrase / amylase

*do **not** allow sucrase / maltase / lactase*

1

(b) no lipase produced / found

1

in stomach / mouth / before small intestine

**OR**accept lipase only produced / found (1)

in small intestine / pancreas (1)

*if no other mark is awarded lipid is not broken down in the stomach****or** lipid is digested in small intestine gains **1** mark*

1

(c) enzymes only work in solution / when dissolved

**or**

because enzyme / lipase / it is dry

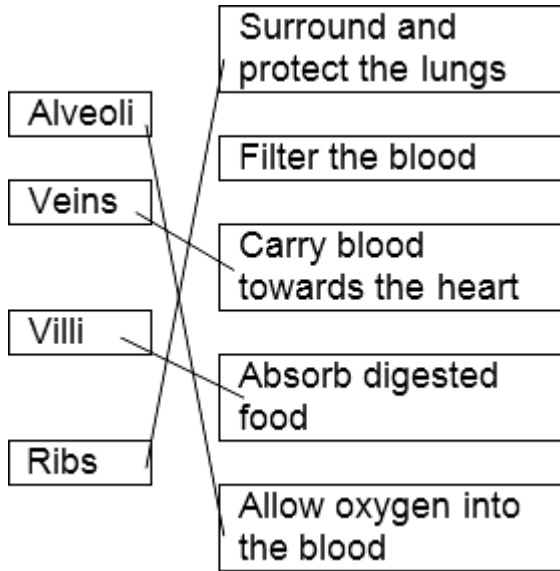
*allow enzymes only work in presence of water **or** enzymes do not work when dry**ignore other physical conditions*

1

**[5]**

35

(a)



4 correct = 4 marks  
 3 correct = 3 marks  
 2 correct = 2 marks  
 1 correct = 1 mark  
 extra line from a structure cancels the mark

4

(b) diffusion

1

[5]

36

(a) transpiration

1

(b) increase then decrease

1

maximum rate at 36 - 38 (°C) / 540 - 560 (grams per day)

*any figure in these ranges*

1

(c) (i) reduce water loss / prevent wilting

*allow stops water loss*

1

(ii) 40 - 45 °C

1

[5]

- 37** any **two** from:
- arthritis  
*ignore descriptions*
  - diabetes
  - high blood pressure
  - heart / blood vessel disease  
*ignore cholesterol*
- [2]**

- 38** (a) (i) any **two** from:
- fibres not damaged
  - machines last longer / machines not damaged by stones
  - shorter time **or** quicker
  - lower temperature  
*allow cheaper / uses less energy as an alternative to shorter time / lower temperature, if these not given*
- 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
- 1
- [5]**

- 39** (a) shape changed / destroyed (above 45 °C)  
*accept denatured*  
*accept active site changed*  
*do **not** accept enzyme killed*
- 1
- (shape) doesn't fit (other molecules / stain)
- 1

- (b) (i) any **two** from:
- can wash the clothes at higher temperature
  - so wash / enzyme action will be quicker  
*do **not** accept idea of bacteria working faster*
  - enzyme not destroyed at high temperature / 80 °C  
*accept denaturation or description*
- 2
- (ii) high(er) temperature / 80 °C uses more energy / fuel
- 1
- more pollution / named (eg carbon dioxide / global warming) (from electricity production)
- or**
- increased release of hot water (into the environment)
- 1
- [6]**

- 40** (a) (i) capillary
- 1
- (ii) diffusion
- 1
- (b) (i) Z
- ignore any names*
- 1
- (ii) large / increased surface / area / **or** to absorb more food **or** improved diffusion  
*allow all food absorbed*
- 1
- [4]**

- 41** (a) (i) 18
- 1
- (ii) Z
- 1
- (b) (i) red blood cells
- 1

(ii) haemoglobin

1

**[4]****42**

(a) (i) wind

1

temperature

*answers in either order**ignore weather*

1

(ii) different plants have different sizes / different numbers of leaves / different sizes of leaves / different plants take up different amounts of water

*ignore reference to validity**allow different plants need**different amounts of water*

1

(b) in table, in sequence:

C

*all 3 correct = 2 marks*

B

A

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

2

(c) transpiration

1

**[6]****43**

(a) (i) brain

1

(ii) skin

1

(iii) 1/25 **or** 4% **or** 0.04 **or** 1 in 25 **or** 1:25 **or** 1 out of 25

$$\text{allow } \frac{1000}{25000}$$

1

(b) any **two** from:

- increased / high heart rate / pulse rate  
*do not allow pumps more blood unqualified*
- dilation / widening of arteries / arterioles (to skeletal muscles)  
*accept vasodilation unqualified*  
*do not accept reference to veins / capillaries*

**or**

less blood flow to other organs

- increased stroke volume / described

2

(c) *ignore references to breathing*

more respiration / description

**or**

more energy required **or** to provide more energy

1

respiration / process described → CO<sub>2</sub>

*do not accept anaerobic respiration*

1

CO<sub>2</sub> diffuses into blood

1

[8]

44

(a) large surface / large area

1

thin / short distance (from air to blood) / one cell thick / two cells thick

1

good blood supply / many capillaries / capillary network / many blood vessels  
*ignore moist surface*

1

(b) (i) diffusion

*ignore gaseous exchange*

1

(ii) brings (more) oxygen / air into the lungs / alveoli

1

keeps O<sub>2</sub> level high in alveoli

**or**

maintains concentration difference (between alveoli and blood) / keeps O<sub>2</sub> concentration in alveoli > O<sub>2</sub> concentration in blood gains **2** marks

1

**[6]****45**

(a) any **two** from:

- (high) CRP / protein
- (no) heart condition  
*allow health*
- (not high) LDL
- over 50 / age
- number of tablets (each day)  
*ignore time*  
*ignore placebo / rosuvastatin*  
*ignore number of people*

2

(b) any **one** from:

- tablet with no drug  
*allow fake (pill) / dummy (pill) / sugar / chalk (pill)*
- tablet that has no effect  
*allow drug that has no effect*
- tablet without chemicals  
*ignore vitamin / mineral pill*
- tablet that people thought contained statin **or** reference to psychological effect  
*ignore control / different statin*

1

(c) 17802 / large number of people **or** enough people

*ignore control group / fair test / control variables*  
*ignore time / repeats*

1

(d) any **one** from:

*ignore cost*

- placebo group at risk of heart attack **or** to allow statin to be given to everyone
- statin group 54% less likely to get heart attack **or** showed that statin worked **or** showed trial (very) successful

*ignore reliable*

- sufficient information gained / results conclusive

*ignore got results early*

- unethical / unfair to carry on trial

1

(e) to avoid bias **or** show impartiality **or** show results independent

*allow manufacturers could cheat*

*ignore reliability*

*ignore could be sued / blamed if trial went wrong*

*ignore manufacturer would know which group got statin / placebo*

1

(f) any **two** from:

- reduction in LDL

*allow improves LDL:HDL balance **or** LDL and HDL concentrations equal*

*ignore less cholesterol*

*ignore more HDL*

*do **not** accept less HDL*

- reduction in (saturated) fats
- reduces deposition of fat / cholesterol / LDL in walls of blood vessels  
**or**  
blood vessels less likely to be blocked with fat / cholesterol / LDL

2

[8]

46

(a) (i) tissue

*extra box ticked cancels the mark*

1

(ii) organ

*extra ring drawn cancels the mark*

1



- (b) (i) Layer B  
*each extra box ticked cancels 1 mark*

1

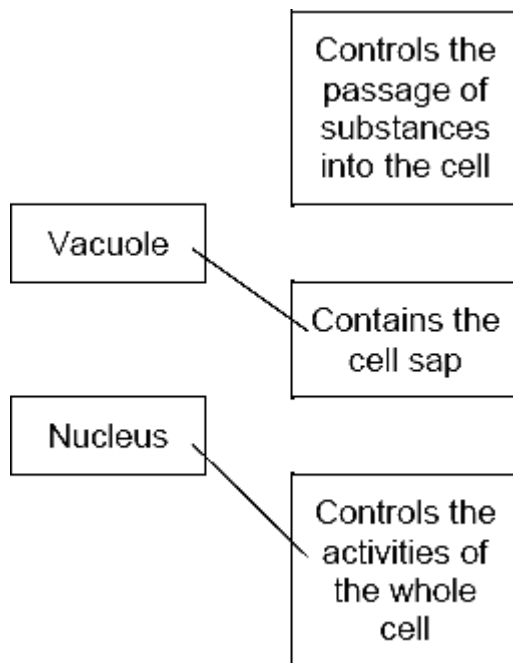
Layer C

1

- (ii) (contain) chloroplasts / chlorophyll  
*other parts disqualify*

1

(c)



*two correct = 2 marks*

*one correct = 1 mark*

*extra line from a part of a cell cancels the mark*

2

[7]

47

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

*ignore reference to recording results every 5 minutes **or** concentrations of lipid / lipase*

- (same) volume / amount / 1 cm<sup>3</sup> lipase  
*allow amount of solution*
- (same) volume / amount / 5 cm<sup>3</sup> lipid  
*allow keep same volumes in the test tubes*
- mixed after 3 minutes / same time before mixing  
*do **not** accept temperature*

1

(b) so that the lipase and the lipid reached the right temperature

1

(c) any **two** from

*ignore explanations*

- decrease in time **or** faster (breakdown)
- then increase in time **or** then slower (breakdown)
- fastest / least time / optimum at 35°C

2

(d) any **two** from:

*ignore 'test at more temperatures' unqualified*

- test more regularly eg test every minute  
*any interval < 5min*
- test at smaller temperature intervals  
*any value < 15°C*  
*allow test more temperatures in the range*
- test between 50 (°C) and 95 (°C)  
*any value in range, eg test at 70*
- repeat at same temperatures  
**or** repeat the investigation  
**or** compare results with others  
*allow do **it** again*

2

(e) (i) (lipase / it) denatured / destroyed / changed shape

*allow damaged / deformed*

*do **not** accept killed*

*ignore broken (down)*

1

(ii) fatty acids and glycerol

1

**[8]****48**

(a) guard cells

1

(b) (i) 2.00 / 2.0 / 2

1

(ii) 0.05 or 1/20

1

(iii) (Q has)

*it = Q*

large(r) surface area / more stomata / thinner cuticle / larger leaves

*accept other sensible answers*

1

(iv) wind 30

*extra box ticked cancels the mark*

1

(c) wilting

*extra ring drawn cancels the mark*

1

**[6]****49**

(a) (i) cholesterol

1

fat

*in this order*

1

(ii) mycoprotein has (approx) half amount of protein / has 11.8 (g) protein while chicken has 22.0 (g)*accept has less protein**ignore less fat*

1

(b) (i) increased

1

(±) constant rate **or** (from 0) to 9.2 / by 9.2(cm) **or** about 1 cm a day **or** increase slower at the beginning and / or at the end

1

(ii) species **A** grows faster / more than species **B****or**species **A** has larger diameter **or** is bigger**or**the growth of species **B** slows down after 6 weeks*accept use of approximate figures*

1

(c) any **two** from:

- pH / acidity / alkalinity  
*ignore references to carbon dioxide / waste products*
- (speed of) stirring  
*ignore time in the fermenter*
- oxygen (concentration) / aeration  
*ignore initial amount of Fusarium*
- ion concentration / named eg  $\text{-NH}_4^+$   
*allow ammonia*
- pressure

2

**[8]****50**

(a) blood has red (blood) cells / haemoglobin

1

haemoglobin combines with / carries oxygen

*ignore 'mix'*

**NB** Blood can form oxyhaemoglobin = 2 marks

1

(b) blood gains oxygen / becomes oxygenated (in the lungs)

*idea of acquiring oxygen must be unambiguous*

1

blood loses oxygen to the muscles / cells

1

because muscles are respiring (aerobically)

1

to provide energy (for exercise)

1

**[6]**

**51**

D – many microvilli (1)

Ex – provide large surface area (1)

*five points made  
max 3 descriptions  
max 3 explanations*

D – many capillaries / good blood supply (1)

Ex – maintain concentration / diffusion gradient **or** quickly removes food (1)

D – thin wall / one cell thick surface / capillaries near surface (1)

*allow villi are thin  
ignore villi are one cell thick*

Ex – short distance for food to travel (1)

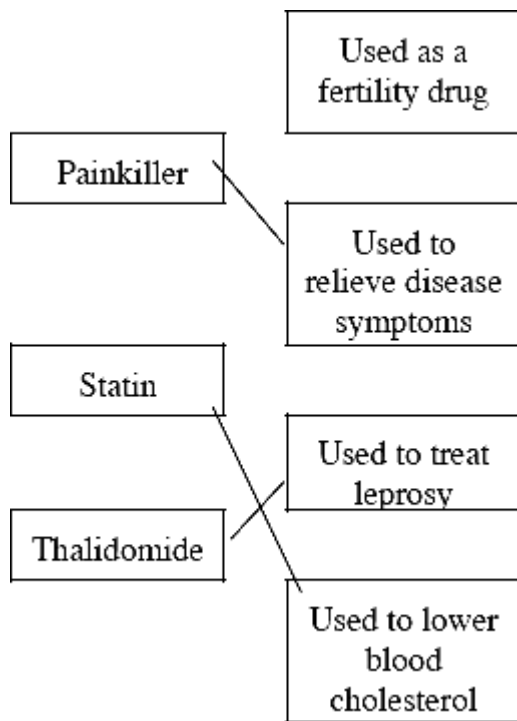
D – many mitochondria (1)

Ex – provide energy / ATP for active uptake / transport (1)

**[5]**

**52**

(a)



*all three correct = 3 marks  
two correct = 2 marks  
one correct = 1 mark  
extra line from a statement cancels  
the mark*

3

(b) (i) 8

1

(ii) 3210

1

(c) (i) if it is toxic

1

(ii) if it has side effects

1

[7]

53

(a) fatty acids

1

glycerol

1

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

- (same) amount /  $1\text{cm}^3$  fat
- (same) amount /  $10\text{cm}^3$  lipase / enzyme
- (kept for) 24 hours **or** (same length of) time

1

(ii) temperature

*allow heat / warmth*

1

(c) (carry out experiments) using more temperatures / smaller intervals

*ignore repeat unqualified**do not accept longer time*

1

between  $20$  and  $60\text{ }^\circ\text{C}$  / around  $40\text{ }^\circ\text{C}$ *accept extra single temperature in range  $20\text{ }^\circ\text{C} - 60\text{ }^\circ\text{C}$  but cannot be  $20\text{ }^\circ\text{C}$ ,  $40\text{ }^\circ\text{C}$  or  $60\text{ }^\circ\text{C}$* 

1

(d) (i) 'strong' acid

1

- (ii) enzyme works / not destroyed / not denatured / not damaged  
*do **not** accept enzyme not killed*  
*accept any indication that the fat is digested*  
*accept same as tube 3 / tube at 40 °C*  
*accept optimum temperature / at or near body temperature*

1

[8]

54

- (a) pancreas

*either order*

1

small intestine

1

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

- to give them time to come to temperature of the water-bath  
*accept so (they / both) are at the same temperature*
- at / near body temperature / best / optimum temperature
- otherwise reaction would take place at a series of different temperatures  
**or** sensible statement about control / fair test

2

- (c) (i) 0.42

*allow in range 0.42 to 0.425*

1

- (ii) 0.021

*correct answer with or without working*  
*allow ecf from (c)(i) ie (c)(i) ÷ 20 correctly calculated for **2** marks*  
*if answer incorrect 0.42 ÷ 20 **or** (c)(i) ÷ 20 gains **1** mark*

2

- (iii) (all) starch digested / gone / used up / turned to sugar

*allow the amount of sugar stays the same / maximum*

1

- (iv) any **two** from
- allow reference to active site once only as alternative to first or second bullet point*
- enzyme destroyed / denatured / damaged / shape changed  
*do **not** accept killed*
  - unable to fit (starch molecule)
  - starch can't be digested  
*enzymes don't work is insufficient*

2

**[10]****55**

(a) (i) villus

1

(ii) its outer surface is one cell thick

*cancel 1 mark for each extra box ticked*

1

it has a large surface area

1

it has good blood supply

1

(b) diffusion

1

**[5]****56**(a) (i) **B or D**

1

(ii) **A or B**

1



(b) any **four** from:

*more / faster must be implied at least once for full marks*

- increased blood (flow)  
*ignore reference to breathing*
- (more) oxygen supplied **or** aerobic respiration  
*allow less anaerobic (respiration) **or** and prevents oxygen debt*
- (more) glucose / sugar / food supplied  
*ignore feeding*
- (higher rate of) respiration
- (more) energy needed / released  
*allow made*
- (more) carbon dioxide removed
- (muscles) doing (more) work **or** muscles contracting
- remove heat / cooling
- remove lactic acid **or** less lactic acid formed

4

**[6]****57**

(a) C

1

(b) (i) guard (cell)

1

(ii) temperature water movement / transpiration  
through stomata / pores / holes / (region) X**or**

petroleum jelly blocks / covers stomata / pores / holes / X

1

stomata / pores / holes / X found on lower surface

1

**[4]**

58

(a) any **two** from:

- arthritis  
*allow damaged joints*
- diabetes  
*accept high blood sugar*
- high blood pressure
- strokes  
*allow blocked blood vessels / thrombosis*
- allow breathing difficulties  
*ignore cancer*  
*ignore high cholesterol*

2

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

*to gain marks there must be a comparison*  
*ignore comparison at single age*

- lower number of women deaths up to age of 75-80
- higher number of women deaths after 80  
*ignore women die older or men die younger*
- men's peak higher
- men's peak at an earlier age
- men's death start earlier than women
- more men than women die of heart disease

2

(ii) any **two** from:

- men smoke more (cigarettes)  
*ignore alcohol*
- more men smoke
- men under more stress
- men less active
- more men overweight / eat more / less diet conscious **or** different fat distribution  
*ignore reference to body size*
- genetic factors
- men might have lower metabolic rate  
*ignore references to hormones*
- men less likely to visit doctor even though they have symptoms

2

(c) *points can be in any order*

laboratory tests / tests on tissues

**or**

tests on animals

**or**

tests for toxicity

*ignore computer simulations*

1

tests for side effects on volunteers / healthy people / small numbers

1

widespread testing

**or**

testing for optimum dose

**or**

test on patients / sick people

**or**

test to see if it is effective

*accept use of placebo*

1

[9]