Q1.

(a) (A) stomach

1

(B) small intestine

allow ileum
ignore intestine unqualified

1

(C) liver

1

(b) soluble

1

catalyse

1

denatured

1

this order only

(c) amino acids

1

(d) any **one** from:
- for growth

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

allow to strengthen bones
ignore for energy

1

(e) stomach

1

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

3–4

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

1–2

No relevant content

0

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

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

precaution is required

(g) fat

1

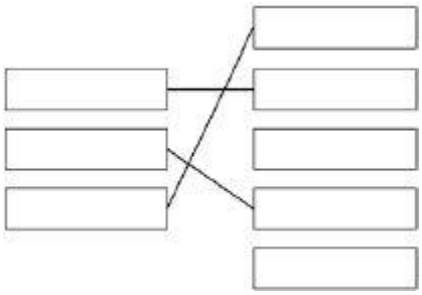
(h) type 2 diabetes

1

[15]

Q2.

(a)



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

1
1
1

(b) C

1

(c) (vessel) B

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

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

1

or
lumen is small / narrow

allow description of 'lumen'

1

(d) 95

1

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

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

1

(f) 250 × 60 (= 15 000)

or
15 000

allow 0.25 × 60

1

15

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

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

1

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

(g) any **two** from:

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

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

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

  allow only 7 days recovery

- lower risk of a heart attack (during procedure)

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

2

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

allow only a 5% chance of failure

1

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

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

1

[14]

Q3.

(a) diffusion

1

(b) A

1

(c) B

1

(d) (earthworm) can absorb more oxygen (in a given time)
or
increases / more gas exchange

allow get / obtain / take in more oxygen
ignore easier absorption of oxygen
ignore references to food

1

(e) lipase

1

(f) more oxygen (in soil with earthworms)

allow earthworms bring oxygen to soil

1

(for) more (aerobic) respiration

*do **not** accept anaerobic respiration*

1

(of) bacteria / fungi / microorganisms / microbes / decomposers

1

reference to more is only needed once for the first two marking points

(g) fertilisation

ignore sexual reproduction

1

(h) asexual (reproduction)

allow cloning

1

[10]

Q4.

(a) (for calcium)

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

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

1

(for vitamin B-12)

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

allow alternative route with correct rounding

1

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

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

1

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

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

(b) **Level 2:** Scientifically relevant facts, events or processes are identified and

given in detail to form an accurate account.

4–6

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

1–3

No relevant content

0

Indicative content

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

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

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

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

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

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

1

(and) fatty acids lower the pH

1

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

1

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

ignore human error unqualified
ignore experimental error or examples of this

1

(e) bile emulsifies fats

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

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

1

creates a larger surface area (of fat)

1

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

allow fatty acids produced by action of lipase more quickly

1

[16]

Q5.

(a) pancreas

1

(b) liver

1

glycogen

1

in this order

(c) would be digested / broken down (by enzymes / protease / pepsin / acid or to amino acids)

allow denatured (by acid)

1

(d) use of 14.2 **and** 6.8

1

7.4

*allow an answer of 7.2 or 7.3 (using 14.1 and / or 6.9) for **1** mark*

1

*an answer of 7.4 scores **2** marks*

(e) any **one** from:

- (person A's) results are higher

  ignore A peaks at a higher level than B

- (A) increases for a longer time **or** peaks later

- (A) takes longer to decrease **or** takes longer to return to normal

  allow other correct comparisons

  allow a description using pairs of figures from graph at a given time

1

allow converse comparisons with person B as the subject

(f) a negative correlation

1

(g) less carbohydrate / sugar / fat in diet

allow go on a diet
allow eat less
allow balanced / healthy diet

or

lose weight **or** maintain a healthy weight

ignore diet unqualified

1

(more) exercise

allow examples of exercise

1

[10]

Q6.

(a) kills microorganisms / bacteria / fungi / viruses / microbes

allow to remove microorganisms / bacteria / fungi / viruses / microbes

ignore germs

allow so mycoprotein is not contaminated

1

(which) compete for food / oxygen
or
which make toxins

allow so mycoprotein is safe to eat

or
which are pathogens
or
which might kill the fungus / *Fusarium*

1

(b) 30 °C

1

(c) for (aerobic) respiration

*do **not** accept anaerobic*

1

(which) releases energy (for growth)

*do **not** accept produces energy*

allow glucose is used to make other organic substances e.g. protein

1

(d) any **two** from:

so *Fusarium* can
- grow faster / better
- get sufficient food / glucose / minerals

allow more / enough

- get sufficient oxygen

allow more / enough

- get rid of sufficient carbon dioxide

allow more / enough
allow waste

- be kept at a (suitable) temperature

  allow to avoid 'clumping'

2

(e) 200 grams

1

[8]

Q7.

(a) *x*-axis: scale + labelled, including units

scale ≥ ½ width of graph paper label: biomass in g/m²

1

bar widths correct

± ½-square each side
allow 1 mark if 3 correct

2

all 4 bars correctly labelled

large fish + small fish + invertebrate (animals) + algae
or
(trophic level) 4 + 3 + 2 + 1
or
tertiary consumer + secondary consumer + primary consumer + producer

ignore bar heights

1

(b) $\frac{840-10}{840} \times 100$

allow equivalent calculation

1

98.809523... / 98.810 / 98.81 / 98.8

1

99

allow answer given to two significant figures from an incorrect calculation in step 2

1

*an answer of 99 scores **3** marks*

(c) inedible parts / example

*allow eaten by other animals **or** not all organisms eaten*

or

egested / faeces

allow not digested
allow excretion / urine

ignore *waste*

or

respiration / as CO_2

ignore energy losses

ignore movement

1

(d) bacteria decay organic matter / sewage / algae / dead plants

1

(by) digestion

allow example such as starch broken down to sugar

or

protein broken down to amino acids

1

(and) bacteria respire aerobically

or

respire using oxygen

1

(which) lowers oxygen concentration (in water)

or

fish have less oxygen

allow reduced respiration of fish

1

(so) reduced energy supply causes death of fish

allow toxins in the sewage kill fish

ignore pathogens or (pathogenic) bacteria cause disease in fish and kills them

1

[13]

Q8.

(a) (**A**) bronchus

allow bronchi

allow bronchiole

1

(**B**) trachea

allow windpipe

1

(**C**) alveolus

allow alveoli

ignore air sac

1

(b) circulatory system

1

(c) **Q**

1

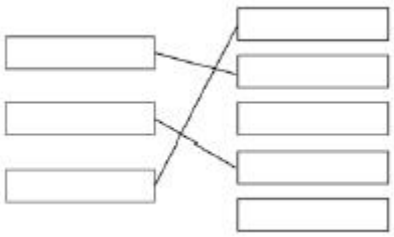
(d) guard cell

1

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

1

(f)



1 *mark for each correct line*

extra line from a tissue negates the mark for that tissue

3

[10]

Q9.

(a) movement of particles from (an area of) high concentration to (an area of) low concentration

allow movement of particles down a concentration gradient

*do **not** accept along / across a concentration gradient*

1

(b) oxygen

allow O_2

carbon dioxide

allow CO_2

in this order only

*both needed for **1** mark*

1

(c) less diffusion

allow less gas will enter / leave the blood

allow ecf from (b)

1

(because of the) reduced / smaller surface area

1

(d) (**B**) very low birth mass

1

(**C**) extremely low birth mass

1

(e) any **one** from:

- men would be included in the study (can't be pregnant)

- children / older (post-menopausal) women would be included in the study

ignore reference to cost

1

(f) any **three** from:

- higher percentage of pregnant women have never smoked (compared with non-pregnant women)
- higher percentage of pregnant women are ex-smokers (compared with non-pregnant women)
- lower percentage of pregnant women currently smoke (compared with non-pregnant women)
- in both pregnant and non-pregnant women, the highest percentage of women have never smoked

allow converse throughout

allow appropriate use of correct figures throughout

3

(g) scatter graph

1

(h) **B**

1

(i) there is no correlation (between the variables)

allow (all) the points are widely scattered

allow idea that the person with the longest birth time does not have the highest risk

1

[13]

Q10.

(a) an undifferentiated / unspecialised cell

1

that can differentiate / become / change into (many) other cell types

1

(b) (malignant tumours) invade / spread to other tissues via the blood (benign don't)
or
(malignant tumours) form secondary tumours in other organs

ignore cancer unqualified

allow converse

allow metastasises

1

(c) mitosis

correct spelling only

1

(d) glucose

answers in any order

ignore sugar

1

protein / amino acids

1

(e) no need to wait for a donor
or
can be done immediately

1

(so) no risk of rejection
or
no need for immunosuppressant drugs

*if no other marks awarded, allow for **1** mark idea of ethics surrounding the use of tissue from another / dead person*

1

(f) stent opens up the trachea

1

allowing air to flow through
or
allowing patient to breathe

1

(g) **Level 3 (5-6 marks):**
A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

Level 2 (3-4 marks):
Some logically linked reasons are given. There may also be a simple judgement.

Level 1 (1-2 marks):
Relevant points are made. They are not logically linked.

Level 0
No relevant content

Indicative content

embryos advantages
- can create many embryos in a lab
- painless technique
- can treat many diseases / stem cells are pluripotent / can become any type of cell (whereas bone marrow can treat a limited number)

embryos disadvantages
- *harm / death to embryo*
- *embryo rights / embryo cannot consent*
- *unreliable technique / may not work*

bone marrow advantages
- no ethical issues / patient can give permission
- can treat **some** diseases
- procedure is (relatively) safe / doesn't kill donor
- tried and tested / reliable technique
- patients recover quickly from procedure

bone marrow disadvantages
- *risk of infection from procedure*

- *can only treat a few diseases*
- *procedure can be painful*

both procedures advantage

can treat the disease / problem

both procedures disadvantages

- *risk of transfer of viral infection*
- *some stem cells can grow out of control / become cancerous*

[16]

Q11.

(a) vena cava

1

(b) 0.5 mm = 0.05 cm

1

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

allow alternative correct substitution

1

24.875

1

25 (s)

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

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

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

1

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

1

(blood) enters left atrium

1

(blood) enters (the) left ventricle

1

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

allow blood travels through arterioles

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

1

ignore ref to valves / systole / diastole throughout

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

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

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

No relevant content (0 marks)

Indicative content

S = structural F = functional

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

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

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

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

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

- (S) cells of the villi have microvilli / more projections
- (F) to further increase the surface area / increase the number of proteins in the membrane / to allow more active transport to take place

[15]

Q12.

(a) salivary glands and pancreas

1

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

1

shape of active site is unique / complementary to substrate

allow converse

or

substrate is specific to active site / enzyme

allow enzyme has a high specificity for substrate

1

bonds (within starch / substrate

or

between sugar molecules) are broken

1

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

1

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

or
to get the starch and amylase / solutions to the same temperature / 20 °C
or
to get the starch and amylase / solutions to the (same) temperature of the water bath

1

(e) **40 °C**
all wells contain a symbol
and
must contain at least two crossed (×) wells at the end
allow final three wells crossed
(×)

1

60 °C
all wells contain a symbol
and
must have fewer crossed (×) wells at the end than at 40 °C
allow all wells ticked (✓)
*for either mp do **not** allow a crossed well followed by a ticked well*

1

(f) more accurate
allow (so) closer to (the) true value

1

(because) it is a quantitative measure
allow (it's) an actual value as opposed to an opinion
or
less / not subjective
allow colour is only qualitative

1

(g) 0.07 (%)

1

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

1

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

1

(i) 1.08 (arbitrary units)

1

at 80 °C, enzyme / amylase has denatured
allow description of denaturation
*do **not** allow enzyme is killed*

1

so starch is not broken down (at all)
allow the concentration of starch is still 0.5%

1

[16]

Q13.

(a) to kill microorganisms on / in the flask
or
so only microorganisms in the milk caused the results
allow bacteria / fungi / microbes
*do **not** accept viruses*
ignore germs

1

(b) heating

1

to over 100 °C
allow place in oven / pressure cooker
*do **not** accept disinfectant*
allow other suitable method – e.g. use of UV

1

(c) to prevent microorganisms entering from the air
allow bacteria / fungi / microbes for microorganisms
*do **not** accept viruses*
ignore germs

1

(d)

0	olive-green	**7**
1	olive-green	**7**
2	olive-green	**7**
3	orange-green	**6**

*all correct for **1** mark*

1

(e) (pH meter) – more accurate / more precise
allow more exact
allow can measure to 0.1 pH unit
***or** to smaller intervals of pH*

1

(leaving…6 days) – obtain greater pH change
or
because there was (very) little change in 3 days
allow more acid will be made

1

(f) scale > $\frac{1}{2}$ of x-axis
and

x-axis labelled (time in) days

1

points plotted correctly

*all 7 correct = **2** marks*

*5 or 6 correct = **1** mark*

2

line of best fit = smooth curve through points

*do **not** accept ruled point-to-point*

1

(g) (1st day) too few bacteria

1

(after day 1 more bacteria so more) acid made

1

(days 5-6) sugar / food used up
or
low pH denatures enzymes
or
low pH kills bacteria

allow enzymes do not work

*do **not** accept enzymes killed*

1

(h) (similarity) – same start pH /
pH7 and end pH / pH4.5
or
same pH change / change = 2.5

1

(difference) – faster

1

[16]

Q14.

(a) any **two** from:

- sprinkled through air
- air spaces between stones
- thin layer over stones (for efficient diffusion)
- slow flow (for efficient diffusion)

2

(b) green algae

1

(c) (large / small) protist

1

(d) **Level 2 (3-4 marks):**
Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

Level 1 (1-2 marks):
Facts, events or processes are identified and simply stated but their relevance is not

clear.

No relevant content (0 marks)

Indicative content

digestion:
- (external) enzymes released
- role of enzymes – e.g. amylase / protease / lipase
- substrates & products – e.g. starch ⟶ sugar / protein ⟶ amino acids / fat ⟶ fatty acids

absorption:
- by diffusion / active transport

deamination:
- amino acids ⟶ ammonia / ammonium ions

release of other ions:
- e.g. phosphate / nitrate / magnesium

respiration:
- produces carbon dioxide (+ water)
  or
  equation is given
- release of energy allows other processes to take place e.g. active transport

[8]

Q15.

(a) red blood cell

1

(b) 44

1

(c) retina

1

(d) **7** and **8** / the parents
do not have **A** (allele)
or only have **a** (allele) **or** are **aa**

*allow converse – if parents had an **A** (allele) they would have Stickler syndrome*

1

so children cannot inherit **A**
or can only inherit **a**

or

the parents show the recessive characteristic

so must be homozygous
(recessive)
or must be **aa**
or parents cannot have **A**

1

(e) parental genotypes:
12 = Aa and 18 = aa
or parental gametes:
12 = A + a and 18 = a + a

1

derivation of offspring genotypes
allow ecf

1

identification of **Aa** offspring as Stickler

1

probability = 0.25 / $\frac{1}{4}$ / 1 in 4 / 25% / 1:3
*allow ecf – e.g. 0.5 if **12 = AA***
*do **not** accept 3:1*
*do **not** accept 1:4*

1

[9]

Q16.

(a) ventricle

1

(b) lungs

1

(c) valve circled on heart

1

(d) no fatty deposit

1

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

1

(e) statins

1

stent

1

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

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

2

(g) 8 (%)

1

(h) more males have coronary heart disease than females

1

[11]

Q17.

(a) to show the experiment was more repeatable

1

(b) (circle) 0.0 at 20 °C

1

(c) ignored it / did not use it

ignore repeated it

1

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

1

(e) 60 °C

1

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

1

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

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

0 marks:
No relevant content.

Indicative content

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

4

[10]

Q18.

(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]

Q19.

(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]

Q20.

Level 3 (5–6 marks):
A detailed and coherent explanation is provided with most of the relevant content, which demonstrates a comprehensive understanding of the human circulatory system . The response makes logical links between content points.

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

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

0 marks:
No relevant content.

Indicative content

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

accept annotated diagrams

[6]

Q21.

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

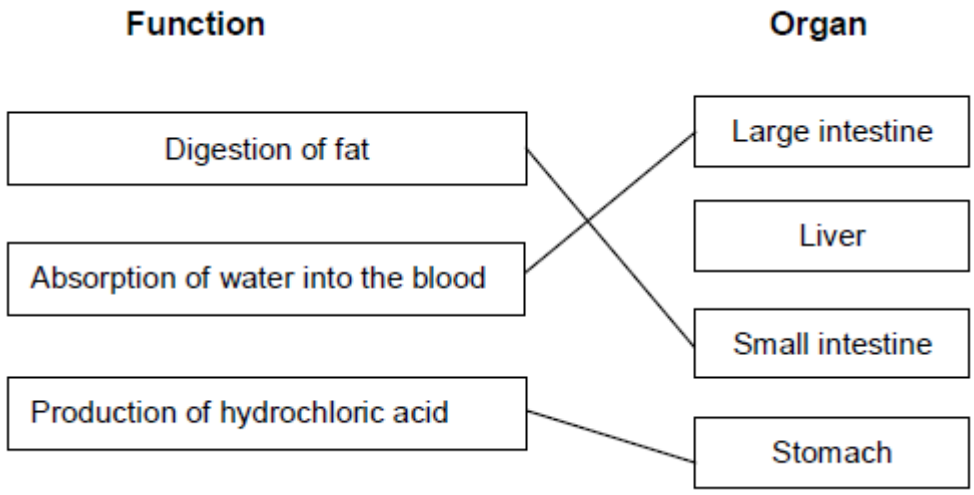
1

small intestine = **D**

1

stomach = **B**

1



(ii)

extra lines cancel

3

(b) The concentration in the blood is lower.

1

[7]

Q22.

(a) (i) without <u>oxygen</u>

allow not enough oxygen
ignore air
ignore production of CO_2
ignore energy

1

(ii) more / high / increased lactic acid (at end)

allow approximate figures (to show increase)
ignore reference to glucose

1

(b) (i) 1.5

allow only 1.5 / 1½ / one and a half

1

(ii) increases at first **and** levels off

ignore subsequent decrease

1

suitable use of numbers eg
rises to 10 / by 9 (dm^3 per min)
or
increases up to 1.5 (min) / levels off after 1.5 (min) (of x axis timescale)
allow answer in range 1.4 to 1.5
or
after the first minute (of the run)

1

(iii) supplies (more) oxygen

1

supplies (more) glucose

1

need 'more/faster' once only for full marks
*allow removes (more) CO_2 / lactic acid / heat as an alternative for either marking point one **or** two, **once** only*

for (more) respiration

1

releases (more) energy (for muscle contraction)
*do **not** allow energy production or for respiration*

1

[9]

Q23.

(a) a catalyst / speeds up a reaction
ignore it is not used up

1

it is a protein **or** it is specific / described **or** it has an active site
allow it only acts on one molecule

1

(b) cytoplasm

1

(c) **Advantage:**

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

1

Disadvantage:

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

1

[5]

Q24.

(a) The damaged alveolus has a smaller surface area.

1

(b) Less oxygen is taken in.

1

[2]

Q25.

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

- glucose
- oxygen
- carbon dioxide
- urea
- water

allow hormones

allow named example of a product of digestion

1

(ii) (cardiac) muscle

allow muscular

1

(b) (i) **B**

1

(ii) **D** atrium / atria

ignore references to left or right

1

E ventricle(s)

ignore references to left or right

1

(c) (i) a vein

1

(ii) an artery

1

(iii) keeps artery open / wider

allow ecf from part cii

1

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

1

[9]

Q26.

(a) (healthy alveolus has a) larger surface area

allow larger SA:Volume ratio

accept converse for alveoli from person with emphesema

*allow walls between alveoli disintegrate **or** fluid accumulation in alveoli*

1

(b) less oxygen into the blood / muscles

less only needed once

1

(so) less respiration

ignore ref. to anaerobic respiration

1

(and therefore) less energy is released (for exercise)

*do **not** allow energy is produced / made*

*do **not** allow energy **for** respiration*

1

[4]

Q27.

(a) (i) doesn't have valves

allow veins have valves

1

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

allow has a smaller lumen

ignore references to elastic (in walls)

1

(ii) any **two** from:

- (artery has) more oxygen
- (artery has) more glucose

allow (artery has) more amino acids / fatty acids

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

ignore urea

ignore reference to pressure

accept converse for veins if veins is clearly stated

2

(b) any **two** from:

- no rejection

allow no tissue matching required

- abundant supply
- low risk of infection

allow named example ie HIV, CJD

- longer shelf life

allow less space needed for storage

ignore side effects

2

[6]

Q28.

(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]

Q29.

(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 cm^3
- for same time period
- repetitions (3+ times)
- calculate mean for each.

6

(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]

Q30.

(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]

Q31.

(a) (i) a catalyst

1

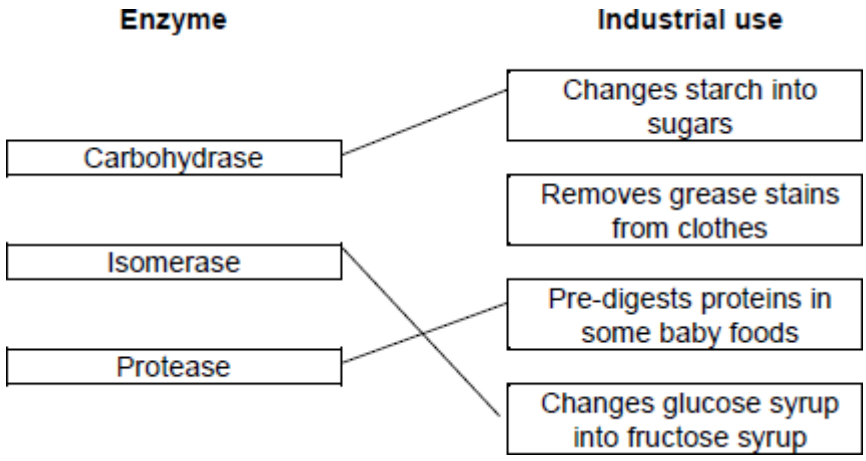
(ii) protein

1

(iii) salivary glands

1

(b)



extra lines from any enzyme cancels that mark

3

[6]

Q32.

(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]

Q33.

(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 <u>more blood</u> (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]

Q34.

(a) (i) alveoli / alveolus

allow air sacs

allow phonetic spelling

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
  allow air sacs
- large surface / area
- thin (exchange) surface **or** short diffusion pathway
  accept only one / two cell(s) thick
- good blood supply / many capillaries
  allow (kept) ventilated or maintained concentration gradient.

2

[6]

Q35.

(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]

Q1.

(a) any **two** from:

- carbon dioxide / CO_2
- urea
- protein
- water / H_2O
- 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]

Q2.

(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]

Q3.

(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 <u>filaments</u>

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]

Q4.

(a) (i) diffusion

1

(ii) carbon dioxide

accept CO_2 / CO2

*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 / CO_2 (exchange)

*do **not** accept air*

1

[6]

Q5.

(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]

Q6.

(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 <u>on</u> <u>enzyme</u>

1

[17]

Q7.

(a) (i) capillaries

1

(ii) platelets

1

(iii) fibrinogen changes to fibrin

1

(b)

✓	×	×	✓
×	✓	×	✓
✓	✓	✓	✓
×	×	×	✓

***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 O_2 / food / blood supply to body cells or cells can't respire
ignore 'cells die' / 'person dies' - look for cause

1

[11]

Q8.

(a) (i) stomach

1

(ii) small intestine

1

(b)

salivary glands	stomach	pancreas	small intestine

amylase	✓	×	✓	✓
lipase	×	×	✓	✓
protease	×	✓	✓	✓

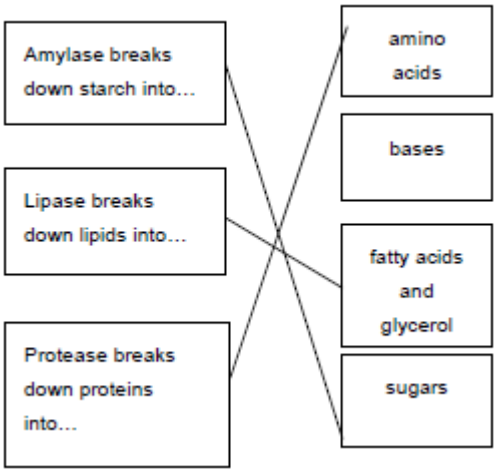
__1__ mark per correct row
or
if no correct row max __1__ mark for any one correct column

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]

Q9.

(a) (i) muscular

1

(ii) **7**

1

(iii) an electrical device

1

(b) (i) in sequence:

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 / O_2 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]

Q10.

(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

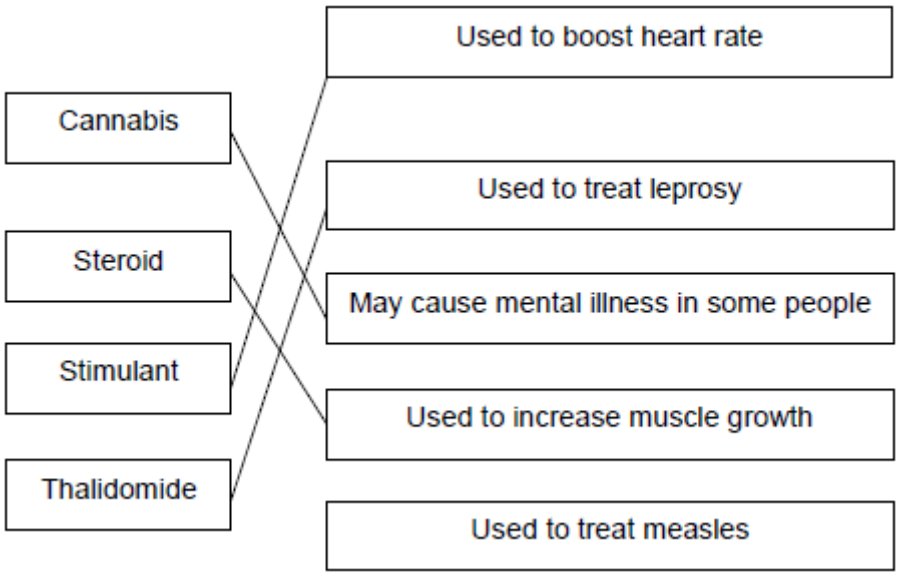
ignore diabetes

1

[6]

Q11.

(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]

Q12.

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

1

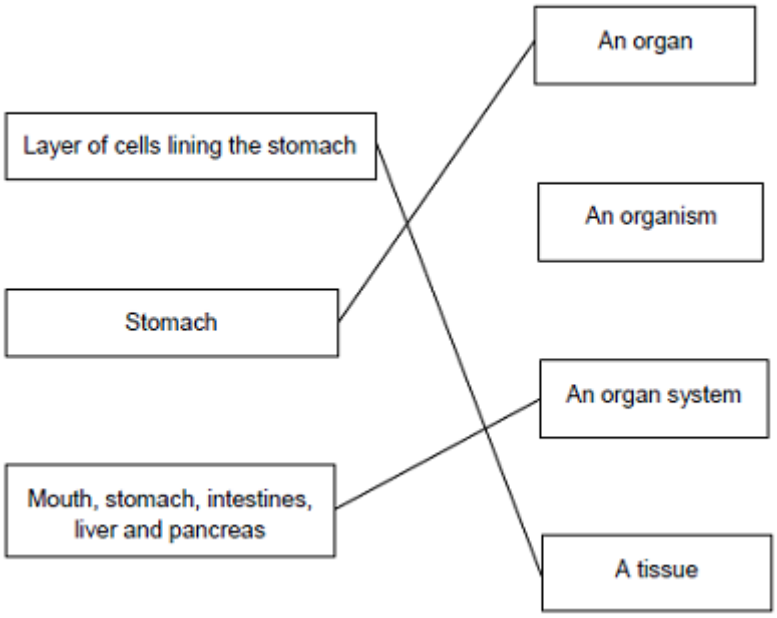
B = cytoplasm
*do **not** accept cytoplast*

1

(ii) To control the activities of the cell

1

(b)



extra lines cancel

3

[6]

Q13.

(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) <u>enzyme / pepsin</u> denatured / shape changed

*do **not** allow enzyme killed*

allow enzyme 'destroyed'

1

<u>enzyme / pepsin</u> no longer fits (substrate)

allow enzyme / pepsin does not work

1

(c) hydrochloric (acid)

allow phonetic spelling

accept HCl

allow HCL

ignore hcl

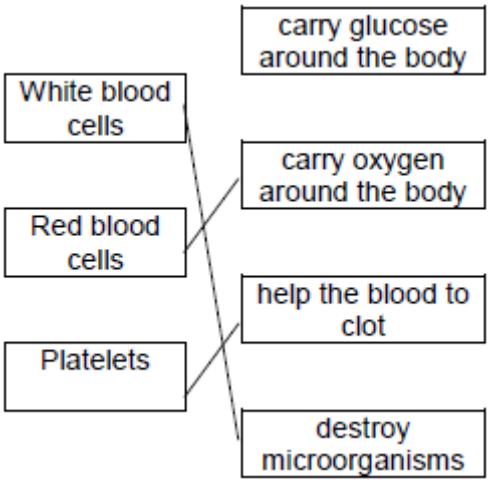
*do **not** allow incorrect formula –e.g. H_2Cl / HCl_2*

1

[8]

Q14.

(a) (i)



one mark for each line

extra line negates a mark

3

(ii) any **one** from:

- carbon dioxide / CO_2
- 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]

Q15.

(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]

Q16.

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]

Q17.

(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 CO_2 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]

Q18.

(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

[11]

Q19.

(a) (i) mitochondrion / mitochondria

must be phonetically correct

1

(ii) carbon dioxide / CO_2

1

water / H_2O

1

in either order
*accept CO2 but **not** CO^2*
*accept H2O **or** HOH but not H^2O*

(iii) diffusion

1

high to low concentration
allow down a concentration gradient

1

through (cell) membrane **or** through cytoplasm
*do **not** accept cell wall*

1

(b) ribosomes make proteins / enzymes

1

using amino acids

1

part A / mitochondria provide the energy for the process
allow ATP
*do **not** accept produce or make energy*

1

[9]

Q20.

(a) genes

1

chromosomes

1

(b) (i) higher yield

1

less use of pesticides

1

(ii) any **two** from:

- uncertain about effects on health
- fewer bees
- might breed with wild plant

- seeds only from one manufacturer

2

[6]

Q21.

(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]

Q22.

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

- fibres not damaged
- machines last longer / machines not damaged by stones

*Only **one** from:*

- shorter time or quicker
- 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]

Q23.

(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]

Q24.

(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]

Q25.

(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]

Q26.

(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]

Q27.

(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) <u>yeast</u> grows best / better / well **or** optimum temperature for <u>yeast</u> / more <u>yeast</u> present

allow <u>yeast</u> works best / better / well

1

(yeast) makes CO_2 **or** respires / respiration

allow fermentation

1

(ii) <u>bacterium</u> grows best / better / well / more <u>bacteria</u> present **or** optimum temperature for <u>bacterium</u>

ignore microorganisms / microbes

allow works / respires best / better / well

1

(bacterium) makes (lactic) acid

*do **not** allow wrong acid*

1

[7]

Q28.

(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]

Q29.

(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]

Q30.

(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) ÷ 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]

Q31.

(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 ± 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 ± 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]

Q32.

(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 <u>increase</u> in mass / weight (relative to height) / obesity

1

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

allow causes Type 2 diabetes

1

(ii) any **three** from:

- related to <u>described</u> 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]

Q33.

(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]

Q34.

(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]

Q35.

(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

5

[6]

Q1.

(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]

Q2.

(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]

Q3.

(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

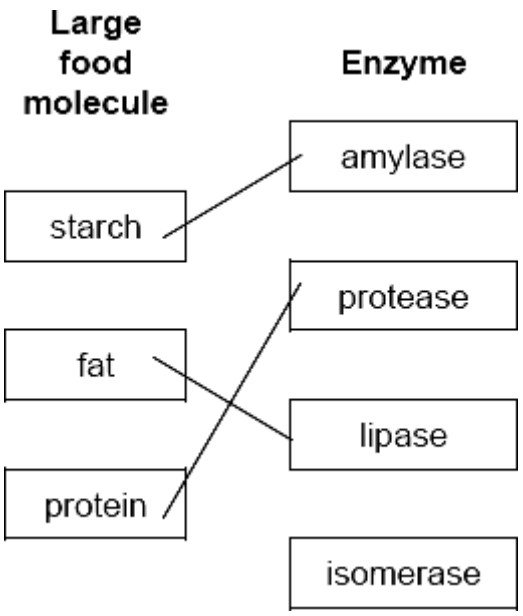
widespread testing
or
testing for optimum dose
or
test on patients / sick people
or
test to see if it is effective
accept use of placebo

1

[9]

Q4.

(a) (i)



*all three correct = **3** marks*
*two correct = **2** marks*
*one correct = **1** mark*

extra line from a large food molecule cancels the mark

3

(ii) sugars

1

fatty acids and glycerol

1

amino acids

must be in this order

1

(b) liver

1

[7]

Q5.

(a) B

no mark for ÉBÉ, alone

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

accept reference to microvilli
accept reasonable descriptions of the surface
*do **not** accept wall / cell wall*
ignore villi / hairs / cilia

1

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

- insulin / hormone

if named hormone / enzyme must be correct for pancreas

- enzyme / named enzyme

1

(ii) <u>many</u> ribosomes

1

(ribosomes) produce protein

accept insulin / hormone / enzyme named is (made of) protein

or

allow <u>many</u> mitochondria (1)

provide energy to build protein **or** to make protein (1)

accept ATP for energy

1

[4]

Q6.

(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 45(°C)) increase in temperature increases rate / *speed* of reaction
- reference to molecules moving faster / colliding faster / harder / more collisions
- optimum / best at 45(°C)

  allow value(s) in range 41 - 49
- high temps / above 45(°C) (rate slows due to) denaturation of enzyme /lactase

  *allow synonyms of denaturation but **not** killed*

  *denaturation at high **and** low temperature does **not** gain this mark*

  ignore body temperature

  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 fat / lipid

  allow description of emulsification eg fat is broken down / broken up into droplets
- enzymes (in small intestine) work (more effectively / better)

  allow better for enzymes

2

[7]

Q7.

(a) B

1

(b) Narrow(er) small(er) / thin(ner)(air) passages / bronchioles

allow muscle fibres are contracted

allow oxygen instead of air

or less air can pass through

ignore reference to surface area

or harder for air to enter

1

(c) (i) salbutamol causes relaxation / reduces contraction

1

(ii) widens / enlarges / bronchioles / (air) passages

allow oxygen instead of air

or allows air through more easily

or allows person to breathe more easily

1

[4]

Q8.

(a) (i) 120

1

(ii) 11 760 **or**
correct answer from candidate's answer to (a)(i)

correct answer with or without working

if answer incorrect

120 × 98 ***or***
candidate's answer to (a)(i) × corresponding SV gains ***1*** *mark*

if candidate uses dotted line / might have used dotted line(bod) in (a)(i) ***and*** *(a)(ii) no marks for (a)(i) but allow full ecf in (a)(ii) eg 140 x 88 = 12320 gains* ***2*** *marks*

2

(b) trained athlete has higher stroke volume / more blood per beat

1

same volume blood expelled with fewer beats

or for same heart rate more blood is expelled

1

(c) increased aerobic respiration

or

decreased anaerobic respiration

allow correct equation for aerobic respiration

accept don't have to respire anaerobically

1

increased energy supply / need

1

less lactic acid formed

or to breakdown lactic acid **or** less O_2-debt

1

can do more work **or** can work harder / faster / longer

accept muscle contraction for work

or less fatigue / cramp / pain

1

[9]

Q9.

(a) opaque / less transparent / blue

allow mixture becomes dark / black

ignore thicker

1

(b) (i) 7 (minutes) **or** in range 6.7 to 7

*award **2** marks for correct answer*

if answer is incorrect evidence of selection of 40(% light intensity) either in working **or** in graph 2 for **1** mark

2

(ii) any **two** from:

- slower / takes longer at lower temperatures
- (40°C is) optimum / best temperature

allow near to 37°C / body temperature where enzymes work best

- enzyme denatured / destroyed / damaged at higher temperatures

allow description of denaturation

2

(c) (i) isomerase

allow phonetic spelling

1

(ii) fructose is sweeter than glucose needed in smallerquantities **or** less is needed

2

[8]

Q10.

(a) (i) artery

1

(ii) capillary

1

(b) alveoli

1

red blood cells

1

nucleus

1

[5]

Q11.

(a) (i) 19 800

for correct answer ignore working or lack of working
*165 × 120 but no answer / wrong answer = **1** mark (ignore extras)*

2

(ii) any **two** from:

- for respiration
  ignore oxygen debt
- energy released
  allow energy produced
- prevents anaerobic respiration
- prevents build-up of lactic acid

2

(b) any **two** from:

- increased breathing rate(*)
- increased depth of breathing **or** deep breathing(*)
  *(*)more breathing is max **1** mark*
  ignore increase in heart rate
  allow heavier breathing
  *do **not** allow harder breathing*
- dilation of arteries / vasodilation
  allow blood vessels dilate
  *do **not** allow veins / capillaries dilate*
- blood diverted from elsewhere
  ignore name of organ

2

[6]

Q12.

(a) any **two** from:

- age
- gender
- mass
- number in group
- time

2

(b) any **two** from:

- highest (mean) mass loss on Rosemary Conley **or** Rosemary Conley most effective
- least (mean) mass loss in control group **or** mean

2

(c) (Atkins)

costs least

1

mass loss very similar to other diets **or** second highest mass loss **or** as effective as other diets

1

(d) any **two** from:

- (exercise) increases metabolic rate / respiration
  ignore sweating
- (exercise) needs / uses energy / calories
  allow burns fat / calories
  *do **not** accept energy for respiration*
- (this) energy comes from food / fat
- less food / energy/ calories converted to fat

2

[8]

Q13.

(a) (i) B

1

(ii) any **one** from:

- largest area of / most digestion (of lipid)
  allow agar / jelly / mixture broken down / digested

*do **not** allow digestion of bacteria / lipase*
*ignore digestion **by** bacteria*

- largest clear area

1

(b) any **two** from:

- effect of pH / pH described
- effect of temperature
- effect on different types of lipid / fat
- cost **or** allergic reactions **or** effect on skin / fabrics / **or** environment **or** interaction with other chemicals in powder **or** shelf life

2

(c) enzymes / named enzyme denatured / destroyed
allow active site(of enzyme) altered

1

[5]

Q14.

(a) A = alveolus
allow air sac / alveoli

1

B = diaphragm
ignore labelling of C and D

1

(b) A

1

(c) (i) red blood cells

1

(ii) plasma

1

[5]

Q15.

(a) A
no mark – can be specified in reason part
if B given = no marks throughout
if unspecified plus two good reasons = 1 mark

high(er) pressure in A
allow opposite for B
do not accept 'zero pressure' for B

1

pulse / described in A

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

1

(b) (i) 17

1

(ii) 68

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

1

(c) (i) oxygen / oxygenated blood

allow adrenaline
ignore air

1

glucose / sugar

extra wrong answer cancels eg
sucrose / starch / glycogen / glucagons / water
allow fructose as an alternative to glucose
ignore energy
ignore food

1

(ii) carbon dioxide / CO_2 / lactic acid

allow CO2 / CO^2
ignore water

1

[7]

Q16.

(a) any **two** from:

- neutralises acid / makes conditions alkaline / raises pH
- enzymes (in small intestine) work (more/most effectively) **or** stop/prevents enzymes being denatured
- emulsifies fats/lipids **or** description of emulsification

*do **not** accept breakdown unqualified*

- larger surface area

2

(b) (i) bile / bilirubin / pigment / broken down haemoglobin / substance / cholesterol linked to movement **or** effect

1

does **not** get to the intestine / food / faeces
or cannot leave liver **or** effect not happening (in intestine)

1

(ii) bilirubin / pigment / broken down haemoglobin

not 'bile' alone

1

(deposited) in skin

only award if bilirubin / pigment / broken down haemoglobin given

allow carried in the blood

1

[6]

Q17.

(a) B = rib

1

C = diaphragm

1

(b) (i) D

allow lower case

1

(ii) carbon dioxide

1

[4]

Q18.

(a) (i) A **or** C

allow lower case

1

(ii) B **or** D

allow lower case

1

(b) (i) 60

1

(ii) 4

1

(c) red blood cells

1

[5]

Q19.

(a) (i) increased / thick(er)

allow more / wide(r) / broad

1

(ii) decreased

1

(b) 1

IGNORE working or lack of working

*correct figures from table 2.1 and 1.1 but no answer / wrong answer = **1** mark*

2

[4]

Q20.

(a) any **three** from:

- rose <u>rapidly</u> (during exercise) / use of approximate figures
- then more slowly (during exercise)
  accept rate (of increase) slows down
- to max 126 / at 5 minutes / end of exercise
- <u>rapid</u> fall (during recovery) **or** use of approximate numbers
- then less rapid fall / use of approximate numbers
- returned to resting rate (60 bpm) by 11 minutes

3

(b) arteries dilate / widen

accept muscle in wall relaxes

1

(c)

any **four** from:

- muscles using more energy **or** more energy released
- muscles <u>respire</u> faster
- supply more oxygen
- supply more glucose / sugar
- remove more CO_2
- remove lactic acid
- remove heat / to cool

do **not** accept energy produced

allow for aerobic respiration **or** to prevent anaerobic respiration

'more' needed ONCE only for full marks

4

[8]

Q21.

(a) any **two** from:

- transport up / against concentration gradient / low to high concentration

- uses energy
- use of protein / carrier

2

(b) microvilli – large(r) surface area
accept have carriers

1

mitochondria – release energy **or** make ATP
*do **not** accept 'makes energy'*

1

[4]

Q22.

(a) diet **or** description

1

(b) exercise
or group meetings
or same number of kilocalories per day
or time
or group size

1

(c) any **two** from: eg

- scientists didn't observe amount of exercise
or volunteers cheated on exercise(*)
- scientists didn't observe the amount of food
or volunteers cheated on food(*)
*(*)if no marks awarded for first 2 bullet points allow don't stick to plan **or** cheated for **1** mark*
- mass of subjects not controlled
- age of subjects not controlled
- gender of subjects not controlled
- occupation of subjects not controlled
- different proportions of subjects completed course
allow not all completed course
- low number of subjects
ignore not repeated

2

(d) any **two** from: (yes)

- low carbohydrate / Group 1 / people / they lost more mass
  ignore more people lost weight
  allow greater change in mass

- low carbohydrate / Group 1 / people / they lost more body fat
  ignore more people lost body fat
  allow greater change in body fat

- low carbohydrate diet / Group 1 / people / they resulted in more HDL
  allow better HDL to LDL balance
  allow greater change in HDL

2

[6]

Q23.

(a) lipase

allow phonetic spelling
allow lipidase

1

(b) (i) fall **then** rise owtte eg down **then** up

*allow faster **then** slower*
ignore explanations

1

minimum / least / fastest / best / optimum at 39–41(°C)

allow it falls to 40(°C)
*if no other marks gained, 'falls to an optimum' gains **1** mark*

1

(ii) (yes)

there is no mark for circling 'yes'
*maximum **1** mark if No is circled*

any **two** from:

- less heat / energy / electricity / power required / used / wasted
  ignore lower temperature

- conserves fuel supplies
  or less fuel used

- less pollution from power stations owtte
  accept less global warming
  or
  less CO_2 / carbon emissions / greenhouse gases
  or
  less SO_2 / acid rain

***NB** only direct effects*
less pollution only is not enough

2

(c) any **two** from:

*max **1** mark for reference to cell*

- enzyme / lipase
  accept any named enzyme
- destroyed / denatured
  allow damaged / broken down
  ***not** 'killed'*
- reference to (specific) shape changed
  ignore detergent / it

2

[7]

Q24.

(a) (i) red cell

1

(ii) diffusion

1

(iii) haemoglobin

1

(iv) a nucleus

1

(b) (<u>on diagram</u>) arrow from any part of blood to air

1

[5]

Q25.

(a) any **two** from:

- large surface / area **or** many villi **or** have microvilli
  accept big surface / area
- thin surface **or** thin wall **or** surface 1-cell thick **or** capillaries near surface **or** permeable **or** partially permeable
  accept they are thin
  *do **not** allow thin **cell** wall*
- <u>many</u> blood vessels **or** <u>many</u> capillaries **or** capillary <u>network</u> **or** <u>good</u> blood supply
  ignore 'constant blood flow' owtte
  ignore extras eg moist or reference to gases

- have enzymes

  ignore release enzymes

  - *accept reference to lacteal as 5th point*
  - *allow reference to having mitochondria*

2

(b) (i) small(er) (surface area) / flat(ter) / short(er)
or not as folded
or fewer capillaries owtte

allow small(er) lacteal
ignore references to wide / thick / spread out etc

1

(ii) less absorption (of digested food) / less digestion / diffusion

accept slower for less
accept description of less digestion
accept less food can get in
*do **not** allow zero absorption*
*do **not** allow 'collection' of nutrients*

1

[4]

Q26.

(a) being overweight

*do **not** accept fat unqualified*
allow BMI over 25

1

(b) (i) rose

1

by 8% / from 16% to 24% / by 50% / rapidly then more slowly

1

(ii) any **two** reasonable suggestions

e.g. less active

accept e.g.s like fewer jobs / more cars / less physically demanding employment OWTTE

more food / take-aways / fast food

2

(c) (i) high (blood) cholesterol

*do **not** accept combination of 2 labels*
ignore references to LDL and HDL

1

(ii) answer in range 8-17 inclusive

1

(iii) some deaths related to more than one factor

1

[8]

Q27.

(a) any **two** from:

- birth mass / growth reduced
- smoke contains carbon monoxide
  ignore references to poison
- blood carries less oxygen / fetus receives less oxygen
  *do **not** accept harder for fetus to breathe*

2

(b) (i) it may cause mental illness

1

it may be a 'gateway' drug to more harmful substances

three answers max 1
three answers max 0

1

(ii) it is less addictive than amphetamines, tobacco or alcohol

1

it is not associated with major sociological problems

three answers max 1
four answers max 0

1

[6]

Q28.

(a) any **three** from:

- water
  allow breathing / oxygen / carbon dioxide
- ions / minerals / salts
  allow sodium / chloride, other ions neutral
- temperature
  allow heat
- blood sugar
- heart rate
- blood pressure
  ignore urea

3

(b) contraceptive drug

1

fertility drug

1

(c) (i) eg nicotine, alcohol, cocaine, heroin, painkillers, tranquilisers, LSD

allow cannabis / weed or other alternative names

allow tobacco

ignore smoking / ecstasy

1

(ii) alters body chemistry **or** craving / needing / dependence

allow psychological dependence

1

withdrawal symptoms on stopping

allow withdrawal described

allow 'feel ill without it'

1

[8]

Q29.

red (blood cell)

1

platelet

1

white (blood cell)

1

plasma

1

[4]

Q30.

(a) correctly labelled on diagram

(i) 'X' on an alveolus

centre of X on the alveolus wall or inside the alveolus

***not** if the centre is outside*

1

(ii) arrow pointing downwards

accept anywhere but must point down

1

(b) in sequence

1 trachea

2 bronchi

3 bronchioles

4 alveoli

1

(c) diffusion

accept positive indicator

1

[4]

Q31.

(a) in sequence

starch

1

sugar

1

protein

1

amino acids

1

(b) (too large **or** insoluble

*do **not** accept "breaking up"*
*do **not** accept complex*

accept 'need to make molecules smaller / soluble' – reverse argument

1

cannot be absorbed **or**
cannot enter blood **or**
cannot pass through wall / lining of intestine / gut or villi

"body" not enough
***not** large intestine*

1

(c) mouth

accept positive indication

1

(d) enzymes

allow catalysts
*do **not** accept catalase*

1

[8]

Q32.

(a) lipase

1

(b) fatty acid

ignore glycerol

1

(c) (i) 0.25 or $\frac{1}{4}$

if <u>correct</u> answer ignore working or lack of working

$\frac{(8.7-7.7)}{4}$ *for **1** mark*

2

(ii) fats emulsified **or** described re. Small droplets **or** large S.A. (for enzyme action) **or** fats 'mix' better with water

*do **not** allow breakdown / breakup unqualified*

1

[5]

Q33.

thicker surface

1

reduced surface area

accept fewer alveoli

1

[2]

Q34.

(i) <u>On diagram:</u>

oxygen arrow to blood from air **and** CO_2 arrow to air from blood

1

oxygen arrow to red blood cell

1

CO_2 arrow from plasma

1

(ii) diffusion

1

(iii) large surface **or** large area

*do **not** accept space*

1

[5]

Q35.

(a) (i) protease

accept peptidase ***or*** *named protease*
e.g. pepsin / trypsin
allow 'proteinase'

1

(ii) amino acids

accept peptides / polypeptides / peptones

1

(b) points plotted accurately

$\pm \frac{1}{2}$ *square*

deduct ***1*** *mark per error*

2

best fit curve **or** ruled point-to-point

if double line within $\frac{1}{2}$ *square*
allow sharp apex
do ***not*** *allow single straight line*
if no points line defines points
if (5,0) not plotted only penalise ***1*** *mark*
bar graph wide bars – ***no*** *marks*

bar graph ± $\frac{1}{2}$ *square max* ***2*** *for points*

1

(c) (i) 2 **or** correct from candidate's graph

± $\frac{1}{2}$ *square*

1

(ii) stomach

1

(d) proteins are large / product is small

1

proteins (may be) insoluble / product is soluble

1

cannot be absorbed / cannot enter blood **or** cannot pass through gut lining

accept reverse referring to product

1

[10]

Q1.

(a) hold cells together **or** prevent flow of cells **or** trap cells

1

(b) 12500

if correct answer, ignore working / lack of working

$\frac{100}{0.008}$ *for **1** mark*

ignore any units

2

(c) (i) size RBC approximately same size capillary **or**
no room for more than one cell **or**
only one can fit **or**
RBC is too big

allow use of numbers

*do **not** accept capillaries are narrow*

1

(ii) more oxygen released (to tissues) **or**
more oxygen taken up (from lungs)

1

and any **two** from:

- slows flow **or** more time available
- shorter distance (for exchange) **or** close to cells / capillary wall
- more surface area exposed

2

[7]

Q2.

in correct sequence:

breathing

1

diffusion

1

respiration

1

[3]

Q3.

(a) (i) liver

1

(ii) <u>on diagram</u>:

'**X**' on liver

must be unambiguous (eg not overlapping gall bladder)
intersection of X in liver

1

(b) stomach

1

<u>small</u> intestine

accept duodenum or ileum
extra wrong answers cancel the mark,
eg small intestine (colon) = no marks

1

(c) amylase not produced by stomach

accept no starch digesting enzymes in the stomach
accept correct enzyme not in stomach
accept <u>only</u> proteases in stomach
*do **not** accept protease does not digest starch*

1

acid / low / wrong pH in stomach **or** enzyme would be denatured in stomach **or** amylase only works in neutral / alkaline conditions

incorrect extra information cancels mark
*do **not** accept amylase does not work in the stomach*

1

[6]

Q4.

(a) (i) haemoglobin / oxyhaemoglobin

must be phonetic

1

(ii) carries oxygen **or** forms oxyhaemoglobin

Ignore references to CO_2 / iron
cancel if extras like food / glucose

1

from lungs to tissues

1

(b) no nucleus **or** biconcave disc (described)

ignore references to size
ignore vague references to being 'round' / 'donut' shaped etc.

1

[4]

Q5.

an atrium

1

an artery

1

a semi-lunar valve

1

[3]

Q6.

(a) (i) count the pulse **or** count beats in artery in wrist neck **or** feel the pulse **or** take the pulse **or** find the pulse

*accept use of heart monitor **or** heart meter*

1

(ii) 80

2 marks for correct answer

*1f answer incorrect allow **1** mark for showing 8000 divided by 100 **or** indicating cardiac output divided by stroke volume*

2

(iii) Increased activity stroke volume
falls / gets less / should get higher / reach a peak

*accept does not increase **or** changes from 134 cm^3 to 127 cm^3*

1

(iv) 1ncreased / more ventricle contractions

*accept heart beat faster **or** it beats faster **or** more powerful contractions*

1

(b) (stronger heart muscle) increases cardiac output **or** increases stroke volume

*accept pumps more blood (per beat) **or** pumps blood faster*

ignore heart bigger

1

so more (oxygenated) blood can be sent to muscles

accept more oxygen sent to muscles

1

[7]

Q7.

(i) oxygen into the blood stream

*arrow **must** start inside alveolus and finish outside the capillary*

1

(ii) carbon dioxide out of the blood stream

*arrow **must** start inside the capillary and finish inside the alveolus*

1

(iii) carries/takes up/releases oxygen or carbon dioxide

accept forms oxyhaemoglobin

1

[3]

Q8.

(a) **A** white blood cell/leucocytes / phagocytes / lymphocytes

SEPARATE MARKING POINTS

1

make/contain antibodies/antitoxins
or
destroy/engulf/kill bacteria

*do **not** accept fight infection*
*do **not** accept fight disease*

1

B platelets

1

help clot the blood

*do **not** accept stick together*
*do **not** accept from scabs*

1

C plasma

1

carries/transports all the cells/digested food/waste products/hormones/carbon dioxide/platelets/dissolved minerals/antibodies/antitoxins/water

allows blood to flow

1

(b) any four from:

(oxygen) diffuses

1

has affinity for/combines with oxygen / forms oxy-haemoglobin

*do **not** accept absorbed*

1

in areas of high oxygen concentration

n.b. 'pick up oxygen' is stem of question

1

in conditions of low oxygen concentration it breaks down and releases the oxygen

low oxygen concentration can be implied e.g. active muscles

1

[10]

Q9.

(a) capillaries

1

(b) (oxygen) in red blood cells **or** haemoglobin

*the candidate **must** make clear which substance is which for **2** marks*

1

(carbon dioxide dissolved in) the plasma

accept in haemoglobin in regions of high carbon dioxide concentration

*accept for **1** mark oxygen + CO_2 is transported by red blood cells **or** haemoglobin*

*do **not** credit red + white blood cells **or** combinations of right + wrong answers*

1

(c) **one** mark for each up to a maximum of **three**

red blood cells

*award **1** mark for blood cells if no red or white*

white blood cells (or named white blood cell up to **2**)

platelets

urea

accept nitrogenous waste

*do **not** credit waste substances **or** products*

minerals (**or** one named mineral)

*accept ions **or** salts*

vitamins

water

hormones (named hormone up to 3)

protein (named blood proteins up to 2)

glucose

accept other named soluble sugar

*do **not** credit sugar(s) **or** blood sugar **or** sucrose*

fatty acids **or** glycerol

amino acids

digested food **or** nutrients (if individual foods not credited)

*do **not** credit starch **or** carbohydrates*

*do **not** credit nutrition **or** food*

*do **not** credit oxygen*
*do **not** credit haemoglobin*

carbon dioxide
accept nitrogen

antibodies

antitoxins

drugs **or** toxins (named up to 2)

bacteria **or** viruses

cholesterol

3

[6]

Q10.

one;

1

diffuse;

1

narrow;

1

lowered;

1

[4]

Q11.

(a) liver

1

mouth or salivary glands **or**
duodenum **or** small intestine **or**
pancreas

1

pancreas
*accept duodenum **or** ileum **or** small intestine*
*do **not** accept stomach*

1

stomach **or** duodenum **or** ileum **or**
small intestine **or** pancreas

1

(b) teeth breakdown food
accept chewing

1

amylase **or** saliva (breaks down starch)

1

(c) produces <u>bile</u> (salts)

1

emulsifies (fat) **or** produces droplets **or** disperses fat)

1

[8]

Q12.

(i) liver

1

(ii) liver **or** B stores glycogen **or** pancreas **or** D makes insulin

1

clear description of link

1

[3]

Q13.

X – oxygen

accept O_2

Y – carbon dioxide

accept CO_2

[2]

Q14.

(i) any **two** from:

urea

carbon dioxide

water

lactic acid

2

(ii) higher concentration of glucose **or** more glucose in blood than cells

1

<u>diffuses</u> across

1

[4]

Q15.

(a) (i) transport of substances **or** named substance
or blood around the body
each for 1 mark

2

(ii) breaks down *(**not digests**)* food absorption (into blood)
each for 1 mark

3

(b) water filtered from blood
smaller proportion reabsorbed
therefore larger volume
of dilute urine produced
each for 1 mark

4

[9]

Q16.

(a) A – artery
B – capillary
C – vein

3

(b) transport OWTTE

1

(c) increased oxygen decreased carbon dioxide

2

[6]

Q17.

(i) eyes as sense organs/detector/receptors in eye,
electrical signals (impulses),
to co-ordinator,
then to leg muscles/effector
for 1 mark each

4

(ii) affects the nervous system and slows down the reactions
for 1 mark

1

[5]

Q18.

(a) A vein / venule
B capillary
C artery / arteriole
each for 1 mark

3

(b) *idea that* substances or named substance pass in or out / diffuses
between blood and tissue

each for 1 mark
e.g. oxygen passes from blood to cells gains 2 marks

2

[5]

Q19.

(a) 10

for 1 mark

1

(b) digested / broken down / made soluble by protease / enzyme
in stomach / in small intestine / from stomach / from pancreas
into amino acids amino acids/smaller molecules/products of digestion absorbed into blood

any four for 1 mark each

4

[5]

Q20.

(a) correctly labelled structures (i – iv)

each for 1 mark

(allow labels as words or numbers: allow without guidelines if unambiguously labelled)

4

(b) *ideas of*
diffusion
greater concentration of oxygen in alveolus / high to low oxygen concentration
membrane / alveolus permeability

any two for 1 mark each

2

[6]

Q21.

(a) digested / broken down / made soluble by protease enzyme
in stomach in small intestine / from stomach / from pancreas
into amino acids
amino acids / small molecules absorbed into blood

any four for 1 mark each

4

(b) *ideas that*
lipase / enzyme works best in alkaline / neutral conditions
acid denatures or inactivates enzyme / inhibits enzyme activity
bile emulsifies fat / bile produces larger surface area of fats / bile alkaline
for enzyme to work on / which increase activity of enzymes

any three for 1 mark each

3

[7]

Q22.

(a) (i) mitosis

for 1 mark

1

(ii) 1
fertilised egg cell has 1 albino gene from father splits to produce identical cells / produced by mitosis

each for 1 mark

3

(b) (i) less protection from UV light / UV radiation

for 1 mark

1

(ii) ideas of uncontrolled multiplication of mutated cells reject fast / rapid cell division cells invade of other parts / cells transported in blood

each for 1 mark

2

[7]

Q23.

(i) increase in CO_2 concentration leads to increase in volume of air inhaled
increase of % carbon dioxide has little effect over most of range / large increase when % carbon dioxide > 5.6 %

each for 1 mark

2

(ii) *idea that*
depth of breathing changes at low % carbon dioxide, in crease in % CO_2 results in volume of each breath increasing without increase / little increase in number of breaths

each for 1 mark

2

[4]

Q24.

(a) trachea / windpipe
bronchus
alveoli
diaphragm

for 1 mark each

4

(b) alveoli / air sacs (*reject* capillaries)

for one mark

1

(c) respiration

for one mark

1

[6]

Q25.

pancreas produces lipase
which breaks down / digests fats into fatty acids and glycerol
liver produces bile / hydrogen carbonate
which neutralises acids / makes alkaline
provides optimum / best / most effective pH for lipase / enzyme action
bile emulsifies fats / description
increasing the surface area for lipase / enzyme to act on

any five for 1 mark each

(digestion is in stomach / liver / pancreas – penalise only once)

[5]

Q26.

(a) allow carbon dioxide to enter / gaseous exchange (oxygen neutral) (transpiration neutral)

for one mark

1

(b) guard (cells)

for one mark

1

(c) stops / reduces the rate of water loss / transpiration (*reject* if dark initiated)
stops / reduces wilting / description e.g. drooping / maintains turgor

for 1 mark each

2

[4]

Q27.

(a) any **three** from

(concentration of) oxygen increases

by 60 (units)

allow oxygen more than doubles for 2 marks

(concentration of) carbon dioxide decreases

from 46 to 40 by 6 units

allow 'by a small amount'

N.B. usually the first 2 marks will be for the change in oxygen and carbon dioxide.

The third mark will be for a quantitative comment on one of these changes

3

(b) plasma

1

red (blood) cell / haemoglobin / oxyhaemoglobin

1

[5]

Q28.

(a) 11

accept 10.5 – 11.5

1

(b) ideas of

increase / rises

1

frequently / often

1

energetically / violently

1

[4]

Q29.

(a) (i) all plots correct

Tolerance ± $\frac{1}{2}$ square
allow 1 mark for 2 correct plots

2

(ii) 6

correct answer with no working = 2
allow 1 mark for (60 ÷ 100) × 10
N.B. correct answer from incorrectly recalled relationship / substitution = 0

2

(b) lungs

1

liver

1

kidneys

1

[7]

Q30.

(a) falls

1

from 0.25

1

to 0.19

but by 0.06 gains two marks

if neither figure given, accept steadily / at constant rate for one mark
accept mass of oxygen inversely related / negative correlation to height above sea level for 2 marks

1

(b) (i) 1.8

accept correct readings from graph for (5 and 6.8) if subtraction incorrect for one mark

allow one mark for correct subtraction from incorrect readings

2

(ii) (blood can carry) more oxygen

1

[6]

Q31.

(a) (i) trachea

accept windpipe

1

(ii) (left) lung **or** lungs

do not credit right lung

1

(b) carbon dioxide **or** water vapour

do not credit just 'water'

1

oxygen

answers in terms of used air or fresh air or of temperature differences are not acceptable

1

[4]

Q32.

(a) (i) the three features correctly labelled on cheek cell (which are referred to in part (ii)

label lines should touch or end very close to part no marks if leaf cell labelled

nucleus

cytoplasm

cell membrane

mitochondrion

accept mitochondria or one of these could be labelled
vacuole

3

(ii) any **three** from

feature	**function**
nucleus	controls cell

*accept contains genetic material **or** genes **or** chromosomes **or** stores information*
do not credit the brain of the cell

cytoplasm	where respiration occurs

*accept contains food **or** mitochondria*

	or reactions occurs
membrane	less water **or** chemicals

accept surrounds the cell or lets some things in but not others
*do not credit keeps things out **or** protection*

	in and **or** out
mitochondria	where energy released

ecf from leaf cell labelling
*accept chloroplasts make sugar **or** glucose*
accept vacuole contains sap
*accept if cell wall mis labelled on cheek cell, support **or** hold together*

3

(b) fight **or** ingest **or** kill bacteria **or** germs **or** viruses **or** microbes

accept produce antitoxins or antibodies fight disease (organisms)
do not credit fungus

1

(transport) oxygen **or** carry haemoglobin

*accept transport carbon dioxide **or** helps form scabs*

1

[8]

Q33.

(a) (i) oxygen

do not credit air

1

(ii) lung(s)

*do not credit blood **or** nose or windpipe alone but accept as a neutral answer if included with lungs*

1

(b) oxygen

1

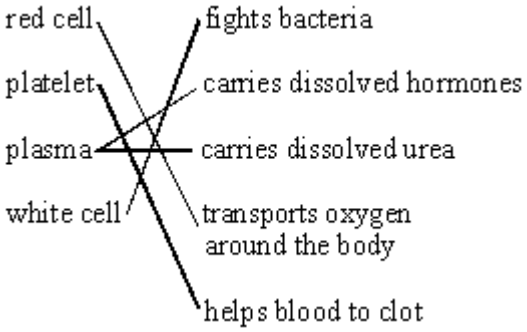
lactic acid

both words required

1

[4]

Q34.



ticks or crosses on the RHS

[5]

Q35.

(a) (i) mouth **or** saliva

accept small intestine

1

starch

1

maltose **or** glucose

do not credit sugar

1

(ii) small intestine

*accept duodenum **or** jejunum*

do not credit intestines

1

fats **or** lipids **or** oils

fatty acids **or** glycerol

2

(b) (i) salivary

accept pancreas

1

(ii) pancreas

*accept small intestine **or** ileum*

1

[8]

Q1.

(i) respiration

1

(ii) oxygen **or** O_2

*do not accept O **or** O^2*

1

(iii) carbon dioxide **or** CO_2

do not accept CO^2

1

[3]

Q2.

(a) to transfer / provide / give release energy

***or** production of ATP / adenosine triphosphate (molecules)*

accept to give heat

1

(b) (i) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

accept any other

n : 6n : 6n : 6n ratio

do not credit if any other changes have been made

1

(ii) glucose

do not credit sugar / sucrose

1

(c) (i) any **two** from

large surface

thin (surface)

moist (surface)

(with a good) blood supply

2

(ii) carbon dioxide

accept water vapour

do not credit just water

1

(d) (i) anaerobic (respiration)

1

(ii) any **three** from

in mitochondria

glucose decomposes / breaks down / reacts

***or** glucose → lactic acid for (2) marks*

to give lactic acid

***or** breathing hard*

***or** lactic acid → CO2 + water*

causing pain

(leaving an) oxygen debt

(quick) source of energy

(but) less efficient than aerobic respiration

accept less efficient than with oxygen

3

[10]

Q3.

(a) oxygen passes from the air/lungs into the body

gains 1 mark

but

oxygen passes from the air/lungs into the blood

gains 2 marks

carbon dioxide passes from the body into the air/lungs

gains 1 mark

but

carbon dioxide passes from the blood into the air/lungs

gains 2 marks

4

(b) increased/5% more

gains 1 mark

but

6 times more (in air breathed out)

gains 2 marks

2

[6]

Q4.

(a) *idea*

O_2 increases

CO_2 decreases

for 1 mark each

2

(b) (i)

reduced	unchanged	increased
digestive system	brain	skin
bone		muscles
		heart and arteries

All (6) correct gains 4
5 correct gains 3
4 correct gains 2
2/3 correct gains 1

Correct wording not needed if unambiguous. No mark if organ repeated.

4

(ii) more/higher/quicker/faster

gains 1 mark

but

7500 more/from 5,000 to 12,500 more

gains 2 marks

but

7500 cm^3/min more

gains 3 marks

or 2½ times more

3

[9]

Q5.

(a) carbon dioxide in range 2.5-5%

gains 1 mark

but

carbon dioxide closer to 4% than to 3% or 5%

gains 2 marks

OR

oxygen in range 15-17.5%

gains 1 mark

but

If 3 sectors drawn and two correctly labelled, award marks and ignore remaining sector

Oxygen and carbon dioxide sectors labelled

for 1 mark

3

(b) carbon dioxide

oxygen

for 1 mark each

Do not allow water vapour.

(Allow correct symbols/formulae)

2

[5]

Q6.

(a) less / low

gains 1 mark

but

(also) half as much ***or*** still one fifth of what's breathed in

gains 2 marks

2

(b) for energy / respiration [credit for movement / to keep warm]

[Do not allow "to live"]

for 1 mark

1

[3]

Q7.

(a) (i) increasing one increases the other

gains 1 mark

but

they increase in proportion/ 1/5 taken in at first / 3/10 taken in after 2 weeks

gains 2 marks

2

(ii) *idea that* more/faster diffusion with higher concentration

for 1 mark

or
with more oxygen particles/molecules (in same space)

1

(b) (i) can take more oxygen from (the same) air/changes from 30 to 45/increases by 15

gains 1 mark

but
takes 50% more or 1.5 times as much

gains 2 marks

or
increases by 15 mg breath

2

(ii) more red blood cells develop
or
more haemoglobin in the blood
(not just 'acclimatises')

for 1 mark

1

(iii) 75
60

each for 1 mark

2

[8]