Mark schemes

Q1.

(a) trachea

1

(b) any two from:

- only one air space (per balloon)

  or

- alveoli not represented
- blood vessels / capillaries not represented
  bronchioles not represented

  do not accept bronchi not represented
- glass tube not flexible (like trachea / bronchi)
- bell jar does not move during breathing (like ribs)
- ribs have gaps between them
- rib cage contains muscles
- pleural cavity not represented

2

(c) any two from:

- speed (of treadmill)
- type of exercise or all were running
- (biological) sex or all male
- all were non-smokers
- time spent running

allow ran for 8 minutes

ignore reference to time interval for counting breaths

2

(d) 0 minutes = 20
8 minutes = 42

allow value for 8 minutes in the range 41.5 to 42.5

1

(42 - 20) ÷ 20 × 100
or
22 ÷ 20 × 100

allow correct substitution from incorrect graph readings (i.e. ±1 small square) at 0 minutes and / or 8 minutes

1

110 (%)

allow correct calculation from incorrect graph readings from previous step

1

(e) to get more oxygen (into the blood)

allow using more oxygen (in muscles)

1

for use in respiration or for releasing energy (for muscle contraction)

or

to remove more carbon dioxide (1)

produced in respiration (1)

allow to reduce anaerobic respiration

do not accept produces / makes / creates energy

1

(f) any one from:

- heart / pulse rate
  allow heart beat per minute
- depth / volume of breathing
  allow amount of sweat
- volume of sweat
- body temperature
  allow body mass / measurement

1

(g) any one from:

- (lung) cancer
- increased blood pressure
- lung disease
  allow named example of lung disease e.g. asthma
- low birth weight in babies of mothers who smoke
- increased risk of heart / cardiovascular disease
  allow persistent cough ignore cough unqualified

1

[12]

Q2.

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

1

(b) mitochondria / mitochondrion

1

(c) any two from:

- movement / muscle contraction
- keeping warm
- active transport
- building larger molecules
  ignore reference to metabolism unqualified

allow examples of movement
allow examples of building larger molecules e.g. making (named) proteins / cellulose
allow cell division
ignore growth

2

(d) any two from:
- anaerobic produces lactic acid and aerobic does not
  allow anaerobic creates an oxygen debt and aerobic does not
- aerobic produces carbon dioxide and anaerobic does not
- aerobic produces water and anaerobic does not
- aerobic occurs (mainly) in the mitochondria and anaerobic does not
  allow anaerobic only occurs in the cytoplasm
- anaerobic releases less energy than aerobic
  allow anaerobic releases less ATP (than anaerobic)
  do not accept anaerobic produces / makes / creates less energy

2

(e) carbon dioxide

1

ethanol

1

(f) pondweed takes in CO2 for photosynthesis

1

snail and pondweed are respiring producing CO2
if no other mark awarded allow rate of respiration = rate of photosynthesis for 1 mark

1

(g) (no light so) no photosynthesis
or
plant is not taking in CO2
and
snail and plant are respiring and so are releasing CO2

1

(h) snail is being decayed / decomposed / broken down
ignore being fed on

1

(by) decomposers / bacteria (in pond water / snail)

allow fungi / microbes / microorganisms

1

(therefore) respiration (of decomposers / bacteria) releases CO2

do not accept anaerobic respiration

1

[14]

Q3.

(a) increased (at first)

1

until 4 minutes or 50 breaths per minute

1

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

1

(b) 175 (beats per minute)

1

(c) 140 (beats per minute)

1

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

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

1

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

5–6

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

3–4

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

1–2

No relevant content

0

Indicative content

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

- so more oxygen to blood
- more carbon dioxide removed

- more oxygen to muscles
- needed for (increased) respiration
- to release / provide energy
- for muscle contraction
- anaerobic respiration occurs
- due to lack of oxygen
- which causes a build-up of lactic acid
- oxygen debt
- muscle fatigue / pain

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

[12]

Q4.

(a) temperature

1

volume of yeast and water

1

(b) 28

1

(c) carbon dioxide

1

(d) the greater the mass of sugar, the greater the volume of foam / gas produced

allow reference to weight / amount of sugar
allow reference to amount of foam / gas
allow positive correlation
ignore names of gases
ignore directly proportional

1

(e) no respiration occurs
or
sugar / glucose is needed for respiration

ignore no reaction occurs

1

(f) for comparison / to compare

allow as a control (experiment)
allow as a base line
do not accept as a control variable

or
to check that no other factor / variable is influencing the results

allow answers in the context of the

investigation e.g. to prove that the results obtained were due to the sugar (and nothing else)

or

to ensure validity

ignore fair test / accuracy

1

(g) (it) stops the oxygen / air getting in / through

ignore (it) stops the oxygen / air getting out

ignore gases unqualified

1

(h) ethanol

1

[9]

Q5.

(a) any one from:

- respiration
- formation of proteins
- formation / breakdown of glycogen
- breakdown of (excess) protein or formation of urea
- photosynthesis or formation of glucose / starch (in plants)

ignore formation of carbohydrates

1

allow other correct reference to metabolic reactions in cells

ignore reference to digestion

(b) males have a higher metabolic rate than females after five years of age

1

the mean metabolic rate of females decreases faster than males up to 25 years of age

1

each additional tick negates a mark

(c) $\frac{17}{53} \times 100$

1

32.075472...

allow correct rounding of this to at least 4 significant figures

1

32.1

allow a correct reduction to 3 significant figures from an incorrect calculation for marking point 2

1

an answer of 32.1 scores 3 marks

(d) any two from:

allow converse

- (person) R heart rate rose / increased more slowly than (person) S
- (person) R heart rate levelled off whereas (person) S continued to increase
- (person) R heart rate rose less (overall / after 5 minutes of exercise) than S

allow correct use of figures
e.g. R increased (overall) by 39 bpm / 65% and S by 54 bpm / 69%
ignore lack of units

2

(e) correct scale and axis labelled

allow min(s)
do not accept 'm'
the zero is not required on the x-axis

1

all points plotted correctly (to within ± ½ square)

allow 4 or 5 correct plots for 1 mark

2

line joined point to point or correct curved line of best fit

1

(f) $\frac{132 - 78}{12}$

allow $\frac{54}{12}$

allow sequential deductions of 12 four or five times

1

4.5 (minutes) / 4½ minutes / 4 minutes 30 seconds / 4:30

do not accept 4:50 or 4 minutes 50 seconds

1

an answer of 4.5 minutes scores 2 marks

(g) Level 3: The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically

sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content

- two groups of people – non-smokers and smokers
- have at least five people in each group or large groups
- get each person to do (named) exercise
- controlled variables:
  - same number of people in each group or large groups
  - same gender
  - same level of activity / exercise
  - same age
  - no health issues / illnesses
  - same type of exercise
  - same time for exercise
- record heart rate for each person before and after exercise
- calculate increase in heart rate for each person after exercise
- compare results for each group

for level 3, students should refer to at least 5 smokers and 5 non-smokers, carrying out exercise with control variables and a means of determining an increase in heart rate

for level 2, students should refer to 'groups' of smokers and non-smokers exercising

[20]

Q6.

(a) $C_6H_{12}O_6$

1

(b) atmospheric air contains less carbon dioxide than exhaled air

allow converse

1

(flask B goes more cloudy because) carbon dioxide is produced in (aerobic) respiration (by woodlice)

do not accept anaerobic respiration

1

(c) for comparison / to compare

allow answers in the context of the investigation e.g.

or
to check that no other factor / variable is influencing the results

to prove that the results obtained were due to the woodlice respiring and nothing else

or

to prove that the woodlice produced the carbon dioxide and nothing else

1

(d) (flask A) would remain colourless

ignore references to clear

allow not cloudy

1

(flask B) would remain colourless

1

(e) lactic acid

1

(f) alcohol / ethanol

1

[8]

Q7.

(a) no oxygen (is used)

1

(b) muscles become fatigued / stop contracting

1

because not enough energy is transferred

1

(c) carbon dioxide

1

(d) count the bubbles
or
measure volume of gas

1

in a given time

1

(e) brewing / bread making

allow other suitable use of fermentation in food industry

1

[7]

Q8.

(a) glucose is absorbed by diffusion into the bloodstream

1

then blood delivers glucose to muscles in capillaries

1

(b) to stop air getting in

1

(c) yellow

1

(d) collect the CO2 / gas with a measuring cylinder / gas syringe

1

(volume collected) in a certain time using a timer / watch

1

(e) yeast produces ethanol but muscles produce lactic acid
marks can be awarded from correct word or balanced symbol equations

1

yeast produces CO2 but muscles do not
answers must be comparative

1

both release small amounts of energy

1

ignore both occur without oxygen

[9]

Q9.

(a) (i) without oxygen
allow not enough oxygen
ignore air
ignore production of CO2
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 (dm3 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) CO2 / 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]

Q10.

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

1

(b) Less oxygen is taken in.

1

[2]