AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.4.2 RESPIRATION (PACK 3)

SCORE	PERCENTAGE
/198	%

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Q1.

(a) (i) plotting values for pulse rates;

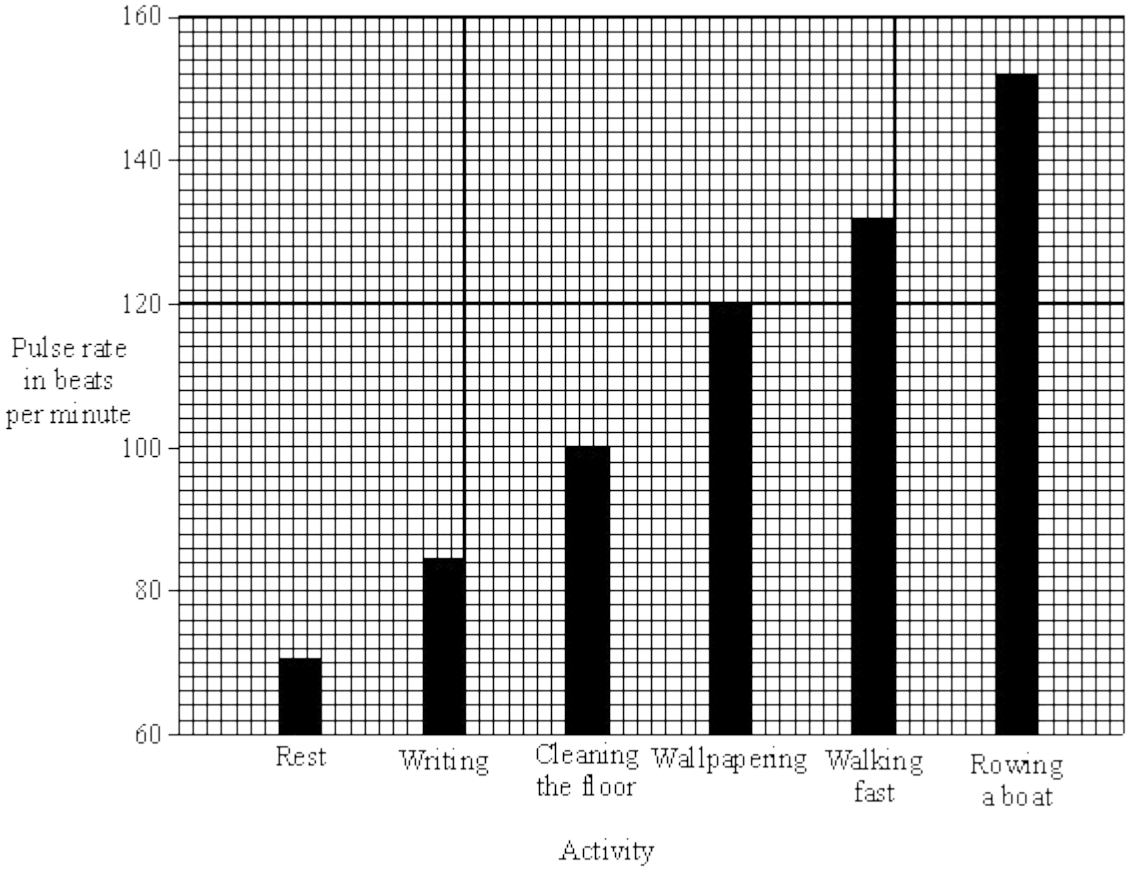
2 marks- minus 1 mark for each error to a maximum of 2

Accept values if plotted on blood volume bar chart

Non-horizontal tops to bars producing variable values = 1 error

If drawn as a line graph =1 mark maximum

2



(ii) **Either**

volume of blood went up then fell;

Accept went to a maximum then fell

pulse rate increased (steadily);

*Accept went up steadily **or** kept going up*

2

Or

at first **or** with low activity **or** with moderate activity both pulse and volume increased;

Accept activity up to wall- papering

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with more activity pulse continued to increase but volume fell;

(b) Any **two** of

with increased activity greater muscle use **or** greater respiration;

need more glucose **or** oxygen;

Accept more sugar

heart beat faster;

Do not accept more air

*Accept more blood needed **or** blood flows faster*

*If 'more' **or** equivalent stated once it can be accepted elsewhere by implication*

2

[6]

Q2.

X – oxygen

accept O_2

Y – carbon dioxide

accept CO_2

[2]

Q3.

(i) <u>with exercise</u> rate rises;

accept between 1 – 2 minutes rate rises

1

(when exercise stops) rate falls slowly;

*accept gentle fall **or** steady fall*

for answers which <u>just describe a rise then a fall allow one mark only</u> as an alternative to the first two points

1

rate does not return to normal **or** to starting **or** to resting rate

*accept rate returns to normal after five minutes **or** three minutes of rest **or** after recording ended*

1

(ii) 86 (per minute);

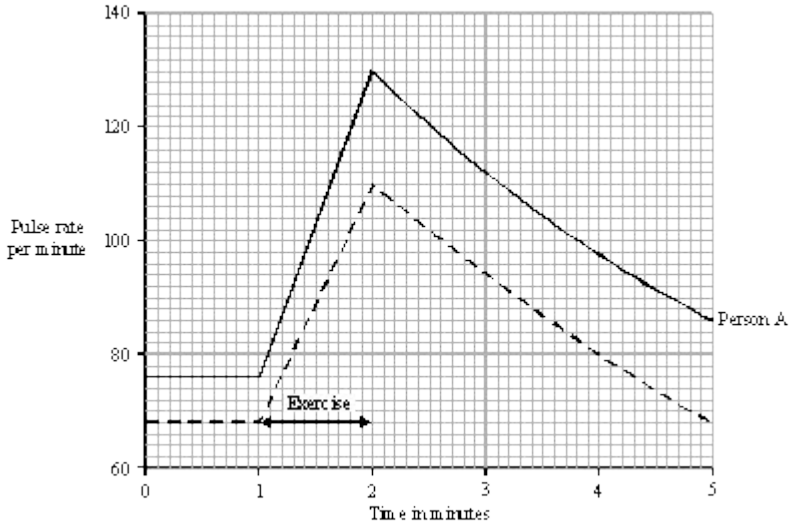
1

(iii) plotting points;

deduct one mark for each error to max of two

if 68 wrongly plotted count as one error (ignore the quality of the line)

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2

[6]

Q4.

(a) oxygen;)
carbon dioxide;) *allow symbols*
water)

each for 1 mark

3

(b) graph with reasonable vertical scales;
accurate plotting of all points (ignore lines) and labelling lines
histogram – must be coded

gains 3 marks

3

(c) 6 of:
during exercise the level of CO_2 (in the blood) rises;
increased breathing to remove excess CO_2;
increased oxygen supply to muscles;
or increased breathing takes in more O_2
or increased heart rate takes more O_2 to muscles;
increased supply of sugar to muscles;
increased respiration rate;
enable faster rate of energy release;
reference to lactic acid (allow even though not on syllabus)/O_2 debt;
to avoid cramp;
anaerobic reference;
reference to removal of 'heat';

6

(d) high carbon dioxide concentration;
brain/central nervous system;
heart muscles (both)

3

[15]

Q5.

(a) glucose/sugar water

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for 1 mark each

2

(b) (i) 204

for 1 mark

1

(ii) 49 **gains 2 marks**

(incorrect answer, but correct method gains 1)

2

(iii) 3 **gains 2 marks**
(incorrect answer, but correct method gains 1)

2

[7]

Q6.

(a) (i) reduced sharply

for 1 mark

1

(ii) converted to glucose which is respired to produce energy

(allow answers in terms of glucagon)

gains 3 marks

3

(b) (i) athlete A's was most effective
since resulted in highest muscle glycogen level on day of race
for energy release during race

for 1 mark each

3

(ii) e.g. excess carbohydrate stored as glycogen rather than fat in short term
particularly if glycogen stores depleted

for 1 mark each

2

[9]

Q7.

(a) oxygen,
carbon dioxide or water (vapour)

for 1 mark each

2

(b) idea of more air per breath/deeper breaths

for 1 mark

1

(c) (i) respiration

for 1 mark

1

(ii) carbon dioxide,
water

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for 1 mark each

2

(iii) more energy required,
for increased muscular activity

for 1 mark each

2

[8]

Q8.

(a) more energy needed,
for increased muscular activity

for 1 mark each

2

(b) increased sweat production,
evaporation of sweat cools body,
vasodilation OWTTE,
more heat loss (by radiation)

for 1 mark each

4

[6]

Q9.

(i) the higher the rate of oxygen consumption, the shorter the time taken to complete

for 1 mark

1

(ii) the faster oxygen is taken into the blood,
the faster energy can be released in the muscles,
and the faster the athlete can run

for 1 mark each

3

[4]

Q10.

(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]

Q11.

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(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]

Q12.

(i) 0.25 × 100 / 25

gains 1 mark

but
1%

gains 2 marks

2

(ii) muscle contraction / limb movement / moving around / chewing
heartbeat / breathing / internal muscle activity
maintaining body temperature / keeps body warm
active uptake synthesising substances (*reject* growth)

any three for 1 mark each

3

[5]

Q13.

(a) 11

accept 10.5 – 11.5

1

(b) ideas of

increase / rises

1

frequently / often

1

energetically / violently

1

[4]

Q14.

(a) falls

1

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from 0.25

1

to 0.19

but by 0.06 gains two marks

if <u>neither</u> 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) <u>more</u> oxygen

1

[6]

Q15.

any **three** from:

heat produced by muscles

<u>during</u> exercise

accept <u>when</u> working

by respiration

(skin) temperature over muscles rises / more blood to skin over muscles

*allow vasodilation **or** arterioles dilate over muscles*
reject capillaries dilate
sweating neutral

[3]

Q16.

(a) respiration

reject start respiring / respire only at night

1

no photosynthesis because no light

1

(b) photosynthesis rate greater than respiration rate

1

reject no respiration / photosynthesis only

photosynthesis since light

1

[4]

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Q17.

(a) 850

1

(b) (i) more

because exercise makes us sweat **or** work harder

accept to cool the body

do not credit body hotter or giving off more heat

2

(ii) more

because she respires more

*accept she breathes (in and out) more **or** heavier **or** faster*

2

(iii) less

because (more) water has been lost by sweating **or** breathing out **or** other methods

accept arguments about conservation of water

2

(c) kidney

1

[8]

Q18.

(a) (i) trachea

accept windpipe

1

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

do not credit right lung

1

(b) carbon dioxide **or** water <u>vapour</u>

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]

Q19.

(i) (aerobic) respiration

do not credit anaerobic respiration

accept cellular respiration

1

(ii) carbon dioxide and water (vapour)

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both required

do not credit heat

1

[2]

Q20.

(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]

Q21.

(i) 6 in both spaces

do not credit if any formula has been altered

1

(ii) glucose

*allow fructose **or** dextrose*

1

(iii) mitochondria

accept organelles

1

[3]

Q22.

(i) any **two** from

* (heart) more muscular

accept bigger

* (heart) more powerful

accept more efficient

accept stronger

2

(ii) * pauses longer between (heart) beats

accepts beats more slowly

accept heart rate decreases

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* less fast around the heart

recovers more quickly not just 'heart healthier'

do not credit pulse rate slower

2

[4]

Q23.

(a) more water vapour

accept more water

1

more carbon dioxide

1

less oxygen

1

(b) (i) glucose

accept carbohydrate(s)

accept sugar(s)

1

(ii) heat

***or** thermal*

***or** <u>internal</u> kinetic*

1

(iii) lungs

accept alveoli / alveolus

do not credit air sacs

do not credit capillaries

both neutral if included with lungs

1

(c) oxygen

accept O_2

1

lactic

1

[8]

Q24.

(a) (i) photosynthesis

1

(ii) respiration

do not credit combustion

do not credit decay

1

(iii) dry

*accept hot **or** windy **or** drought*

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1

(b) any **three** from

* evaporation (of water)
or loss of water vapour

* (mostly) from the leaf / leaves
do not credit incorrect reference to leaves

* through the stomata
accept through each stoma
accept through the stomas(sic)

* causing a pull
***or** causing an increase in osmotic potential (at the top of the plant)*
***or** causing an increase in water potential (at the top of the plant) **or** causing a decrease in osmotic pressure (at the top of the plant)*

* (so that) water moves up (through the plant)
do not credit water vapour moves up through the plant

* as the transpiration stream

* water enters through roots (and goes up plants)

3

[6]

Q25.

(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]

Q26.

(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

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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]

Q27.

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

energy is neutral

1

formulae all correct

with no omissions / deletions

correctly balanced

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credit 1 mark if the answer is the exact reverse of an incorrect answer for (a)

1

(ii) and **three** from

take up of (soluble) substances / ions against the concentration gradient

or *when the concentration (of the substance / ions) is greater inside the cell / cytoplasm than outside it*

through the (semi-permeable) (cell) membrane energy from mitochondria

or *energy from respiration*
not just energy

3

[5]

Q28.

(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]

Q29.

(a) *idea*
O_2 increases
CO_2 decreases

for 1 mark each

2

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(b) (i)

<u>reduced</u>	<u>unchanged</u>	<u>increased</u>
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]

Q30.

(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 <u>and</u> carbon dioxide sector<u>s</u> labelled

for 1 mark

3

(b) carbon dioxide
oxygen

for 1 mark each

Do not allow water vapour.
(Allow correct symbols/formulae)

2

[5]

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Q31.

(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]

Q32.

(a) (i) points correctly plotted

all correct gains 2 marks
2 correct gains 1 mark

each part of line correctly drawn (i.e. curve + straight line)

for 1 mark each part of line

4

(ii) 3 (or according to plotted graph)
litres per second

for 1 mark each

2

(b) lungs
blood

for 1 mark each

2

(c) (i) *ideas that*

- energy transferred <u>faster</u> in 100m race
- carbon dioxide produced faster during 1500m race / more
- carbon dioxide produced

for 1 mark each

3

correct reference to twice / half as fast in either / both cases

for a further mark

1

(ii)
- respiration during 100m race (mainly) anaerobic
- respiration during 1500m race (mainly) aerobic
- aerobic respiration produced carbon dioxide
- anaerobic respiration produced / lactic acid

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for 1 mark each

1

[13]

Q33.

(a)
- appropriate scales (> halfway along each axis)
- all points correctly plotted to better than ½ a square
- lines carefully drawn

(*allow* point to point in this case)

N.B.

- no mark available for labelling axes
- *allow* either orientation

for 1 mark each

3

(b) (i) *ideas that*

- energy transferred faster in 100m race

(*not* more energy transferred)

- carbon dioxide produced faster during 1500m race

for 1 mark each

(*allow* more carbon dioxide produced)

correct reference to twice / half as fast in either / both cases

for 1 further mark

3

(ii)
- respiration during 100m race (mainly) anaerobic
- respiration during 1500m race aerobic
- aerobic respiration produces carbon dioxide
- anaerobic respiration doesn't produce carbon dioxide / produces lactic acid

any two for 1 mark each

2

(c) *ideas that*

- there is an oxygen debt / more than normal oxygen needed
- lactic acid needs to be oxidised / combined with oxygen

for 1 mark each

2

[10]

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