AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.4.2 RESPIRATION (PACK 2)

SCORE	PERCENTAGE
/224	%

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Q1.

(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]

Q2.

(a) LHS – glucose

1

RHS – water

allow H_2O / H2O

1

(b) so the earthworms' body temperature would change to 20°C

1

(c) (i) 56 or 55 or 54

*if incorrect answer given accept 60 - 5 for **1** mark*
*or 60 – 6 for **1** mark*
*or 60 – 4 for **1** mark*

2

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(ii) one-tenth of answer to (c)(i) eg 5.5

1

(at 10°C / lower temperature):

lower rate of respiration

allow chemical reactions slower or enzymes less active

ignore breathing

do not allow anaerobic

1

worms less active / worms release less energy / worms use less energy

1

(d) (i) anomalous result / not in line with other data / does not fit the pattern

1

(ii) more representative / more reliable / can check 'repeatability' / see if get similar values / identify anomalies

ignore valid / more fair

ignore reproducible

ignore 'to remove' anomalies

do not accept more accurate or more precise

1

[10]

Q3.

(a) in yeast:

'it' equals yeast

makes alcohol / makes CO^2 / does not make lactic acid

do not allow uses / involves alcohol / CO^2

1

(b) (i) any two from:

allow amount of yeast

- volume of yeast / suspension
- volume of sugar / solution
- concentration of sugar

amount of sugar = max 1 for sugar

- temperature

(total) volume = 1 mark if no other volume

ignore concentration of yeast

2

(ii) most / more CO^2 given off with fructose **or**

'it' equals fructose

faster CO^2 production

or

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faster respiration

allow faster fermentation

*do **not** allow aerobic respiration*

1

so (rate of) alcohol production will be greatest / more (with fructose)

1

[5]

Q4.

(a) (i) carbon dioxide

accept CO_2 / CO2

*do **not** accept CO^2*

1

(ii) fermentation / respiration

ignore aerobic / anaerobic

1

(b) most / more gas (produced)

*do **not** allow 'a lot'*

or

allow alternative descriptions

liquid level lowest

ignore name of gas

1

(c) (i) repeat

ignore reference to average or mean

or

compare with results of others

1

(ii) if reliable - get same / similar results

*allow same pattern but **not** pattern alone*

or

allow no anomalies

small range

ignore anomalies unqualified

1

(d) use smaller intervals

can be implied

1

around 30°C **or** between 25°C and 35°C

*do **not** allow for temperatures below 25°C above 35°C*

ignore references to sensitivity or precision (of thermometer)

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*NB do at 28°C, 30°C and 32°C = **2** marks*

1

[7]

Q5.

(a) person with muscle disease:

allow reverse argument for healthy person

any **three** from:

NB all points are comparative except peak (point 3)
*allow use of **two** approximate figures as a comparison*

- higher resting rate **or** higher at start
- when exercise starts / then increases more / more rapidly
  accept description eg rise …. fall
- peaks (then falls)
- levels off later than healthy person
- higher rate during exercise
  *if no other marks awarded allow **1** mark for 'it's higher'*
- greater range

3

(b) (i) oxygen

accept adrenaline
accept O_2
*do **not** accept O, O2 or O^2*

1

(ii) cannot release sugar / glucose (from glycogen)

or

cannot store glucose / sugar (as glycogen)

1

need to receive glucose / sugar (from elsewhere)
ignore oxygen

1

for energy / respiration / cannot store energy
ignore aerobic / anaerobic

1

[7]

Q6.

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

*if diet given as answer = max **2***

- age (of athlete)

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- gender (of athlete)
- starting concentration of glycogen
- type / intensity of exercise
- length of exercise period
- number of training sessions
  *if none of these points gained amount of exercise = **1** mark*
- time interval between exercise sessions
- exercise at same time of day
  *if last four points not awarded allow time (for exercise) for **1** mark*
  ignore references to amount of energy
  ignore they are both athletes

3

(ii) any **two** from:

- intensity of exercise
- amount of exercise between sessions
- starting concentration of glycogen
- fitness / health
- metabolic rate / respiration rate
- amount / mass of muscle / physique
- aspects of diet qualified, eg amount of food eaten
  *do **not** accept amount of carbohydrate*
  *if no other marks awarded allow height / mass / weight for **1** mark*

2

(iii) (B has) less glycogen
he = B

or (B's glycogen) fell more
accept use of approximate figures

or (B's glycogen) built up less
allow other correct observations from graph eg A is lower at end of first session
ignore rate of fall

1

(b) athlete **A** (no mark)
to gain full marks 'more' must be given at least once

athlete **A** had more glycogen / **B** has less (only if A chosen to complete marathon)

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*accept converse argument for **B***

1

(glycogen / glucose) used in respiration

ignore anaerobic

1

(more) energy released / available in athlete **A**

allow 'energy made'

1

and either energy used for movement / muscle action / to run
or
(extra) glycogen → (more) glucose

1

[10]

Q7.

(a) LHS: carbon dioxide **AND** water

in either order

*accept CO_2 **and** H_2O*
allow CO2 and H2O
if names given ignore symbols

*do **not** accept CO^2 / H^2O / Co / CO*
ignore balancing

1

RHS: sugar(s) / glucose / starch / carbohydrate(s)

accept $C_6H_{12}O_6$
allow C6H12O6
*do **not** accept $C^6H^{12}O^6$*

1

(b) (i) light is needed for photosynthesis

or

no photosynthesis occurred (so no oxygen produced)

1

(ii) oxygen is needed / used for (aerobic) respiration

full statement

*respiration occurs **or** oxygen is needed for anaerobic respiration gains **1** mark*

2

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

1

use of figures, ie

max. production at 40 °C
or maximum rate of 37.5 to 38

1

(ii) <u>25 – 35 °C</u>

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

1

or temperature is a limiting factor over this range

<u>40 – 50 °C</u>

denaturation of proteins / enzymes
ignore denaturation of cells
ignore stomata

1

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

1

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

1

because respiration rate is higher at > 35 °C
or
respiration reduces the effect of photosynthesis

1

[12]

Q8.

(a) 7.15 to 7.45 <u>am</u> **and** 7.15 to 7.45 <u>pm</u>
both *required, either order*
accept in 24 hr clock mode

1

(b) (i) 11

1

(ii) 32.5 to 33
allow answer to (b)(i) + 21.5 to 22

1

(c) any **two** from:

- more photosynthesis than respiration
- more biomass / carbohydrate made than used
  allow more food made than used
- so plant able to grow / flower
  accept plant able to store food

2

[5]

Q9.

(a) (i) 6 peaks in heart rate
*accept 6 increases / spikes **or** goes very high 6 times*
allow heart rate increases each time he runs

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1

(ii) 2.5 / 2½

allow 2 minutes 30 seconds

*do **not** accept 2.3 / 2:3 / 2.30*

1

(b) *more / faster / a lot **must** be stated at least once for full marks*

(more) oxygen supplied / needed

allow less anaerobic (respiration)

or (more) aerobic respiration

***or** prevents oxygen debt*

1

(more) glucose / sugar / food supplied / needed

ignore feeding

1

(more) energy needed / released

allow energy produced / made

1

(more) carbon dioxide / heat / lactic acid removed (from muscles) **or** more cooling

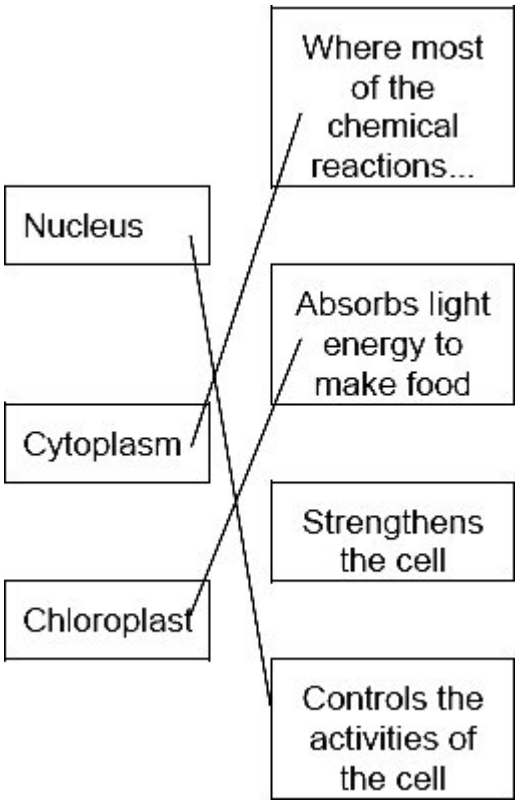
or less lactic acid formed

1

[6]

Q10.

(a)



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1 *mark for each correct line*
mark each line from left hand box
two lines from left hand box cancels mark for that box

3

(b) energy

1

[4]

Q11.

(a) (i) brain

1

(ii) skin

1

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

allow $\frac{1000}{25000}$

1

(b) any **two** from:

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

  or
  less blood flow to other organs
- increased stroke volume / described

2

(c) *ignore references to breathing*

<u>more</u> respiration / description
or
<u>more</u> energy required **or** to provide <u>more</u> energy

1

respiration / process described → CO_2
*do **not** accept anaerobic respiration*

1

CO_2 <u>diffuses</u> into blood

1

[8]

Q12.

(a) (i) glycogen

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1

(ii) respiration

1

(b) (i) 483 kJ

1

(ii) oxygen

1

(iii) dilate

1

(c) supplies more / a lot of oxygen **or** removes more carbon dioxide **or** release more energy / faster respiration

1

[6]

Q13.

(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]

Q14.

insufficient / no oxygen available

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1

for (just) aerobic <u>respiration</u>

or
<u>respires</u> anaerobically

1

[2]

Q15.

(a) (i) C and D

1

(ii) cell wall

1

(b) (i) A

1

(ii) D

1

(c) respiration

1

[5]

Q16.

(a) microorganisms

1

(b) moist

1

(c) respiration

1

(d) roots

1

[4]

Q17.

(a) (i) 150

1

(ii) any **two** from:

accept correct use of numbers
accept pulse rate

- lower resting rate
- lower rate during exercise
- recovers faster after exercise

allow a general statement about lower rate if neither of the first two points given

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2

(b) glucose

1

oxygen

1

[5]

Q18.

(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]

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Q19.

(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]

Q20.

(a) any **two** from:

- age
- gender
- mass
- number in group

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- 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 <u>for</u> respiration*
- (this) energy comes from food / fat
- less food / energy/ calories converted to fat

2

[8]

Q21.

(a) A

1

(b) (i) diffusion

1

(ii) respiration

1

(iii) mitochondria

1

(iv) photosynthesis

1

[5]

Q22.

(a) A

no mark – can be specified in reason part
if B given = no marks throughout

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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]

Q23.

(a) No

no mark
if yes max 1 for correct statement

diffusion is down the concentration gradient

accept by diffusion ions would leave the root

1

to enter must go up / against the concentration gradient
or concentration higher in the root
or concentration lower in the soil

1

(b) (i) 0.9 **or** 3.25

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for correct answer with or without working
if answer incorrect 1.3 ***or*** *their rate – 0.4 gains 1 mark*
or *130 – 40* ***or*** *90 gains 1 mark*

2

(ii) (uptake) by active transport

1

requires energy

more energy from aerobic respiration

1

or

more energy when oxygen is present

1

[7]

Q24.

(a) 4000

award ***both*** *marks for correct answer, irrespective of working*
1500 + 2000 + 500 gains ***1*** *mark*

2

(b) day 2 (no mark)

any **two** from:

max ***1*** *mark if correct day not identified or if no day given*

- more (water in) breath / breathing
- more (water in) sweat / sweating
  accept a lot of sweating
- less (water in) urine
  if no other marks awarded allow ***1*** *mark for more water lost on day 2*

2

(c) (i) respiration

1

(ii) cools / removes heat owtte
ignore 'maintains body temperature' unqualified

1

(iii) osmosis

1

[7]

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Q25.

(a) B = rib

1

C = diaphragm

1

(b) (i) D

allow lower case

1

(ii) carbon dioxide

1

[4]

Q26.

(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]

Q27.

(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)

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any **four** from:

- muscles using more energy **or** more energy released
- muscles respire 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]

Q28.

(a) increased speed
or harder exercise / running
→increased need / use / loss of energy

1

allow further you run / walk the more energy you need

increased mass / bigger → increased use of energy

1

(b) any **three** from:

- supply / using (more / enough) oxygen
  or get (more) oxygen in blood(*)
- remove (more) CO_2(*)
- doing (more) work
  or
  using (more) energy allow produce energy(*)
  (*)need reference to 'more' ONCE only for full marks
- for respiration
- prevent build up of lactic acid
  or prevent oxygen debt
  or prevent anaerobic (respiration)
  or allow aerobic (respiration)

3

[5]

Q29.

(a) circulation / mixing / described

1

or

temperature maintenance

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supply <u>oxygen</u>

*do **not** allow oxygen for anaerobic respiration*

or

for <u>aerobic</u> conditions

or

for <u>faster</u> respiration

1

(b) any **one** from:

- energy supply / fuel
  or use in respiration

  *do **not** allow just food / growth*

  ignore reference to aerobic / anaerobic

- <u>material</u> for growth
  or to <u>make</u> mycoprotein

1

(c) (heat / energy) from <u>respiration</u>

allow <u>exothermic</u> reactions

allow description eg <u>breakdown</u> of glucose / catabolism

ignore metabolism

ignore aerobic / anaerobic

1

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

- compete (with Fusarium) for food / oxygen
  or reduce yield of Fusarium

- make toxic waste products
  or they might cause disease / pathogenic
  or harmful to people / Fusarium

  *do **not** allow harmful unqualified*

1

(ii) any **two** from:

- steam / heat treat / sterilise fermenter (before use)

  ***not** just clean*

  *allow sterilisation unqualified for **1** mark*

- steam / heat treat / sterilise glucose / minerals / nutrients / water (before use)

  ***not** just use pure glucose*

- filter / sterilise air intake

- check there are no leaks

2

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(e) any **three** from:

- beef is best **or** beef is better than mycoprotein(*)
- mycoprotein <u>mainly</u> better than wheat(*)
- more phenylalanine in wheat than in mycoprotein(*)
  allow equivalent numerical statements(*)
- but no information given on other amino acids / costs / foods

3

<u>overall conclusion</u>:

statement is incorrect

or

it would be the best source for vegetarians

or

for given amino acids, beef is the best source

or

three foods provide insufficient data to draw a valid conclusion

1

[11]

Q30.

(a) 94.8

1

(b) (i) to cool (the body) / maintain (body) temperature
*do **not** accept let out heat*

1

(ii) water **and** ions

1

(iii) water ignore CO_2, and vapour

1

(c) any **two** from:

used in respiration

provides energy

(energy) needed for movement / running / muscle action

2

[6]

Q31.

<u>in correct sequence</u>:

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breathing

1

diffusion

1

respiration

1

[3]

Q32.

(a) respire

1

oxygen / glucose
glucose / oxygen
} each once only

2

blood

1

carbon dioxide / heat
heat / carbon dioxide
} each once only

2

[6]

Q33.

(a) (before exercise) – 9 to 11 **and** (after exercise) – 12 **or** 13

***both** correct*

1

(b) 0.75 to 0.90

ignore working or lack of working

eg. 2.35 – 1.55 ***or*** $\frac{(2.35-1.0)\times 60}{100}$ ***or** other suitable figures for **1** mark*

2

(c) any **four** from:

still need to remove <u>extra</u> carbon dioxide

still need to remove heat / to cool

(some) anaerobic respiration (in exercise)

lactic acid made (in exercise)

oxygen needed to break down lactic acid **or** suitable reference to oxygen debt

lactic acid broken down to CO_2 and water **or** lactic acid changed into glucose

4

[7]

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Q34.

(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 <u>to muscles</u>

accept more oxygen sent to muscles

1

[7]

Q35.

any **four** from:

more energy / respiration required

*accept it prevents / reduces anaerobic respiration **or** less / no lactic acid*

reference to increase must be made, but only needed once, provided inference is clear for remainder of points.

accept 'delivered more quickly' for 'increase'

increase oxygen uptake into blood (in lungs)

increase oxygen delivery to muscles

increase glucose delivery to muscles

increase removal of heat from muscles **or** increase delivery of heat to skin

increase removal of carbon dioxide from muscles

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increase removal of carbon dioxide from blood (in lungs)

[4]

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