Name: _____

Class: _____

Date: _____

Organisation part 1 AQA Triple Biology

Time: **76 minutes**

Marks: **69 marks**

Comments:

1. Blood contains different types of cell.

(a) Complete the sentences.

Choose answers from the box.

antibiotics	**antitoxins**	**painkillers**	**pathogens**

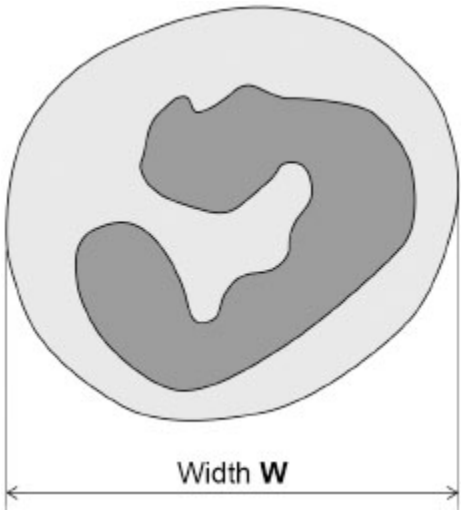
White blood cells defend the body against _____.

Some white blood cells release chemicals that neutralise toxins. These chemicals are called _____.

(2)

(b) **Figure 1** shows a white blood cell.

Figure 1



The image of the white blood cell in **Figure 1** is magnified 4000 times.

Calculate the real width of the white blood cell.

Complete the following steps.

Measure width **W** in millimetres (mm).

Width **W** = _____ mm

Convert your measurement to micrometres (µm).

1 millimetre (mm) = 1000 micrometres (µm).

_____

_____

Width **W** in micrometres = _____ µm

Calculate the real width of the white blood cell.

Use the equation:

$$\text{real width} = \frac{\text{width W (µm)}}{\text{magnification}}$$

_____

_____

_____

Real width = _____ µm

(4)

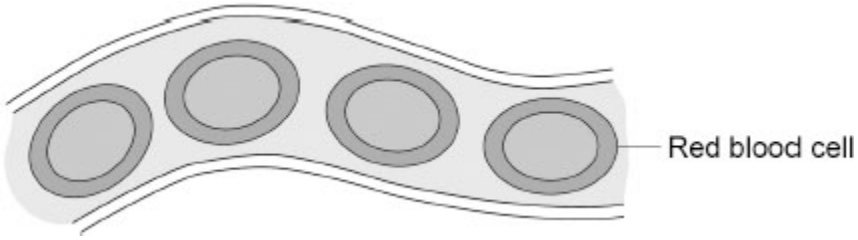
The table below shows information about different types of blood vessel.

Blood vessel	**Width of blood vessel in micrometres (µm)**	**Pressure of blood travelling through the blood vessel**
Artery	10 000	High
Capillary	10	Low
Vein	20 000	Very low

(c) The width of a red blood cell is 8 µm.

Figure 2 shows red blood cells in one type of blood vessel.

Figure 2



Which type of blood vessel is shown in **Figure 2**?

Use the table above.

Tick (✓) **one** box.

Artery ☐

Capillary ☐

Vein ☐

(1)

(d) Explain why arteries need to have thick walls.

Use the table above.

_____

_____

_____

_____

(2)

Coronary arteries in the heart can become narrowed.

(e) What happens inside coronary arteries to cause them to become narrowed?

_____

_____

(1)

(f) Explain why narrowed coronary arteries can be dangerous.

_____

_____

_____

_____

(2)

(g) Treatments are available for some cardiovascular diseases.

Draw **one** line from each cardiovascular disease to a treatment for the disease.

Cardiovascular disease	Treatment
A blocked coronary artery	Antibiotics
Heart failure	Heart transplant
High blood cholesterol	Statins
	Stent

(3)

(h) Why is coronary heart disease described as a 'non-communicable disease'?

_____

_____

(1)

(Total 16 marks)

2. Eating too much carbohydrate can cause obesity.

(a) Name **one** disease that obesity is a risk factor for.

_____

(1)

Table 1 shows information about sugar intake and obesity in different countries.

Table 1

Country	Mean sugar intake per person per day in grams	Mean obesity rate in arbitrary units
A	122	18
B	80	9
C	172	25
D	150	23
E	110	15
F	144	19
G	192	32

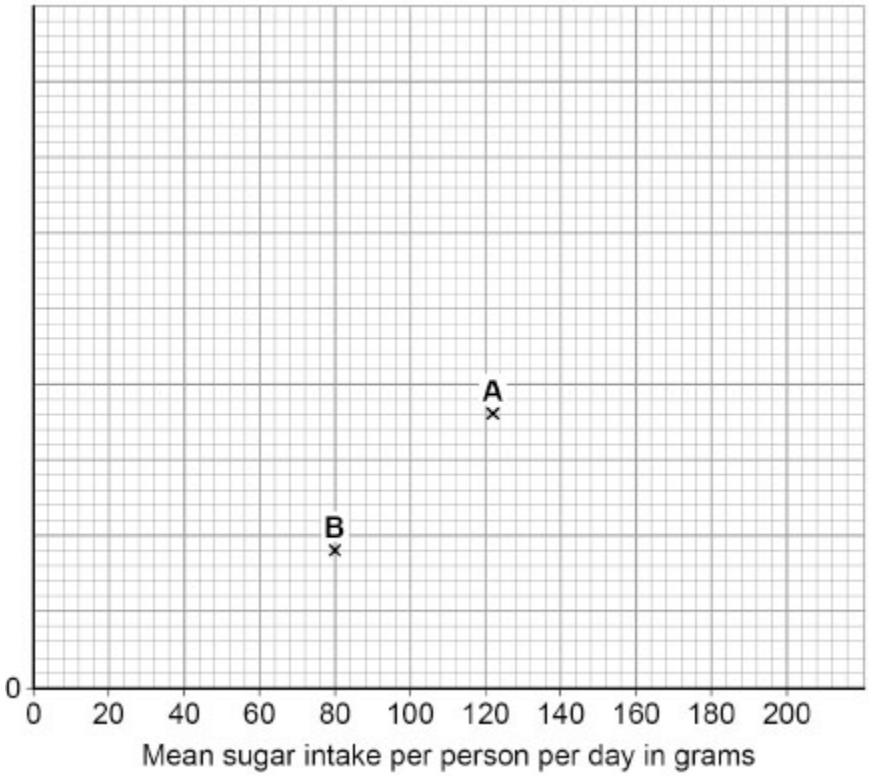
(b) Complete **Figure 1**.

You should:

- label the *y*-axis
- add the scale for the *y*-axis
- plot the data for countries **C**, **D**, **E**, **F** and **G** from **Table 1**
- draw a line of best fit.

Countries **A** and **B** have been completed for you.

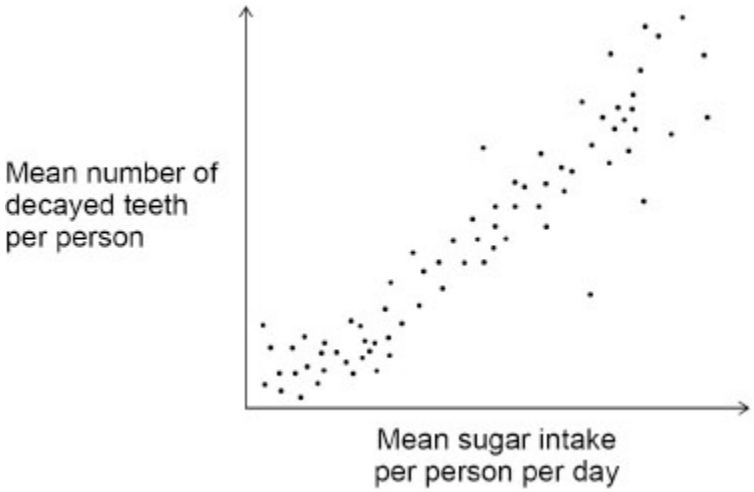
Figure 1



(4)

Figure 2 shows information about the relationship between sugar intake and tooth decay.

Figure 2



(c) Name the type of graph shown in **Figure 2**.

_____

(1)

(d) What relationship is shown between the two variables in **Figure 2**?

Tick (✓) **one** box.

Inversely proportional ☐

No correlation ☐

Positive correlation ☐

(1)

Sugars and starch are carbohydrates.

A student investigated the effect of temperature on the activity of amylase.

For each temperature, the student:

- mixed starch and amylase together
- added iodine solution after 5 minutes.

The iodine solution was yellow-brown before it was added to the mixture.

Table 2 shows the results.

Table 2

Temperature in °C	**Colour of iodine solution**
10	blue-black
30	yellow-brown
60	blue-black
90	blue-black

(e) Explain the results at 30 °C and at 90 °C.

30 °C _____

_____

_____

_____

90 °C _____

_____

_____

_____

(4)

(f) How could the student change the investigation to find a more precise temperature that amylase works best at?

Tick (✓) **one** box.

Test more temperatures between 10 °C and 30 °C. ☐

Test more temperatures between 10 °C and 60 °C. ☐

Test more temperatures between 30 °C and 60 °C. ☐

Test more temperatures between 30 °C and 90 °C. ☐

(1)

(g) Protease enzymes are involved in protein digestion.

Different types of protease enzyme are active in different organs of the digestive system.

Complete **Table 3** to identify the organ where each protease enzyme is active.

Table 3

Protease enzyme	**Optimum pH**	**Organ where enzyme is active**
Pepsin	2	
Trypsin	8	

(2)

(Total 14 marks)

3. Plants and animals have adaptations that help them survive.

A stingray is an animal that lives in the sea.

Seagrass is a plant that grows on the sea floor.

The figure below shows a stingray swimming above seagrass.

(a) Draw **one** line from each adaptation of **seagrass** to how the adaptation helps the seagrass survive.

Adaptation of seagrass	**How the adaptation helps the seagrass to survive**
Flexible leaves	Keep seagrass in one place on the sea floor
Long, deep roots	Poison animals that try to eat the seagrass
	Stop seagrass breaking in strong water currents

(2)

In the stingray, gas exchange takes place in the gills.

(b) Name the organs where gas exchange takes place in humans.

_____

(1)

(c) Gills are adapted to maximise gas exchange.

Which **two** features of gills help to maximise gas exchange?

Tick (✓) **two** boxes.

Gills are not open at night. ☐

Gills have a large surface area. ☐

Gills have a low temperature. ☐

Gills have thin walls. ☐

Gills have very few capillaries. ☐

(2)

(d) Stingrays rest on the sea floor.

The table below shows information about the metabolic rate of a stingray.

Activity of stingray	**Metabolic rate in arbitrary units**
Resting	484
Swimming	944

Calculate how many times greater the metabolic rate of the stingray is when swimming compared with when resting.

Give your answer to the nearest whole number.

(3)

(e) When the metabolic rate of the stingray increases, the rate of aerobic respiration in the stingray increases.

Complete the word equation for aerobic respiration.

Choose answers from the box.

carbon dioxide	**magnesium**	**nitrogen**	**oxygen**	**water**

glucose + _____ → _____ + _____

(3)

(f) Explain why the rate of respiration in the stingray increases when the stingray starts to swim.

(3)

(g) Some plants can use anaerobic respiration.

Which **two** substances are produced during anaerobic respiration in plants?

Tick (✓) **two** boxes.

- Carbon dioxide ☐
- Ethanol ☐
- Hydrochloric acid ☐
- Oil ☐
- Protein ☐

(2)

(Total 16 marks)

4. Plants are made of cells, tissues and organs.

(a) Which part of a plant is the largest?

Tick (✓) **one** box.

- A guard cell ☐
- A leaf ☐
- A root hair ☐

(1)

Students investigated the effect of concentration of salt solution on the mass of pieces of potato.

This is the method used.

1. Cut two pieces of potato to the same size.
2. Record the mass of each piece of potato.
3. Place one piece of potato into a beaker containing a dilute salt solution.
4. Place the other piece of potato into a beaker containing a concentrated salt solution.
5. After 20 minutes, remove each piece of potato from its solution.
6. Record the change in mass of each piece of potato.
7. Repeat steps 1 to 6 two more times.

The table below shows the results.

Solution	**Change in mass of piece of potato in grams**			
	Test 1	**Test 2**	**Test 3**	**Mean**
Dilute salt solution	1.1	1.1	1.4	**X**
Concentrated salt solution	–7.2	–6.8	–32.4	–7.0

(b) Calculate mean value **X** in the table above.

_____

_____

_____

_____

X = _____ grams

(2)

There is an anomalous result for the concentrated salt solution in the table.

(c) Draw a ring around the anomalous result in the table above.

(1)

(d) What did the students do with the anomalous result when calculating the mean in the table above?

_____

(1)

(e) What name is given to a variable that is kept the same during an investigation?

Tick ✓ **one** box.

Control variable ☐

Dependent variable ☐

Independent variable ☐

(1)

(f) One variable the students kept the same during the investigation was the size of the pieces of potato.

Which other variable did the students keep the same?

Tick ✓ **one** box.

Change in mass of pieces of potato ☐

Concentration of salt solution ☐

Time in the salt solution ☐

(1)

(g) The pieces of potato in the concentrated salt solution decreased in mass.

Complete the sentence.

Choose the answer from the box.

excretion	**osmosis**	**respiration**

Water moved out of the potato by the process of _____.

(1)

(h) The potato cells have a partially permeable membrane.

Which particles can pass through a partially permeable membrane?

Tick ✓ **one** box.

No particles ☐

Some particles ☐

All particles ☐

(1)

(i) How could the students improve their investigation?

Tick ✓ **one** box.

Boil the pieces of potato at the start. ☐

Leave the skin on some pieces of potato. ☐

Use more concentrations of salt solution. ☐

(1)

(Total 10 marks)

5. The table below shows information about four jellyfish.

The jellyfish are listed in order of increasing size.

Jellyfish	**Size of jellyfish**	**Surface area in mm^2**	**Volume in mm^3**	**Surface area to volume ratio**
A	Smallest ↓	3 600	1 200	**X**:1
B		50 000	25 000	2:1
C		1 800 000	6 000 000	0.3:1
D	Largest	7 500 000	125 000 000	0.06:1

(a) Calculate value **X** in the table above.

X = _____

(2)

(b) Describe the relationship between the size of a jellyfish and its surface area to volume ratio.

Use the table above.

(1)

The jellyfish in the table above take oxygen into their cells by diffusion.

(c) Name **one** other substance that enters cells by diffusion.

Do **not** refer to oxygen in your answer.

(1)

(d) Suggest **two** factors that affect the rate of diffusion of oxygen into a jellyfish.

1 _____

2 _____

(2)

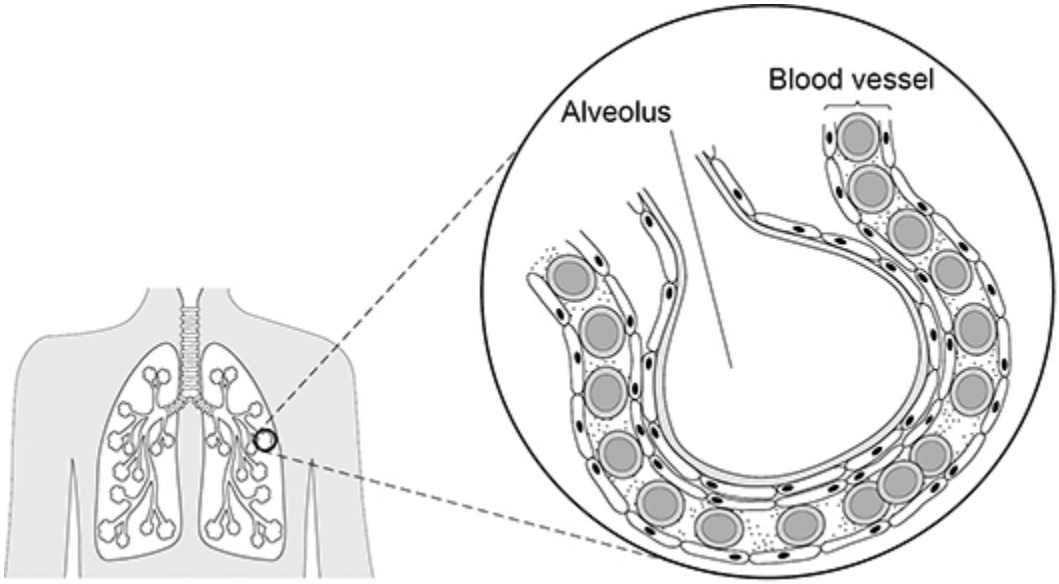
(e) Some organisms take in oxygen using a respiratory system.

In humans, gas exchange takes place in the lungs.

Name the organs where gas exchange takes place in **fish**.

(1)

(f) The figure below shows parts of the human breathing system.



Explain how the human breathing system is adapted to maximise the rate of gas exchange.

(6)

(Total 13 marks)

1. (a) pathogens

1

antitoxins

in this order only

1

(b) *measurement*

60 (mm)

allow measurement in the range 59 (mm) to 61 (mm)

1

conversion

60 000 (µm)

allow correct conversion from incorrect measurement

1

substitution

$= \frac{60\,000}{4\,000}$

allow correct substitution using incorrect conversion

1

real width

15 (µm)

allow correct calculation using incorrectly converted value

1

(c) capillary

1

(d) (blood in arteries) has high pressure

1

(so need thick walls) to withstand / maintain the pressure

or

(so need thick walls) to prevent bursting

ignore to increase the pressure

*allow **2** marks for to withstand / maintain high pressure*

1

(e) deposits / build-up / increase of fat(ty material)

allow deposits / build-up / increase of cholesterol

allow deposits / build-up / increase of plaque

1

(f) less / no blood flow

1

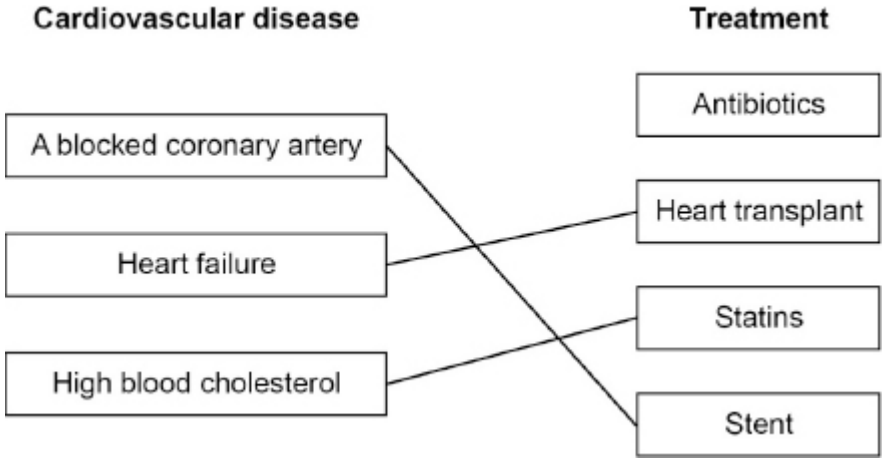
(so) less / no oxygen / glucose transported (to heart / body)

*allow **2** marks for less oxygenated blood flows*

*if no other marks awarded allow **1** mark for idea that it will lead to a heart attack*

1

(g)



do **not** accept more than one line from a box on the left

3

(h) because it cannot be spread / passed on (from one person to another)

or

because it is not caused by a pathogen / bacterium / virus / fungus / protist / microorganism / microbe

allow not contagious / infectious

ignore because it is a lifestyle disease

1

[16]

2. (a) type 2 diabetes

ignore diabetes unqualified
*do **not** accept type 1 diabetes*
allow high blood pressure
allow (coronary) heart disease
***or** CHD*
*allow cardiovascular disease **or** CVD*
allow stroke
allow heart attack
allow (osteo)arthritis
allow cancer
allow sleep apnoea
allow liver disease
allow other correct diseases
ignore high cholesterol
ignore heart failure

1

(b) correct scale **and** *y*-axis labelled 'mean obesity rate in arbitrary units'

1

all points plotted correctly

allow a tolerance of ± ½ small square
*allow 3 or 4 correct plots for **1** mark*
ignore letters

2

line of best fit drawn

ignore line extended beyond plotted points
ignore line joined point to point with straight lines

1

(c) scatter (diagram / graph)

allow scattergram

1

(d) positive correlation

1

(e) (30 °C)
(iodine solution remains yellow-brown because)
starch is not present

allow (iodine solution remains yellow-brown because)

all / the starch had been broken down

1

(because) amylase / enzyme broke starch down

allow (because) the amylase / enzyme is active / working

allow (because this is close to) the optimum / best temperature for amylase / enzyme

1

(90 °C)
(iodine solution blue-black because) starch was (still) present

allow (iodine solution blue-black because) starch was not broken down

allow (because) the amylase / enzyme had no effect on starch

1

(because) the amylase / enzyme has denatured

allow description of denaturation

allow amylase / enzyme is destroyed / damaged

*do **not** accept amylase / enzyme has been killed*

1

(f) test more temperatures between 10 °C and 60 °C

1

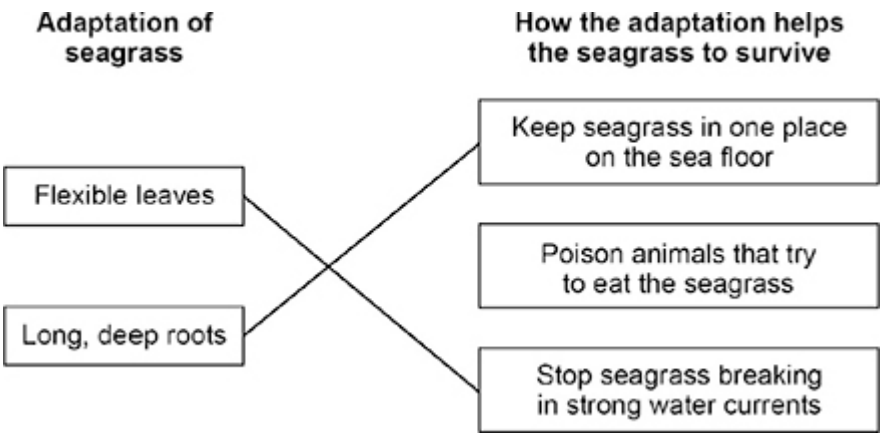
(g)

Protease enzyme	**Optimum pH**	**Organ where enzyme is active**
		stomach
		small intestine allow ileum / duodenum

2

[14]

3. (a)



2

do **not** accept more than one line from a box on the left

(b) lungs

ignore alveoli

1

(c) gills have a large surface area

1

gills have thin walls

1

(d)

$\frac{944}{484}$

1

1.9(50413...)

1

2

allow correct rounding from incorrect division

1

(e) *LHS*
oxygen

1

RHS
carbon dioxide

1

water

1

in either order

allow formulae

(f) (stingray is) moving

ignore swimming

1

(so) muscles (contract)

1

(which) needs energy (from respiration)

*do **not** accept energy produced / made / created*

*do **not** accept energy released for respiration*

OR

(when swimming) muscles (1)

(muscles) contract (1)

(which) needs energy (from respiration) (1)

*do **not** accept energy produced / made / created*

*do **not** accept energy released for respiration*

1

(g) carbon dioxide

1

ethanol

1

[16]

4. (a) a leaf

1

(b)

$$\frac{1.1 + 1.1 + 1.4}{3}$$

1

or

$$\frac{3.6}{3}$$

1.2 (grams)

if no answer given on answer lines, allow an answer in the table

1

(c) ring around −32.4 (grams)

table takes precedence

allow (−) 32.4 (grams) written by question

1

(d) did not include it

allow ignored it

1

(e) control variable

1

(f) time in the salt solution

1

(g) osmosis

1

(h) some particles

1

(i) use more concentrations of salt solution

1

[10]

5. (a) **View with the table**

$$\frac{3\,600}{1\,200}$$

1

3

allow 3:1

*do **not** accept if a unit is given*

1

if no answer in answer space allow answer in the table

(b) as size increases, (surface area to volume) ratio decreases

allow as one increases, the other decreases

allow as size decreases, (surface area to volume) ratio increases

1

(c) any **one** from:

- carbon dioxide
- glucose / sugar
- water
- ions / minerals / salts

allow a correct chemical formula

allow named ions

allow other correct substances eg amino acids / fatty acids / glycerol

ignore nutrients / food

1

(d) any **two** from:

- concentration gradient

  allow description
- surface area

  allow surface area : volume ratio

  ignore size unqualified
- thickness of exchange surface

  allow thickness of skin
- presence of a blood / circulatory system
- temperature (of surroundings)

2

(e) gills

1

(f) **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

- large number of alveoli
- large surface area

- alveolus and blood vessel / capillary are in close proximity
- alveoli / capillaries have thin walls **or** alveoli / capillaries have walls that are one cell thick
- to reduce diffusion distance

- has a good blood supply **or** has a capillary network
- to maintain concentration gradient
- to remove oxygen quickly **or** to deliver carbon dioxide quickly
- (capillary network) increases surface area (for diffusion)

- lungs are ventilated **or** lungs continually move air in and out
- (ventilation) brings in oxygen **or** removes carbon dioxide
- to maintain concentration gradient

Types of adaptation of the lungs are required for **Level 3.**

[13]