Mark schemes

1

(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]

2

(a) active transport

1

(b) by transpiration stream / pull

1

in xylem

1

(c) any **three** in the correct order from:

- mount epidermis on a slide
- count stomata in one area
- repeat in four more areas
- repeat method on other surface of leaf
- calculate mean

allow nail varnish film

3

(d) 1

allow numbers written out in a line with middle number circled

1

(e) (44 + 41 + 40 + 42 + 39) / 5 = 41.2

1

41

*allow 41 with no working shown for **2** marks*

1

*allow 41.2 for **1** mark*

(f) less water lost

1

so it does not wilt

1

[11]

3

(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 CO_2 / 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 CO_2 but muscles do not

answers must be comparative

1

both release small amounts of energy

1

ignore both occur without oxygen

[9]

4

(a) (0.15 / 1.35) × 100

1

11.1 (%)

*allow 11.1 (%) with no working shown for **2** marks*

1

(b) to allow results to be compared
or
they had different masses at the start

1

(c) axis correct scale and labelled

1

5 points correctly plotted

*allow ecf from **05.1***

*allow **1** mark for 4 points correctly plotted*

2

line of best fit

1

(d) 0.5

allow 0.45–0.55

1

(e) (0.0 to 0.4) water moves into cells

1

(0.6 to 0.8) water leaves cells

1

by osmosis

1

(f) any **two** from:
- concentration of solutions
- drying of chips
- accuracy of balance
- evaporation from tubes

2

[13]

5

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]

6

(a) (i) nucleus

1

(ii) diffusion

1

(b) increases / larger surface area (for diffusion)

ignore large surface area to volume ratio

1

(c) (i) sugar / glucose

accept amino acids / other named monosaccharides

1

(ii) against a concentration gradient
or
from low to high concentration

1

(iii) (active transport requires) energy

1

(from) respiration

1

(d) minerals / ions

accept named ion ignore nutrients

***do not accept** water*

1

[8]

7 (a)

Structure	**Organ**	**Organ system**	**Tissue**
Stomach	✓		
Cells lining the stomach			✓
Mouth, oesophagus, stomach, liver, pancreas, small and large intestine		✓	

all 3 correct = 2 marks
2 correct = 1 mark
1 or 0 correct = 0 marks

2

(b) (i) diffusion

allow phonetic spelling

1

(ii) glucose

1

(iii) mitochondria

1

[5]

8

(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]

9

(a) (i) water / H_2O

accept oxygen

allow H_2O

*do **not** allow H^2O or H2O*

1

(ii) the mineral ions are absorbed by active transport

1

the absorption of mineral ions needs energy

1

(iii) have (many root) <u>hairs</u>

1

(which) give a large surface area (for absorption)

1

(b) carbon dioxide in
or
oxygen out
or
control water loss

accept gas exchange
ignore gases in and out
ignore gain / lose water

1

(c) (i) guard cells

1

(ii) (stomata are) closed

allow there is no gap / space

1

(iii) plant will wilt / droop

ignore die

1

[9]

10 (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 <u>blood</u> 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]

11 (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]

12 (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]

13 (a) more concentrated

must be a comparison

1

than the cell / cytoplasm

accept more salty / solutes / ions

*accept cell is less concentrated than solution for **2** marks*

1

(b) (i) turgid

1

(ii) plasmolysed

accept flaccid

1

(c) any **four** from:

- water left the cells (in A)
- by osmosis
- from dilute to more concentrated solution

  accept high to low water potential or from high to low water concentration
- via partially permeable membrane
- so cell membrane shrank away from cell wall

4

(d) water enters the cells (by osmosis)

*allow **1** mark for:*

1

they burst / lyse / lysis occurs

water leaves and cell shrinks (if they think it is hypertonic solution)

1

animal cells have no cell wall **or** plant cells have a cell wall

1

cell wall prevents lysis / bursting / allows turgidity

allow correct description

1

[12]

14 (a) (i) chloroplast

1

(ii) cell wall

1

(b) (i) osmosis

accept diffusion

1

(ii) cell wall (prevents bursting)

1

(c) (i) carbon dioxide

allow correct formula

1

glucose

allow sugar / starch

1

(ii) any **two** from:

- light sensitive spot detects light
- tells flagellum to move towards light
- more light = more photosynthesis

2

(d) (cell has) larger SA:volume ratio

1

short (diffusion) distance

allow correct description

1

(diffusion) via cell membrane is sufficient / good enough

or

flow of water maintains concentration gradient

1

[11]

15 (a) (i) xylem

1

(ii) water

1

minerals / ions / named example(s)

ignore nutrients

1

(b) (i) movement of (dissolved) sugar

allow additional substances, eg amino acids / correct named sugar (allow sucrose / glucose)

allow nutrients / substances / food molecules if sufficiently qualified

ignore food alone

1

(ii) sugars are made in the leaves

1

so they need to be moved to other parts of the plant for respiration / growth / storage

1

(c) (i) mitochondria

1

(ii) for movement of minerals / ions

Do not accept 'water'

1

against their concentration gradient

1

[9]

16 (a) (i) variation in masses / more representative / more typical / more reliable / average / mean / reference to anomalies

or

one worm to light to measure change

do not allow more accurate / more precise

ignore fair test / valid / repeatable / reproducible

1

(ii) remove solution / liquid (on outside of worm)

allow 'water'

1

(iii) variable amounts removed from each worm

ignore reference to length of timing

1

(iv) equal sizes of worm / more worms (in each group) / wash off all the sand / repeats / use more accurate balance / use smaller concentration intervals

allow reference to improve blotting technique eg blot before / blot more thoroughly

1

(b) (i) different (starting) masses / sizes / weights (at different concentrations)

1

allows comparisons / shows pattern / shows trend

1

(ii) (+)20

*correct answer = **2** marks, with or without working*

or

$$\frac{7.5}{37.5} \times 100 \quad / \quad \frac{7.5}{37.5} \quad / \quad \left(\frac{45.0}{37.5} - 1\right) \times 100$$

*for **1** mark*

2

(c) (i) graph:

points correct

allow ± 1 mm

*–**1** mark per error*

allow ecf from part b(ii)

2

label on x-axis including units – ie Concentration of salt in arbitrary units

1

line of best fit = smooth curve / ruled straight line

anomaly (4.0, –52) either plotted and ignored re. line

***or** not plotted*

do not allow point to point

allow best fit for ecf from 2bii

1

(ii) on graph:

ring drawn around point at (4.0, –52)

allow (5.0, –50) if cand. line indicates this

1

(iii) sensible suggestion – eg used wrong solution / used 5.0% instead of 4.0% / different length of time in solutions / ref to error in blotting / balance not zeroed / error in weighing

allow some lugworms died

allow error in calculation

1

(d) (i) 2.9 to 3.0 / correct for candidate's graph ± 0.1

1

value of no change in mass / worms in equilibrium with soln / described

allow small(est) mass change

1

(ii) water loss

1

by osmosis / diffusion

1

from dilute region in the worm to more concentrated solution outside

allow correct description in terms of high to low <u>water</u> concentration / high to low water potential

salt solution is hypertonic

concentration unqualified = salt concentration

1

[19]

17 (a) motor

allow efferent / postsynaptic

*allow **another** relay (neurone)*

1

(b) release of chemical (from relay neurone)

allow ecf for 'motor' neurone from (a)

allow release of neurotransmitter / named example

1

chemical crosses gap / junction / synapse

allow diffuses across

allow chemical moves to X

1

chemical attaches to X / motor / next neurone (causing impulse)

1

(c) (curare) decrease / no contraction

accept (muscle) relaxes

1

(strychnine) increase / more contraction

*if no other mark awarded allow 1 mark for (curare) decrease / no response **and** (strychnine) increase / more response*

1

[6]

18 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 apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 – 2 marks)
An example is given of a named substance
or
a process
or
there is an idea of why diffusion is important eg definition.

Level 2 (3 – 4 marks)
At least one example of a substance is given
and
correctly linked to a process in either animals or plants.

Level 3 (5 – 6 marks)
There is a description of a process occurring in either animals or plants that is correctly linked to a substance
and
a process occurring in the other type of organism that is correctly linked to a substance.

examples of points made in the response

Importance of diffusion:

- to take in substances for use in cell processes
- products from cell processes removed

Examples of processes and substances:

- for gas exchange / respiration: O_2 in / CO_2 out
- for gas exchange / photosynthesis: CO_2 in / O_2 out
- food molecules absorbed: glucose, amino acids, etc
- water absorption in the large intestine
- water lost from leaves / transpiration
- water absorption by roots
- mineral ions absorbed by roots

extra information

Description of processes might include:

- *movement of particles / molecules / ions*
- *through a partially permeable membrane*
- *(movement of substance) down a concentration gradient*
- *osmosis: turgor / support / stomatal movements*

[6]

19 (a) osmosis

1

partially permeable

1

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

allow correct answers in terms of A

- vacuole is small(er)
- cytoplasm has shrunk

allow cytoplasm is smaller

- gap between cytoplasm and cell wall
- cell wall curves inwards

allow cell B is flaccid or cell A is turgid

- the (cell) membrane has moved away from the wall

2

(ii) any **one** from:

- water will move / diffuse in
- (cells) will swell
- (cells) will burst

ignore turgid

1

(c) villi give the small intestines a large surface area

1

villi have many blood capillaries

1

[7]

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

- (water through a) partially permeable

accept 'semi permeable' / selectively permeable

- membrane
- from dilute to (more) concentrated solution

allow 'from a high concentration of water to a lower concentration (of water)'
allow 'from high water potential to low water potential'
allow 'down a concentration gradient of water'

*do **not** accept 'along a concentration gradient of water'*

- (it's a) passive (process)

allow requires no energy

3

(b) (there are) many <u>hairs</u> **or** thin <u>hairs</u> **or** <u>hairs</u> are one cell thick

1

(which gives) large / increased surface area **or** short diffusion pathway

1

(so there is) more diffusion / osmosis (of water into the root)

ignore absorption

1

[6]

21 (a) (i) A = nucleus

1

B = (cell) membrane

1

(ii) any **two** from:

ignore shape

- no (cell) wall
- no (large / permanent) vacuole
- no chloroplasts / chlorophyll

2

(b) because high to low oxygen / concentration **or** down gradient

allow 'more / a lot of oxygen molecules <u>outside</u>'

ignore along / across gradient

1

(c) a tissue

1

[6]

22 (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]

23 (a) **A** sperm

1

B egg

1

C fertilised egg

1

D embryo

1

(b) insert into mother

ignore fertilise / check fertilisation / check viability

1

womb / uterus

1

(c) (i) one quarter

1

(ii) no / little chance of success over 42

1

reference to table of only two women in the age bracket 40-42 years became pregnant

*the statement 'only 2 out of 53 40-42 year old women became pregnant / had babies' gains **2** marks*

1

(iii) so fewer twins / multiple births
or
multiple births more dangerous

1

[10]

24 (a) (i) diffusion

apply list principle

1

(ii) **A**

apply list principle

1

(b) (i) osmosis

apply list principle

1

(ii) **R**

apply list principle

1

[4]

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

*do **not** mix routes. If both routes given award marks for the greater.*

1

ribosomes produce <u>protein</u>

accept amylase / enzyme / carbohydrase is made of protein

or

(allow)

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

mitochondria provide energy to build / make <u>protein</u> (1)

accept ATP instead of energy

1

[4]

26 (a) both parents **Aa**

*accept other upper and lower case letter without key **or** symbols with a key*

allow as gametes shown in Punnett square

1

aa in offspring correctly derived from parents
or
aa correctly derived from the parents given

ignore other offspring / gametes

for this mark parents do not have to be correct

1

offspring **aa** identified as having cystic fibrosis

*may be the only offspring shown **or** circled / highlighted / described*

1

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

accept converse if clear, eg if you (only) took one it might have cystic fibrosis / might not be fertilised

- (more) sure / greater chance of healthy / non-cystic fibrosis egg / embryo / child

  accept some may have the allele

  reference to 'suitable / good embryo' is insufficient

- greater chance of fertilisation

1

(ii) **advantages**

to gain 3 marks both advantage(s) <u>and</u> disadvantage(s) must be given

max 3

any **two** from:

ignore references to abortion unless qualified by later screening

- greater / certain chance of having child / embryo without cystic fibrosis / healthy
- child with cystic fibrosis difficult / expensive to bring up
- cystic fibrosis (gene / allele) not passed on to future generations

disadvantages

any **two** from:

- operation dangers / named eg infection
  ignore risk unqualified
- ethical or religious issues linked with killing embryos
  accept wrong / cruel to embryos accept right to life argument
  ignore embryos are destroyed
- (high) cost of procedure
- possible damage to embryo (during testing for cystic fibrosis / operation)

plus

conclusion

a statement that implies a qualified value judgement
eg it is right because the child will (probably) not have cystic fibrosis even though it is expensive
or
eg it is wrong because embryos are killed despite a greater chance of having a healthy baby

***note**: the conclusion mark cannot be given unless a reasonable attempt to give both an advantage and a disadvantage is made*

*do **not** award the mark if the conclusion only states that advantages outweigh the disadvantages*

1

(c) any **three** from:

- osmosis / diffusion
  *do **not** accept movement of ions / solution by osmosis / diffusion*
- more concentrated solution outside cell / in mucus
  assume concentration is concentration of solute unless answer indicates otherwise or accept correct description of 'water concentration'
- water moves from dilute to more concentrated solution
  allow correct references to movement of water in relation to concentration gradient
- partially permeable membrane (of cell)
  allow semi / selectively permeable

3

[11]

27

(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]

28

(a) xylem **and** phloem
either order
allow words ringed in box
allow mis-spelling if unambiguous

1

(b) (i) movement / spreading out of particles / molecules / ions / atoms
ignore names of substances / 'gases'

1

from high to low concentration
accept down concentration gradient
ignore 'along' / 'across' gradient
ignore 'with' gradient

1

(ii) oxygen / water (vapour)

allow O_2 / O2

ignore O^2/ O

allow H_2O / H2O

ignore H^2O

1

[4]

29 (a) solution in soil is more dilute (than in root cells)

concentration of water higher in the soil (than in root cells)

1

so water moves from the dilute to the more concentrated region

*so water moves <u>down</u> (its) concentration gradient **or** water moves from a high concentration <u>of water</u> to a lower concentration*

1

concentration of ions in soil less (than that in root cells)

1

so energy needed to move ions

or

ions are moved against concentration gradient

the direction of the concentration gradient must be expressed clearly

accept correct reference to water potential or to concentrations of water

1

(b) any **three** from:

- movement of water from roots / root hairs (up stem)
- via xylem
- to the leaves
- (water) evaporates
- via stomata

3

(c) (i) 0.67/0.7

accept 0.66, 0.6666666... or ⅔ or 0.6

*correct answer gains **2** marks with or without working*

if answer incorrect allow evidence of $\frac{100}{150}$ *for **1** mark*

*do **not** accept 0.6 or 0.70*

2

(ii) during the first 30 minutes

any **one** from:

- it was warmer
- it was windier
- it was less humid
- there was more water (vapour) in the leaves

1

so there was more evaporation

ignore 'water loss'

or

stomata open during first 30 minutes **or** closed after 30 minutes (1)

so faster (rate of) evaporation in first 30 min **or** reducing (rate of) evaporation after 30 min (1)

1

[11]

30 (a) oxygen / O_2

allow O_2

do not accept O^2

or

carbon dioxide / CO_2

allow CO2

do not accept CO^2

1

(b) any **four** from:

ignore references to tail used for locomotion

ignore reference to nostrils

- because structure X / gills has threads / filaments **or** is thin **or** tadpole has longer tail
- there is an increased surface area
- there is a shorter diffusion pathway
- therefore an increase in exchange

  ignore food
- eyes (now visible in older tadpole)
- so that food / danger etc can be seen

  accept reference to a good blood supply

  accept increased water flow over gills / tail will increase diffusion of gases

4

[5]

31 (a) 

*the shape must be (roughly) circular **and** not shaded, for the mark*

accept the shape drawn in the key if it is not contradictory

1

(b) dominant

1

(c) (i) a half (50%)

1

(ii) Some of B's sperm cells have an X chromosome

1

[4]

32 (a) water enters (funnel / sugar solution) **or** water diffuses in (to the funnel)

*do **not** accept if diffusion of sugar*

1

membrane partially / selectively / semi permeable **or** by osmosis

allow description

1

because concentration (of sugar) greater
inside funnel than outside / water / in beaker

assume 'concentration' refers to sugar unless candidate indicates otherwise
the position of the solutions may be implied

1

(b) (level / it) rises more slowly **or** levels out earlier **or** does not rise as much

accept inference of less steep gradient (of graph)

allow less / slower osmosis / diffusion / less water passes through or less water enters funnel

allow water enters / passes through slower

1

less difference in concentration (between solution / funnel and water / beaker)

accept due to lower diffusion / concentration gradient / described

1

[5]

33 (a) (i) capillary

1

(ii) diffusion

1

(iii)

Carbon dioxide	low(er)	high(er)

1

Oxygen	high(er)	low(er)

1 *mark for each correct row*

1

(b) (i) red blood cells

1

(ii) haemoglobin

1

[6]

34 (a) (i) (too) big

1

cannot fit / pass through filter / through (pores) in membrane / cannot be filtered

*too big to be filtered = **2** marks*

1

(ii) water

1

(iii) partially permeable

1

(b) any **two** from:

- hazards of operation / named eg
- may be rejected **or** need to use immunosuppressant drugs / long term drug use **or** transplant may need to be replaced
- susceptible to other infections
- shortage of donors
- high initial cost

2

[6]

35 (a) (i) (cell) membrane

1

(ii) vacuole

1

(b) any **two** from:

- (cell) wall
- chloroplast(s)

  ignore chlorophyll
- vacuole

  ignore cell sap

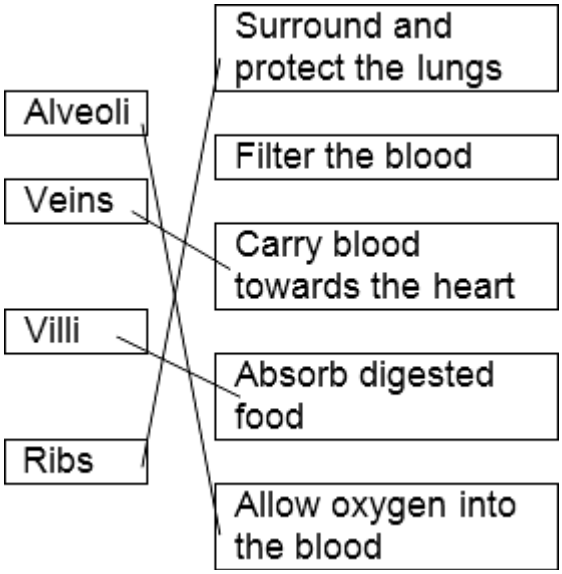
2

(c) diffusion

1

[5]

36 (a)



*4 correct = **4** marks*

*3 correct = **3** marks*

*2 correct = **2** marks*

*1 correct = **1** mark*

extra line from a structure cancels the mark

4

(b) diffusion

1

[5]