Topic Test: OxfordAQA International GCSE Combined Science 9204 Biology

Bioenergetics

Name: _____

Class: _____

Date: _____

Time: **71 minutes**

Marks: **71 marks**

Comments:

1 The body uses enzymes to digest (break down) large food molecules into smaller molecules.

(a) (i) Draw **one** line from **each** large food molecule to the enzyme that acts on it.

Large food molecule	Enzyme
starch	amylase
fat	protease
protein	lipase
	isomerase

(3)

(ii) Draw a ring around the correct answer to complete each sentence.

Starch is broken down into

- amino acids.
- fatty acids and glycerol.
- sugars.

Fat is broken down into

- amino acids.
- fatty acids and glycerol.
- fructose.

Protein is broken down into

- amino acids.
- fructose.
- sugars.

(3)

(b) Bile helps digestion.

Where is bile produced?

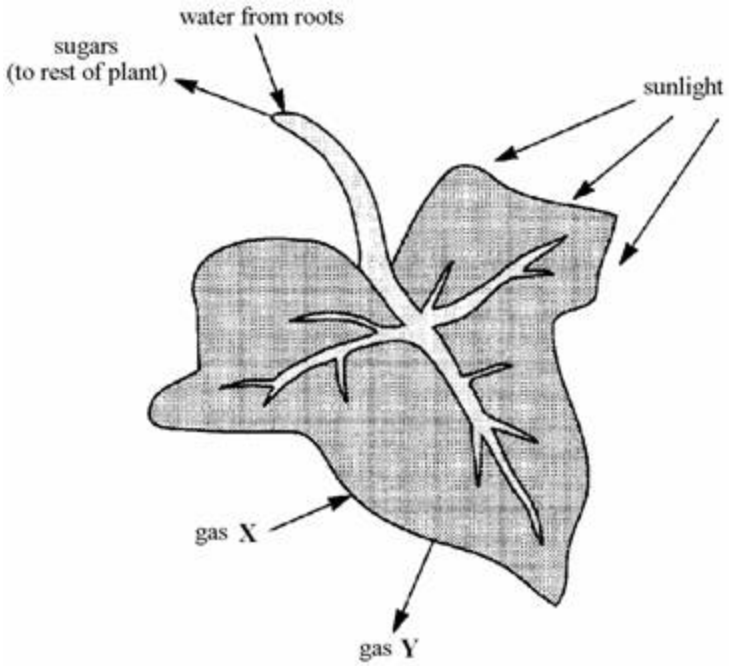
Draw a ring around **one** answer.

liver **mouth** **stomach**

(1)

(Total 7 marks)

2 The diagram shows a plant leaf during photosynthesis.



(a) Name:

(i) gas **X**; _____

(ii) gas **Y**. _____

(2)

(b) Why is sunlight necessary for photosynthesis?

_____

_____

(1)

(Total 3 marks)

3 (a) Complete the word equation for photosynthesis.

Use words from the box.

chlorophyll	minerals	oxygen	water

carbon dioxide + _____ → glucose + _____

(2)

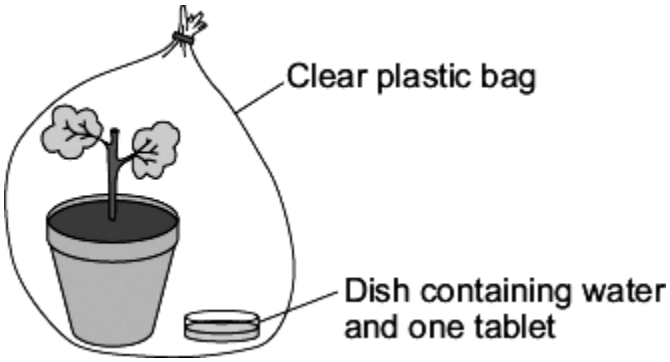
(b) Plants may grow faster if they have more carbon dioxide.

Indigestion tablets dissolve in water to form a solution.
This solution slowly gives off carbon dioxide.

A student set up an investigation to see what concentration of carbon dioxide is best for increasing the growth of geranium plants.

The student:

- put a geranium plant in a clear plastic bag
- put a dish containing water and one tablet in the bag
- sealed the top of the bag.



The student:

- set up 5 more experiments each with water and a different number of tablets
- left all the plants in a well-lit place for four weeks.

The student used a clear plastic bag, not a black plastic bag.

Explain why.

_____

_____

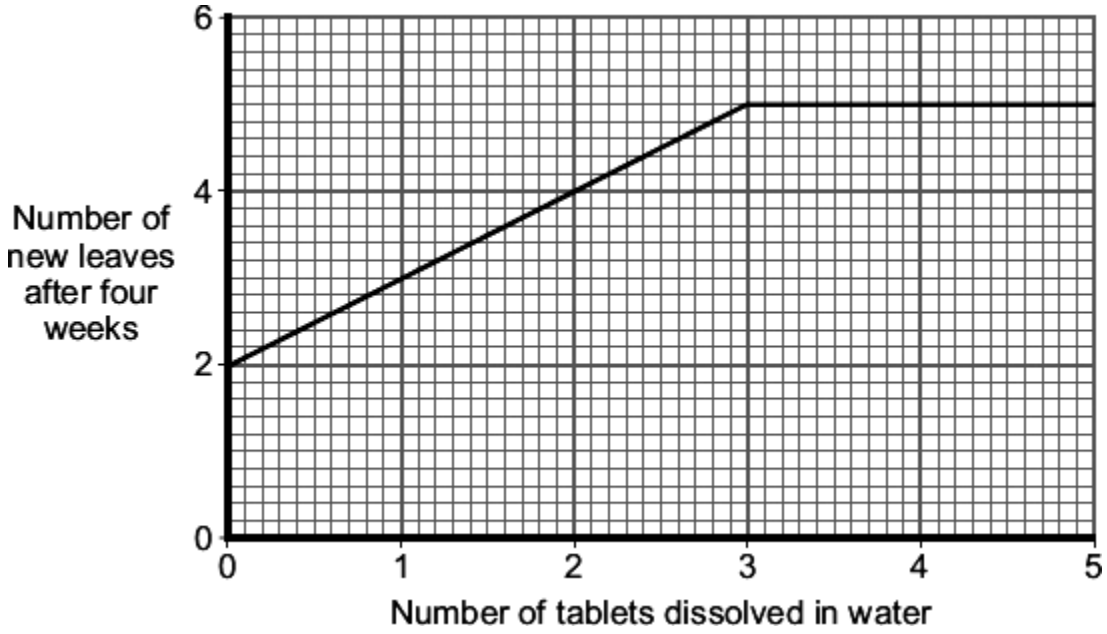
_____

_____

(2)

(c) After four weeks, the student counted the number of new leaves on each plant.

The graph shows his results.



Describe the effect of increasing the number of tablets dissolved in water on the number of new leaves that grew in four weeks.

_____

_____

_____

_____

_____

_____

(3)

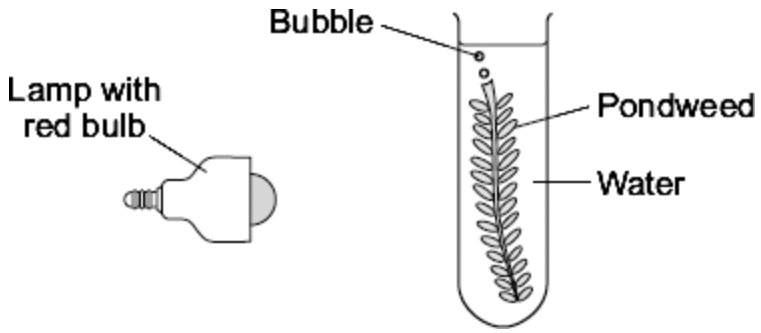
(Total 7 marks)

4 A group of pupils investigated the way in which the colour of light affects photosynthesis.

The pupils:

- put a piece of pondweed into a test tube of water
- shone light from a lamp with a red light bulb onto the pondweed
- counted the bubbles of gas produced by the pondweed every minute for three minutes.

The diagram shows the experiment.



The pupils repeated their experiment using a yellow light bulb, a green light bulb and a blue light bulb.

(a) (i) What was the independent variable in the investigation?

_____

(1)

(ii) To make the investigation fair the pupils needed to control some variables.

Suggest **one** variable that the pupils should have controlled during their investigation.

_____

(1)

(iii) It is better to count the bubbles every minute for three minutes than to count all the bubbles in three minutes.

Why?

_____

_____

(1)

(b) The table shows the pupils' results.

Colour of bulb	Number of bubbles produced in one minute			
	1st minute	2nd minute	3rd minute	Mean
Red	24	19	21	21
Yellow	18	14	15	16
Green	6	4	3	4
Blue	32	34	32	33

Algae are tiny organisms that photosynthesise.
In natural light algae grow very quickly on the sides of a fish tank.
The algae make it difficult to see the fish.

(i) What would be the best colour of light bulb to illuminate the fish tank to reduce the growth of algae?

Use the results in the table to help you to decide.

Draw a ring around **one** answer.

red **yellow** **green** **blue**

(1)

(ii) Explain why the colour you have chosen is the best.

_____

_____

_____

_____

(2)

(Total 6 marks)

5 Fats are broken down into fatty acids and glycerol during digestion.

(a) What is the name of the enzyme that digests fats?

Tick (✓) **one** box.

Amylase ☐

Hydrochloric acid ☐

Lipase ☐

Protease ☐

(1)

Some students investigated the effect of bile on the rate of fat digestion in milk. They used a pink indicator called phenolphthalein.

Phenolphthalein becomes colourless when the fat in the milk has been digested.

This is the method used.

1. Set up five test tubes as shown in **Table 1**.

Table 1

Tube number	Liquids added to tube
1	Enzyme and water
2	Bile and water
3	Enzyme and bile
4	Boiled enzyme and bile
5	Enzyme and boiled bile

2. Stand all the tubes in a beaker of water at 30 °C for 10 minutes.

3. Add 3 cm^3 of milk and three drops of indicator to each test tube.

4. Record the time taken for the indicator in the mixture to change from pink to colourless.

(b) Suggest why the tubes were left in the beaker of water for 10 minutes before adding the milk and indicator.

_____

_____

(1)

(c) The teacher said that the students should repeat the investigation three more times.

Give **two** reasons why it is important to repeat the investigation.

1. _____

_____

2. _____

_____

(2)

(d) The fatty acids produced during this reaction change the indicator from pink to colourless.

The students found it difficult to determine when the indicator turned colourless.

Which piece of equipment could be used instead of an indicator to measure the digestion of fat?

_____

(1)

(e) Give **two** other ways the students could improve their investigation.

1. _____

_____

2. _____

_____

(2)

The students repeated the investigation using an improved method.

Table 2 shows the students' results.

Table 2

Liquids added to test tube	**Time taken to turn colourless in minutes**
Enzyme and water	4
Bile and water	No change after 20 minutes
Enzyme and bile	2
Boiled enzyme and bile	
Enzyme and boiled bile	2

(f) Predict the time taken in minutes for the mixture containing boiled enzyme and bile to turn colourless.

Explain why you made this prediction.

Prediction _____

_____

Explanation _____

_____

_____

_____

_____

(3)

(g) Give **three** conclusions about bile that can be made from the results in **Table 2**.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(Total 13 marks)

6

(a) (i) What name is given to an enzyme which catalyses the breakdown of protein?

_____

(1)

(ii) What product is formed when protein is broken down by the enzyme?

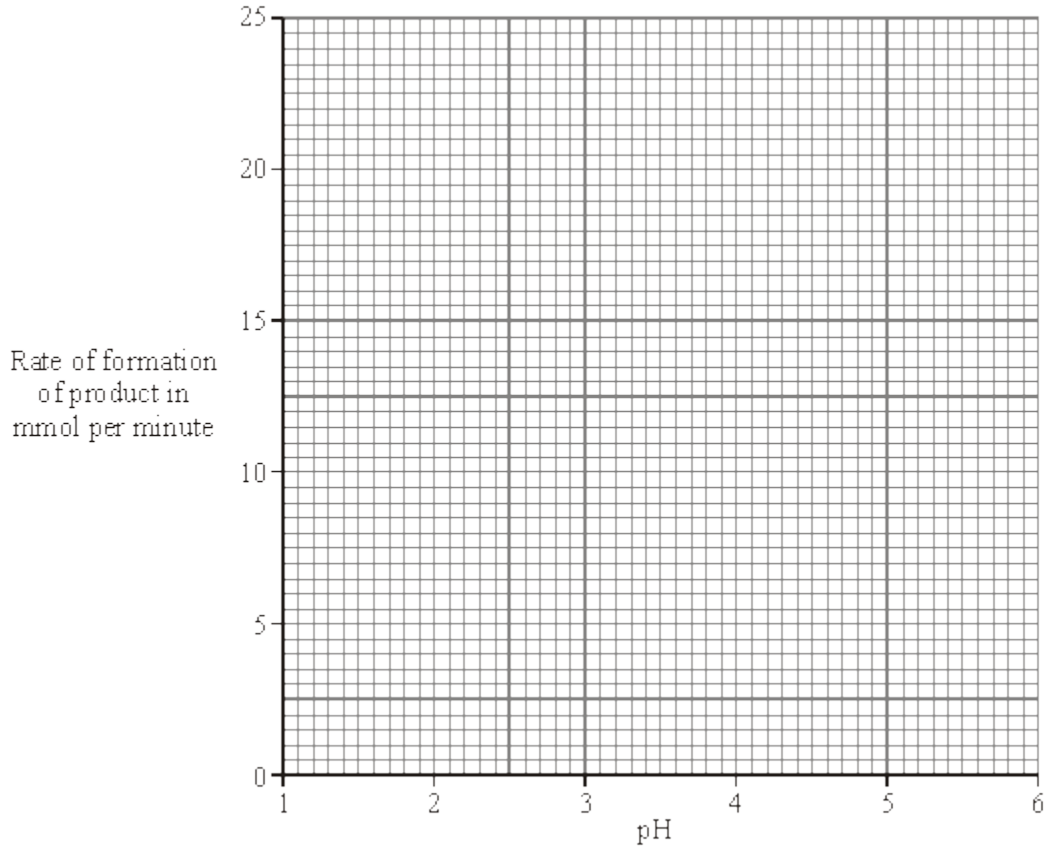
_____

(1)

The table shows the effect of pH on the activity of an enzyme which catalyses the breakdown of protein.

pH	1.0	2.0	3.0	4.0	5.0
Rate of formation of product in mmol per minute	10.5	23.0	10.5	2.5	0.0

(b) Draw a graph of the data in the table.



(3)

(c) The enzyme is produced by the human digestive system.

(i) At what pH does this enzyme work best? _____

(1)

(ii) Suggest which part of the digestive system produces this enzyme.

_____

(1)

(d) Why is it necessary to break down proteins in the digestive system?

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

7 (a) Blood contains several components.

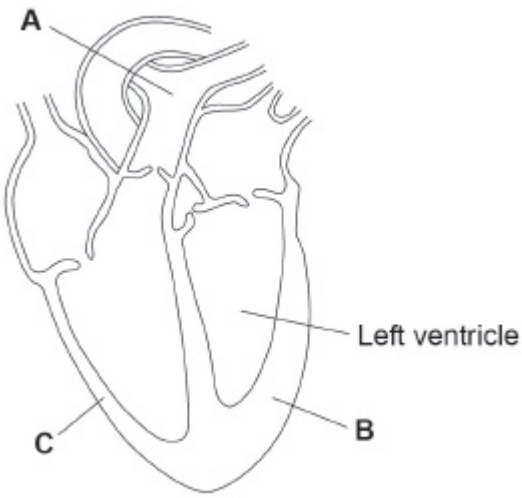
Draw one line from each component to its function.

Component	Function
Plasma	carries oxygen
Platelet	helps to destroy pathogens
White blood cell	contains water and proteins
	helps the blood to clot

(3)

Figure 1 shows a section through a human heart.

Figure 1



(b) Name the blood vessel **A**.

_____

(1)

(c) Explain why the wall of the heart is thicker at **B** than at **C**.

_____

_____

_____

_____

_____

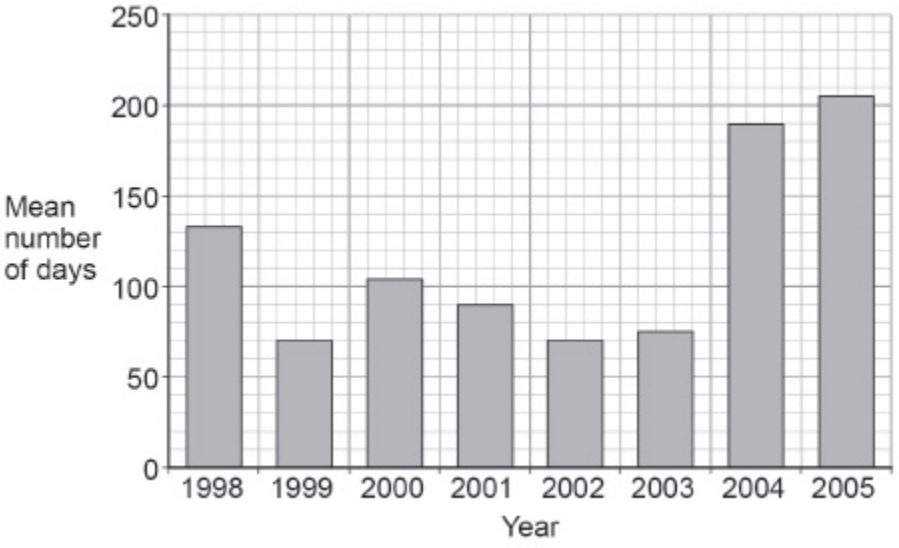
_____

(3)

(d) People with heart disease may receive a heart transplant.

Figure 2 shows the mean number of days people with heart disease waited for a heart transplant in one country between 1998 and 2005.

Figure 2



Calculate the difference between the mean number of days people waited for a heart transplant in 2005 compared with 2002.

_____

_____

Difference = _____ days

(1)

(e) Read the following newspaper article.

> Heart transplants can treat a number of heart conditions. After a successful operation the transplant can last for 20 years. Some patients can wait more than 6 months for a heart transplant and many die before a suitable transplant becomes available.
>
> In recent years doctors have started to use mechanical heart devices instead of heart transplants. These devices can also be used to prolong life before a heart transplant.
>
> One of these devices is readily available and is called the Jarvik Heart. It is inserted into the left ventricle and can last for 2–5 years. It can treat patients with problems associated with the left ventricle but there is an increased risk of clots and strokes.

Evaluate the use of the Jarvik Heart compared with living heart transplants.

(6)

(Total 14 marks)

8 (a) During breathing, oxygen moves from the air into the blood in the lungs.

Explain how oxygen moves from the air into the blood.

_____

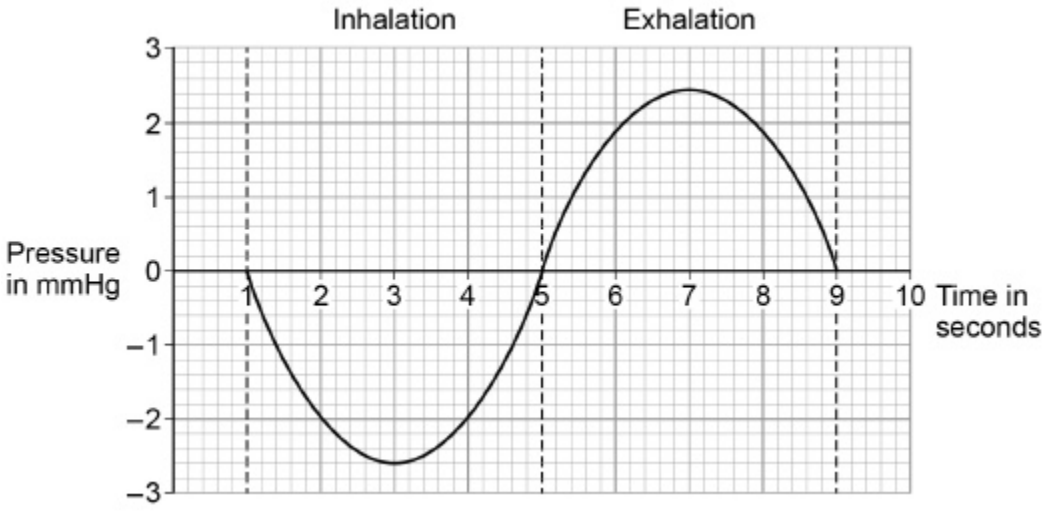
_____

_____

_____

(2)

The graph below shows how pressure changes in the lungs during breathing.



(b) Calculate the percentage increase in pressure between maximum inhalation and maximum exhalation.

Give your answer to three significant figures.

Percentage increase = _____ %

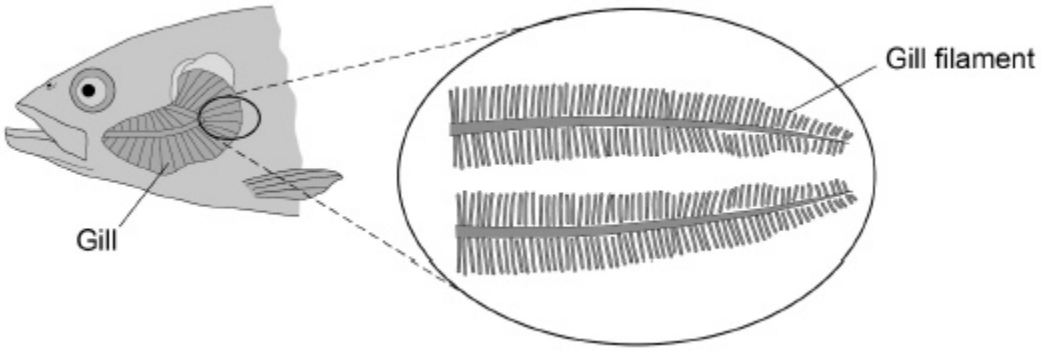
(3)

(c) Explain what causes the pressure change during inhalation and how this causes air to enter the lungs.

(4)

Fish have gills for gas exchange.

The diagram below shows a fish head and gill.



(d) Give **two** ways the gills are adapted to maximise gas exchange.

1. _____

_____

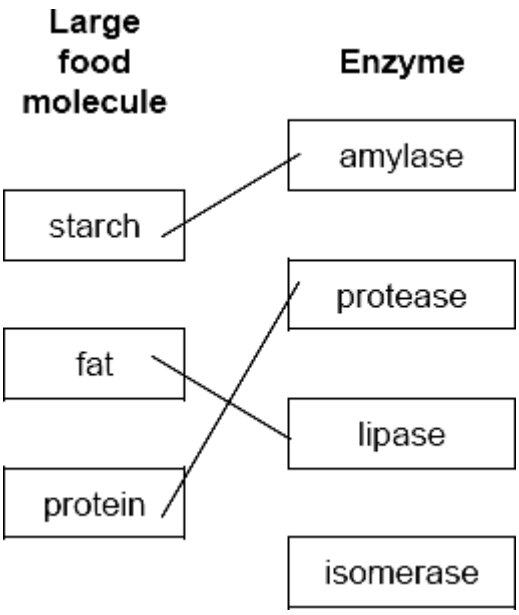
2. _____

_____

(2)

(Total 11 marks)

1 (a) (i)



*all three correct = **3** marks*
*two correct = **2** marks*
*one correct = **1** mark*
extra line from a large food molecule cancels the mark

3

(ii) sugars

1

fatty acids and glycerol

1

amino acids

must be in this order

1

(b) liver

1

[7]

2 (a) (i) carbon dioxide / CO_2 (*reject* CO)

(ii) oxygen / O_2 / O (*reject* water vapour)

for 1 mark each

2

(b) (provides) energy

for 1 mark

1

[3]

3 (a) water

1

oxygen

in this order only

accept correct chemical symbols

allow H_2O / OH_2

1

(b) allow light (in / through) / need light

*do **not** accept attracts light*

ignore heat / moisture / carbon dioxide

ignore so the plants can be seen

accept the converse, ie the black plastic bag would not let light in (1)

1

for photosynthesis / make sugar / glucose

so there would be no photosynthesis (1)

*do **not** allow make food unqualified*

1

(c) Increase (in leaves / new leaves)

ignore growth unqualified

1

(then) level off **or** number of (new) leaves (then) stays the same

1

numerical statement eg max at 3 tablets / 5 (new) leaves

should refer to one of the first two marking points

*for every extra tablet get 1 extra leaf = **2** marks*

*for every extra tablet get 1 extra leaf then it levels off = **3** marks*

1

[7]

4

(a) (i) colour of light / bulb / lamp

allow wavelength for colour

allow bulb alone

*do **not** accept light / colour unqualified*

1

(ii) any **one** from eg

- temperature
  allow heat
- light intensity **or** distance between lamp and plant / tube
  allow amount / brightness of light
  ignore light unqualified
- carbon dioxide
  allow symbols
- other light in room
  allow use a dark room
- mass / size / amount / age / type of pondweed
  allow same piece of pondweed
  ignore pondweed unqualified
- volume / amount of water
  ignore reference to time

1

(iii) improved reliability
*allow for reliability **or** less likely to lose count*

or

can spot anomalies / changes
allow reference to calculating a mean / average
ignore reference to accuracy / precision / fair

1

(b) (i) green

1

(ii) any **two** from:
ignore references to colour

- least / less bubbles / gas / oxygen / mean
  *reference to least / less needed only once, in context, for **2** marks*
- least / less photosynthesis
- least / less glucose / sugar / carbohydrate / food made
  only penalise no once, ie
  *no bubbles = **0** mark*
  *no bubbles so no photosynthesis = **1** mark*
  allow most / more green light reflected (by chloroplasts)

2

[6]

5 (a) lipase

1

(b) to ensure all chemicals/reagents are at the correct/same/at 30 °C temperature (before mixing)

1

(c) any **two** from:
- allows elimination/identification of anomalies
- allows a more accurate mean to be calculated

*do **not** allow reproducibility*

- can compare repeated results/check patterns are the same/allows for repeatability

2

(d) use pH meter/probe

1

(e) any **two** from:
- record time in smaller intervals
- use a thermostatically controlled water bath
- use the same volume of indicator
- include a control of water with milk and indicator
- use same volume of enzyme/ bile/liquids (in tubes)
- use same concentration of enzyme/bile
- repeat investigation at 37 °C
- stir/mix contents of tubes

allow use more precise measurements for one mark

2

(f) (Prediction:)
no change (after 20 minutes) or more than 20 minutes

1

(Explanation:)
enzyme denatured

or

substrate/fat no longer fits active site

or

shape of active site changed

*do **not** allow enzyme killed*

1

(so) pH of mixture does not change

or

no fatty acids produced

allow active site damaged/destroyed

1

(g) bile reduces the time taken for the enzyme to break down fats

or

bile increases the enzyme's rate of reaction

1

bile does not (chemically) digest fats

1

boiling bile has no effect upon its activity

allow bile is not a protein/enzyme

1

[13]

6

(a) (i) protease

accept peptidase ***or*** *named protease*
e.g. pepsin / trypsin
allow 'proteinase'

1

(ii) amino acids

accept peptides / polypeptides / peptones

1

(b) points plotted accurately

$\pm \frac{1}{2}$ *square*

deduct ***1*** *mark per error*

2

best fit curve **or** ruled point-to-point

if double line within $\frac{1}{2}$ *square*
allow sharp apex
do ***not*** *allow single straight line*
if no points line defines points
if (5,0) not plotted only penalise ***1*** *mark*
bar graph wide bars – ***no*** *marks*

bar graph $\pm \frac{1}{2}$ *square max* ***2*** *for points*

1

(c) (i) 2 **or** correct from candidate's graph

$\pm \frac{1}{2}$ *square*

1

(ii) stomach

1

(d) proteins are large / product is small

1

proteins (may be) insoluble / product is soluble

1

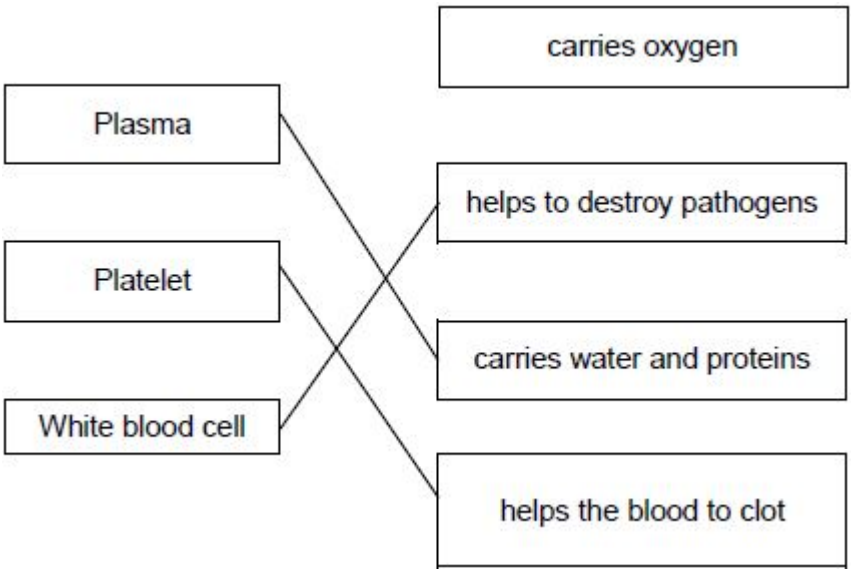
cannot be absorbed / cannot enter blood **or** cannot pass through gut lining

accept reverse referring to product

1

[10]

7 (a)



If more than one line is drawn from a component then no mark.

3

(b) **Pulmonary** artery

1

(c) Stronger / more (muscle) contraction

1

(to create) higher (blood) least once pressure

comparative must be given at comparative must be given at least once

1

(to) pump blood all around the body

1

(d) 135

1

(e) **Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5–6

Level 2: Some logically linked reasons are given. There may also be a simple judgement.

3–4

Level 1: Relevant points are made. They are not logically linked.

1–2

No relevant content

0

Indicative content

allow converse arguments

Advantages of Jarvik Heart
- no need to wait for the transplant
- surgery less drastic

Disadvantages of Jarvik Heart
- more chance of blood clots and strokes
- only lasts up to 5 years
- the mechanical motor can fail
- only treats one heart condition

Comparisons
- mechanical only lasts 5 years but a heart transplant last much longer, 20 years
- mechanical heart only treats one heart problem but heart transplants treat many
- mechanical heart readily available but a heart for transplant may not be

Additional detailed knowledge
- no chance of being rejected by the body [for mechanical heart]
- do not need to take anti-rejection drugs [for mechanical heart]
- may cause an immune response, ref to foreign antigens [for heart transplant]

[14]

8 (a) diffusion

1

from high concentration to low concentration

1

(b)

$$\frac{2.45-(-2.6)}{-2.60}\times 100$$

Usual allowance of ± half a small square means a reading of +2.4 or +2.5 is acceptable instead of +2.4

1
1

194.231

1

an answer of 194 scores 2 marks

194 (%)

(c) diaphragm contracts

or

flattens

1

or

intercostal muscle contracts (to raise ribs)

which causes the volume (of the thorax) to increase

must be in the correct order

1

causing pressure (in thorax) to decrease

1

below zero

allow below atmospheric pressure

1

(d) many filaments (gives large surface area)

allow ref to large surface area alone.
or
allow water flowing over gills (maintains concentration gradient)
or
good blood supply (maintains concentration gradient)

1

filaments thin

or

short diffusion pathway

1

[11]