Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|

Centre Number | Candidate Number

# Pearson Edexcel Level 1/Level 2 GCSE (9–1)

## Friday 9 June 2023

Afternoon (Time: 1 hour 45 minutes)

**Paper reference** **1BI0/2H**

# Biology
## PAPER 2

**Higher Tier**

**You must have:**
Ruler, calculator

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*

### Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

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P 7 2 6 2 9 A 0 1 2 8

Pearson

**Answer ALL questions. Write your answers in the spaces provided.**

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

**1** Figure 1 shows a stream flowing near a fertiliser factory.

The factory burns coal as a source of energy.

The factory releases waste into the stream and sulfur dioxide into the air.

Samples of water were taken at five points, A, B, C, D and E, as shown on Figure 1.

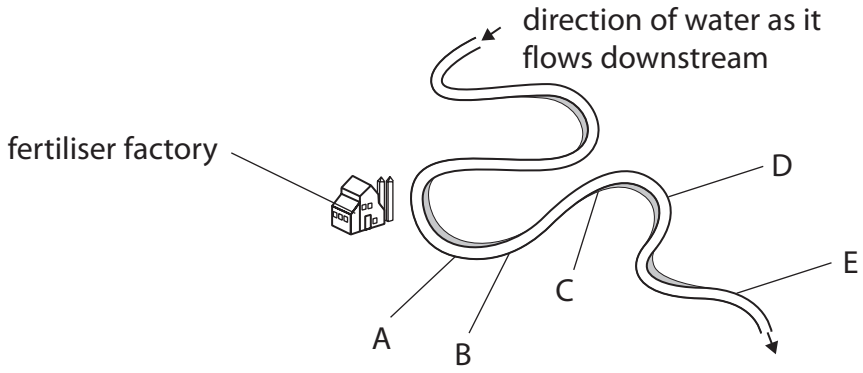



**Figure 1**

Figure 2 shows the oxygen concentration in the water at the five points along the stream.

| point along stream | oxygen concentration (ppm) |
|---|---|
| A | 1.5 |
| B | 2.7 |
| C | 3.4 |
| D | 4.4 |
| E | 4.5 |

**Figure 2**

(a) (i) Calculate how many times greater the oxygen concentration is at point E than at point A.

**(1)**

4.5/1.5=3

..... times greater

(ii) State how the oxygen concentration changes from point A to point E.

**(1)**

oxygen concentration increases
(then levels off)

(iii) Which indicator species would be most likely to be seen in the water at point A?

**(1)**

- ☒ **A** freshwater shrimp
- ☒ **B** lichen
- ☒ **C** sludgeworm
- ☒ **D** stonefly

(iv) Explain where the biodiversity will be highest in the stream.

**(3)**

there would be most biodiversity in the stream
at {point D to E / E /furthest from the factory}
as oxygen concentration is highest here
so organisms can {survive
/ respire}

(b) Figure 3 shows rose leaves infected with blackspot fungus.

(Source: © Manfred Ruckszio/Shutterstock)

**Figure 3**

State why rose plants growing near this factory are not infected with blackspot fungus.

**(1)**

blackspot fungus will not grow where areas have high sulfur dioxide

**(Total for Question 1 = 7 marks)**

**2** People with diabetes cannot always control the concentration of glucose in their blood.

(a) Two people eat identical meals.

One person has diabetes, the other person does not have diabetes.

Figure 4 shows the concentration of glucose in the blood of these two people after eating the meals.

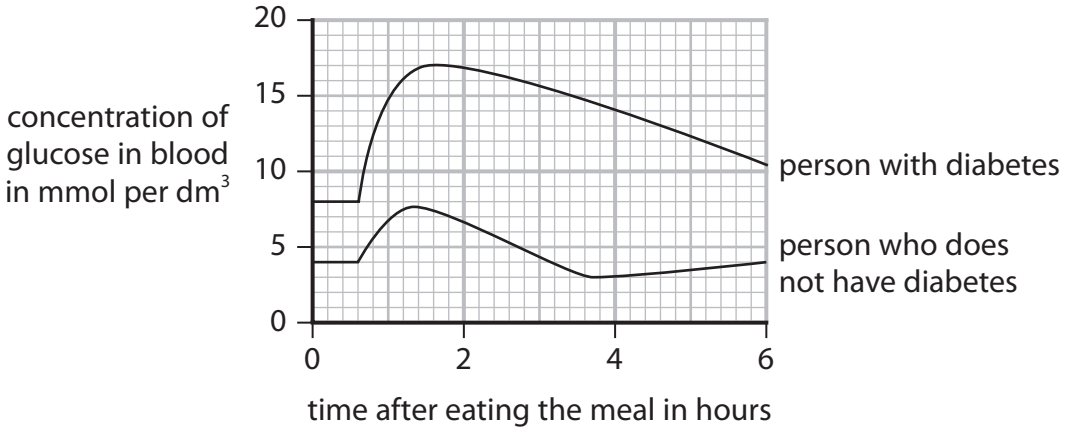



**Figure 4**

(i) Calculate the maximum increase in the concentration of glucose in the blood of the person with diabetes.

**(1)**

9 mmol per $dm^3$

(ii) Water moved out of the red blood cells of the person with diabetes when the concentration of glucose in the blood was above 15 mmol per $dm^3$.

Explain why water moved out of the red blood cells of the person with diabetes.

**(2)**

(water moves out) by osmosis because the concentration of glucose is higher in the blood (plasma) across a partially permeable membrane

(b) The pancreas produces a hormone that causes the concentration of glucose in the blood to decrease.

(i) Name this hormone.

**(1)**

insulin

(ii) State how this hormone is transported from the pancreas to its target organs.

**(1)**

n the blooc

(iii) Which is the target organ for the hormone that controls the concentration of glucose in the blood?

**(1)**

- ☒ **A** kidney
- ☒ **B** pancreas
- ☒ **C** liver
- ☒ **D** lung

(c) Explain how type 2 diabetes can be controlled.

**(3)**

exercise
control diet / lose weight
to {reduce / control} **blood glucose**

**(Total for Question 2 = 9 marks)**

**3** Respiration occurs in cells.

(a) Why do cells respire?

**(1)**

- ☒ **A** to produce nitrogen
- ☒ **B** to release oxygen
- ☒ **C** to produce glucose
- ☒ **D** to release energy

(b) An athlete runs every day as part of their training.

(i) Explain why the breathing rate of the athlete increases when running.

**(2)**

to absorb **more** oxygen (into the blood / body) so that **more** respiration can occur / more energy is released

(ii) When the athlete is running, their muscle cells use both aerobic respiration and anaerobic respiration.

State **two** differences between aerobic respiration and anaerobic respiration.

**(2)**

1 aerobic respiration uses oxygen / anaerobic does not use oxygen

2 aerobic respiration releases more energy / anaerobic releases less energy

(c) Bromothymol blue (BTB) solution is an indicator of pH.

Figure 5 shows the colour of BTB at different pH levels.

| **pH** | 4 | 5 | 6 | 7 (neutral) | 8 |
|---|---|---|---|---|---|
| **colour** | yellow | yellowy green | light green | green | blue |

**Figure 5**

When air is passed through green BTB, for one minute, the solution stays green.

When a person breathes out through a straw into BTB for one minute the solution turns yellow.

(i) Explain why the air breathed out turns the BTB solution yellow.

**(2)**

you breathe out (air with a high concentration of) carbon dioxide

which forms a (weak) acid (when it dissolves)

(ii) A scientist placed pondweed into two sealed test tubes containing green BTB solution.

Test tube A was kept in the dark.
Test tube B was kept in the light.
All other conditions were kept the same.
Figure 6 shows these test tubes at the start of the investigation.

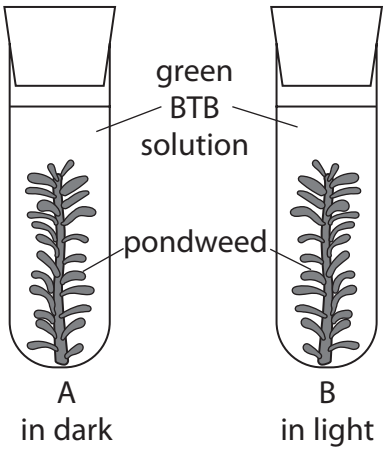



**Figure 6**

Figure 7 shows the colour of the BTB solution after 5 hours.

| Tube A (in dark) | Tube B (in light) |
|---|---|
| yellowy green | green |

**Figure 7**

Explain the results for tube A and tube B shown in Figure 7.

**(2)**

tube A - respiration took place (producing carbon dioxide) / photosynthesis did not take place
tube B – photosynthesis took place (using up the carbon dioxide)

**(Total for Question 3 = 9 marks)**

**4** (a) A student wanted to make a jacket to wear in cold weather.

The student compared the insulation properties of wool as a natural material with polyester as a synthetic material.

Each material was wrapped around a beaker containing hot water as shown in Figure 8.

The temperature was recorded every 2 minutes for 12 minutes.

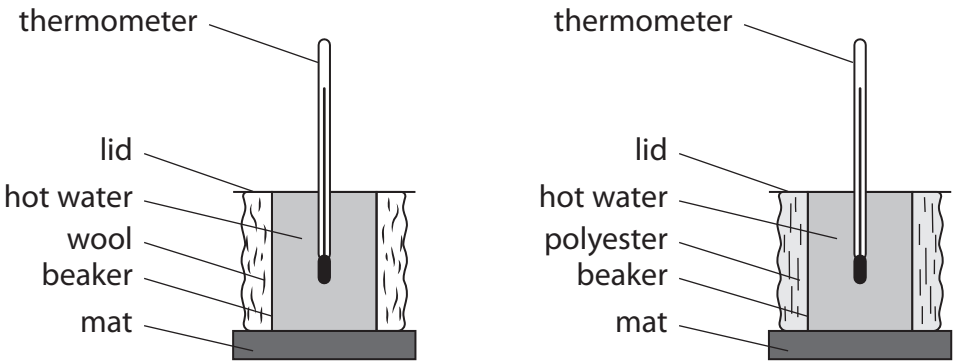



**Figure 8**

(i) Which part of the body controls the regulation of body temperature?

**(1)**

- ☒ **A** kidney
- ☒ **B** pituitary gland
- ☒ **C** hypothalamus
- ☒ **D** pancreas

(ii) State **one** variable that should be controlled in this investigation.

**(1)**

lume of water in each beak

(iii) Describe a control that could be used for this investigation.

**(2)**

repeat the experiment / set the apparatus up as shown in Figure 8
without the insulating material

(b) The results for this investigation are shown in Figure 9.

| wool | |
|---|---|
| time in minutes | temperature in °C |
| 0 | 64 |
| 2 | 61 |
| 4 | 56 |
| 6 | 53 |
| 8 | 49 |
| 10 | 45 |
| 12 | 42 |

| polyester | |
|---|---|
| time in minutes | temperature in °C |
| 0 | 82 |
| 2 | 74 |
| 4 | 68 |
| 6 | 63 |
| 8 | 59 |
| 10 | 53 |
| 12 | 48 |

**Figure 9**

(i) Compare and contrast the temperature changes for wool and polyester in this investigation.

**(2)**

with both materials the temperature drops over time

the drop in temperature for polyester was faster / greater than wool

(ii) State **one** improvement to this investigation that would make the results more comparable.

**(1)**

with the same starting temper

(c) (i) Wearing an insulated jacket may cause a person to sweat.

Explain how sweating helps to regulate temperature in humans.

**(2)**

sweat is released onto (the surface of) the skin
which evaporates
that cools the body / removes heat

(ii) Sweat contains urea.

State where and how urea is produced in the human body.

**(2)**

(urea) is produced in the
liver
from (excess) amino acids /
protein

**(Total for Question 4 = 11 marks)**

**5** A student investigated the effect of light intensity on the photosynthesis of pondweed.

A light source was placed at different distances from the pondweed.

The bubbles produced were counted for 2 minutes.

Figure 10 shows the apparatus that was used.

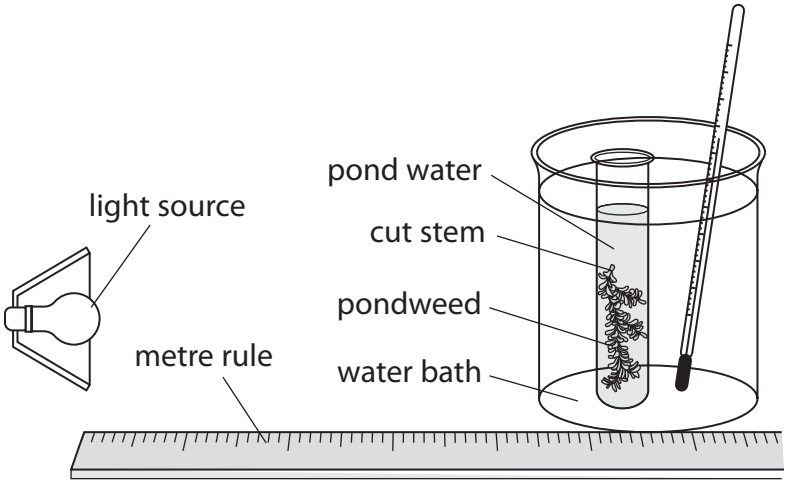



**Figure 10**

(a) (i) State why the student included a water bath in the apparatus.

**(1)**

naintain a constant temperal

(ii) State **two** variables that should be controlled when completing this investigation.

**(2)**

1 extraneous light

2 temperature

(b) Figure 11 shows the results of this investigation.

| distance from the lamp in cm | number of bubbles in two minutes | light intensity in arbitrary units |
|---|---|---|
| 5 | 62 | 0.04 |
| 10 | 60 | 0.01 |
| 15 | 43 | 0.0044 |
| 20 | 32 | 0.0025 |
| 25 | 11 | ? |

**Figure 11**

(i) The light intensity was calculated using the inverse square law for photosynthesis.

Calculate the light intensity at a distance of 25 cm from the lamp.

Include the equation for the inverse square law in your answer.

**(3)**

light intensity $\propto \frac{1}{d^2}$

$1 \div \{25^2 / 625\}$
0.0016 (arbitrary units

..... arbitrary units

(ii) Explain how the student could improve this investigation to get a more accurate measurement of the gas produced.

**(2)**

collect the gas produced
using a **gas syringe** / measuring cylinder
to get a measurement of volume of {oxygen / gas}

(c) Devise a plan to show that temperature is a limiting factor in photosynthesis.

Use the apparatus shown in Figure 10.

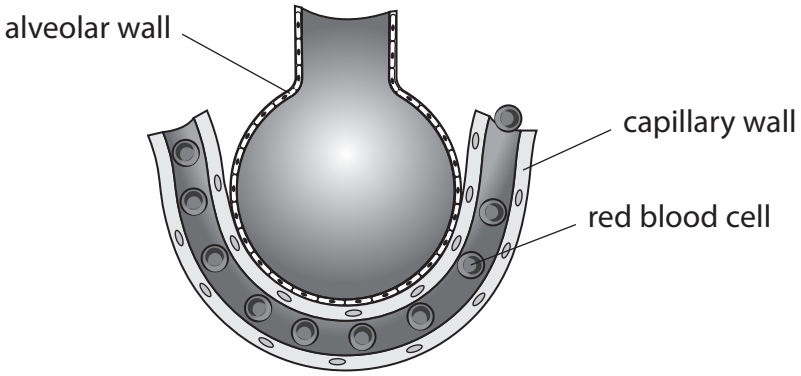
**(3)**

keep the light at the same distance from the pondweed
count the number of bubbles / measure the oxygen produced
repeat at different temperatures

**(Total for Question 5 = 11 marks)**

**6** Gas exchange happens in the alveoli in the lungs.

Figure 12 shows an alveolus and a capillary.




(adapted from : sciencepics/shutterstock)

**Figure 12**

(a) (i) Name the gas used in respiration that moves from the alveolus into the capillary.

**(1)**

Oxygen

(ii) Name the gas produced by respiration that moves from the capillary into the alveolus.

**(1)**

$CO_2$

(iii) The capillary wall is only one cell thick.

Explain how gases move from the alveolus to the capillary.

**(3)**

by diffusion
down a concentration gradient / from high concentration to a low concentration
through a membrane

(iv) Explain the advantages of red blood cells passing one at a time through this narrow capillary.

**(3)**

to reduce the distance over which diffusion occurs (1)
makes the blood flow slower (1)
increases the surface area (1)
to increase {diffusion / gas exchange}

(b) The average number of alveoli in each human lung is 280 million.

The surface area of 1 million alveoli is 0.25 $m^2$.

Calculate the total surface area of a human lung.

**(2)**

$280 \times 0.25$
$= 70\ m^2$

**(Total for Question 6 = 10 marks)**

**7** Figure 13 shows part of a food web of organisms found in the cold Antarctic Ocean.

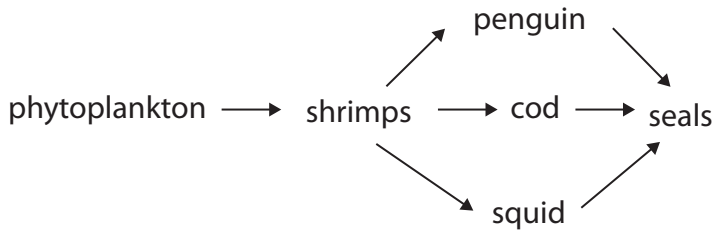



**Figure 13**

(a) Which term describes phytoplankton in this food web?

**(1)**

- ☒ **A** consumer
- ☒ **B** producer
- ☒ **C** predator
- ☒ **D** prey

(b) Humans are removing large numbers of cod from the Antarctic Ocean.

(i) State why the removal of cod could lead to a decrease in the numbers of squid and penguins.

**(1)**

**seals** will eat more penguins and squid

(ii) Explain why the removal of cod could lead to an increase in the numbers of squid and penguins.

**(2)**

less **competition** for food (for penguins and squid)
because fewer shrimps will be eaten by the cod / more shrimps available / more food available

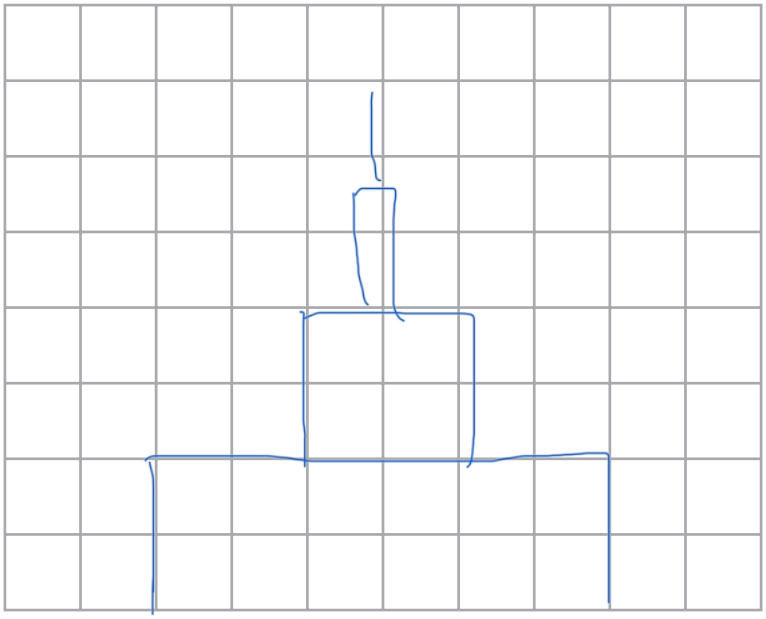
(c) Figure 14 shows information about the biomass of some organisms in one part of the Antarctic Ocean.

| organism | biomass in tonnes |
|---|---|
| phytoplankton | 200 |
| shrimps | 40 |
| cod | 10 |
| seals | 0.5 |

**Figure 14**

(i) Draw and label a pyramid of biomass for this food chain.

**(2)**



(ii) Seals are mammals.

Explain why the conversion of biomass from phytoplankton to shrimps is more efficient than the conversion of biomass from cod to seals.

**(2)**

the idea that seals have (to maintain) a constant body temperature
there is more heat loss

(d) Cod are being overfished in the Antarctic Ocean.

Suggest **two** actions that could be taken by humans to increase the number of cod in the Antarctic Ocean.

**(2)**

1 reduce the amount of fishing for cod / fishing quotas

2 breed in captivity / release new cod / use fish farms

**(Total for Question 7 = 10 marks)**

**8** Figure 15 shows the changes in the levels of the hormones of the menstrual cycle.

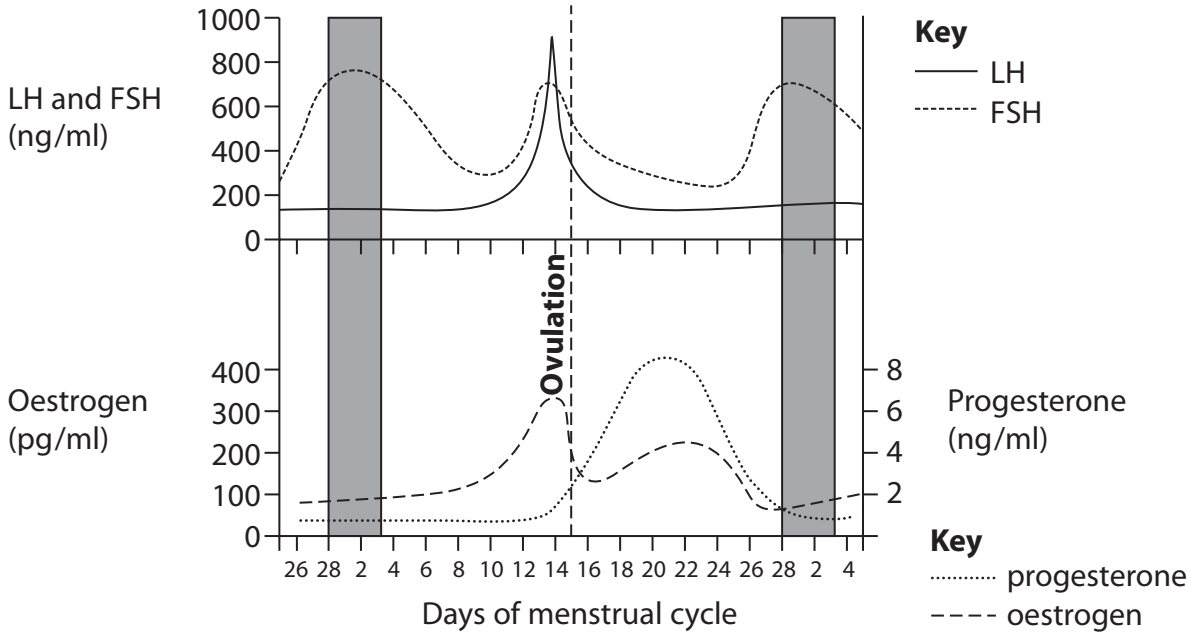



**Figure 15**

(a) (i) The maximum concentration of oestrogen is just before ovulation.

Which is the maximum concentration of oestrogen?

**(1)**

- ☒ **A** 8 ng/ml
- ☒ **B** 210 pg/ml
- ☒ **C** 320 pg/ml
- ☒ **D** 900 ng/ml

(ii) Explain how **two** of the hormones shown in Figure 15 cause ovulation.

**(3)**

? FSH causes the {egg / follicle} to mature )

? FSH stimulates oestrogen

? **high levels** of oestrogen

(iii) State the number of days for the first menstruation shown in Figure 15.

**(1)**

3

(iv) Explain how the levels of each hormone in the woman shown in Figure 15 would be different, if she was pregnant.

**(4)**

FSH levels remain low as no {egg / follicle} would mature
LH levels remain low so ovulation would not occur

progesterone inhibits {FSH / LH} / oestrogen inhibits FSH
progesterone levels remain high to maintain the lining of the uterus
high levels of oestrogen {build up / maintain} the lining of the uterus

**(Total for Question 8 = 9 marks)**

**9** Figure 16 shows a photomicrograph of two stomata in a leaf.

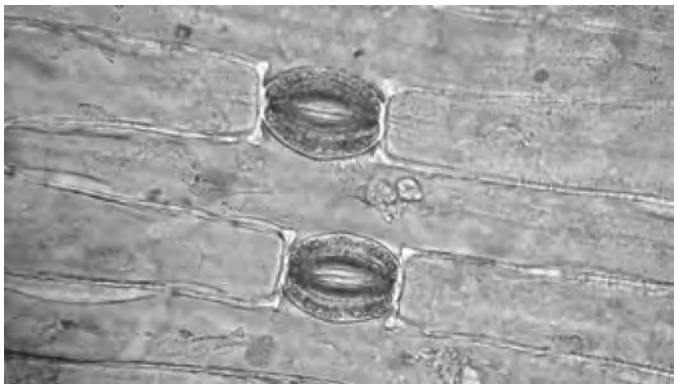


**Figure 16**

(a) (i) The length of one guard cell in this image is 6 mm.

Convert the length of this guard cell into micrometres (μm).

**(1)**

000 μı

(ii) The image has been magnified 150×.

Calculate the actual size of the guard cell.

Give your answer in standard form in mm.

**(3)**

6 ÷ 150
0.04 (mm)
$4.0 \times 10^{-2}$

..... mm

(b) Explain the role of denitrifying bacteria in the nitrogen cycle.

**(2)**

denitrifying bacteria) convert nitrates (1)
? back into (atmospheric) nitrogen

*(c) Describe how carbon is cycled through the biotic and abiotic components of an ecosystem.

**(6)**

**Biotic**

**Plants**

During photosynthesis plants take in carbon dioxide from the atmosphere

During respiration plants release carbon dioxide into the atmosphere

Plants store carbon compounds e.g. glucose

Carbon is transferred to animals when they are eaten

**Animals**

Animals release carbon dioxide when they respire

Animals ingest carbon compounds e.g. glucose when they eat plants or animals

**Decomposers**

Decomposers release carbon dioxide during respiration

Decomposers break things down

**Abiotic**

Burning fossil fuels releases carbon dioxide or carbon (particulates) into the atmosphere

The oceans can absorb carbon dioxide

Carbon can be stored in carbonate rocks

Erosion of carbonate rocks releases carbon dioxide

? Volcanoes releasing carbon dioxid

**(Total for Question 9 = 12 marks)**

**10** Blood is filtered in the kidney.

Figure 17 shows the diameter of some molecules found in human blood.

| molecule | diameter in nanometres (nm) |
|---|---|
| X | 0.6 |
| Y | 1.0 |
| Z | 15 |

**Figure 17**

(a) (i) Which part of the nephron is the site of ultrafiltration?

**(1)**

☒ **A** distal convoluted tubule

☒ **B** collecting duct

☒ **C** glomerulus

☒ **D** loop of Henle

(ii) Molecule Z is a protein.

Explain why protein is not usually found in urine.

**(2)**

the protein molecule is large / 15nm
so will not fit through the glomerulus / will not enter the bowman's capsule

(iii) Haemolytic anaemia is a disease that causes red blood cells to burst.

Haemoglobin is not found in the urine of people who do not have haemolytic anaemia.

The diameter of a haemoglobin molecule is 5.5 nm.

Explain why haemoglobin can be found in the urine of people with haemolytic anaemia.

**(3)**

haemoglobin is inside red blood cells
red blood cells are too big to pass into the nephron
haemoglobin is small enough to pass into the nephron

*(b) Describe how the water content of the blood is controlled in the nephron.

**(6)**

**water content too low**

hypothalamus detects there is too little water in the blood

ADH released

from the pituitary gland

into the blood

As the collecting duct becomes more permeable

more water is reabsorbed into the blood

by osmosis

more concentrated urine

smaller volume urine produced

**water content too high**

hypothalamus detects there is too much water in the blood

ADH lowered / not released

from the pituitary gland

collecting duct is less permeable

less water reabsorbed into the blood

more dilute urine

larger volume urine produced

**(Total for Question 10 = 12 marks)**

**TOTAL FOR PAPER = 100 MARKS**

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