Materials
For this paper you must have:
- Ruler
- Pencil, Rubber, Protractor and Compass
- Scientific calculator, which you are expected to use when appropriate

Instructions
- Answer all questions
- Answer questions in the space provided
- All working must be shown
- Do all rough work in this book. Cross out any rough work you don't want to be marked

Information
- The marks for the questions are shown in brackets
Our lungs help us to breathe.
The image below shows the human breathing system.

(a)  (i) Name part A.

______________________________________________________________________________

(ii) Give one function of the ribs.

______________________________________________________________________________

(b)  (i) Use the correct answer from the box to complete the sentence.

<table>
<thead>
<tr>
<th>active transport</th>
<th>diffusion</th>
<th>osmosis</th>
</tr>
</thead>
</table>

Oxygen moves from the air inside the lungs into the blood by the process of __________________________.

(ii) Use the correct answer from the box to complete the sentence.

<table>
<thead>
<tr>
<th>arteries</th>
<th>capillaries</th>
<th>veins</th>
</tr>
</thead>
</table>

Oxygen moves from the lungs into the blood through the walls of the __________________________.
(iii) Inside the lungs, oxygen is absorbed from the air into the blood.

Give **two** adaptations of the lungs that help the rapid absorption of oxygen into the blood.

1. __________________________________________________________
   __________________________________________________________

2. __________________________________________________________
   __________________________________________________________

(Total 6 marks)

Plants need different substances to survive.

**Figure 1** shows the roots of a plant.

(a)  (i) Mineral ions are absorbed through the roots.

Name **one** other substance absorbed through the roots.

______________________________________________________________

(1)
(ii) The plant in Figure 1 has a higher concentration of mineral ions in the cells of its roots than the concentration of mineral ions in the soil.

Which two statements correctly describe the absorption of mineral ions into the plant's roots?

Tick (✓) two boxes.

- The mineral ions are absorbed by active transport.
- The mineral ions are absorbed by diffusion.
- The mineral ions are absorbed down the concentration gradient.
- The absorption of mineral ions needs energy.

(2)

(iii) The plant in Figure 1 has roots adapted for absorption.

Figure 2 shows a magnified part of a root from Figure 1.

Figure 2

Describe how the root in Figure 2 is adapted for absorption.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(2)
(b) The leaves of plants have stomata.

What is the function of the stomata?

___________________________________________________________________
___________________________________________________________________

(c) Figure 3 shows the underside of two leaves, A and B, taken from a plant in a man’s house.

Figure 3

![Figure 3](image_url)

(i) In Figure 3, the cells labelled X control the size of the stomata.

What is the name of the cells labelled X?

Tick (✓) one box.

- Guard cells
- Phloem cells
- Xylem cells

(ii) Describe how the appearance of the stomata in leaf B is different from the appearance of the stomata in leaf A.

___________________________________________________________________
___________________________________________________________________

(1)
(iii) The man forgets to water the plant.

What might happen to the plant in the next few days if the stomata stay the same as shown in leaf A in Figure 3?

________________________________________________________________________________________

________________________________________________________________________________________

(1)
(Total 9 marks)
Scientists investigated the effect of different factors on health.

(a) People who are not active may have health problems.

The graph shows the percentage of 16-year-olds in some countries who are not active.

(i) What percentage of 16-year-olds in the UK are not active?

__________________ %

(1)

(ii) What percentage of 16-year-olds in the UK are active?

__________________ %

(1)

(iii) A newspaper headline states:

People in the UK are the laziest in the world.

Information in Figure 1 does not support the newspaper headline.

Suggest one reason why the newspaper headline may be wrong.

____________________________________________________________________

____________________________________________________________________

(1)
(b) Doctors gave a percentage rating to the health of 16-year-olds. 100% is perfect health.

The table shows the amount of exercise 16-year-olds do and their health rating.

<table>
<thead>
<tr>
<th>Amount of exercise done in minutes every week</th>
<th>Health rating as %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30</td>
<td>72</td>
</tr>
<tr>
<td>90</td>
<td>76</td>
</tr>
<tr>
<td>180</td>
<td>82</td>
</tr>
<tr>
<td>300</td>
<td>92</td>
</tr>
</tbody>
</table>

What conclusion can be made about the effect of exercise on health?

Use information from the table.

___________________________________________________________________

___________________________________________________________________

(1)

(c) Inherited factors can also affect health.

Give one health problem that may be affected by the genes someone inherits.

Draw a ring around the correct answer.

being malnourished having a high cholesterol level having a deficiency disease

(1)

(d) White blood cells are part of the immune system.

Use the correct answer from the box to complete each sentence.

<table>
<thead>
<tr>
<th>antibiotics</th>
<th>antibodies</th>
<th>pathogens</th>
<th>vaccines</th>
</tr>
</thead>
</table>

(i) When we are ill, white blood cells produce ______________________ to kill microorganisms.

(1)

(ii) Many strains of bacteria, including MRSA, have developed resistance to drugs called

___________________________________________________________

(1)

(Total 7 marks)
The heart is part of the circulatory system.

(a) (i) Name one substance transported by the blood in the circulatory system.

______________________________________________________________

(1)

(ii) What is the main type of tissue in the heart wall?

______________________________________________________________

(1)

(b) Figure 1 shows the human heart.

(i) Which blood vessel, A, B or C, takes blood to the lungs? [ ]

(1)

(ii) Name parts D and E shown in Figure 1.

D ____________________________________________________________

E ____________________________________________________________

(2)
(c) **Figure 2** shows three types of blood vessel, F, G and H.

![Diagram of blood vessels](image)

(i) What type of blood vessel is F?

Tick (✔) one box.

- an artery
- a capillary
- a vein

(ii) A man needs to have a stent fitted to prevent a heart attack.

In which type of blood vessel would the stent be placed?

Tick (✔) one box.

- an artery
- a capillary
- a vein

(1)
(iii) Explain how a stent helps to prevent a heart attack.

The image below shows some cells in the lining of the stomach.

5

The image below shows some cells in the lining of the stomach.

(a) (i) Use words from the box to name structures A and B.

<table>
<thead>
<tr>
<th>cell membrane</th>
<th>chloroplast</th>
<th>cytoplasm</th>
<th>vacuole</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(ii) What is the function of the nucleus?

Tick (✓) one box.

To control the activities of the cell

To control movement of substances into and out of the cell

To release energy in respiration
(b) Draw one line from each part of the human body to its correct scientific name.

<table>
<thead>
<tr>
<th>Part of human body</th>
<th>Scientific name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer of cells lining the stomach</td>
<td>An organ</td>
</tr>
<tr>
<td>Stomach</td>
<td>An organism</td>
</tr>
<tr>
<td>Mouth, stomach, intestines, liver and pancreas</td>
<td>An organ system</td>
</tr>
<tr>
<td></td>
<td>A tissue</td>
</tr>
</tbody>
</table>

(3)
(Total 6 marks)
In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Plants transport many substances between their leaves and roots.

The diagram below shows the direction of movement of substances through a plant.
Describe how ions, water and sugar are obtained and transported through plants.

In your answer you should refer to materials moving upwards in a plant and to materials moving downwards in a plant.

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(Total 6 marks)

Carbon dioxide enters a plant through stomata on the leaves.

(a) Name the cells that control the size of the stomata.

______________________________________________________________________________

(1)
(b) Scientists grew tomato plants in air containing different concentrations of carbon dioxide.

The scientists recorded the number of stomata found on the lower surface of the leaves of plants grown at each carbon dioxide concentration.

The graph below shows the results.

(i) Describe the relationship between the mean number of stomata per mm\(^2\) and carbon dioxide concentration.

(ii) Suggest a reason for the relationship you described in part (b)(i).
(c) (i) Suggest one disadvantage to a plant of having a large number of stomata per mm$^2$ on each leaf.

________________________________________________________________________________________

________________________________________________________________________________________

(1)

(ii) Suggest one environmental condition where a large number of stomata per mm$^2$ on each leaf would be a disadvantage.

________________________________________________________________________________________

________________________________________________________________________________________

(1)

(Total 6 marks)

8 Catalase is an enzyme found in many different tissues in plants and animals. It speeds up the rate of the following reaction.

\[ \text{hydrogen peroxide} \xrightarrow{\text{catalase}} \text{water} + \text{oxygen} \]

**Figure 1** shows a 25-day-old broad bean seedling.

![Figure 1](image_url)

Some students investigated whether different parts of bean seedlings contained different amounts of catalase.

The students:
- put hydrogen peroxide into five test tubes
- added a different part of a bean seedling to each tube
- recorded the results after half a minute.

If there was catalase in part of the seedling, oxygen gas was given off. When oxygen gas is given off, foam is produced in the tubes.
Figure 2 shows the results.

The students made the following conclusions:

- most parts of a bean seedling contain catalase
- the seed contains a lot of catalase
- stems and roots have quite a lot of catalase
- the leaves have a little bit of catalase
- the seed coat has hardly any catalase.

The students’ teacher said that the students needed to improve their investigation in order to make valid conclusions.
(a) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Describe how you would carry out an investigation to compare the amounts of catalase in different parts of bean seedlings.

You should include details of how you would make sure your results give a valid comparison of the amounts of catalase.

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(b) Scientists investigated the effect of pH on the activity of the enzyme catalase in a fungus.

The table below shows the scientists’ results.

<table>
<thead>
<tr>
<th>pH</th>
<th>Enzyme activity in arbitrary units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Test 1</td>
</tr>
<tr>
<td>3.0</td>
<td>0</td>
</tr>
<tr>
<td>4.0</td>
<td>6</td>
</tr>
<tr>
<td>5.0</td>
<td>38</td>
</tr>
<tr>
<td>5.5</td>
<td>80</td>
</tr>
<tr>
<td>6.0</td>
<td>100</td>
</tr>
<tr>
<td>6.5</td>
<td>94</td>
</tr>
<tr>
<td>7.0</td>
<td>61</td>
</tr>
<tr>
<td>8.0</td>
<td>22</td>
</tr>
</tbody>
</table>
(i) Calculate the mean enzyme activity at pH 5.0.

________________________________________________________________________
________________________________________________________________________

Mean = _______________ arbitrary units

(ii) On the graph paper in Figure 3, draw a graph to show the scientists’ results. Remember to:
• add a label to the vertical axis
• plot the mean values of enzyme activity
• draw a line of best fit.

Figure 3

(iii) At what pH does the enzyme work best?

____________________
Lipase is an enzyme that digests fat.

(a) (i) Complete the equation to show the digestion of fat.

Use the correct answer from the box.

| glucose | glycerol | glycogen |

fat $\xrightarrow{\text{lipase}}$ fatty acids + __________________________

(ii) Name one organ that makes lipase.

___________________________________________________________________

(b) Some students investigated the effect of bile on the digestion of fat by lipase.

The students:
1. mixed milk and bile in a beaker
2. put the pH sensor of a pH meter into the beaker
3. added lipase solution
4. recorded the pH at 2-minute intervals
5. repeated steps 1 to 4, but used water instead of bile.

Suggest two variables that the students should have controlled in this investigation.

1. _________________________________________________________________
   _________________________________________________________________

2. _________________________________________________________________
   _________________________________________________________________

(Total 15 marks)
(c) The graph shows the students' results.

(i) Why did the pH decrease in both investigations?

________________________________________________________________________

________________________________________________________________________

(1)

(ii) Bile helps lipase to digest fat.

What evidence is there in the graph to support this conclusion?

________________________________________________________________________

________________________________________________________________________

(1)

(iii) Suggest **one** reason why the contents of both beakers had the same pH at the end of the investigations.

________________________________________________________________________

________________________________________________________________________

(1)

(Total 7 marks)
The image below shows some cells on the lower surface of a leaf.

(a) What are the cells labelled X called?

Draw a ring around the correct answer.

- guard cells
- palisade cells
- mesophyll cells

(b) Water loss by evaporation from leaves is called **transpiration**.

A student set up an experiment to investigate water loss from leaves.

The student:

- took two leaves, A and B, from a plant
- put Vaseline (grease) on both sides of Leaf B; did nothing to Leaf A
- wrote down the mass of each leaf
- attached the leaves onto a string as shown in the diagram below.
Leaf A  
(no treatment)  
Leaf B  
(both surfaces covered in Vaseline)

- left the leaves for 48 hours
- wrote down the mass of each leaf again
- calculated the percentage (%) change in mass for each leaf.

(i) Give one variable that the student controlled in this investigation.

___________________________________________________________________
___________________________________________________________________

(ii) The mass of Leaf A was 1.60 g at the start of the investigation. After 48 hours it was 1.28 g.

Calculate the % decrease in mass over 48 hours.

___________________________________________________________________
___________________________________________________________________

% decrease = __________________

(c) Vaseline blocks the stomata.

The % change in mass of Leaf B was less than Leaf A after 48 hours. Explain why.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(1)
Give three environmental conditions that would increase transpiration.

1. _________________________________________________________________
2. _________________________________________________________________
3. _________________________________________________________________

(Total 8 marks)

The circulatory system contains arteries and veins.

(a) (i) Describe how the structure of an artery is different from the structure of a vein.

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

(2)

(ii) A comparison is made between blood taken from an artery in the leg and blood taken from a vein in the leg.

Give two differences in the composition of the blood.

1. ____________________________________________________________
2. ____________________________________________________________

(2)

(b) During operations patients can lose a lot of blood. Patients often need blood transfusions to keep them alive.

The text shows information about a new artificial blood product.

---

Sea worms give hope for people in need of blood transfusions

Scientists have carried out a five-year trial using a new artificial blood product. The scientists have used a protein from sea worms to create the new artificial blood and the results from the trial are very positive. Thousands of sea worms can be grown and collected.

During the trial, mice were given blood transfusions of the artificial blood. The bodies of the mice tolerated the artificial blood and the artificial blood did not cause any side effects.
Suggest **two** possible advantages of using the new artificial blood, instead of using human blood for a transfusion in humans.

1. _________________________________________________________________
   ___________________________________________________________________

2. _________________________________________________________________
   ___________________________________________________________________

(Total 6 marks)

The diagram below shows a cross-section of a plant root. The transport tissues are labelled.

12

(a) (i) What is tissue A?

Draw a ring around the correct answer.

- cuticle
- epidermis
- xylem

(ii) Name **two** substances transported by tissue A.

1. _________________________________________________________________

2. _________________________________________________________________

(b) Phloem is involved in a process called translocation.

(i) What is translocation?

___________________________________________________________________
___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

(1)
(ii) Explain why translocation is important to plants.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

(2)

(c) Plants must use active transport to move some substances from the soil into root hair cells.

(i) Active transport needs energy.

Which part of the cell releases most of this energy?

Tick (✓) one box.

mitochondria  

nucleus  

ribosome  

(1)

(ii) Explain why active transport is necessary in root hair cells.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

(2)

(Total 9 marks)