Materials
For this paper you must have:

- Ruler
- Pencil and Rubber
- 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

Information
• The marks for the questions are shown in brackets
Figure 1 shows an animal cell.

(a) What is structure A?

Tick one box.

- Cell membrane
- Cell wall
- Chromosome
- Cytoplasm

(1)
(b) What is structure B?

Tick one box.

- Chloroplast
- Mitochondria
- Nucleus
- Vacuole

(1)

(c) Figure 2 shows a sperm cell.

Figure 2

Describe how a sperm cell is adapted to carry out its function.

........................................................................................................................
........................................................................................................................

(1)
(d) Substances can move into and out of cells by three processes.

The diagrams show the concentration of different substances inside and outside a root hair cell.

How would each substance move into the root hair cell?

Draw one line from each root hair cell to the correct process.

**Root hair cell**

<table>
<thead>
<tr>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active transport</td>
</tr>
<tr>
<td>Diffusion</td>
</tr>
<tr>
<td>Osmosis</td>
</tr>
</tbody>
</table>

(2)
(Total 5 marks)
The figure below shows a scale drawing of one type of cell in blood.

(a) Use the scale to determine the width of the cell.

Give your answer to the nearest micrometre.

........................................................................................................................................................................
........................................................................................................................................................................

Width of cell = .................................. micrometres

(1)

(b) Complete the table below.

<table>
<thead>
<tr>
<th>Part of the blood</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carries oxygen around the body</td>
</tr>
<tr>
<td></td>
<td>Protects the body against infection</td>
</tr>
<tr>
<td>Plasma</td>
<td></td>
</tr>
</tbody>
</table>

(3)
Platelets are fragments of cells. Platelets help the blood to clot.

Suggest what might happen if the blood did not clot.

When an organism grows, new cells are produced by cell division.

(a) What type of cell division happens to produce new body cells?

Tick one box.

- Differentiation
- Meiosis
- Mitosis

(b) Why can cancers grow very large?

Tick one box.

- Cancer cells are specialised
- Cell division is slow
- Cell division is uncontrolled

(c) Give one factor which increases the risk of getting cancer.

........................................................................................................................
........................................................................................................................
........................................................................................................................

(Total 5 marks)
Survival rates for people with cancer have improved a lot. People who are alive 10 years after diagnosis are usually considered to be cured.

The figure below shows data for people diagnosed with cancer in 1961 and 2001.

78% of people diagnosed with breast cancer in 2001 were alive 10 years later.

Complete the figure above to show this information.

Which type of cancer diagnosed in 1961 had the highest survival rate?

Tick one box.

Breast

Prostate

Skin

Testicular
(f) Which type of cancer shows the biggest improvement in the percentage of people alive after 10 years?

Tick one box.

Breast

Prostate

Skin

Testicular

(g) Suggest two reasons why the survival rates for all cancers have increased.

1 ....................................................................................................................

2 ....................................................................................................................

(Total 8 marks)
Amylase is an enzyme that digests starch.

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

This is the method used.

1. Mix amylase solution and starch suspension in a boiling tube.
2. Put the boiling tube into a water bath at 25 °C.
3. Remove a drop of the mixture every 30 seconds and test it for the presence of starch.
4. Repeat the investigation at different pH values.

The table below shows the students' results.

<table>
<thead>
<tr>
<th>pH</th>
<th>Time when no starch was detected in minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td>7.0</td>
</tr>
<tr>
<td>5.5</td>
<td>4.5</td>
</tr>
<tr>
<td>6.0</td>
<td>3.0</td>
</tr>
<tr>
<td>6.5</td>
<td>2.0</td>
</tr>
<tr>
<td>7.0</td>
<td>1.5</td>
</tr>
<tr>
<td>7.5</td>
<td>1.5</td>
</tr>
<tr>
<td>8.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

(a) The student concluded pH 7.25 was the optimum pH for the amylase enzyme.

This is not a valid conclusion.

Suggest two reasons why.

1 ........................................................................................................................................
2 ........................................................................................................................................

(2)
(b) The student did another investigation.

This is the method used.

1. Put amylase solution and starch suspension into a boiling tube.

2. Make the pH 7.25.

3. Put the boiling tube into a water bath at 25 °C.

4. Measure the amount of sugar produced every 30 seconds.

The results are shown in the figure below.

![Graph showing sugar production over time](image)

Calculate the mean rate of sugar produced per minute during the first 5 minutes.

Mean rate = .................................. units per minute

(2)
(c) Iodine solution is added to a sample taken from the boiling tube after 10 minutes and 60 minutes.

Suggest what you would see in these samples.

After 10 minutes .................................................................

........................................................................................................................

After 60 minutes .................................................................

........................................................................................................................

(d) The scientist repeated the investigation at 37 °C.

Draw a line on the figure above to show the predicted results.

(Total 8 marks)

Malignant tumours are called cancers.

(a) Describe how a tumour can spread to different parts of the body.

........................................................................................................................

........................................................................................................................

........................................................................................................................

........................................................................................................................

........................................................................................................................
(b) Survival rates for people with cancer have improved a lot.

Some people who are alive 10 years after diagnosis are considered to be cured.

The figure below shows data for people diagnosed with cancer in 1961 and 2001.

Look at the data in the figure above for skin cancer.

Calculate the percentage increase in the survival rate of people diagnosed with skin cancer in 1961 compared to 2001.

Give your answer to three significant figures.

........................................................................................................................................................................
........................................................................................................................................................................

Survival rate increase = ......................... %  

(2)
(c) Look at the data in the figure above for bowel and prostate cancer.

Compare the survival rates for bowel and prostate cancer.

Suggest reasons for the comparisons you have made.

----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
(4) (Total 8 marks)

(a) Blood is made up of four main components.

Red blood cells and white blood cells are two of these components.

Describe the functions of the two other components of blood.

----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
(2)

(b) The heart is often described as a double pump.

Describe why.

----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
----------------------------------------------------------------------------------
(1)
In coronary heart disease (CHD) layers of fatty material build up inside the coronary arteries. This can cause a heart attack.

Statins and stents can be used to reduce the risk of a heart attack in people with CHD.

Evaluate the use of statins and stents in people with CHD.

Remember to include a justified conclusion.
Figure 1 shows a diagram of the human heart.

**(a)** Name parts A and B.

- A ....................................................................................................................
- B ....................................................................................................................

**(b)** What is the function of blood vessel C?

Tick **one** box.

- To take blood from the heart around the body
- To take blood from the body to the heart
- To take blood from the heart to the lungs
- To take blood from the lungs to the heart
Coronary heart disease (CHD) develops when layers of fatty material build up in the coronary artery.

One treatment for CHD is to insert a stent into the coronary artery.

**Figure 2** shows a stent in a coronary artery.

**Figure 2**

Explain why the stent helps to prevent a heart attack.

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
(d) Look at the table below.

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of deaths from CHD per 100 000 population per year</th>
<th>Amount of fruit and vegetables eaten in kg per person per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>285</td>
<td>180</td>
</tr>
<tr>
<td>B</td>
<td>250</td>
<td>320</td>
</tr>
<tr>
<td>C</td>
<td>198</td>
<td>250</td>
</tr>
<tr>
<td>D</td>
<td>151</td>
<td>220</td>
</tr>
<tr>
<td>E</td>
<td>125</td>
<td>244</td>
</tr>
</tbody>
</table>

Plot the missing bars for countries D and E on Figure 3.

Use data from the table above.

Figure 3
(e) People in country B are more likely to die from CHD than people in country E.

How many more times as likely are people to die from CHD in country B than in country E?

(1)

(f) A student concluded:

‘The factor that causes CHD is not eating enough fruit and vegetables.’

Evaluate the student’s conclusion.

Use data from Figure 3, and your own knowledge, in your answer.

(6)

(Total 16 marks)
Statins are drugs used to treat coronary heart disease (CHD).
New drugs must be trialled before they can be licensed for use.
Some scientists trialled two different types of statin.
The scientists:
• conducted the trial on 325 patients with a history of CHD in their family
• used a double-blind trial method
• measured the change in blood cholesterol levels over two years
• measured the change in thickness of an artery wall over two years.
(a) During the trials the statins are tested for side effects.
Give two other reasons why the statins are trialled before use.
1 .....................................................................................................................
........................................................................................................................
2 .....................................................................................................................
........................................................................................................................
(b) Describe how the double-blind method is used in this trial.
........................................................................................................................
........................................................................................................................
........................................................................................................................
........................................................................................................................
........................................................................................................................
........................................................................................................................
........................................................................................................................
The results of drug trials are **peer reviewed** before they are published.

Why are peer reviews important in drug trials?

Tick **one** box.

- To calculate the best dose
- To check the drug works
- To make sure the scientist gets credit
- To prevent false claims
(d) The table below shows the results of the trial.

<table>
<thead>
<tr>
<th></th>
<th>Drug A</th>
<th>Drug B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients who died during the trial</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Number of patients who reported aching muscles</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Number of patients who reported mild abdominal cramps</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Change in blood cholesterol level in percentage</td>
<td>-50.5</td>
<td>-41.2</td>
</tr>
<tr>
<td>Change in thickness of artery wall in mm</td>
<td>-0.0033</td>
<td>+0.032</td>
</tr>
</tbody>
</table>

Drug A is more effective than Drug B.

Give two reasons that support this conclusion.

Use information from the table above.

1 ....................................................................................................................

........................................................................................................................

2 ....................................................................................................................

........................................................................................................................

(2)

(e) A scientist concludes that Drug A is a safer drug than Drug B.

Give two reasons why this is not a valid conclusion.

........................................................................................................................

........................................................................................................................

........................................................................................................................

........................................................................................................................

........................................................................................................................

(2)
Coronary heart disease (CHD) can be caused by many factors.

The table below shows data related to CHD for five countries.

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of deaths from CHD per 100 000 population per year</th>
<th>Percentage of the population who smoke tobacco</th>
<th>Percentage of the population who drink alcohol heavily</th>
<th>Amount of fruit and vegetables eaten in kg per person per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>285</td>
<td>36</td>
<td>19</td>
<td>180</td>
</tr>
<tr>
<td>B</td>
<td>251</td>
<td>63</td>
<td>34</td>
<td>404</td>
</tr>
<tr>
<td>C</td>
<td>186</td>
<td>47</td>
<td>36</td>
<td>251</td>
</tr>
<tr>
<td>D</td>
<td>149</td>
<td>23</td>
<td>34</td>
<td>218</td>
</tr>
<tr>
<td>E</td>
<td>128</td>
<td>27</td>
<td>12</td>
<td>222</td>
</tr>
</tbody>
</table>

(a) Name one risk factor for CHD that is not shown in the table above.

(b) A student concludes that the main cause of CHD is not eating enough fruit and vegetables. Give three reasons why the student’s conclusion is not correct. Use information from the table above.
(c) Explain how the build-up of fatty material can damage the heart.

(4)

(d) Describe how statins can help to reduce deaths from CHD.

(2)

(Total 10 marks)

The figure below shows a cross-section through a plant root.

(a) What is tissue A?

(1)
A student is given samples of two fluids.

One fluid is from the phloem of a plant and one from the xylem of a plant.

The student is asked to work out which fluid is from the phloem and which is from the xylem.

She measures the pH and the concentrations of sugar, nitrate ions and potassium ions of each fluid.

The table below shows the student’s results.

<table>
<thead>
<tr>
<th></th>
<th>Fluid A</th>
<th>Fluid B</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Sugar in mg / cm³</td>
<td>118</td>
<td>1.18</td>
</tr>
<tr>
<td>Nitrate ions in mg / cm³</td>
<td>10</td>
<td>600</td>
</tr>
<tr>
<td>Potassium ions in μg / cm³</td>
<td>1.18</td>
<td>2500</td>
</tr>
</tbody>
</table>

Which fluid is from the phloem, and which is from the xylem?

Explain your answer.

Use the information from the table above.

(c) In fluid A, how many times greater is the concentration of sugar than the concentration of potassium ions?
(d)  The concentration of potassium ions in the soil is 3.9 μg / cm³

The concentration of potassium ions in the root tissue is 2500 μg / cm³

Explain why the concentration is so much higher in the roots than in the soil.

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
\[\text{(3)}\]
(Total 10 marks)