Organisation
Higher / Foundation

Name: ________________________
Class: ________________________
Date: ________________________

Time: 452 minutes

Marks: 450 marks

Comments:
Q1.

The heart pumps blood around the body. This causes blood to leave the heart at high pressure.

The graph shows blood pressure measurements for a person at rest. The blood pressure was measured in an artery and in a vein.

(a) Which blood vessel, A or B, is the artery?

Blood vessel ____________

Give two reasons for your answer.

Reason 1 ___________________________________________________________

Reason 2 ___________________________________________________________
(b) Use information from the graph to answer these questions.

(i) How many times did the heart beat in 15 seconds? ________________________________

(ii) Use your answer from part (b)(i) to calculate the person’s heart rate per minute.

______________________________________________________________________________

______________________________________________________________________________

Heart rate = ___________ beats per minute (1)

(c) During exercise, the heart rate increases. This supplies useful substances to the muscles and removes waste materials from the muscles at a faster rate.

(i) Name **two** useful substances that must be supplied to the muscles at a faster rate during exercise.

1. _________________________________________________________________________

2. _________________________________________________________________________ (2)

(ii) Name **one** waste substance that must be removed from the muscles at a faster rate during exercise.

______________________________________________________________________________ (1)

(Total 7 marks)

Q2.

The diagram shows part of the circulatory system.
(a) Name the types of blood vessel labelled A, B and C on the diagram.

A ________________________________
B ________________________________
C ________________________________

(3)

(b) What is the job of the circulatory system?

___________________________________________________________________
___________________________________________________________________

(1)

(c) Give two ways in which the composition of blood changes as it flows through the vessels labelled X on the diagram.

1. _________________________________________________________________
   __________________________________________________________________

2. _________________________________________________________________
   __________________________________________________________________

(2) (Total 6 marks)
Some students set up the following apparatus.

![Diagram of two flasks connected with cotton wool and water]

The balances show the same mass at the start of the investigation.

After 24 hours the mass of flask B was the same but the mass of flask A had changed.

(i) Describe and explain the change to the mass of flask A.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(ii) Why did the students need to set up flask B?

___________________________________________________________________
___________________________________________________________________

(Question 4)

The diagram shows part of the human digestive system.
(i) Name part B.

___________________________________________________________________

(1)

(ii) Describe the role of B and D in reducing blood sugar levels.

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

(2) (Total 3 marks)

Q5.

Capillaries are blood vessels in the body which join the arteries to the veins. They have walls which are one cell thick and so are able to exchange substances with the body cells.
(i) Name two substances that travel from the muscle cells to the blood in the capillaries.

1. _________________________________________________________________
2. _________________________________________________________________  (2)

(ii) Glucose is one substance that travels from the blood in the capillaries to the body cells. Explain how this happens.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________  (2)
(Total 4 marks)

Q6. (a) Complete the table to give one site where digestive substances are made.

<table>
<thead>
<tr>
<th>Digestive substance</th>
<th>One site of production</th>
</tr>
</thead>
<tbody>
<tr>
<td>bile</td>
<td></td>
</tr>
<tr>
<td>amylase</td>
<td></td>
</tr>
<tr>
<td>lipase</td>
<td></td>
</tr>
</tbody>
</table>
| protease            |                        |  (4)

(b) Describe two ways that the mouth can break down starchy foods.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________  (2)

(c) Describe how the liver helps to digest fats.
Q7.
(a) Photosynthesis is a process that takes place in green plants.
   (i) What type of energy is needed for this process?
       ________________________________________________________________
       (1)
   (ii) What substance in the plant absorbs this energy?
       ________________________________________________________________
       (1)
   (iii) In which part of the plant cell does photosynthesis take place?
       ________________________________________________________________
       (1)
   (iv) Write a balanced chemical equation for photosynthesis.
       _______________________________ → _______________________________
       (3)
(b) Describe two ways you could speed up photosynthesis.
       ________________________________________________________________
       ________________________________________________________________
       ________________________________________________________________
       (2)
(c) The diagram shows the outline of a cross-section of a leaf. Name cells 1 and 2 and describe how they are involved in photosynthesis.
Q8.

The diagram shows four parts of blood.

(a) Complete the table to give the name and function of the parts labelled A, B and C.

<table>
<thead>
<tr>
<th>Letter</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Red blood cells contain haemoglobin. Explain how this enables red blood cells to pick up oxygen from the alveoli and release it to cells in other parts of the body.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Q9.
(a) Complete the following sentences.

Green plants produce their own food by a process called photosynthesis. In this process the raw materials are ___________________________ and carbon dioxide. Glucose and _______________________________ are produced. _____________________________ energy is absorbed by the green substance called ____________________________.

(b) Name two things that can happen in the plant to the glucose produced in photosynthesis.

1. _________________________________________________________________
2. ________________________________________________________________

(c) Plants need mineral salts.

(i) Through which part do mineral salts get into the plant?

___________________________________________________________________

(ii) Explain why water is important in this process.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Some students set up water cultures to find out how plants use nitrates. They had two sets of nutrient solutions. A full solution provided the plant with all the required nutrients. The results table shows the average mass of the seedlings after 28 days of growth.

<table>
<thead>
<tr>
<th>Culture solution</th>
<th>Average mass of seedling in g</th>
</tr>
</thead>
<tbody>
<tr>
<td>distilled water</td>
<td>0.14</td>
</tr>
<tr>
<td>full solution with no nitrates</td>
<td>0.29</td>
</tr>
<tr>
<td>full solution</td>
<td>0.43</td>
</tr>
</tbody>
</table>

(d)  
(i) Give a conclusion you could make from these results.

(ii) Calculate the difference in average mass caused by the addition of nitrates to the culture solution.

(iii) What are nitrates used for in the seedling?

(iv) Some factors need to be controlled to keep this test fair. Name two of them.

1. ___________________________________________
2. ____________________________________________________________

(v) Suggest one way you could improve the experiment.
Q10.
A person did five different activities in turn. These activities needed increasing amounts of energy. For each activity two measurements were made. These were the rate of contraction of the left ventricle and its stroke volume (the volume of blood pumped at each beat). From these measurements the cardiac volume was calculated.

Some of these results are shown in the table and the bar chart.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Rate of contraction of left ventricle in beats per minute</th>
<th>Cardiac output in cm$^3$ per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting upright</td>
<td>68</td>
<td>5500</td>
</tr>
<tr>
<td>Slow walking</td>
<td>98</td>
<td>8000</td>
</tr>
<tr>
<td>Moderate walking</td>
<td>130</td>
<td>12000</td>
</tr>
<tr>
<td>Fast walking</td>
<td>150</td>
<td>17500</td>
</tr>
<tr>
<td>Running</td>
<td>190</td>
<td>19000</td>
</tr>
</tbody>
</table>

(a) (i) Describe how a person can count the rate of beating of the left ventricle.

(ii) Calculate the rate of ventricle contraction in beats per minute when the person was walking slowly. Show clearly how you work out your final answer.
Rate of ventricle contraction ______________ beats per minute. (2)

(iii) The pattern of results for stroke volume shows an anomalous result when the person is running. In what way is it anomalous?

______________________________________________________________

______________________________________________________________

(1)

(iv) There was a change in cardiac output when the person’s movement changed from fast walking to running. How did the heart produce this change?

______________________________________________________________

______________________________________________________________

(1)

(b) Over a period of time, regular exercise can strengthen the heart muscle. This change in the heart muscle enables a person to run for longer before lactic acid build up occurs. Explain the reason for this.

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

(2)

(Total 7 marks)

Q11.

The diagram gives information about some parts of the human digestive system.
(a)  
(i)  Name the organ which makes bile.

______________________________________________________________________________________

(1)  

(ii) Label this organ with the letter X on the diagram.

(1)  

Information in the table may help you to answer parts (b) and (c).

(b) Name two parts of the digestive system where protein is digested.

1. ________________________________

2. ________________________________

(2)  

(c) Suggest two reasons why starch is not digested in the stomach.

1. _________________________________________________________________

2. _________________________________________________________________

______________________________________________________________________________________

______________________________________________________________________________________

(2)
Q12.

(a) (i) Name the red pigment found in red blood cells.

______________________________________________________________ (1)

(ii) Describe, in detail, the function of this red pigment.

______________________________________________________________

______________________________________________________________

______________________________________________________________ (2)

(b) Describe one other way in which the structure of a red blood cell is different from the structure of a white blood cell.

______________________________________________________________ (1)

Q13.

Four leaves were removed from the same plant. Petroleum jelly (a waterproofing agent) was spread onto some of the leaves, as follows:

Leaf A: on both surfaces
Leaf B: on the lower surface only
Leaf C: on the upper surface only
Leaf D: none applied

Each leaf was then placed in a separate beaker, as shown in diagram 1.

![Diagram 1]

Each beaker was weighed at intervals. The results are shown in the graph.
(a) Give evidence from the graph in answering the following questions.

(i) Which surface (upper or lower) loses water most rapidly? ________________

Evidence ______________________________________________________
________________________________________________________________

(ii) Is water lost from both surfaces of the leaf? ________________

Evidence ______________________________________________________
________________________________________________________________

(1)

(b) Diagram 2 shows the appearance of each surface of the leaf as seen through a microscope.
Diagram 2

(i) Name space X and cell Y.

X ________________________________

Y ________________________________

(ii) Use information in diagram 2 to explain why the results are different for leaves B and C.

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

________________________________________________________________________________________

(Total 6 marks)

Q14.

(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.

<table>
<thead>
<tr>
<th>pH</th>
<th>1.0</th>
<th>2.0</th>
<th>3.0</th>
<th>4.0</th>
<th>5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of formation of product in mmol per minute</td>
<td>10.5</td>
<td>23.0</td>
<td>10.5</td>
<td>2.5</td>
<td>0.0</td>
</tr>
</tbody>
</table>

(b) Draw a graph of the data in the table.
The enzyme is produced by the human digestive system.

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

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

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

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(Total 10 marks)
A group of students looked at stomata on four different species of plants, A, B, C, and D. They estimated the number of stomata per cm$^2$ on the upper and lower surfaces of the leaves of the four species.

Their results are shown in the table.

<table>
<thead>
<tr>
<th>Plant species</th>
<th>Estimated number of stomata per cm$^2$ of leaf surface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper surface of leaf</td>
</tr>
<tr>
<td>A</td>
<td>4000</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>8500</td>
</tr>
<tr>
<td>D</td>
<td>8000</td>
</tr>
</tbody>
</table>

(a) Which plant species probably lives in a dry region? 

Explain the reason for your answer.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(b) All four species have more stomata on the lower surface of their leaves than on the upper surface.

Suggest how this could help the plants to survive better.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Q16.

Diagram 1 shows two villi in the small intestine of a healthy person.
(a) Describe two features of the villi which help the small intestine to function.

1. _________________________________________________________________

___________________________________________________________________

2. _________________________________________________________________

___________________________________________________________________

(2)

(b) Diagram 2 shows two villi in the small intestine of a person with coeliac disease.

(i) How do the villi of the person with coeliac disease differ from those of a healthy person?

___________________________________________________________________

___________________________________________________________________

(1)

(ii) Suggest how this difference might affect how well the small intestine functions.

___________________________________________________________________

___________________________________________________________________

(1)

(Total 4 marks)
Q17.
Enzymes are used in biological detergents.

(a) Name the type of enzyme that digests stains containing fats.
___________________________________________________________________

(b) A new detergent is marketed as being ‘environmentally-friendly’.

Scientists compared the performance of this new detergent with an existing detergent.

They measured the time taken by the two detergents to remove a fat stain at different temperatures.

The graph shows their results.

![Graph showing time taken to remove stain vs. temperature]

(i) Describe the effect of increasing the temperature on the time taken by the existing detergent to remove the stain.

______________________________________________________________
______________________________________________________________
______________________________________________________________
______________________________________________________________

(ii) The new detergent works at a lower temperature than the existing one.

Is the new detergent likely to be more ‘environmentally-friendly’ than the existing detergent?

Draw a ring around your answer. Yes / No

Explain the reason for your answer.

______________________________________________________________
______________________________________________________________
Q18.

A popular diet book claims that a low-carbohydrate diet results in quicker weight loss and a more healthy body than a low-fat diet.

Scientists carried out an investigation to see if this claim is true.

- They used 120 overweight volunteers divided into two equal groups.
- **Group 1** was given a diet containing less than 20 g of carbohydrate per day.
- **Group 2** was given a low-fat diet. This contained less than 30% of energy from fat and less than 300 mg of cholesterol per day.
- Both groups were given the same exercise programmes and a weekly information meeting.
- Both groups were allowed only 2000 kilocalories per day.

The results after 24 weeks are shown in the table.

<table>
<thead>
<tr>
<th></th>
<th>Group 1 Low-carbohydrate diet</th>
<th>Group 2 Low-fat diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of volunteers</td>
<td>76%</td>
<td>57%</td>
</tr>
<tr>
<td>who completed the trial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean change in body mass</td>
<td>−12.9%</td>
<td>−6.7%</td>
</tr>
<tr>
<td>Mean change in body fat mass</td>
<td>−9.4 kg</td>
<td>−4.8 kg</td>
</tr>
<tr>
<td>Mean change in blood HDL</td>
<td>+55 mg per litre</td>
<td>−16 mg per litre</td>
</tr>
<tr>
<td>concentration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean change in blood LDL concentration</td>
<td>+16 mg per litre</td>
<td>−74 mg per litre</td>
</tr>
</tbody>
</table>

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

___________________________________________________________________ (1)

(b) Give one variable that the scientists tried to control in this investigation.

___________________________________________________________________ (1)

(c) Give two ways in which the method used by the scientists could have led to unreliable data.

1. _________________________________________________________________

___________________________________________________________________

2. _________________________________________________________________

___________________________________________________________________ (2)

(d) Does the data support the claim in the book?

Draw a ring around your answer. Yes / No

Give two reasons for your answer.

1. __________________________________________________________________

___________________________________________________________________

2. __________________________________________________________________

___________________________________________________________________ (2)

(Total 6 marks)

Q19.

The small intestine is lined with millions of villi.
The diagram shows the structure of a villus.
In the small intestine, some of the products of digestion are absorbed into the blood by **active transport**.

(a) Explain what is meant by *active transport*.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(2)

(b) How do microvilli and mitochondria help in the active transport of the products of digestion from the small intestine into the blood?

Microvilli ________________________________________________________________

________________________________________________________________________

Mitochondria ____________________________________________________________

________________________________________________________________________

(2)

(Total 4 marks)

**Q20.**

A student pedalled an exercise cycle at constant speed for 5 minutes. The student’s heart rate was recorded at one-minute intervals during the exercise and also during recovery.

The results are shown in the graph.
(a) Describe, in as much detail as you can, the changes in heart rate between 0 and 14 minutes.

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________

(3)

(b) How do arteries supplying the leg muscles alter the rate of blood flow through them during exercise?

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

(1)

(c) Explain how an increase in heart rate helped the student during exercise.

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________
Q21.
Diet and exercise affect health.

(a) Many people are obese (very overweight).
Obesity can lead to heart disease.
Other than heart disease, name two conditions which are linked to obesity.
1. _________________________________________________________________
2. _________________________________________________________________

(b) The graph shows the number of deaths from heart disease each year in the UK.

The pattern for deaths from heart disease in men is different from the pattern in women.

(i) Give two differences between the patterns for men and women.
1. _________________________________________________________________
2. _________________________________________________________________

(ii) Suggest two reasons for the difference in the number of deaths from heart disease in men and women between the ages of 40 and 60.
1. _________________________________________________________________
2. _________________________________________________________________
Scientists have developed drugs to reduce the concentration of cholesterol in the blood.

Give the **three** main stages in testing a new drug before it is sold to the public.

1. ___________________________________________________________________________
2. ___________________________________________________________________________
3. ___________________________________________________________________________

(Total 9 marks)

Q22.

(a) Name the process by which water is lost from plant leaves.

____________________________________________________________________________________

(1)

(b) Some students set up the apparatus shown in the diagram to measure the water loss from a potted plant.

The apparatus was placed in different environmental conditions:

A in still air at 20 °C.
B in still air at 25 °C.
C in a wind at 20 °C.
D in a wind at 25 °C.

Readings from the balance were recorded by a datalogger at 10-minute intervals.
The results are given in the table.

<table>
<thead>
<tr>
<th>Time in minutes</th>
<th>Balance reading in grams</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>0</td>
<td>285.6</td>
</tr>
<tr>
<td>10</td>
<td>285.3</td>
</tr>
<tr>
<td>20</td>
<td>284.9</td>
</tr>
<tr>
<td>30</td>
<td>284.7</td>
</tr>
</tbody>
</table>

(i) Under which conditions, A, B, C or D, was water lost most rapidly? 

(ii) Explain, as fully as you can, why water was lost most rapidly under these conditions.

Q23.

Diagrams A, B and C show cells from different parts of the human body, all drawn to the same scale.

A  

B  

C

Key
- Mitochondrion
- Ribosome
(a) Which cell, A, B or C, appears to have adaptations to increase diffusion into or out of the cell? 

 Give one reason for your choice.

___________________________________________________________________
___________________________________________________________________

(1) 

(b) (i) Cell C is found in the pancreas.

 Name one useful substance produced by the pancreas.

___________________________________________________________________
___________________________________________________________________

(1)

(ii) Use information from the diagram to explain how cell C is adapted for producing this substance.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2)

(Total 4 marks)

Q24.

(a) The table shows the effect of exercise on the action of one person’s heart.

<table>
<thead>
<tr>
<th>Heart rate in beats per minute</th>
<th>At rest</th>
<th>During exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>72</td>
<td>165</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Volume of blood leaving the heart in each beat in cm(^3)</th>
<th>75</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart output in cm(^3) per minute</td>
<td>5400</td>
<td></td>
</tr>
</tbody>
</table>

(i) Calculate the heart output for this person during exercise.

Show clearly how you work out your answer.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(Total 4 marks)
Q25.
Many people who are overweight try slimming programmes.
A research study evaluated four different slimming programmes over 6 months.
Scientists selected a group of 40 people for each slimming programme and a control group.
Each of the five groups was matched for age, gender and mass.
The graph shows the results of the study.
(a) Give two control variables that were used in this study.
1. ________________________________________________________________
2. ________________________________________________________________

(2)

(b) Give two conclusions that can be drawn from the results of this study.
1. ________________________________________________________________
2. ________________________________________________________________

(2)

(c) The costs of the four programmes were:
• Atkins book cost £3
• Rosemary Conley classes cost £140 for 6 months
• Weight Watchers classes cost £170 for 6 months
• Twice-daily Slim-Fast meal replacements cost £240 for 6 months.

Use this information and the graph to answer this question.
Which is the most cost effective of the four programmes?

_____________________________________________________

Explain the reason for your answer.

_____________________________________________________

Some slimming programmes include daily exercise.

Explain how daily exercise helps a person to lose mass.

Q26.

A group of students investigated the effect of temperature on the action of the enzyme lipase.

The students:

• put 1 cm$^3$ of lipase solution into a test tube
• put 5 cm$^3$ of lipid into a different test tube
• put both tubes in a water bath at 5 °C for 3 minutes
• mixed the lipid with the lipase solution.

Every five minutes the students tested a sample of the mixture for lipid, until no lipid remained.

The students repeated the experiment at different temperatures.

(a) To make their investigation fair the students needed to control some variables.

Give one variable the students controlled in their investigation.
(b) The tubes of lipase solution and lipid were kept separately in the water bath for 3 minutes before mixing. Why?

Tick ( ✓ ) one box.

- So that the lipase broke down the lipid quickly
- So that the lipase and the lipid reached the right temperature
- To give enough time for the lipase to break down the lipid
- To give enough time for the water bath to heat up

(1)

The table shows the students’ results.

<table>
<thead>
<tr>
<th>Temperature in C</th>
<th>Time taken until no lipid remained in minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>35</td>
<td>5</td>
</tr>
<tr>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>95</td>
<td>lipid still there after 120 minutes</td>
</tr>
</tbody>
</table>

(c) Describe the effect on the breakdown of the lipid of increasing the temperature from 5 °C to 50 °C.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2)

(d) Suggest two ways in which the students could have improved their investigation.

Use information from the students’ method and the results table to help you.

1. _________________________________________________________________
   __________________________________________________________________
   __________________________________________________________________
   __________________________________________________________________

2. ___________________ ________________________________
(e)  

(i) The lipase did **not** break down the lipid at 95 °C.  
Why?  

(ii) At 35 °C the lipase broke down the lipid after 5 minutes.  
What new substances will be in the tube?  
Draw a ring around one answer.  

- amino acids  
- fatty acids and glycerol  
- sugars  

Q27.  
A student removed three similar leaves from a plant. The student spread petroleum jelly (a waterproofing substance) on some of the leaves, as follows:  

**Leaf A:** on the lower surface  
**Leaf B:** on the upper surface  
**Leaf C:** none.  

The student placed each leaf in a separate beaker. He weighed each beaker at intervals. The results are shown in the table.  

<table>
<thead>
<tr>
<th>Time in hours</th>
<th>Mass of leaf + beaker in grams</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leaf A</td>
</tr>
<tr>
<td>0</td>
<td>50.00</td>
</tr>
<tr>
<td>0</td>
<td>49.99</td>
</tr>
<tr>
<td>3</td>
<td>49.97</td>
</tr>
<tr>
<td>5</td>
<td>49.95</td>
</tr>
</tbody>
</table>

(a) Which leaf, **A**, **B** or **C**, lost most water?  

(b) The diagram shows the appearance of the upper and lower surfaces of one of the leaves under a microscope.
(i) Name cell X. ____________________

(ii) The petroleum jelly had a greater effect when it was spread on the lower surface than when it was spread on the upper surface.

Use information from the diagram to explain why.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

(2)

(Total 4 marks)

Q28.

The diagram shows the human circulation system.
(a)  (i) Give the letter of **one** blood vessel that is an artery. 

(ii) Give the letter of **one** blood vessel that carries oxygenated blood.

(b) During exercise, the heart rate increases.

Explain, as fully as you can, why this increase is necessary.
Some students investigated the effect of pH on the digestion of boiled egg white by an enzyme called pepsin. Egg white contains protein.

The students:
- put a glass tube containing boiled egg white into a test tube
- added a solution containing pepsin at pH 7
- set up six more tubes with solutions of pepsin at different pH values
- left the test tubes for 24 hours at room temperature.

The image below shows one of the test tubes, at the start and at the end of the 24 hours.

(a) (i) Name the product of protein digestion.

______________________________________________________________

(ii) What type of enzyme digests protein?

Tick (✓) one box.

- amylase
- lipase
- protease

(b) The egg white in each tube was 50 mm long at the start of the investigation. The table below shows the students’ results.
<table>
<thead>
<tr>
<th>pH</th>
<th>Length in mm of boiled egg white after 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>50</td>
</tr>
</tbody>
</table>

(i) At which pH did the pepsin work best?

\[ \text{pH} \] \hspace{1cm} (1)

(ii) The answer you gave in part (b)(i) may not be the exact pH at which pepsin works best.

What could the students do to find a more accurate value for this pH?

____________________________________________________________________________________________________________________________________________________ (2)

(iii) There was no change in the length of the egg white from pH 5 to pH 7.

Explain why.

____________________________________________________________________________________________________________________________________________________ (2)

(c) Pepsin is made by the stomach.

Name the acid made by the stomach which allows pepsin to work well.

____________________________________________________________________________________________________________________________________________________ (1)

(Total 8 marks)
Q30.

A patient has a disease. The disease damages his pancreas.

A doctor prescribes a course of treatment for the patient:
‘Take one capsule with each meal.’

Each capsule contains hundreds of small, dry beads.

The beads are made of enzymes. The pancreas normally produces these enzymes.

The outer coating of the capsule is made of lipid.

(a) One enzyme in the beads is lipase.

In a healthy person, lipase is made in the pancreas.

Name two other enzymes made in the pancreas of a healthy person.

1. _________________________________________________________________
2. _________________________________________________________________

(b) The lipid coating on the capsule makes sure that the enzymes are not released until the capsule reaches the small intestine.

Explain how.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(c) The lipase in the beads does not digest the lipid coating around the capsule.

Suggest why.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(Total 5 marks)

Q31.
The human lung has about 80 million alveoli. The diagram shows some alveoli in a human lung.

(a) Give three features of the alveoli that allow large amounts of oxygen to enter the blood.
1. ____________________________________________________________
2. ____________________________________________________________
3. ____________________________________________________________

(b) (i) Name the process by which oxygen passes from the air into the blood.
______________________________________________________________

(ii) Breathing allows large amounts of oxygen to enter the blood. Explain how breathing does this.
______________________________________________________________
______________________________________________________________
______________________________________________________________

(Total 6 marks)

Q32.
Scientists estimate that about one third of cancers in the UK may be linked to obesity.

Name two diseases linked to obesity.
Do not give cancer as one of your answers.

1. ________________________________________________________________
2. ________________________________________________________________

(Total 2 marks)

Q33.

Diagram 1 shows a section through the heart.

(a) On the diagram, name the parts labelled A, B, C and D.

(b) Diagram 2 shows the blood vessels that supply the heart muscle.

Part of one of the blood vessels has become narrower.

(i) Name blood vessel E.
(ii) Give one method of treating the narrowed part of blood vessel E.

(iii) Explain how the method of treatment works.

(c) Diagram 3 shows part of the blood supply in the lungs.

(i) Name the types of blood vessel labelled F, G and H.

F

G

H

(ii) Give one way in which the composition of the blood in vessel F is different from the composition of the blood in vessel H.

Q34.

Scientists at a drug company developed a new pain-killing drug, drug X.
(a) Painkillers do **not** cure infectious diseases.

Why?

(b) The scientists compared drug **X** with two other pain-killing drugs, drug **A** and drug **B**.

In their investigation the scientists:

- chose 600 volunteers. The volunteers were all in pain
- gave 200 of the volunteers a standard dose of drug **A**
- gave 200 of the volunteers a standard dose of drug **B**
- gave 200 of the volunteers a standard dose of drug **X**.

Over the next seven hours the volunteers recorded how much pain they felt.

To get valid results the three groups of volunteers should be matched for as many factors as possible.

Suggest **two** of the factors that should be matched.

(c) The graph shows the results of the investigation.

![Graph of pain percentage decrease over time for drugs A, B, and X.]

(i) How much pain did the volunteers still feel, four hours after taking drug **A**?

____________________________________________ percent

(ii) Give **one** advantage of taking drug **A** and **not** drug **B**.

____________________________________________
(1) (iii) Give two advantages of taking drug B and not drug A.

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

(2) (d) Drug X is much more expensive than both drug A and drug B.

A pharmacist advised a customer that it would be just as good to take drug A and drug B together instead of drug X.

Do you agree with the pharmacist’s advice?

Give reasons for your answer.

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

(3) (Total 10 marks)

Q35.

The graph shows the rate of transpiration from a plant at different times of the day.
Transpiration occurs mainly in the leaves of a plant.

(a) (i) What is transpiration?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

(ii) Through which part of a leaf does most transpiration occur?

________________________________________________________________________

(b) In this investigation, the rate of transpiration decreases between 16:00 hours and 19:00 hours.

(i) Calculate the average rate of decrease per hour in the rate of transpiration over this time.

Show clearly how you work out your answer.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Rate = _______________ arbitrary units per hour

(ii) Suggest **one** explanation for the decrease in the rate of transpiration between 16:00 hours and 19:00 hours.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

(Total 7 marks)

Q36.

(a) The graph shows the effect of pH on the activities of three enzymes, X, Y and Z. These enzymes help to digest food in the human digestive system. Each enzyme is produced by a different part of the digestive system.

(i) What is the optimum (best) pH for the action of enzyme Z?

__________________________________________

(1)

(ii) The stomach makes a substance that gives the correct pH for enzyme action in the human stomach.

Name this substance. ________________________________________________________

(1)

(iii) Which enzyme, X, Y or Z, will work best in the human stomach?

__________________________________________

(1)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*
Different parts of the human digestive system help to break down molecules of fat so that they can be absorbed into the body.

Describe how.

To gain full marks you should refer to:

- the enzyme and where the enzyme is produced
- the products of digestion
- any other chemicals involved.

---

Q37.

The number of people in the UK with tumours is increasing.

(a) (i) Describe how tumours form.

---

(6)

(Total 9 marks)
(ii) Tumours can be malignant or benign.

What is the difference between a malignant tumour and a benign tumour?

________________________________________________________________________

________________________________________________________________________

(1)

(b) Describe how some tumours may spread to other parts of the body.

________________________________________________________________________

________________________________________________________________________

(1)

(c) People from Northern Europe have fair skin and many people have malignant melanoma skin cancer.

The graph shows how the number of people in the UK with malignant melanoma changed between 1985 and 2008.

The bars on the graph show the number of people in the UK who travelled abroad and the number who took cheap holidays in the sun in 1985 and 2005.

(i) Describe the trends in the number of people with malignant melanoma skin cancer between 1985 and 2008.
Q38.

Scientists investigated the effectiveness of three slimming programmes, A, B and C.

The scientists recorded the body mass of four groups of volunteers each month for 6 months. Three of the groups were each given a different slimming programme. The fourth group was a control group.

The graph shows the mean change of body mass each month for all four groups.
(a) (i) What should the control group eat?
______________________________________________________________________________
______________________________________________________________________________
(1)

(ii) Why did the scientists include a control group in this study?
______________________________________________________________________________
______________________________________________________________________________
(1)

(b) (i) The three groups of volunteers using the slimming programmes each showed a similar pattern of body mass loss over the 6 months.
Describe this pattern.
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________
(2)

(ii) All the slimming programmes seemed to be effective.
How does the information in the graph show this?
Q39.

One factor that may affect body mass is *metabolic rate*.

(a) (i) What is meant by *metabolic rate*?

(ii) Metabolic rate is affected by the amount of activity a person does.

Give two other factors that may affect a person's metabolic rate.

1. ____________________________________________________________

2. ____________________________________________________________

(b) Predicted early death is the number of years that a person will die before the mean age of death for the whole population. The predicted early death of a person is affected by their body mass.

Scientists have calculated the effect of body mass on predicted early death.

The graph shows the results of the scientists' calculations.
The number of times above or below ideal body mass is given by the equation:

\[
\frac{\text{Actual body mass}}{\text{Ideal body mass}}
\]

In the UK the mean age of death for women is 82.

A woman has a body mass of 70 kg. The woman’s ideal body mass is 56 kg.

(i) Use the information from the graph to predict the age of this woman when she dies.

______________________________________________________________
______________________________________________________________
______________________________________________________________

Age at death = ___________ years

(2)

(ii) The woman could live longer by changing her lifestyle.

Give two changes she should make.

1. ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

2. ____________________________________________________________
   ____________________________________________________________
   ____________________________________________________________

(2)

(Total 7 marks)

Q40.

(a) The diagrams show the structures of a yeast cell and a bacterial cell.

(i) Both the yeast cell and the bacterial cell have structures A and B.

Name structures A and B.
(ii) The yeast cell and the bacterial cell have different shapes and sizes.

Give **one** other way in which the structure of the bacterial cell is different from the structure of the yeast cell.

________________________________________________________________________

________________________________________________________________________

(1)

(b) Sourdough bread is light in texture and tastes slightly sour. The bread is made using two types of microorganism, a yeast and a bacterium. The bacterium can make acids such as lactic acid. The acid makes the bread taste sour.

The graph shows how the growth rates of the yeast and the bacteria change with temperature.

(i) Sourdough bread rises fastest at 27°C.

Use information from the graph to explain why.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(2)

(ii) The bread tastes most sour if it rises at 32°C.

Use information from the graph to explain why.

________________________________________________________________________
Q41.
The parts of the blood can be separated from each other by spinning the blood in a centrifuge.

The image below shows the separated parts of a 10 cm³ blood sample.

(a) Calculate the percentage of the blood that is made up of plasma.

___________________________________________________________________
___________________________________________________________________

Answer = _______________%

(b) Name three chemical substances transported by the plasma.

1. _________________________________________________________________
2. _________________________________________________________________
3. _________________________________________________________________

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

White blood cells are part of the immune system. White blood cells help the body to defend itself against pathogens.

Describe how pathogens cause infections and describe how the immune system defends the body against these pathogens.
Q42.

The diagram shows part of the human digestive system.

(a) Name the parts of the digestive system labelled A, B, C and D.

A __________________________________________

B __________________________________________

C __________________________________________

D __________________________________________

(b) A student has eaten a steak for dinner. The steak contains protein and fat.

(i) Describe how the protein is digested.
Explain two ways in which bile helps the body to digest fat.

A group of students investigated the action of salivary amylase. The students:

- collected a sample of salivary amylase
- put a different pH solution and 5 cm³ of a food substance in each of 6 test tubes
- added 1 cm³ of salivary amylase to each of the 6 test tubes
- recorded the amylase activity after 10 minutes.

The results are shown in the table.

<table>
<thead>
<tr>
<th>pH</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amylase activity in arbitrary units</td>
<td>12</td>
<td>10</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

(i) Name the food substance that amylase breaks down.

(ii) Suggest what happens to the breakdown of this substance when food reaches the stomach.

Use information from the table to help you to answer this question.
Q43.

The heart pumps the blood around the body. This causes blood to leave the heart at high pressure.

The graph shows blood pressure measurements for a person at rest. The blood pressure was measured in an artery and in a vein.

(a) Which blood vessel, A or B, is the artery?

Blood vessel ________
Give **two** reasons for your answer.

Reason 1 ___________________________________________________________
___________________________________________________________________
___________________________________________________________________

Reason 2 ___________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2)

(b) Use information from the graph to answer these questions.

(i) How many times did the heart beat in 15 seconds? ___________

(1)

(ii) Use your answer from part (b)(i) to calculate the person’s heart rate per minute.

___________________________________________________________________
___________________________________________________________________

Heart rate = __________ beats per minute

(1)

(c) During exercise, the heart rate increases.

The increased heart rate supplies useful substances to the muscles at a faster rate.

Name **two** useful substances that must be supplied to the muscles at a faster rate during exercise.

1. _________________________________________________________________

2. _________________________________________________________________

(2)

(Total 6 marks)

Q44.

The diagram below shows the human digestive system.
(a) (i) What is Organ A?

Draw a ring around the correct answer.

- gall bladder
- liver
- stomach

(ii) What is Organ B?

Draw a ring around the correct answer.

- large intestine
- pancreas
- small intestine

(b) Digestive enzymes are made by different organs in the digestive system.

Complete the table below putting a tick (✓) or cross (✗) in the boxes.

The first row has been done for you.

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>salivary glands</th>
<th>stomach</th>
<th>pancreas</th>
<th>small intestine</th>
</tr>
</thead>
<tbody>
<tr>
<td>amylase</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>lipase</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>protease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(c) The stomach also makes hydrochloric acid.
How does the acid help digestion?

(d) Draw one line from each digestive enzyme to the correct breakdown product.

<table>
<thead>
<tr>
<th>Digestive enzyme</th>
<th>Breakdown products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amylase breaks down starch into......</td>
<td>amino acids.</td>
</tr>
<tr>
<td>Lipase breaks down fats into...</td>
<td>bases.</td>
</tr>
<tr>
<td>Protease breaks down proteins into...</td>
<td>fatty acids and glycerol.</td>
</tr>
<tr>
<td></td>
<td>sugars.</td>
</tr>
</tbody>
</table>

Q45.
Some students investigated the effect of light intensity on the rate of photosynthesis.

They used the apparatus shown in Diagram 1.

Diagram 1

The students:

- placed the lamp 10 cm from the pondweed
counted the number of bubbles of gas released from the pondweed in 1 minute

• repeated this for different distances between the lamp and the pondweed.

(a) The lamp gives out heat as well as light.

What could the students do to make sure that heat from the lamp did not affect the rate of photosynthesis?

______________________________________________________________________________________________

______________________________________________________________________________________________

(1)

(b) The table shows the students’ results.

<table>
<thead>
<tr>
<th>Distance in cm</th>
<th>Number of bubbles per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>84</td>
</tr>
<tr>
<td>15</td>
<td>84</td>
</tr>
<tr>
<td>20</td>
<td>76</td>
</tr>
<tr>
<td>40</td>
<td>52</td>
</tr>
<tr>
<td>50</td>
<td>26</td>
</tr>
</tbody>
</table>

(i) At distances between 15 cm and 50 cm, light was a limiting factor for photosynthesis.

What evidence is there for this in the table?

______________________________________________________________________________________________

______________________________________________________________________________________________

(1)

(ii) Give one factor that could have limited the rate of photosynthesis when the distance was between 10 cm and 15 cm.

______________________________________________________________________________________________

(1)

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

Diagram 2 shows a section through a plant leaf.

Diagram 2
Describe the structure of the leaf and the functions of the tissues in the leaf. You should use the names of the tissues in your answer.

Q46.

Plant roots absorb water from the soil by osmosis.

(a) What is osmosis?
(b) The image below shows part of a plant root.

The plant root is adapted for absorbing water from the soil.

Use information from the diagram to explain how this plant root is adapted for absorbing water.

_________________________________________________________

_________________________________________________________

_________________________________________________________

_________________________________________________________

_________________________________________________________

(3) (Total 6 marks)

Q47.

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.

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

1. ____________________________
2. ____________________________
3. ____________________________

Q48.

Diagram 1 shows a section through the heart.
(a) Use words from the box to name the structures labelled A and B on Diagram 1.

<table>
<thead>
<tr>
<th>aorta</th>
<th>atrium</th>
<th>pulmonary artery</th>
<th>ventricle</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>

(2)

(b) The tissue in the wall of the heart contracts.

(i) What type of tissue is this?

Tick (✓) one box.

- muscular
- glandular
- epithelial

(1)

(ii) What does the heart do when this tissue contracts?

____________________________________________________________________________

____________________________________________________________________________

(1)

(c) Draw arrows on Diagram 2 to complete the route taken by deoxygenated blood through the heart.

Diagram 2
(d) The graph shows the percentage (%) of adults in the UK who have coronary heart disease.

(i) Look at the graph.

Which group of people is most at risk of having coronary heart disease in the UK?

(ii) Explain what happens to the heart in coronary heart disease.
Q49.

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

(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?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(ii) Explain why translocation is important to plants.

________________________________________________________________________

________________________________________________________________________
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

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

Q50.

The photograph shows a fossil of a prehistoric bird called *Archaeopteryx.*
(a) Describe three ways fossils can be made.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(3)

(b) The drawing shows what an *Archaeopteryx* might have looked like when it was alive.

Scientists think that *Archaeopteryx* was a predator.

(i) Look at the drawing.
Write down three adaptations that might have helped *Archaeopteryx* to catch prey.

How would each adaptation have helped *Archaeopteryx* to catch prey?

Adaptation 1

How it helps

Adaptation 2

How it helps

Adaptation 3

How it helps

(ii) *Archaeopteryx* is now extinct.

Give two reasons why animals may become extinct.

1. ____________________________________________________________

2. ____________________________________________________________

Q51.

Gas exchange takes place in the lungs.

The diagram shows an alveolus next to a blood capillary in a lung.

The arrows show the movement of two gases, A and B.
(a) (i) Draw a ring around the correct answer to complete the sentence.

Gases A and B move by

- diffusion.
- osmosis.
- respiration.

(1)

(ii) Gas A moves from the blood to the air in the lungs.

Gas A is then breathed out.

Name Gas A.

______________________________________________________________

(1)

(iii) Which cells in the blood carry Gas B?

Draw a ring around the correct answer.

platelets red blood cells white blood cells

(1)

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

The average surface area of 1 million alveoli is 0.25 m².

Calculate the total surface area of a human lung.

______________________________________________________________

Answer __________________________ m²

(2)

(c) An athlete trains to run a marathon. The surface area of each of the athlete’s lungs has increased to 80 m².

Give one way in which this increase will help the athlete.

______________________________________________________________

______________________________________________________________

(1)

(Total 6 marks)

Q52.

The circulatory system transports substances such as glucose and oxygen around the body.

(a) Name two other substances that the circulatory system transports around the body.

1. _________________________________________________________________

2. _________________________________________________________________

(2)
(b)  
(i) Blood is a tissue. Blood contains red blood cells and white blood cells. 
Name two other components of blood. 
1. ____________________________________________________________
2. ____________________________________________________________  (2)

(ii) The heart is part of the circulatory system. 
What type of tissue is the wall of the heart made of? 
___________________________________________________________________  (1)

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

Every year, many patients need to have heart valve replacements. 
The table gives information about two types of heart valve.

<table>
<thead>
<tr>
<th>Living human heart valve</th>
<th>Cow tissue heart valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>• It has been used for transplants for more than 12 years.</td>
<td>• It has been used since 2011.</td>
</tr>
<tr>
<td>• It can take many years to find a suitable human donor.</td>
<td>• It is made from the artery tissue of a cow.</td>
</tr>
<tr>
<td>• It is transplanted during an operation after a donor has been found.</td>
<td>• It is attached to a stent and inserted inside the existing faulty valve.</td>
</tr>
<tr>
<td>• During the operation, the patient's chest is opened and the old valve is removed before the new valve is transplanted.</td>
<td>• A doctor inserts the stent into a blood vessel in the leg and pushes it through the blood vessel to the heart.</td>
</tr>
</tbody>
</table>

A patient needs a heart valve replacement. A doctor recommends the use of a cow tissue heart valve.

Give the advantages and disadvantages of using a cow tissue heart valve compared with using a living human heart valve. 

Use information from the table and your own knowledge in your answer. 
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Q53.

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.

\[
\text{glucose} \quad \text{glycerol} \quad \text{glycogen} \\
\text{fat} \xrightarrow{\text{lipase}} \text{fatty acids} + \underline{\text{_______}}
\]

(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. _________________________________________________________________
   _________________________________________________________________

(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)

Q54.

Emphysema is a disease of the lungs. People who smoke cigarettes are more likely to suffer from emphysema. The diagrams show lung tissue from a healthy person and lung tissue from a person with emphysema. The diagrams are drawn to the same scale.
Lung tissue from a healthy person

Lung tissue from a person with emphysema

Explain how emphysema reduces the amount of oxygen which diffuses into the blood

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

(Total 2 marks)

Q55.

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)

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.
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.

\[
\text{Mean} = \frac{38 + 65 + 41 + 42 + 39}{5} = \frac{225}{5} = 45
\]

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

____________________

(1)

(iv) Predict the activity of the enzyme at pH 9.0.

____________________ arbitrary units

(1)

(v) Suggest why the enzyme’s activity at pH 3.0 is zero.

______________________________________________________________

______________________________________________________________

(1)

(Total 15 marks)

Q56.

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.
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

(c) 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>---------------------------------------------</td>
<td>----</td>
<td>----</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. ___________________________________________________________________

___________________________________________________________________

(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)

(Total 9 marks)

**Q57.**

A potometer is a piece of apparatus that can be used to measure water uptake by a leafy shoot.

**Figure 1** shows a potometer.

![Figure 1](image-url)
Some students used a potometer like the one shown in Figure 1.

- They measured the water taken up by a shoot in normal conditions in a classroom.
- As the water was taken up by the shoot, the level of water in the capillary tube went down.
- The students recorded the level of the water in the capillary tube at 2-minute intervals for 10 minutes.

Table 1 shows the students' results.

<table>
<thead>
<tr>
<th>Time in minutes</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of water (on scale) in capillary tube in mm</td>
<td>2.5</td>
<td>3.6</td>
<td>4.4</td>
<td>5.4</td>
<td>6.5</td>
<td>7.5</td>
</tr>
</tbody>
</table>

The area of the cross section of the capillary tube was 0.8 mm².

(a) (i) Complete the following calculation to find the volume of water taken up by the shoot in mm³ per minute.

Distance water moved along the scale in 10 minutes = _______ mm

Volume of water taken up by the shoot in 10 minutes = _______ mm³

Therefore, volume of water taken up by the shoot in 1 minute = _______ mm³

(ii) The students repeated the investigation but this time placed the potometer next to a fan blowing air over the leafy shoot.

Suggest how the results would be different. Give a reason for your answer.
(b) The students repeated the investigation at different temperatures.

The results are shown in Table 2.

<table>
<thead>
<tr>
<th>Temperature in °C</th>
<th>Rate of water uptake in mm³ per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>15</td>
<td>0.4</td>
</tr>
<tr>
<td>20</td>
<td>1.0</td>
</tr>
<tr>
<td>25</td>
<td>2.1</td>
</tr>
<tr>
<td>30</td>
<td>3.2</td>
</tr>
<tr>
<td>35</td>
<td>4.0</td>
</tr>
<tr>
<td>40</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Plot the data from Table 2 on the graph paper in Figure 2.

Choose suitable scales, label both axes and draw a line of best fit.
Q58.
The human body is organised to carry out many different functions.

(a) Use words from the box to complete Figure 1 by putting the parts of the body in order of size from smallest to largest.

The smallest one has been done for you.

(c) What would happen to the leaves if the potometer was left for a longer time at 40 °C?

Explain your answer.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(Total 13 marks)
(b) The stomach is made of different types of tissue.

Draw one line from each type of stomach tissue to the correct description.

- **Epithelial tissue**: Allows food to be churned around the stomach
- **Glandular tissue**: Covers the outside and the inside of the stomach
- **Muscular tissue**: Produces digestive juices
- **Coordinates nerve impulses**

(c) Animals can react to their surroundings because they have nervous systems.

A student investigated the behaviour of small animals called woodlice.

The student set up the investigation as shown in Figure 2.

- The student covered one half of a Petri dish with black paper to make that side of the Petri dish dark.
- The other side had no cover.
- The student put five woodlice into each side of the dish and then put the clear Petri dish lid back on the dish.
After 30 minutes, all the woodlice had moved to the dark side of the Petri dish.

(i) In this investigation, what is the **stimulus** that the woodlice responded to?

__________________________________________________________________________

(1)

(ii) In this investigation, what is the **response** that the woodlice made?

__________________________________________________________________________

(1)

(iii) The student concluded that woodlice prefer dark conditions.

Give **two** ways in which the student could improve the investigation to be sure that his conclusion was correct.

1. ____________________________________________________________

__________________________________________________________________________

2. ____________________________________________________________

__________________________________________________________________________

(2)

(Total 9 marks)

**Q59.**

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. ____________________________________________________________________________________________

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

____________________________________________________

Mean rate = ________________ units per minute

(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.
The table shows the volume of blood flowing through different organs at three levels of exercise.

<table>
<thead>
<tr>
<th>Organ(s)</th>
<th>Volume of blood flowing through organ(s) in cm³ per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Light exercise</td>
</tr>
<tr>
<td>Gut</td>
<td>1 100</td>
</tr>
<tr>
<td>Kidneys</td>
<td>900</td>
</tr>
<tr>
<td>Brain</td>
<td>750</td>
</tr>
<tr>
<td>Heart muscles</td>
<td>350</td>
</tr>
<tr>
<td>Skeletal muscles</td>
<td>4 500</td>
</tr>
<tr>
<td>Skin</td>
<td>1 500</td>
</tr>
<tr>
<td>Other</td>
<td>400</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9 500</strong></td>
</tr>
</tbody>
</table>

(a) (i) Which organ has a constant flow of blood through it?

_________________________________________________________________________________________________________(1)

(ii) Which organ has the greatest reduction in the volume of blood supplied during heavy exercise compared with light exercise?

_________________________________________________________________________________________________________(1)

(iii) What proportion of the blood flows through the heart muscle during heavy exercise?

_________________________________________________________________________________________________________(1)

(b) The volume of blood flowing through the skeletal muscles increases greatly during exercise.

Give **two** ways in which the body brings about this increase.

1. _________________________________________________________________
(c) During exercise, the concentration of carbon dioxide in the blood increases. Explain what causes this increase.
Mark schemes

Q1.

(a)  A

no mark – can be specified in reason part
if B given = no marks throughout
if unspecified plus two good reasons = 1 mark

high(er) pressure in A
allow opposite for B
do not accept ‘zero pressure’ for B

pulse / described in A
accept fluctuates / ‘changes’
allow reference to beats / beating
ignore reference to artery pumping

(b) (i)  17

(ii)  68

accept correct answer from candidate’s (b)(i) × 4

(c) (i) oxygen / oxygenated blood
allow adrenaline
ignore air

glucose / sugar
extra wrong answer cancels eg
sucrose / starch / glycogen / glucagons / water
allow fructose as an alternative to glucose
ignore energy
ignore food

(ii) carbon dioxide / CO₂ / lactic acid
allow CO2 / CO²
ignore water

Q2.

(a)  A – artery
B – capillary
C – vein

(b) transport OWTTE
(c) increased oxygen decreased carbon dioxide

Q3.
(i) the mass got less
   *accept it got lighter*
   
   *award 1 mark for water was lost from the plant*
   
   water was taken into the plant or roots absorbed water
   *do not accept soaked into plant*

(ii) to check the effect of the plant or to act as a control or to show that it was not due to evaporation from water
   *do not accept to keep it fair or to check that it was fair*
   *do not accept fair test*

Q4.
(i) liver

(ii) liver or B stores glycogen or pancreas or D makes insulin

   *clear description of link*

Q5.
(i) any two from:
   
   urea
   
   carbon dioxide
   
   water
   
   lactic acid

(ii) higher concentration of glucose or more glucose in blood than cells

   *diffuses across*
Q6.
(a) liver

mouth or salivary glands or
duodenum or small intestine or
pancreas

pancreas

accept duodenum or ileum or
small intestine

do not accept stomach

stomach or duodenum or ileum or
small intestine or pancreas

(b) teeth breakdown food

accept chewing

amylase or saliva (breaks down starch)

(c) produces bile (salts)

emulsifies (fat) or produces droplets
or disperses fat

Q7.
(a) (i) light or solar

do not credit sun’s energy
do not credit radiant

(ii) chlorophyll

(iii) chloroplast

(iv) \( \text{CO}_2 + \text{H}_2\text{O} \)

reactants identified (accept words)

\( \text{C}_6\text{H}_12\text{O}_6 + \text{O}_2 \)

products identified (accept words)

\( 6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_12\text{O}_6 + 6\text{O}_2 \)

balanced equation
(b) any two from:

- increased CO\(_2\) concentration
- increased water supply
- increased temperature (up to a point)
- increased light intensity
  
  do not accept heat or warmth

- altered light quality by less green or increasing other colours

(c) any four points

- palisade (mesophyll)
- lots of chloroplasts or chlorophyll or main site for photosynthesis or absorb maximum amount of light
- guard cells
- CO\(_2\) in or O\(_2\) out or water vapour out
- controls size of stoma or pores in leaf
  
  allow stomata

Q8.

(a) A white blood cell/leucocytes / phagocytes / lymphocytes

SEPARATE MARKING POINTS

- make/contain antibodies/antitoxins
  
  or

- destroy/engulf/kill bacteria
  
  do not accept fight infection
  
  do not accept fight disease

1

B platelets

1

help clot the blood

do not accept stick together

do not accept from scabs

1

C plasma

1

- carries/transport all the cells/digested food/waste products/hormones/carbon
dioxide/platelets/dissolved minerals/antibodies/antitoxins/water allows blood to flow

(b) any four from:

(oxygen) diffuses

has affinity for/combines with oxygen / forms oxy-haemoglobin

\textit{do not accept absorbed}

in areas of high oxygen concentration

\textit{n.b. 'pick up oxygen' is stem of question}

in conditions of low oxygen concentration it breaks down and releases the oxygen

\textit{low oxygen concentration can be implied e.g. active muscles}

Q9.

(a) water [1]

oxygen [1]

(sun) light or solar [1]

\textit{do not accept sun’s}

chlorophyll [1]

\textit{do not accept chloroplasts}

(b) any two from:

stored as fructose
stored as sucrose
stored as starch
stored as oil or lipid
moved or transported away in the phloem

\textit{do not accept “stored” by itself}

respired or burnt up for energy or
fuel changed to protein
changed to cellulose
changed to fructose
changed to starch
changed to oil or lipid

\textit{do not accept “food for plant”}

\textit{do not accept “used up” by itself}

2

(c) (i) roots or root hair (cells)

(ii) the mineral salts are (dissolved) in water [1]
water transports salts throughout the plant
or water enables osmosis or diffusion to take place [1]

(d)  (i) plants grow better with some nutrients than none
or
plants grow better with nitrates than without
*comparison is needed*
*accept “faster” as equivalent to “better”*
*accept don’t grow well with only water*

(ii) 0.14(g)
*units not needed*

(iii) making protein or amino acids
*do not accept help them grow*
*accept named protein or DNA or chlorophyll*

any two from:

(iv) type or variety or starting weight or

(iii) size of seedlings
*keep the environment the same*
*only if light or temperature or day length not already credited*

light
temperature not heat
time of growth
*do not accept the same equipment*
*do not accept help them grow*

day length
amount of culture solution or/size of
*accept named protein, DNA chlorophyll*

boiling tube
number of seedlings per tube
pH
CO₂
humidity

Q10.

(a)  (i) count the pulse or count beats in artery in wrist neck or feel the pulse or take the pulse or find the pulse
*accept use of heart monitor or heart meter*

(ii) 80
*2 marks for correct answer*
If answer incorrect allow 1 mark for showing 8000 divided by 100 or indicating cardiac output divided by stroke volume

(iii) Increased activity stroke volume falls / gets less / should get higher / reach a peak
    accept does not increase or changes from 134 cm³ to 127 cm³

(iv) Increased / more ventricle contractions
    accept heart beat faster or it beats faster or more powerful contractions

(b) (stronger heart muscle) increases cardiac output or increases stroke volume
    accept pumps more blood (per beat) or pumps blood faster
    ignore heart bigger

    so more (oxygenated) blood can be sent to muscles
    accept more oxygen sent to muscles

Q11.
(a) (i) liver

(ii) on diagram:
    ‘X’ on liver
    *must be unambiguous (eg not overlapping gall bladder)*
    intersection of X in liver

(b) stomach

small intestine
    accept duodenum or ileum
    extra wrong answers cancel the mark,
    eg small intestine (colon) = no marks

(c) amylase not produced by stomach
    accept no starch digesting enzymes in the stomach
    accept correct enzyme not in stomach
    accept only proteases in stomach
    do not accept protease does not digest starch

    acid / low / wrong pH in stomach or enzyme would be denatured in stomach or amylase only works in neutral / alkaline conditions
    incorrect extra information cancels mark
    do not accept amylase does not work in the stomach
Q12.
(a) (i) haemoglobin / oxyhaemoglobin
   *must be phonetic*
   
(ii) carries oxygen or forms oxyhaemoglobin
   *Ignore references to CO₂ / iron*
   *cancel if extras like food / glucose*
   
   from lungs to tissues

(b) no nucleus or biconcave disc (described)
   *ignore references to size*
   *ignore vague references to being ‘round’ / ‘donut’ shaped etc.*

Q13.
(a) (i) lower – B loses less (water / mass) than C
   or
   described in terms of petroleum jelly
   *accept converse re Leaf C*
   
(ii) yes - B and C lose less than D or
   B and C lose more than A or
   D loses the *most or*
   A loses the *least*
   *do not accept just ‘all leaves lose some weight’*

(b) (i) X = stoma
   *accept stomata / stomatal pore*
   *do not accept air space*

   Y = guard cell

(ii) petroleum jelly blocks stomata / pores
   or petroleum jelly prevents water loss
   or petroleum jelly waterproofs
   *allow pores are blocked in B*
   
   water (mainly) lost via stomata / pores / X
   or stomata on lower surface only

Q14.
(a) (i) protease
accept peptidase or named protease
e.g. pepsin / trypsin
allow 'proteinase'

(ii) amino acids
accept peptides / polypeptides / peptones

(b) points plotted accurately
\[
\frac{1}{2} \text{ square}
\]

deduct 1 mark per error

best fit curve or ruled point-to-point
\[
\frac{1}{2} \text{ square}
\]
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
\[
\frac{1}{2} \text{ square max 2 for points}
\]

(c) (i) 2 or correct from candidate’s graph
\[
\frac{1}{2} \text{ square}
\]

(ii) stomach

(d) proteins are large / product is small
proteins (may be) insoluble / product is soluble
cannot be absorbed / cannot enter blood or cannot pass through gut lining
accept reverse referring to product

Q15.
(a) B

(B has) low(est) number of stomata
or no stomata on upper surface
or only 800 (on lower surface)

[10]
less transpiration / evaporation / water loss owtte
or water (vapour) is lost via stomata
  only allow zero water loss if linked to no stomata on upper
  surface / linked to leaf B upper surface
  ignore references to leaf surface area

(b) reduce loss / amount of water (vapour)
  accept converse
  or reduced transpiration (from upper surface)
  do not allow no water is lost

warmer above leaf
  accept converse
  or wilted leaf folds over lower surface
  or lower leaf in shade
  ignore reference to dust
  or less light / heat / sun on lower side

Q16.
  (a) any two from:
  • large surface / area or many villi or have microvilli
    accept big surface / area
  • thin surface or thin wall or surface 1-cell thick or
    capillaries near surface or permeable or partially permeable
    accept they are thin
    do not allow thin cell wall
  • many blood vessels or many capillaries or capillary network
    or good blood supply
    ignore ‘constant blood flow’ owtte
    ignore extras eg moist or reference to gases
  • have enzymes
    ignore release enzymes
    • accept reference to lacteal as 5th point
    • allow reference to having mitochondria

  (b) (i) small(er) (surface area) / flat(ter) / short(er)
    or not as folded
    or fewer capillaries owtte
    allow small(er) lacteal
    ignore references to wide / thick / spread out etc
(ii) less absorption (of digested food) / less digestion / diffusion
   accept slower for less
   accept description of less digestion
   accept less food can get in
   do not allow zero absorption
   do not allow ‘collection’ of nutrients

Q17.

(a) lipase
   allow phonetic spelling
   allow lipidase

(b) (i) fall then rise owtte eg down then up
   allow faster then slower
   ignore explanations
   minimum / least / fastest / best / optimum at 39–41(°C)
   allow it falls to 40(°C)
   if no other marks gained, ‘falls to an optimum’ gains 1 mark

(ii) (yes)
   there is no mark for circling ‘yes’
   maximum 1 mark if No is circled
   any two from:
   • less heat / energy / electricity / power required / used / wasted
     ignore lower temperature
   • conserves fuel supplies
     or less fuel used
   • less pollution from power stations
     owtte
     accept less global warming
     or
     less CO₂ / carbon emissions / greenhouse gases
     or
     less SO₂ / acid rain
     NB only direct effects
     less pollution only is not enough

(c) any two from:
   max 1 mark for reference to cell
• enzyme / lipase
  accept any named enzyme

• destroyed / denatured
  allow damaged / broken down
  not 'killed'

• reference to (specific) shape changed
  ignore detergent / it

Q18.
(a) diet or description

(b) exercise
  or group meetings
  or same number of kilocalories per day
  or time
  or group size

(c) any two from: eg
  • scientists didn’t observe amount of exercise
    or volunteers cheated on exercise(*)
  • scientists didn’t observe the amount of food
    or volunteers cheated on food(*)(*)if no marks awarded for first 2 bullet points allow don’t stick to plan or cheated for 1 mark

  • mass of subjects not controlled
  • age of subjects not controlled
  • gender of subjects not controlled
  • occupation of subjects not controlled
  • different proportions of subjects completed course
    allow not all completed course
  • low number of subjects
    ignore not repeated

(d) any two from: (yes)
  • low carbohydrate / Group 1 / people / they lost more mass
    ignore more people lost weight
    allow greater change in mass
  • low carbohydrate / Group 1 / people / they lost more body fat
    ignore more people lost body fat
    allow greater change in body fat
• low carbohydrate diet / Group 1 / people / they resulted in more HDL
  allow better HDL to LDL balance
  allow greater change in HDL

Q19.
(a) any two from:
• transport up / against concentration gradient / low to high concentration
• uses energy
• use of protein / carrier

(b) microvilli – large(r) surface area
  accept have carriers

mitochondria – release energy or make ATP
  do not accept ‘makes energy’

Q20.
(a) any three from:
• rose rapidly (during exercise) / use of approximate figures
• then more slowly (during exercise)
  accept rate (of increase) slows down
• to max 126 / at 5 minutes / end of exercise
• rapid fall (during recovery) or use of approximate numbers
• then less rapid fall / use of approximate numbers
• returned to resting rate (60 bpm) by 11 minutes

(b) arteries dilate / widen
  accept muscle in wall relaxes

(c)
Q21.

(a) any two from:

- arthritis
  allow damaged joints
- diabetes
  accept high blood sugar
- high blood pressure
- strokes
  allow blocked blood vessels / thrombosis
- allow breathing difficulties
  ignore cancer
  ignore high cholesterol

(b) (i) any two from:

to gain marks there must be a comparison
ignore comparison at single age

- lower number of women deaths up to age of 75-80
- higher number of women deaths after 80
  ignore women die older or men die younger
- men's peak higher
- men's peak at an earlier age
- men's death start earlier than women
- more men than women die of heart disease

(ii) any two from:

- men smoke more (cigarettes)
ignore alcohol

- more men smoke
- men under more stress
- men less active
- more men overweight / eat more / less diet conscious or different fat distribution
  ignore reference to body size
- genetic factors
- men might have lower metabolic rate
  ignore references to hormones
- men less likely to visit doctor even though they have symptoms

(c) points can be in any order

laboratory tests / tests on tissues
or
tests on animals
or
tests for toxicity
  ignore computer simulations

tests for side effects on volunteers / healthy people / small numbers

widespread testing
or
testing for optimum dose
or
test on patients / sick people
or
test to see if it is effective
  accept use of placebo

Q22.

(a) transpiration / evaporation / diffusion
  ignore osmosis

(b) (i) D

(ii) any two from:
- more / faster diffusion or evaporation or transpiration
- molecules move faster
- maintains concentration gradient
or keeps water concentration low in the air
or brings in more dry air
or removes damp air / water

Q23.
(a) B

**no mark for ÉBÉ, alone**

large(r) surface / area or large(r) membrane
accept reference to microvilli
accept reasonable descriptions of the surface
do not accept wall / cell wall
ignore villi / hairs / cilia

(b) (i) any one from:

• insulin / hormone
  *if named hormone / enzyme must be correct for pancreas*

• enzyme / named enzyme

(ii) many ribosomes

(ribosomes) produce protein
accept insulin / hormone / enzyme named is (made of) protein

or

allow many mitochondria (1)

provide energy to build protein or to make protein (1)
accept ATP for energy

Q24.
(a) (i) 19 800

*for correct answer ignore working or lack of working*

165 × 120 but no answer / wrong answer = 1 mark (ignore extras)

(ii) any two from:

• for respiration
  ignore oxygen debt

• energy released
  allow energy produced
• prevents anaerobic respiration
• prevents build-up of lactic acid

(b) any two from:

• increased breathing rate(*)
• increased depth of breathing or deep breathing(*)
  (*)more breathing is max 1 mark
  ignore increase in heart rate
  allow heavier breathing
  do not allow harder breathing

• dilation of arteries / vasodilation
  allow blood vessels dilate
  do not allow veins / capillaries dilate

• blood diverted from elsewhere
  ignore name of organ

Q25.
(a) any two from:

• age
• gender
• mass
• number in group
• time

(b) any two from:

• highest (mean) mass loss on Rosemary Conley or Rosemary Conley most effective
• least (mean) mass loss in control group or mean

(c) (Atkins)
costs least
mass loss very similar to other diets or second highest mass loss or as effective as other diets

(d) any two from:

• (exercise) increases metabolic rate / respiration
ignore sweating

- (exercise) needs / uses energy / calories
  allow burns fat / calories
  do not accept energy for respiration

- (this) energy comes from food / fat

- less food / energy/ calories converted to fat

Q26.

(a) any one from:
  ignore reference to recording results every 5 minutes or
  concentrations of lipid / lipase

  - (same) volume / amount / 1 cm³ lipase
    allow amount of solution

  - (same) volume / amount / 5 cm³ lipid
    allow keep same volumes in the test tubes

  - mixed after 3 minutes / same time before mixing
    do not accept temperature

(b) so that the lipase and the lipid reached the right temperature

(c) any two from
  ignore explanations

  - decrease in time or faster (breakdown)

  - then increase in time or then slower (breakdown)

  - fastest / least time / optimum at 35°C

(d) any two from:
  ignore ‘test at more temperatures’ unqualified

  - test more regularly eg test every minute
    any interval < 5min

  - test at smaller temperature intervals
    any value <15°C
    allow test more temperatures in the range

  - test between 50 (°C) and 95 (°C)
    any value in range, eg test at 70

  - repeat at same temperatures
    or repeat the investigation
    or compare results with others
    allow do it again
2

(e) (i) (lipase / it) denatured / destroyed / changed shape
  allow damaged / deformed
  do not accept killed
  ignore broken (down)

(ii) fatty acids and glycerol

Q27.
(a) C

(b) (i) guard (cell)

(ii) temperature water movement / transpiration
  through stomata / pores / holes / (region) X
  or
  petroleum jelly blocks / covers stomata / pores / holes / X

stomata / pores / holes / X found on lower surface

Q28.
(a) (i) B or D

(ii) A or B

(b) any four from:

  more / faster must be implied at least once for full marks

• increased blood (flow)
  ignore reference to breathing

• (more) oxygen supplied or aerobic respiration
  allow less anaerobic (respiration) or and prevents oxygen debt

• (more) glucose / sugar / food supplied
  ignore feeding

• (higher rate of) respiration

• (more) energy needed / released
  allow made

• (more) carbon dioxide removed
• (muscles) doing (more) work or muscles contracting
• remove heat / cooling
• remove lactic acid or less lactic acid formed

Q29.
(a) (i) amino acid(s)
    accept peptide(s)
    do not allow polypeptide(s)

(ii) protease

(b) (i) 2

(ii) repeat
    do not allow other enzyme / substrate
    using smaller pH intervals between pH1 and pH3
    allow smaller intervals on both sides of / around pH2
    allow smaller intervals on both sides of / around answer to (b)(i)

(iii) enzyme / pepsin denatured / shape changed
    do not allow enzyme killed
    allow enzyme ‘destroyed’
    enzyme / pepsin no longer fits (substrate)
    allow enzyme / pepsin does not work

(c) hydrochloric (acid)
    allow phonetic spelling
    accept HCl
    allow HCL
    ignore hcl
    do not allow incorrect formula — e.g. H_2Cl / HCl_2

Q30.
(a) protease
    allow trypsin / peptidase
    do not allow pepsin
    carbohydrase / amylase
do not allow sucrase / maltase / lactase

(b) no lipase produced / found

in stomach / mouth / before small intestine
OR
accept lipase only produced / found (1)
in small intestine / pancreas (1)
if no other mark is awarded lipid is not broken down in the stomach or lipid is digested in small intestine gains 1 mark

(c) enzymes only work in solution / when dissolved
or
because enzyme / lipase / it is dry
allow enzymes only work in presence of water or enzymes do not work when dry
ignore other physical conditions

Q31.

(a) large surface / large area

thin / short distance (from air to blood) / one cell thick / two cells thick

good blood supply / many capillaries / capillary network / many blood vessels
ignore moist surface

(b) (i) diffusion
ignore gaseous exchange

(ii) brings (more) oxygen / air into the lungs / alveoli

keeps O₂ level high in alveoli
or
maintains concentration difference (between alveoli and blood) / keeps O₂ concentration in alveoli > O₂ concentration in blood gains 2 marks

Q32.

any two from:
• arthritis
  ignore descriptions
• diabetes
- high blood pressure
- heart / blood vessel disease
  
  *ignore cholesterol*

Q33.

(a) A aorta
  *ignore left and right* 1

B ventricle 1

C atrium
  *allow atria* 1

D vena cava 1

(b) (i) (coronary) artery
  *allow arteriole* 1

(ii) stent / description
  *accept (coronary) by-pass operation*
  *allow statins*
  *allow diets low in cholesterol*
  *allow balloon (angioplasty)* 1

(iii) (stent) keeps artery open
  *must relate to (b)(ii)* 1

  
  or

  *ignore reference to capillary / vein* 1

(by-pass) new blood vessel / vein connecting around narrowed region;

  
  or

  (statins / low cholesterol diet) remove some of the cholesterol blockage

  
  or

  (balloon) widens / opens the blood vessel 1

which allows (more) blood through or allows blood to go around the blockage

(c) (i) F artery
  *accept arteriole / branch of pulmonary artery* 1

G capillary
H vein

\( H \) accept venule / branch of pulmonary vein;

(ii) F (Pulmonary artery) has less oxygen / more carbon dioxide / more glucose / sugar

accept F (Pulmonary artery) is deoxygenated
accept converse for H (Pulmonary vein)
'It' refers to F

Q34.

(a) don’t kill pathogens / bacteria / viruses / microbes / microorganisms

allow don’t contain antibiotics
ignore antibodies / attack / fight
allow only treat symptoms / pain
ignore kill disease / germs

(b) any two from:

- age
- gender
- extent / severity of pain or how long had pain before trial
- type of pain / illness / site of pain accept 'the pain' for 1 mark, if neither extent or type given ignore pain threshold
- (body) mass / weight / height allow body size / physique
- other medical issues / drugs taken / health / fitness
- ethnicity

(c) (i) 75

ignore calculations / %

(ii) faster pain relief / decrease

allow pain relief sooner or it works quicker

or more pain relief at start / in first 1 \( \frac{3}{4} \) hours

(iii) decrease of pain higher / more
ignore more effective unless qualified by time > 1\frac{3}{4} \text{ hours}
allow effect lasts longer

decrease of pain is longer lasting

(d) any three from:
ignore yes or no

(Yes because)
- rapid pain relief (from A)
- long lasting pain relief (from B)
- and it costs less
- the sum of the pain relief (from A + B) is greater (than X)

(No because)
- drug X gives more pain relief
- (A + B / they ) might interact with each other
- could result in overdose
- could be more / new side effects
  if neither points gained
  allow (more) dangerous

Q35.
(a) (i) water loss
  extra substance(s) cancel
  if transpiration stream described max 1 mark

  as a vapour / by evaporation
  ignore stomata

(ii) stomata / stoma / guard cells
ignore epidermis

(b) (i) 2.8
  correct answer with or without working gains 2 marks
  if answer incorrect:
  allow 1 mark for (8.6 - 0.2) ÷ 3 or 8.4 ÷ 3

(ii) warmer at 16:00 / gets cooler
  or reverse argument for 19.00
faster diffusion / evaporation

- accept sun setting as equivalent to heat or light marking points

or

lighter at 16:00 / gets darker (1)

- if no environmental factor still allow reason mark

stomata open / more open (1)

- eg ‘stomata close later in the day’

or

(more) windy at 16:00 / gets less windy (1)

removal of (more) water vapour / steeper gradient (1)

or

air is less humid at 16.00 (1)

- allow rain at 19.00

- faster diffusion or steeper gradient (1)

Q36.

(a)  
(i)  8.6

- accept value in range 8.5 to 8.7

(ii) hydrochloric acid / HCl

- accept HCL

- accept hydrogen chloride

- ignore hcl / etc.

(iii) X

(b) 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 refer to the information in the Marking guidance.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a simple description of part of a process or a reference to at least one of: mechanical digestion, lipase, product of enzyme action, bile, site of production or site of digestion

Level 2 (3-4 marks)

There is a description of at least one process linking ideas
Level 3 (5-6 marks)
There is a clear description of the process including reference to the majority of: mechanical digestion, lipase, bile, where they are produced, products, function of bile and site of digestion / absorption.

Examples of biological points made in the response:

- mechanical breakdown in mouth / stomach
- fats $\rightarrow$ fatty acids and / or glycerol
- by lipase
- (produced by) pancreas
- and small intestine
- fat digestion occurs in small intestine
- bile
- produced by liver
- neutralises acid from stomach
- produces alkaline conditions in intestine
- refs. to increased surface area related to emulsification or chewing
- products are small molecules / water-soluble
- products absorbed by small intestine

Q37.

(a) (i) (as a result of) uncontrolled / abnormal growth / division of cells

*ignore mutation*

*allow cells dividing with no contact inhibition*

(ii) benign tumours do not invade / spread to other tissues / do not form secondary tumours

*accept converse for malignant*

*accept benign tumours do not metastasise*

(b) via the blood / circulatory system

*accept via lymphatic system*

(c) (i) incidence is increasing

more rapidly (over the years)

*ignore figures*

difference between rich and poor areas is getting less
or

the incidence is rising fastest in people from poor areas

accept converse for people from rich areas

(ii) risk factor is UV from sunlight

ignore ionising radiation

more UK citizens going abroad or taking holidays in the Sun

or

poorer people can afford holidays in the Sun

or

more poorer people are taking holidays in the Sun

---

**Q38.**

(a) (i) idea of ‘normal’ food / diet

\[ \text{e.g. ‘the same as usual’ or ‘the same as before’} \]

allow balanced diet

allow none of the slimming programmes

ignore healthy diet

(ii) for comparison

\[ \text{accept to show the test is valid} \]

allow to show the effect of the slimming programmes

allow to see if the slimming programmes work

ignore idea of fair test / reliable

\[ \text{do not allow accurate / precise} \]

(b) (i) (at first) large / rapid (loss / change of body mass)

then small (loss / change) / levelling off

\[ \text{accept ‘loss of mass decreased’ for 2 marks} \]

(ii) all lost body mass (compared to the control group)

---

**Q39.**

(a) (i) rate of chemical reactions (in the body)

(ii) any two from:

- heredity / inheritance / genetics
• proportion of muscle to fat or (body) mass
  allow (body) weight / BMI
• age / growth rate
• gender
  accept hormone balance or environmental temperature
  ignore exercise / activity

(b) (i) 77
  correct answer with or without working gains 2 marks
  allow 1 mark for 70 / 56 or 1.25 or 5

(ii) increase exercise
  accept a way of increasing exercise
  reduce food intake
  accept examples such as eat less fat / sugar
  allow go on a diet or take in fewer calories
  ignore lose weight
  ignore medical treatments such as gastric band / liposuction

Q40.
(a) (i) A = (cell) wall
  ignore cellulose
  B = cytoplasm

(ii) any one from:
  accept has DNA instead of a nucleus, but not just has DNA
  • bacterial cell / it has no nucleus
    allow no mitochondria
  • DNA free in cytoplasm
    ignore size
  • has no vacuole / no vesicles
    ignore strands of DNA

(b) (i) yeast grows best / better / well or optimum temperature for yeast / more yeast present
  allow yeast works best / better / well
  (yeast) makes CO₂ or respires / respiration
  allow fermentation
(ii) **bacterium** grows best / better / well / more **bacteria** present or optimum temperature for **bacterium**

*ignore microorganisms / microbes*

*allow works / respires best / better / well*

(bacterium) makes (lactic) acid

*do not allow wrong acid*

---

**Q41.**

(a) 55%

**2 marks for correct answer alone**

*accept 54 – 56*

*5.5 / 10 × 100 alone gains 1 mark*

(b) any **three** from:

- amino acids
- antibodies
- antitoxins
- carbon dioxide
- cholesterol
- enzymes
- fatty acid
- glucose
- glycerol
- hormones / named hormones
- ions / named ions
- proteins
- urea
- vitamins
- water.

*ignore blood cells and platelets*

*ignore oxygen*

*max 1 named example of each for ions and hormones*

*allow minerals*

---

(c) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a ‘best-fit’ approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1 – 2 marks)**

There is a description of pathogens with errors or roles confused.

*or*

the immune response with errors or roles confused.

**Level 2 (3 – 4 marks)**

There is a description of pathogens **and** the immune response with some errors or confusion
a clear description of either pathogens or the immune response with few errors or little confusion.

**Level 3 (5 – 6 marks)**

There is a good description of pathogens and the immune response with very few errors or omissions.

**Examples of biology points made in the response:**

- bacteria and viruses are pathogens
  
  *credit any ref to bacteria and viruses*
- they reproduce rapidly inside the body
- bacteria may produce poisons / toxins (that make us feel ill)
- viruses live (and reproduce) inside cells (causing damage).

White blood cells help to defend against pathogens by:

- ingesting pathogens / bacteria / (cells containing) viruses
  
  *credit engulf / digest / phagocytosis*
- to destroy (particular) pathogen / bacteria / viruses
- producing antibodies
- to destroy particular / specific pathogens
- producing antitoxins
- to counteract toxins (released by pathogens)
  
  *credit memory cells / correct description*
- this leads to immunity from that pathogen.

---

**Q42.**

(a)  
A – saliva(ry) gland

B – liver

C – duodenum

  *ignore small intestine*

D – pancreas

  *accept phonetic spellings*


(b)  
(i) any three from:

- chewing / muscle contraction / mechanical digestion
  
  *allow churning*
- protease enzymes
  
  *allow pepsin / trypsin*
- in stomach / small intestine / duodenum / from pancreas
- (break down protein) into amino acids
  
  *allow (poly)peptides*

(ii) neutralises acid pH / makes conditions alkaline
so lipase can work
emulsifies fat
to give large(r) surface area for lipase / enzyme action

(c) (i) starch
    ignore carbohydrate

(ii) breakdown stops
    allow slows down

because stomach produces / contains acid / has low pH
and amylase cannot work in acid / low pH
    accept amylase is denatured / changes shape

Q43.
(a) A
    no mark - can be specified in reason part
    if B given - no marks throughout
    if unspecified + 2 good reasons = 1 mark

    high(er) pressure in A
    allow opposite for B
    do not accept ‘zero pressure’ for B

    pulse / described in A
    accept fluctuates / ‘changes’
    allow reference to beats / beating
    ignore reference to artery pumping

(b) (i) 17

(ii) 68
    accept correct answer from student’s (b)(i) × 4

(c) oxygen / oxygenated blood
    allow adrenaline
    ignore air

    glucose / sugar
    extra wrong answer cancels - eg sucrose / starch / glycogen
    / glucagon / water
    allow fructose
Q44.
(a) (i) stomach
   (ii) small intestine
(b)

<table>
<thead>
<tr>
<th></th>
<th>salivary glands</th>
<th>stomach</th>
<th>pancreas</th>
<th>small intestine</th>
</tr>
</thead>
<tbody>
<tr>
<td>amylase</td>
<td>✓</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>lipase</td>
<td>x</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>protease</td>
<td>x</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

1 mark per correct row
or
if no correct row max 1 mark for any one correct column
(c) enzyme / protease / pepsin most effective in acid conditions / low pH
   accept optimum / correct pH
   do not accept ref to incorrectly named enzymes
   ignore killing bacteria
   ignore acid breaks down food
(d)

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Breakdown products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amylase breaks down starch into...</td>
<td>amino acids</td>
</tr>
<tr>
<td>Lipase breaks down lipids into...</td>
<td>bases</td>
</tr>
<tr>
<td>Protease breaks down proteins into...</td>
<td>fatty acids and glycerol</td>
</tr>
<tr>
<td></td>
<td>sugars</td>
</tr>
</tbody>
</table>

Q45.
(a) any one from:
ignore ‘check temperature’

- add a water bath
- heat screen
- use LED
- low energy bulb / described

(b) (i) rate / number of bubbles decreases
   accept converse with reference to increasing light or shorter distance
   or
   less oxygen / gas released
   ignore reference to rate of photosynthesis

(ii) temperature / CO₂ (concentration)
   accept ‘it was too cool’ or not enough CO₂
   accept number of chloroplasts / amount of chlorophyll
   allow heat
   allow CO₂
   do not allow CO₂

(c) 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 refer to the information in the Marking guidance, and apply a ‘best-fit’ approach to the marking.

0 marks
No relevant content.

Level 1 (1-2 marks)
There is a brief description of at least 1 tissue or at least 1 function of an indicated part of the leaf.

The account lacks clarity or detail.

Level 2 (3-4 marks)
There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf.

Level 3 (5-6 marks)
There is a detailed description of most of the structures and their functions.

Examples of responses:

- epidermis
- cover the plant
- mesophyll / palisade
- photosynthesises
• phloem
• xylem
• transport.

The following points are all acceptable but beyond the scope of the specification:
• (waxy) cuticle – reduce water loss
• epidermis – no chloroplasts so allows light to penetrate
• stomata / guard cells – allow CO\textsubscript{2} in (and O\textsubscript{2} out) or controls water loss
• palisade (mesophyll) – many chloroplasts to trap light
  – near top of leaf for receiving more light
• spongy (mesophyll) – air spaces for rapid movement of gases

Q46.
(a) any three from:
• (water through a) partially permeable
  accept ‘semi permeable’ / selectively permeable
• 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

(b) (there are) many hairs or thin hairs or hairs are one cell thick

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

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

Q47.
(a) guard cells

(b) (i) any one from:
• species / plant
• length of time

*ignore temperature and size of leaves*

(ii) 20

correct answer = 2 marks

\[
\frac{1.6 - 1.28}{1.6} \times 100
\]

accept

\[
\frac{0.32}{1.6} \times 100
\]

or

for 1 mark

(c) less water loss / transpiration / evaporation

(d) hot

*ignore bright / sunny conditions*

dry / low humidity

wind(y)

[8]

Q48.

(a) A - atrium

*ignore references to right / left*

B - ventricle

(b) (i) muscular

(ii) push blood

*accept pump / force*

(c) arrows approx as indicated
arrow(s) showing flow from A to B
from B out / up / to artery

(d) (i) male

65 and over

(ii) fatty deposits / material in (coronary) arteries

allow correct points made about heart attacks

narrows / blocks / reduces flow

decreases oxygen supply (to heart muscle)

Q49.

(a) (i) xylem

(ii) water

minerals / ions / named example(s)

ignore nutrients

(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

(ii) sugars are made in the leaves

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

(c) (i) mitochondria

(ii) for movement of minerals / ions

Do not accept ‘water’

against their concentration gradient

Q50.
(a) any three from:

- parts of organisms have not decayed
  
  accept in amber / resin
  
  allow bones are preserved

- conditions needed for decay are absent
  
  accept appropriate examples, eg acidic in bogs / lack of oxygen

- parts of the organism are replaced by other materials as they decay
  
  accept mineralised

- or other preserved traces of organisms, eg footprints, burrows and rootlet traces
  
  allow imprint or marking of organism

(b) (i) teeth for biting (prey)
  
  must give structure + explanation

  claws to grip (prey)
  
  accept sensible uses

  wing / tail for flight to find (prey)

(ii) any two from:

- new predators
- new diseases
- better competitors
- catastrophe eg volcanic eruption, meteor
- changes to environment over geological time
  
  accept climate change
  allow change in weather

- prey dies out or lack of food
  
  allow hunted to extinction

Q51.

(a) (i) diffusion

(ii) carbon dioxide
  
  accept CO₂ / CO2
  
  do not accept CO²

(iii) red blood cells

(b) 70

if no / incorrect answer then

70 000 000

or
$280 \times 0.25$ gains 1 mark
ignore doubling the answer

(c) allows more gas / oxygen / CO$_2$ (exchange)

*do not accept air*

1

Q52.

(a) any two from:
- carbon dioxide / CO$_2$
- urea
- protein
- water / H$_2$O
- hormones / insulin.

*ignore food / waste / alcohol / drugs / enzymes*
*ignore glucose and oxygen*
*allow two correct hormones for 2 marks*
*allow two correct food components for 2 marks*
*allow antibodies*
*allow antitoxins*

2

(b) (i) plasma

platelets

(ii) (cardiac) muscle

*allow muscular*

1

(c) 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 refer to the information in the Marking Guidance and apply a ‘best-fit’ approach to the marking.

0 marks
No relevant content

Level 1 (1–2 marks)
There is a description of at least one advantage of the cow tissue valve or a description of at least one disadvantage of the cow tissue valve.

Level 2 (3–4 marks)
There is a description of at least one advantage of the cow tissue valve and at least one disadvantage of the cow tissue valve.

Level 3 (5–6 marks)
There is a description of the advantages and disadvantages of the cow tissue valve or
a description of several advantages of the cow tissue valve and at least one disadvantage.

Examples of the points made in the response

Advantages of cow tissue valve:

- abundant supply of cows
- so shorter waiting time
- ignore can take many years to find a suitable human donor
- no need for tissue typing
- quicker operation
- less invasive or shorter recovery time
- cheaper operation costs
- less operation / anaesthetic risks.

Disadvantages of cow tissue valve:

- made from cow so possible objections on religious grounds
- ignore ethical arguments
- new procedure so could be unknown risks
- allow possible transfer of disease from cow
- risks of using a stent eg. blood clots, stent breaking or valve tearing
- not proven as a long term treatment
- may be rejected
- ignore information copied directly from the table without value added.

Q53.

(a) (i) glycerol

(ii) pancreas / small intestine
- accept duodenum / ileum
- ignore intestine unqualified

(b) any two from:
- type of milk
- volume / amount of milk
- vol. bile equals vol. water
- volume of lipase
- concentration of lipase
- temperature
- ignore time interval
- ignore solution unqualified
- do not allow pH
- ignore starting pH
- ignore volume / amount of bile / water
- ignore concentration of bile
- accept amount of lipase if neither volume nor concentration given
(c)  
(i) fatty acid (production)  

(ii) faster reaction / digestion (with bile)  
or  
pH decreases faster (with bile)  
or  
takes less time (with bile)  
or  
steeper fall / line (with bile)  
  allow use of data  
  ignore easier  

(iii) all fat / milk digested  
or  
same amount of fatty acids present  
or  
(lower pH) denatures the enzyme / lipase  
  allow all reactants used up  
  ignore reference to neutralisation  
  allow enzyme won’t work at low pH  
  do not allow enzyme killed  

Q54. 

thicker surface  

reduced surface area  

accept fewer alveoli  

Q55. 

(a) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking guidance and apply a ‘best-fit’ approach to the marking.  

0 marks  
No relevant content.  

Level 1 (1–2 marks)  
The method described is weak and could not be used to collect valid results, however does show some understanding of the sequence of an investigation.  

Level 2 (3–4 marks)  
The method described could be followed and would enable some valid results to be collected, but lacks detail.  

Level 3 (5–6 marks)  
The method described could be easily followed and would enable valid results to be collected.
Examples of the points made in the response:

- bean seedlings of same age
- cut material from same part of each organ (for repeats) e.g. top 1 cm of stem / a whole cotyledon / seed
- equal mass of each organ
  
  accept weight for mass
- grind / homogenise
- in equal amounts of water / buffer
- equal volumes of hydrogen peroxide solution
- equal concentrations of hydrogen peroxide solution
- same temperature
- temperature maintained in water bath
- quantitative measure of gas production eg height of foam in mm / collect gas in graduated syringe in cm³
- for same time period
- repetitions (3+ times)
- calculate mean for each.

(b)  

(i)  

correct answer: 40

1 mark for 45 as the anomalous result has been included in the calculation

or

\((38 + 41 + 42 + 39) \over 4\)

1 mark for 160

or \( \over 4\)

(ii)  

vertical axis correctly labelled:

‘Enzyme activity in arbitrary units’

allow edf from (b)(i)

points plotted correctly ±1 mm

deduct 1 mark for each incorrect plot

suitable line of best fit

not feathery, not point to point

(iii)  

6.0 / 6

allow ± 0.1

if 6.0 not given, allow correct for candidate’s graph ± 0.1

(iv)  

in range 0 to 14 units

allow correct for candidate’s graph

(v)  

enzyme denatured / enzyme (active site) shape changed

allow substrate no longer fits (active site)

ignore reference to temperature

do not allow enzyme dies
Q56.
(a) any **two** from:
   - to work out the correct dose to be given
   - to check that the drug is working correctly
   - to check for toxic effects.

(b) patients are randomly allocated to receive statin or a placebo

so neither patient nor doctor knows who has received which

*answer in terms of only the drug company knows who is taking the statin or the placebo gains 2 marks*

(c) To prevent false claims

(d) drug A reduced the blood cholesterol level more than drug B

drug A reduced the thickness of the artery **or** drug B increased the thickness of the artery

*allow drug A made the artery thinner **or** drug B made the artery thicker*

*ignore side effects*

(e) differences in number of patients reporting side effects are very similar

we don't know what the patients died of

[9]

Q57.
(a) (i) 5.0

(5 × 0.8) **or** 4

*allow ecf from distance*

0.4

*allow ecf from 10-min volume*

(ii) increased (rate of uptake)

more transpiration / evaporation

(b) correct scales

*allow reversed axes*

correctly labelled axes with units
correct points

one plot error = max 1 mark

curved line of best fit

allow correct straight line

(c) leaves wilt

because plants lose too much water (by evaporation)

through the stomata

or

because cells become plasmolysed

or

stomata close

controlled by guard cells

to prevent wilting

Q58.

(a) tissue → organ → organ system

one right for 1 mark

three right for 2 marks

(b) Epithelial tissue → covers the outside and the inside of the stomach

more than one line from a tissue = no mark

Glandular tissue → produces digestive juices

Muscular tissue → allows food to be churned around the stomach

(c) (i) light

ignore dark

(ii) moving (to the dark)

(iii) any two from:

• use more woodlice

• repeat the experiment

• run for a longer time

Q59.

(a) any two from:
• same result at pH 7 and 7.5
  or
could be any pH between 7 and 7.5
  or
not tested at pH 7.25
  or
need to test at smaller pH intervals (between 7 and 7.5)
• accuracy of result only to nearest 0.5 minutes
• no repeats
• difficult to determine end point (colour)

(b) 2.7 / 5

0.54 (units per minute)

\[ \text{allow 0.52 with no working shown for 2 marks} \]

\[ \text{allow 1 mark for 0.52 or 0.56} \]

(c) (after 10 minutes) solution goes black

(after 60 minutes) solution stays the same
  or
does not go black
  or
goes slightly orange

(d) steeper curve

levels off at 11.8 units and before 45 minutes

Q60.

(a) (i) brain

(ii) skin

(iii) 1/25 or 4% or 0.04 or 1 in 25 or 1:25 or 1 out of 25

\[ \text{allow } \frac{1000}{25000} \]

(b) any two from:

• increased / high heart rate / pulse rate
  \[ \text{do not allow pumps more blood unqualified} \]

• dilation / widening of arteries / arterioles (to skeletal muscles)
  \[ \text{accept vasodilation unqualified} \]
  \[ \text{do not accept reference to veins / capillaries} \]
or
less blood flow to other organs
• increased stroke volume / described

(c) ignore references to breathing

more respiration / description
or
more energy required or to provide more energy

respiration / process described → CO₂

do not accept anaerobic respiration

CO₂ diffuses into blood