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London Examinations IGCSE

Biology (4325)

Exemplar candidate responses from the May 2005 examination session

January 2006

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Exemplar candidate responses

London Examinations IGCSE

Biology

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This booklet should be read in conjunction with the specification for IGCSE Biology and with the and Mark Scheme with Examiners' Report for the May 2005 examinations. Both documents are available on our website: www.edexcel.org.uk/international

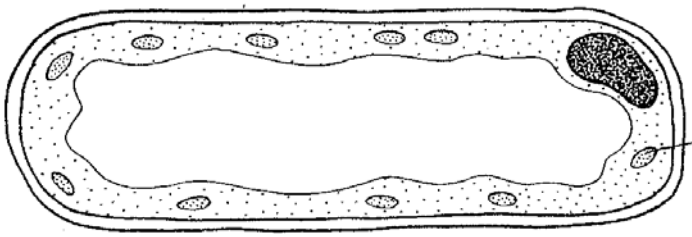
Paper 2H

Question 1, sample 1

Leave blank

1. Plants make food in their leaves.

(a) The diagram shows a cell from a leaf.



(i) On the diagram, draw a line from the letter **F** to one of the structures where food is made.

(1)

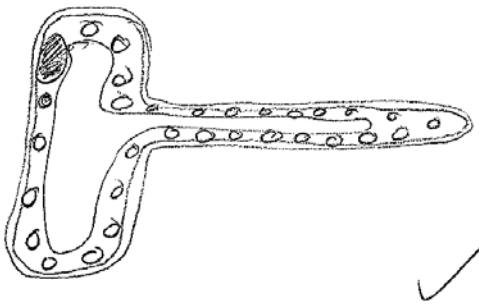
(ii) Name the part of the cell where food is made.

Chloroplasts

(1)

(b) To make food, plant cells need water. Water enters the plant through cells in the roots called root hair cells.

(i) In the space below, draw a root hair cell, showing how its shape would differ from the leaf cell shown in part (a).



(1)

Leave blank

(ii) Explain how the shape of the root hair cell helps it to take in water.

it has a cell membrane which is selective permeable membrane absorbs water by Osmosis, also it has a Cyto Plasmic Prolongation to increase surface Area so more water absorbed

(2) 2

(iii) Describe the process by which water enters the root hair cells.

The process is Osmosis, it the movment of water molecules from high water potential to low water Potential through a ~~de~~ selective membrane. This molecules of water moves from the soil to surrounds the Cell through the Cell membrane.

(3) Q1 3

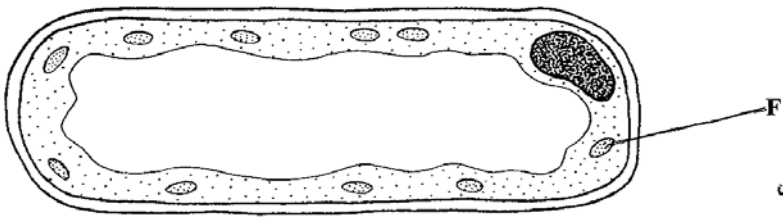
(Total 8 marks) 5

Question 1, sample 2

Leave blank

1. Plants make food in their leaves.

(a) The diagram shows a cell from a leaf.



1

(i) On the diagram, draw a line from the letter **F** to one of the structures where food is made.

(1)

1

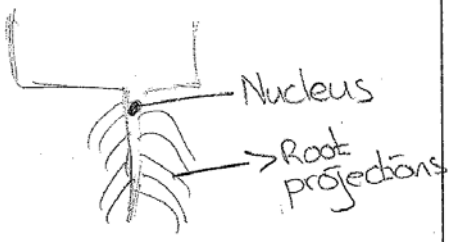
(ii) Name the part of the cell where food is made.

Chloroplast

(1)

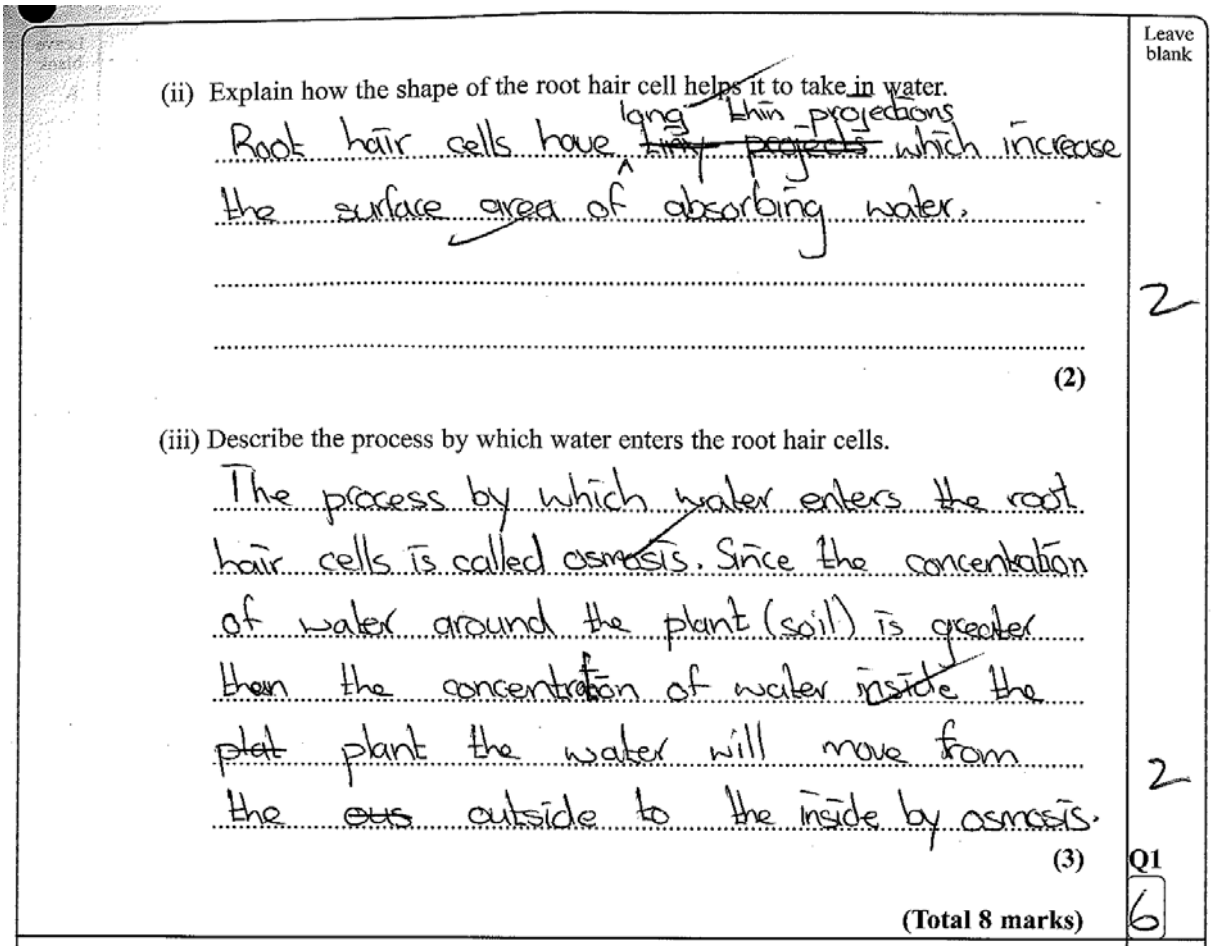
(b) To make food, plant cells need water. Water enters the plant through cells in the roots called root hair cells.

(i) In the space below, draw a root hair cell, showing how its shape would differ from the leaf cell shown in part (a).



0

(1)



(ii) Explain how the shape of the root hair cell helps it to take in water.

Root hair cells have long thin projections which increase the surface area of absorbing water.

2

(2)

(iii) Describe the process by which water enters the root hair cells.

The process by which water enters the root hair cells is called osmosis. Since the concentration of water around the plant (soil) is greater than the concentration of water inside the plant the water will move from the outside to the inside by osmosis.

2

(3)

(Total 8 marks)

Leave blank

Q1

6

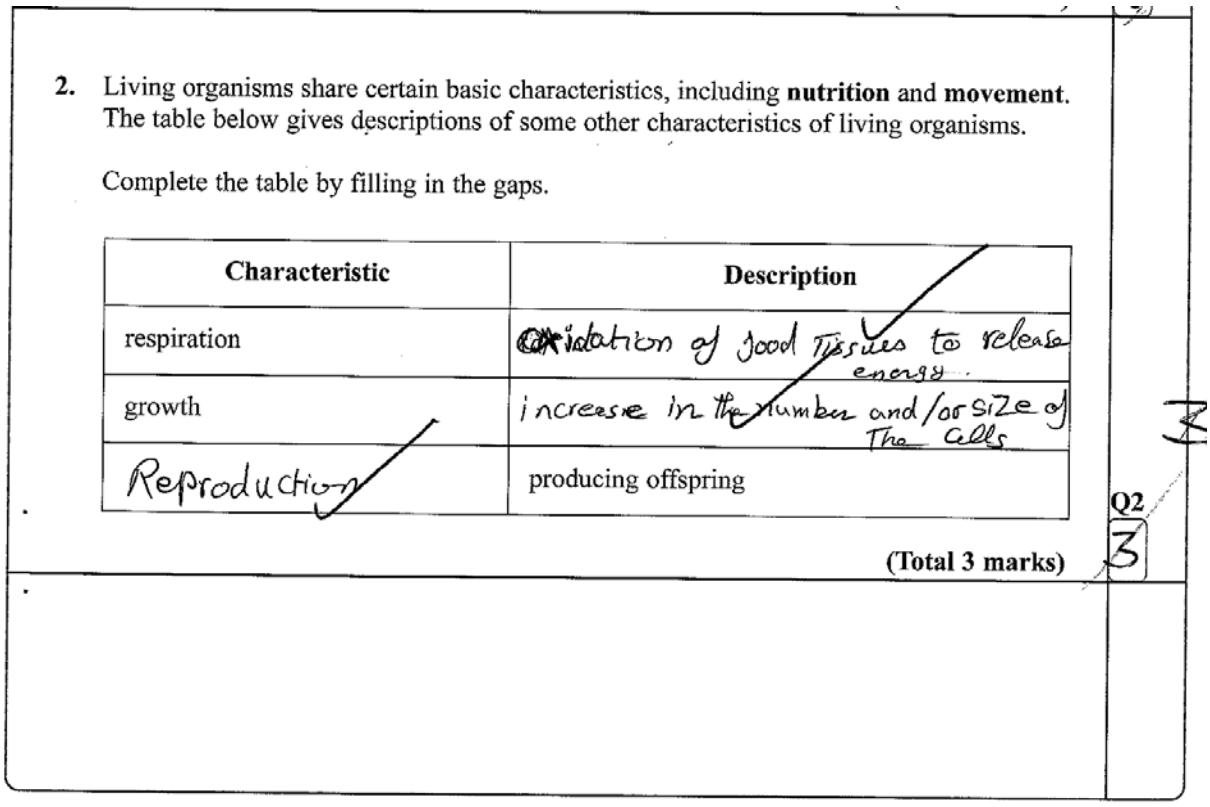
Question 1 (out of 8)

This question tested understanding of simple plant cell structure and the way in which plant cells take up water. Most candidates were able to draw a label line to a chloroplast and to name the organelle correctly. Drawings varied in quality but many appreciated that the cell is similar in shape, but differs in that it possesses a root hair extension. Many understood that the increase in surface area would allow more water to be absorbed. There was evidence of confusion between active uptake and osmosis in part (b) (iii), but those who understood that water is absorbed by osmosis were also able to write about the need for a water concentration gradient and that a selectively permeable membrane is involved.

Sample 1 (score 8) **A* standard**
Full marks were awarded. This candidate had a clear understanding of the biology and was able to write in extended prose effectively.

Sample 2 (score 6) **B/C standard**
This candidate failed to draw a root hair cell and failed to give a complete explanation of osmosis by not mentioning the selectively permeable membrane.

Question 2, sample 1



2. Living organisms share certain basic characteristics, including **nutrition** and **movement**. The table below gives descriptions of some other characteristics of living organisms.

Complete the table by filling in the gaps.

Characteristic	Description
respiration	Oxidation of food tissues to release energy.
growth	increase in the number and/or size of the cells
Reproduction	producing offspring

(Total 3 marks)

Q2 3

Question 2 (out of 3)

Candidates were able to recall that reproduction is the characteristic of living organisms that helps them produce offspring. However, only the better candidates were able to provide accurate, erudite descriptions of respiration and growth.

Sample 1 (score 3) **A* standard**
Full marks were awarded for good answers. 'Food molecules' might be a better phrase than 'food tissues'.

Question 3, sample 1

Leave blank

3. A poisonous snake bites a man's toe.

The passage below describes how the snake venom travels from the toe to the brain. Use suitable words to complete the sentences in the passage.

The venom travels to the heart in the largest vein called the ~~pulmonary~~ vein vena cava

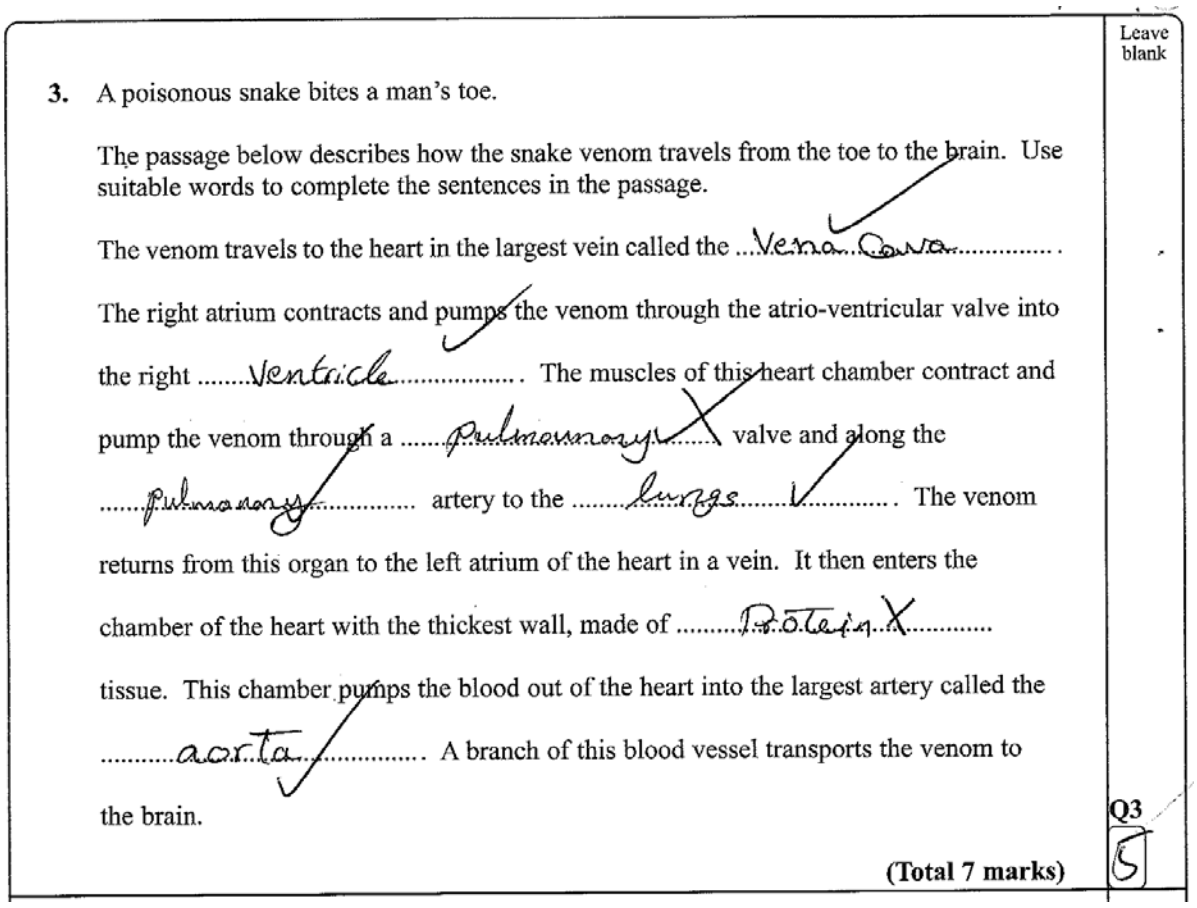
The right atrium contracts and pumps the venom through the atrio-ventricular valve into the right ventricle. The muscles of this heart chamber contract and pump the venom through a semi-lunar valve and along the pulmonary artery to the lungs. The venom returns from this organ to the left atrium of the heart in a vein. It then enters the chamber of the heart with the thickest wall, made of thick ~~blood~~ muscular tissue. This chamber pumps the blood out of the heart into the largest artery called the aorta. A branch of this blood vessel transports the venom to the brain.

7

Q3 7

(Total 7 marks)

Question 3, sample 2



Leave blank

3. A poisonous snake bites a man's toe.

The passage below describes how the snake venom travels from the toe to the brain. Use suitable words to complete the sentences in the passage.

The venom travels to the heart in the largest vein called the ...Vena Cava.....

The right atrium contracts and pumps the venom through the atrio-ventricular valve into the right .....Ventricle..... The muscles of this heart chamber contract and pump the venom through a .....pulmonary..... valve and along the .....pulmonary..... artery to the .....lungs..... The venom returns from this organ to the left atrium of the heart in a vein. It then enters the chamber of the heart with the thickest wall, made of .....Protein..... tissue. This chamber pumps the blood out of the heart into the largest artery called the .....aorta..... A branch of this blood vessel transports the venom to the brain.

Q3 5

(Total 7 marks)

Question 3 (out of 7)

This question was well answered by most candidates. It required candidates to choose suitable words to complete a passage of writing. The more difficult parts concerned recalling the name of the valve as the semi-lunar valve, and recalling that the heart is mostly composed of muscle tissue.

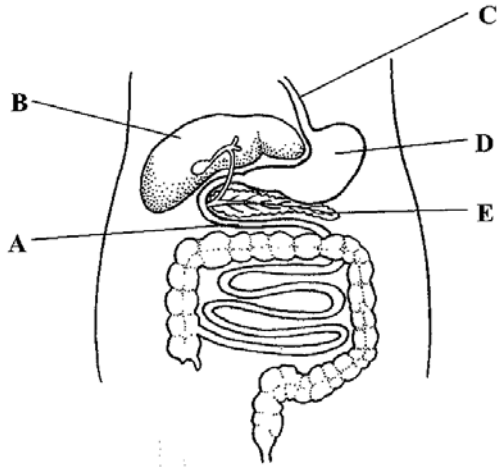
Sample 1 (score 7) **A* standard**
All the words chosen were acceptable.

Sample 2 (score 5) **B standard**
The pulmonary valve is incorrect as is the tissue being named as protein rather than muscle.

Question 4, sample 1

Leave blank

4. The diagram shows part of the human digestive system.



(a) The table below lists some processes that occur in the human digestive system.

Complete the table using letters from the diagram to show where each process occurs. Write **one** letter only in each box.

Process	Letter
protein is first digested	D ✓
fat is emulsified	BA ✓
bile is produced	B ✓
insulin is released	E ✓

(4)

4

(b) (i) Name the process by which muscles move food through the gut.

Peristalsis ✓

(1)

1

(ii) What biological term describes the process of removing undigested food from the body?

Egestion ✓

(1)

1

Q4

(Total 6 marks)

6

Question 4 (out of 6)

This question tested basic knowledge about digestion. Most candidates answered part (a) with little difficulty. There was some confusion shown by weaker candidates who thought protein is first digested in the oesophagus, that bile is produced by the pancreas, that fat is emulsified in the liver and that insulin is released from the liver. A pleasing number of candidates knew that peristalsis is the process that moves food through the gut but many thought excretion is responsible for removing undigested food from the body rather than the correct response of egestion.

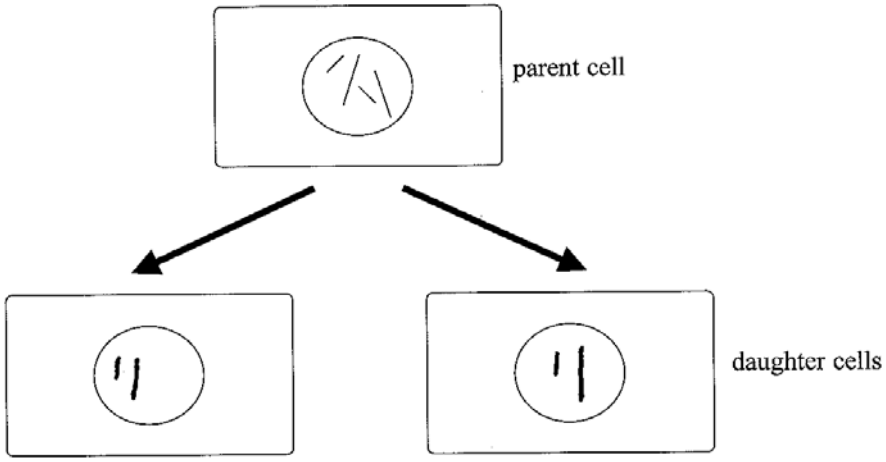
Sample 1 (score 6) **A* standard**
All parts correctly answered demonstrating excellent recall.

Question 5, sample 1

Leave blank

5. (a) Cells can divide by mitosis. The diagram below shows the chromosomes in a parent cell before mitosis takes place.

(i) Complete the diagram to show the chromosomes in each daughter cell.



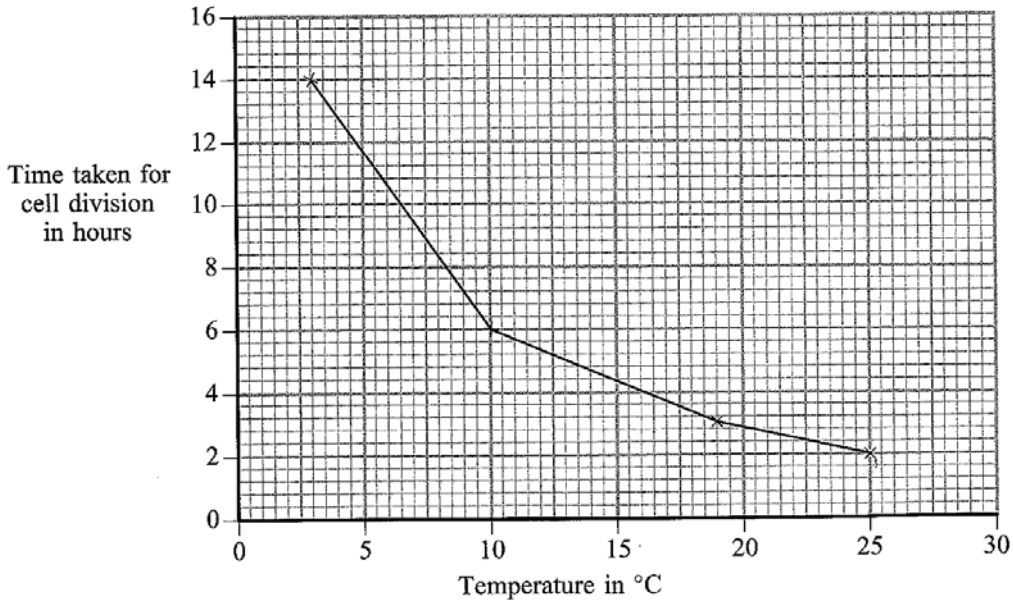
(1)

(ii) What is the diploid number of the parent cell?

46

(1)

(b) The graph below shows the time taken for cells to divide by mitosis at different temperatures.



D1

Leave blank

(i) How does the increase in temperature affect the time taken for cell division to occur?

Increase in temperature speeds up cell division process. 1

(1)

(ii) Starting with one cell, at 25 °C, how many cells would there be after

2 hours 2 2

8 hours ..... 16 .....

(2) Q5

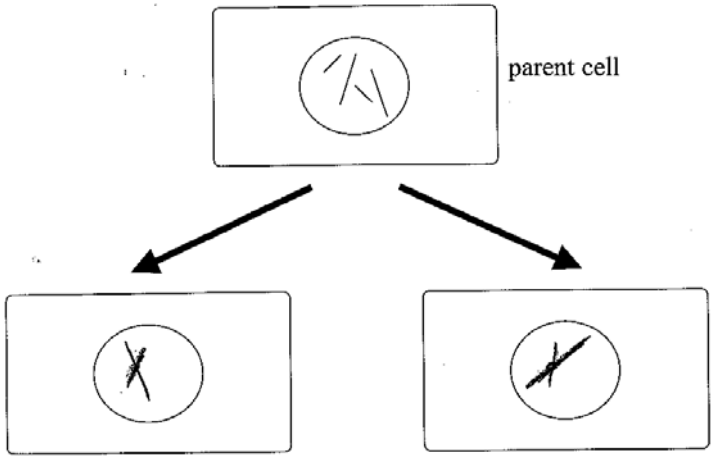
(Total 5 marks) 3

Question 5, sample 2

Leave blank

5. (a) Cells can divide by mitosis. The diagram below shows the chromosomes in a parent cell before mitosis takes place.

(i) Complete the diagram to show the chromosomes in each daughter cell.



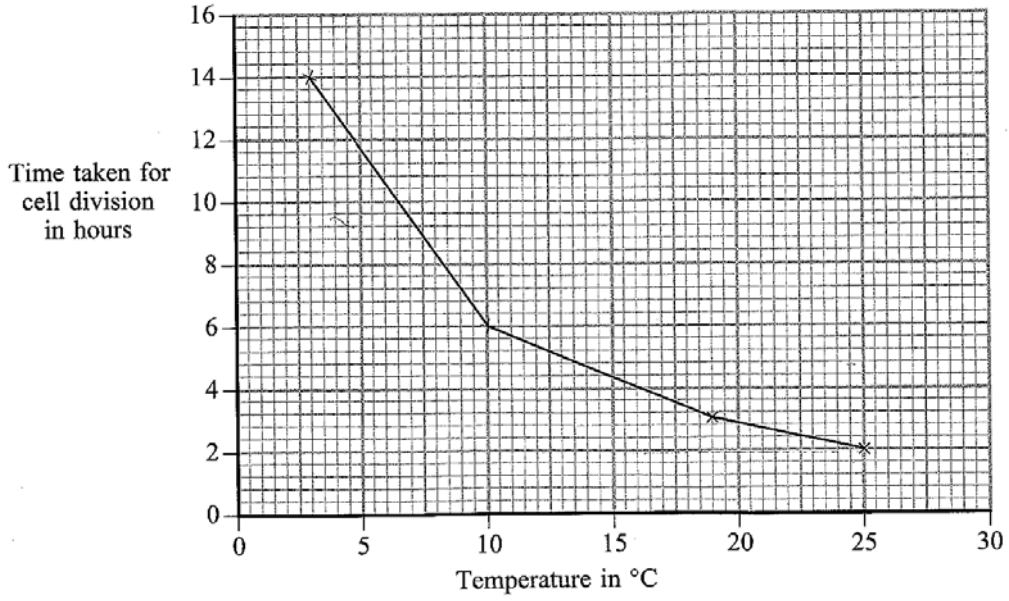
(1)

(ii) What is the diploid number of the parent cell?

~~23~~ 46

(1)

(b) The graph below shows the time taken for cells to divide by mitosis at different temperatures.



Q2

(i) How does the increase in temperature affect the time taken for cell division to occur?

Increase in temperature causes cell division to happen at a faster rate. ✓ **(1)**

Leave blank: 1

(ii) Starting with one cell, at 25 °C, how many cells would there be after

2 hours ..1..

8 hours ..4..

(2)

Leave blank: 0

(Total 5 marks)

Q5: 1/5

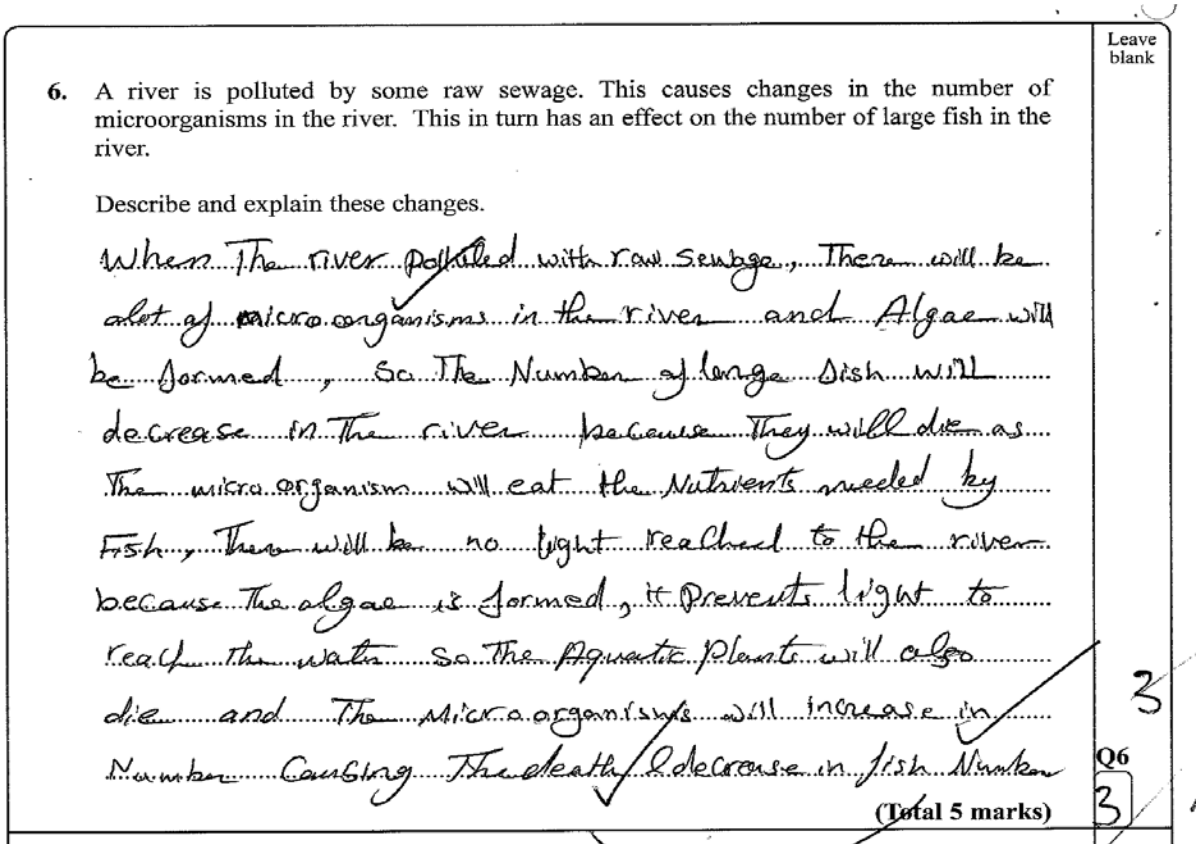
Question 5 (out of 5)

This question challenged many and indicated that the process of mitosis is difficult for students to understand. It was not unusual to see the daughter cells with the haploid number of chromosomes drawn, and many gave 2 or 46 as their answer to the diploid number of the parent cell. Most appreciated that increasing temperature would cause cell division to quicken, though many struggled to express this point clearly. Many failed to calculate that there would be 2 cells after 2 hours and 16 after 8 hours.

Sample 1 (score 3) **B/C standard**
This candidate had drawn the result of meiosis, not mitosis. Therefore, no credit was given. The diploid number of 46 is found in human cells but the cell in the question has a diploid number of 4. Most candidates were able to provide a correct response to part (b) (i), but this candidate stands out form many by being able to correctly calculate the number of cells produced after 2 and 8 hours.

Sample 2 (score 1) **D standard**
The only correct response was the description of the relationship between temperature and time taken for cell division. All the numerical responses were incorrect and the chromosomes drawn in answer to (a) (i) are not worthy of credit.

Question 6, sample 1



Leave blank

6. A river is polluted by some raw sewage. This causes changes in the number of microorganisms in the river. This in turn has an effect on the number of large fish in the river.

Describe and explain these changes.

When The river polluted with raw sewage, There will be alot of micro organisms in the river and Algae will be formed, So The Number of large fish will decrease in The river because They will die as The micro organism will eat the Nutrients needed by Fish, There will be no light reached to the river because The algae is formed, it Prevents light to reach the water So The Aquatic plants will also die and The Micro organisms will increase in Number Causing The death / decrease in fish Number

3

Q6 3

(Total 5 marks)

Question 6 (out of 5)

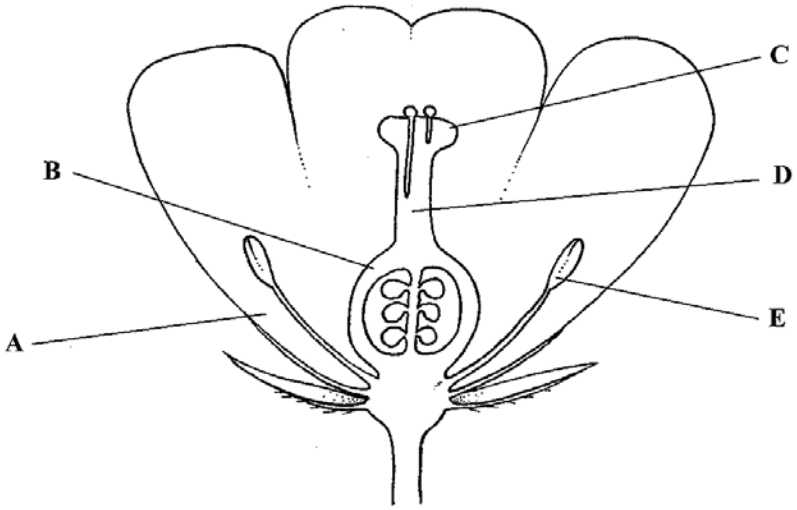
This question tested the ability to write continuous prose. Candidates would benefit from practising writing extended prose as there will always be questions of this type in the examination paper. Precision, relevance and erudition are required. Those who fully understood the role of bacteria in decomposing dead organic material, consuming oxygen by aerobic respiration and the consequence of this on the survival of fish, did very well. Often answers showed confused understanding with fish being killed by toxins in the raw sewage, or describing, in too much detail, algal blooms and eutrophication.

Sample 1 (score 3) **C standard**
Some of the ideas are here, though the candidate was fortunate to be awarded the idea of fish death. Ideally, fish death should be linked to a lack of oxygen, but ideas are marked independently. The ideas of decomposition reducing the oxygen content as a result of microbial respiration are not present.

Question 7, sample 1

Leave blank

7. The diagram shows a section through a flower.



(a) Name the parts labelled **A**, **B**, **C** and **D**.

A Petals

B ovary

C Stigma

D Style

(4)

4

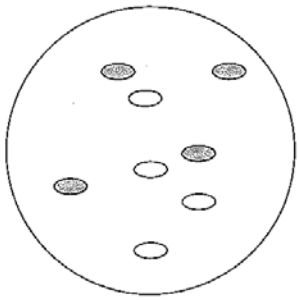
4

Leave blank

(b) Part **E** produces pollen. In some flowers the pollen grains contain starch.

The gene for making starch in the pollen grains has two alleles. The allele **B** for making starch is dominant and the allele **b** is recessive.

Some pollen grains were collected from one flower and tested to see if they contained starch. The diagram below shows the results seen using a light microscope.



Key pollen grain containing starch

pollen grain not containing starch

(i) Name the substance used to test for starch.

Iodine ✓

(1)

(ii) If the pollen grains contain starch, what colour will they be after this test?

blue ~~black~~ colour will appear

(1)

2

Leave blank

(c) Pollen grains are haploid, so contain only one allele for a character.

Look at the diagram in (b) showing the pollen grains.

(i) What is the genotype of the flower that produced these pollen grains? Tick the correct answer.

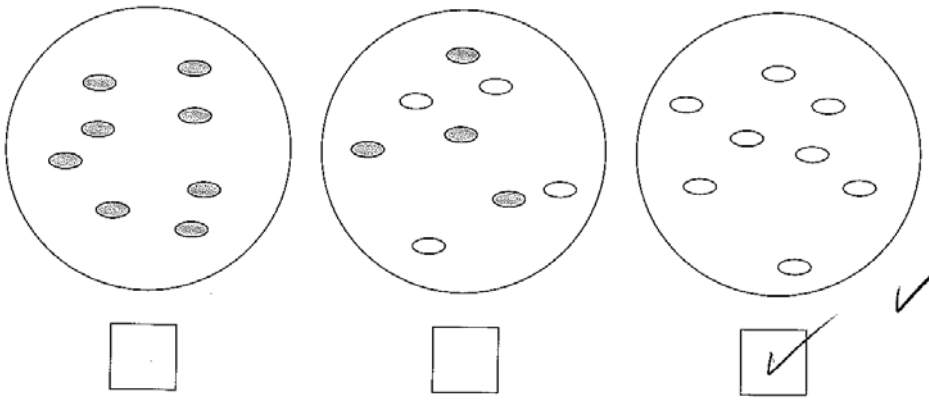
BB (homozygous dominant) ☐

Bb (heterozygous) ☑

bb (homozygous recessive) ☐

(1)

(ii) Pollen is collected from a flower that is homozygous recessive and tested for starch. Which of the following shows the results you would expect to see? Tick the box under the correct answer.



☐ ☐ ☑

(1)

(Total 8 marks)

Q7

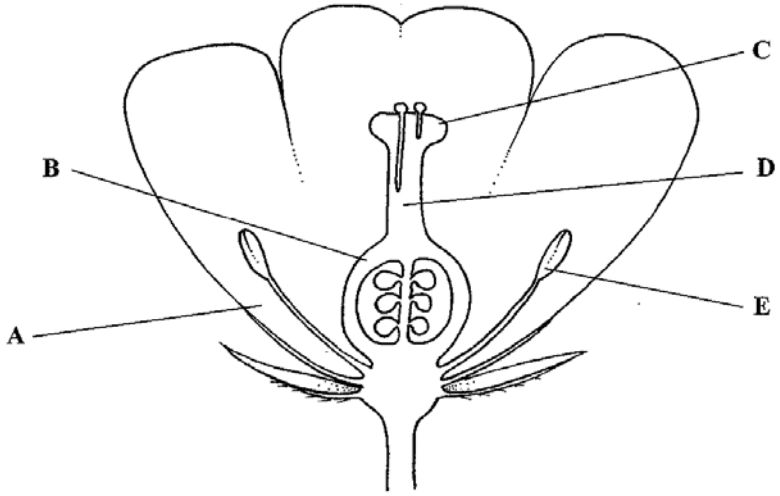
2

8

Question 7, sample 2

Leave blank

7. The diagram shows a section through a flower.



(a) Name the parts labelled **A**, **B**, **C** and **D**.

A Petal ✓

B Ovary ✓

C Stigma

D Style ✓

(4)

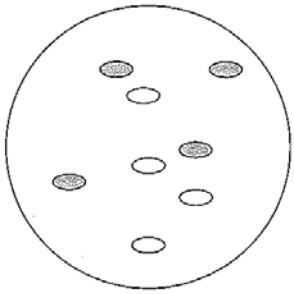
4

Leave blank

(b) Part **E** produces pollen. In some flowers the pollen grains contain starch.

The gene for making starch in the pollen grains has two alleles. The allele **B** for making starch is dominant and the allele **b** is recessive.

Some pollen grains were collected from one flower and tested to see if they contained starch. The diagram below shows the results seen using a light microscope.



Key pollen grain containing starch

pollen grain not containing starch

(i) Name the substance used to test for starch.

Benedict's Solution 0

(1)

(ii) If the pollen grains contain starch, what colour will they be after this test? 0

Brown

(1)

Leave blank

(c) Pollen grains are haploid, so contain only one allele for a character.

Look at the diagram in (b) showing the pollen grains.

(i) What is the genotype of the flower that produced these pollen grains? Tick the correct answer.

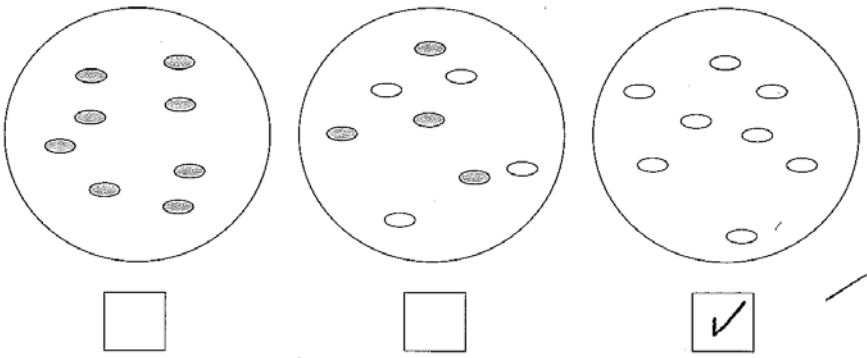
BB (homozygous dominant) ☐

Bb (heterozygous) ☑

bb (homozygous recessive) ☐

(1)

(ii) Pollen is collected from a flower that is homozygous recessive and tested for starch. Which of the following shows the results you would expect to see? Tick the box under the correct answer.



☐ ☐ ☑

(1)

(Total 8 marks)

Q7

6

Question 7 (out of 8)

This question combined testing knowledge of flower parts, food tests and genetics. Most candidates were able to identify the flower parts correctly though weaker candidates thought the stigma and style were the anther and filament. The use of iodine solution to test for starch and the resulting blue black colour was known by many. Possibly helped by the layout of part (c), many were able to appreciate that the genotype was heterozygous in part (i), and that in part (ii), pollen from a homozygous recessive flower would not contain any starch.

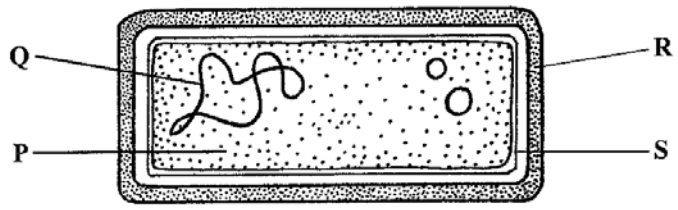
Sample 1 (score 8) **A* standard**
All responses were correct with no ambiguity.

Sample 2 (score 6) **B standard**
This candidate only failed with the questions linked to food tests. Iodine solution is used to test for starch and the colour anticipated if the pollen grains contained starch would be blue black.

Question 8, sample 1

Leave blank

8. The diagram shows a typical bacterium, with parts labelled **P**, **Q**, **R** and **S**.



(a) (i) Which part is made from DNA?

Q

(1)

(ii) Which part is the cytoplasm?

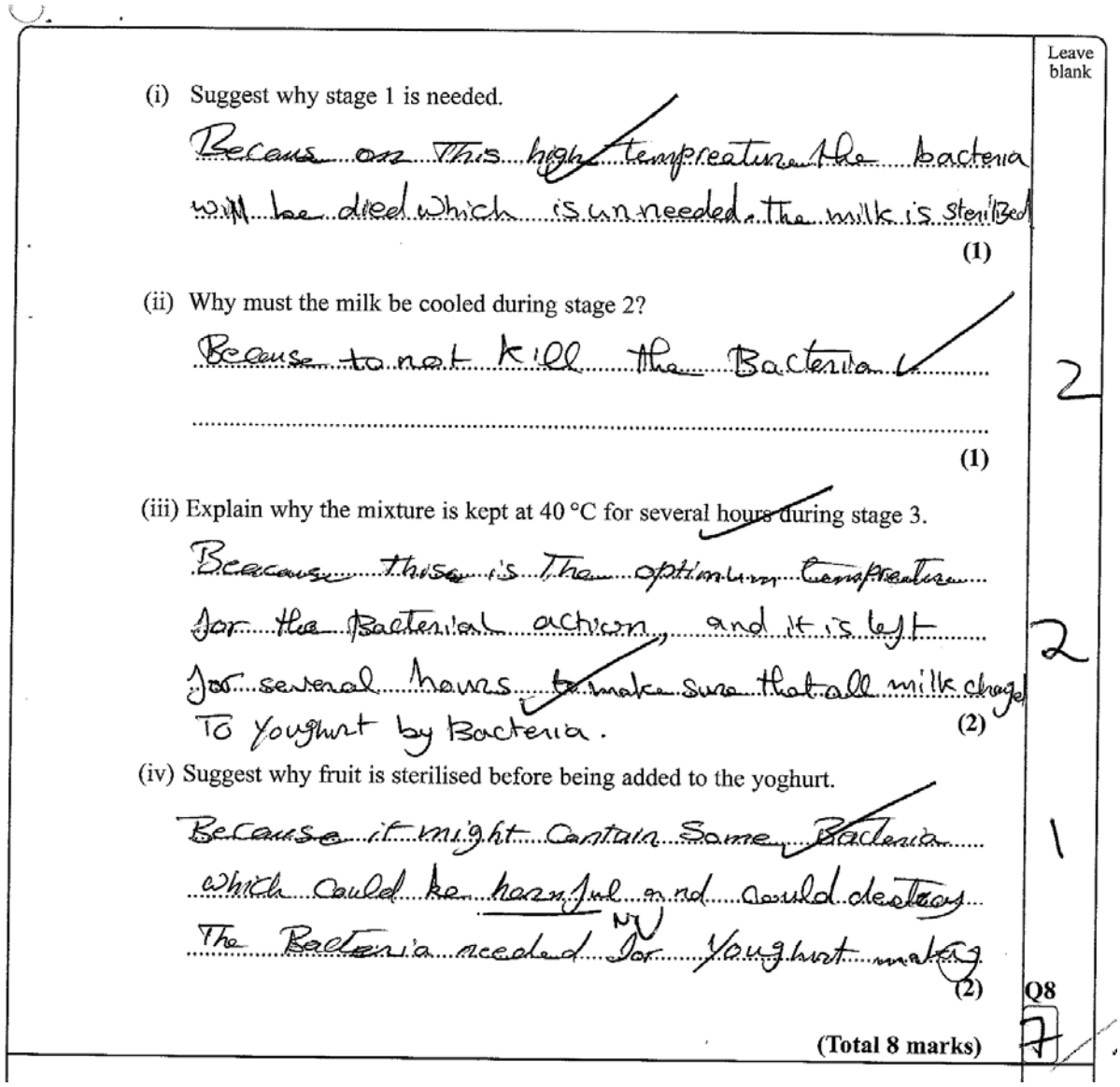
P

(1)

2

(b) *Lactobacillus* are bacteria that are used to make yoghurt. The table lists four stages, 1, 2, 3 and 4, and a description of what happens at each stage in the production of fruit-flavoured yoghurt.

Stage	Description
1	Raw milk is heated to 90 °C for 30 minutes
2	The milk is cooled to 40 °C and bacteria are then added
3	The mixture is kept at 40 °C for several hours until yoghurt is made
4	Fruit is sterilised and added to the yoghurt



Leave blank

(i) Suggest why stage 1 is needed.

Because as this high temprecature the bacteria will be died which is un needed. the milk is sterilled

(1)

(ii) Why must the milk be cooled during stage 2?

Because to not kill the Bacteria

(1)

2

(iii) Explain why the mixture is kept at 40 °C for several hours during stage 3.

Beacause this is the optimum temprature for the Bacterial action, and it is left for several hours to make sure that all milk chage To youghurt by Bacteria.

(2)

2

(iv) Suggest why fruit is sterilised before being added to the yoghurt.

Because it might contain Some Bacteria which could be harmful and could destroy The Bacteria needed for Youghurt making

(2)

1

Q8

(Total 8 marks)

7

Question 8 (out of 8)

This question tested knowledge about the structure of bacteria and the process of manufacturing yoghurt. Most candidates understood that the nucleoid is made of DNA and that P was the cytoplasm. Part (b) was answered well, though expression was often difficult to decipher. In part (b), the idea of bacteria being killed was preferred to the idea of them being denatured, and the term 'germs' should be avoided. Cooling is needed so as not to kill the added bacteria, and recognition of the optimum temperature for reproduction of bacteria or the functioning of their enzymes was expected in (b) (iii). Most good candidates appreciated the need to kill surface bacteria before adding fruit in order not to contaminate the product.

Sample 1 (score 7) **A*/A standard**
This candidate did extremely well. The answer to (b) (ii) gained credit, though it would have been better to have stated that it is the added bacteria that must not be killed.
In (b) (iv), one mark was lost because the reason why the bacteria might be harmful was required.

Question 9, sample 1

Leave blank

9.

Chemical fertilisers are used to increase crop yields. As an alternative to using chemicals seeds can be treated with "biofertiliser".

This biofertiliser provides a way of coating seeds with nitrogen fixing bacteria before they are sown. Biofertiliser is, for example, used in parts of India to improve crop yield.

A comparison was made of the yield of a crop grown using three different treatments. The table shows the results.

Treatment used	Crop yield in tonnes per hectare
no fertiliser	4.0
chemical fertiliser	4.4
biofertiliser	5.6

(a) (i) When compared with using no fertiliser, what is the increase in crop yield using chemical fertiliser?

~~5.6 - 4 = 1.6~~ 4.4 - 4 = 0.4 tonnes per hectare

(1)

1

(ii) When compared with using no fertiliser, the percentage increase in crop yield when using chemical fertiliser is 10%. Calculate the percentage increase in crop yield when using biofertiliser compared with using no fertiliser. Show your working.

$$\frac{5.6 - 4.4}{4.4} = 27.27\%$$

Answer 27.27 %

(2)

0

Leave blank

(b) Explain how nitrogen fixing bacteria help the crop to grow.

Nitrogen fixing bacteria absorb the nitrogen in the air through small air passages in the soil, and use it to respir converts the nitrogen gas into nitrates. These nitrates which are in the soil are ~~absorbs~~ absorbed by the crop by active uptake and are used to build up proteins for the rest of the plant. Therefore nitrogen fixing bacteria is essential for ~~the~~ crop growth.

(4)

4

(c) One disadvantage of chemical fertilisers is that they may need to be applied several times during the growth of the crop. Give **one** reason for this.

Because the nutrients in the chemical fertiliser will be used up by the crop and so, it will have to be applied several times.

(1)

1

Q9

(Total 8 marks)

6

Question 9, sample 2

Leave blank

9.

Chemical fertilisers are used to increase crop yields. As an alternative to using chemicals seeds can be treated with "biofertiliser".

This biofertiliser provides a way of coating seeds with nitrogen fixing bacteria before they are sown. Biofertiliser is, for example, used in parts of India to improve crop yield.

A comparison was made of the yield of a crop grown using three different treatments. The table shows the results.

Treatment used	Crop yield in tonnes per hectare
no fertiliser	4.0
chemical fertiliser	4.4
biofertiliser	5.6

(a) (i) When compared with using no fertiliser, what is the increase in crop yield using chemical fertiliser?

0.4 tonnes per hectare

(1)

(ii) When compared with using no fertiliser, the percentage increase in crop yield when using chemical fertiliser is 10%. Calculate the percentage increase in crop yield when using biofertiliser compared with using no fertiliser. Show your working.

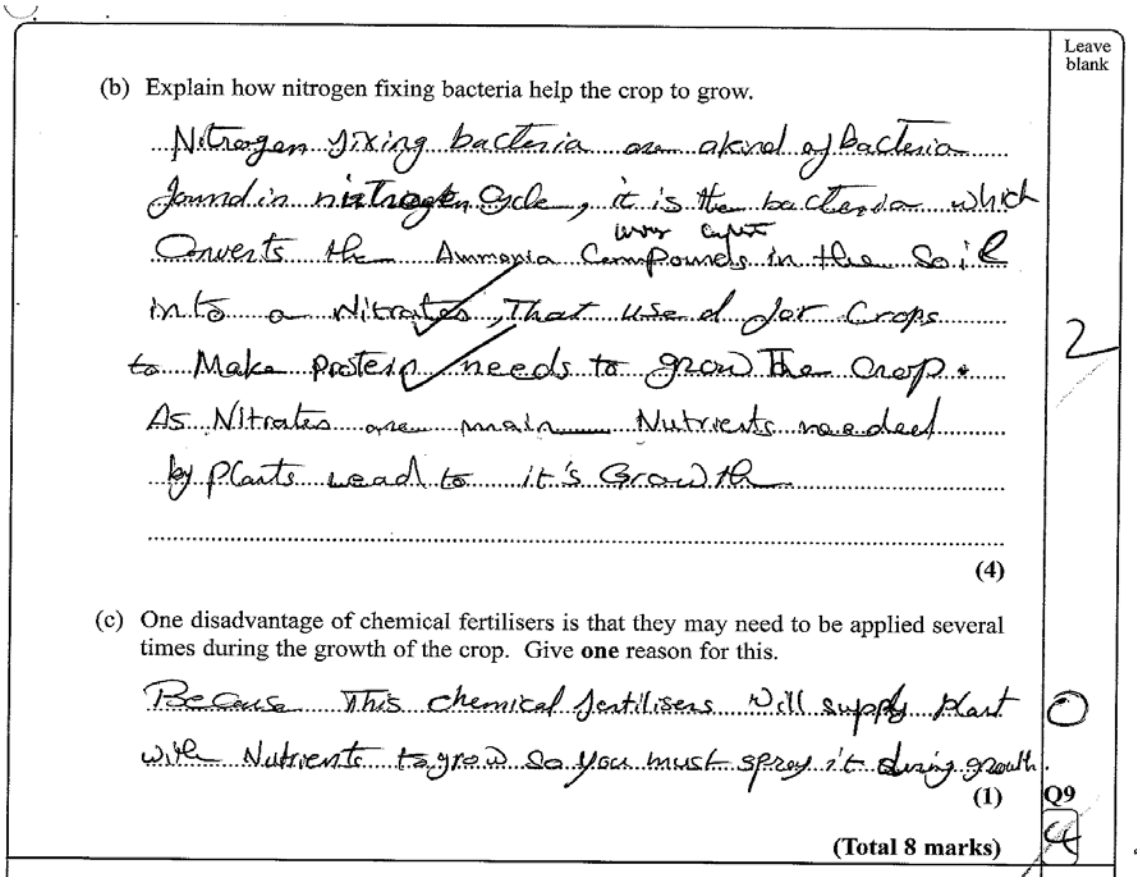
$5.6 - 4.0 = 1.6$

$5.6 + 4.0 = 9.6$

Percentage $= \frac{1.6}{9.6} \times 100 = 16.7$

Answer 16.7 %

(2)



(b) Explain how nitrogen fixing bacteria help the crop to grow.

Nitrogen fixing bacteria are a kind of bacteria found in nitrogen cycle, it is the bacteria which converts the Ammonia Compounds (wrong spelt) in the soil into a Nitrates, That used for Crops to Make protein needs to grow The crop. As Nitrates are main Nutrients needed by Plants lead to it's Growth

(4)

(c) One disadvantage of chemical fertilisers is that they may need to be applied several times during the growth of the crop. Give **one** reason for this.

Because this chemical fertilisers will supply Plant with Nutrients to grow so you must spray it during growth.

(1)

Q9

(Total 8 marks)

Leave blank

2

0

4

Question 9 (out of 8)

This question involved tackling a few calculations before testing knowledge of the nitrogen cycle and the use of chemical fertiliser. A pleasing number of candidates were able to calculate a 0.4 tonnes per hectare increase in crop yield. A few failed to read the question carefully and calculated a 1.6 tonnes per hectare increase. In (a) (ii), the correct answer of 40% was often seen on scripts. With incorrect answers, credit was available for some indication of correct working. Knowledge of the nitrogen cycle is limited and many candidates introduced the names of other types of bacteria and the role they play. In part (c), a pleasing number of candidates appreciated that the chemical fertiliser might be used up or leached.

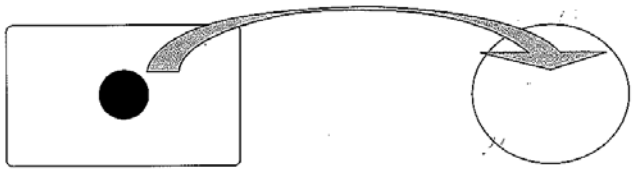
Sample 1 (score 6) **A standard**
The first calculation caused little difficulty but calculating percentage increase was incorrectly answered. Firstly, the candidate should have subtracted 4.0 from 5.6 and then divided the answer by 4.0 before multiplying by 4.0. No marks could be awarded for any working. Part (b) obtained full marks, showing good knowledge of the nitrogen cycle. The idea offered in (c) was acceptable. Candidates also were credited with ideas linked to leaching.

Sample 2 (score 4) **C standard**
Again, percentage increase was incorrectly calculated but one mark was given for some correct working. Candidates are encouraged to show their working as it gives them an opportunity for credit. Knowledge of the nitrogen cycle was poorly expressed, with the main point of obtaining atmospheric nitrogen not getting a mention. The idea offered in (c) was not accepted because it is not clear that the chemicals in the fertiliser are being used up by the crop.

Question 10, sample 1

Leave blank

10. (a) The diagram shows a stage in the cloning of animals. The nucleus of an egg cell is removed and replaced with the nucleus from a body cell called the donor cell. This modified cell is shown as egg cell **X**.



donor cell egg cell **X**

In the table, tick the row with the correct description of the nucleus that was removed from the original egg cell and the nucleus in egg cell **X** that came from the donor cell.

Nucleus in original egg cell	Nucleus in egg cell X	Tick
haploid	haploid	
haploid	diploid	
diploid	haploid	✓
diploid	diploid	

X

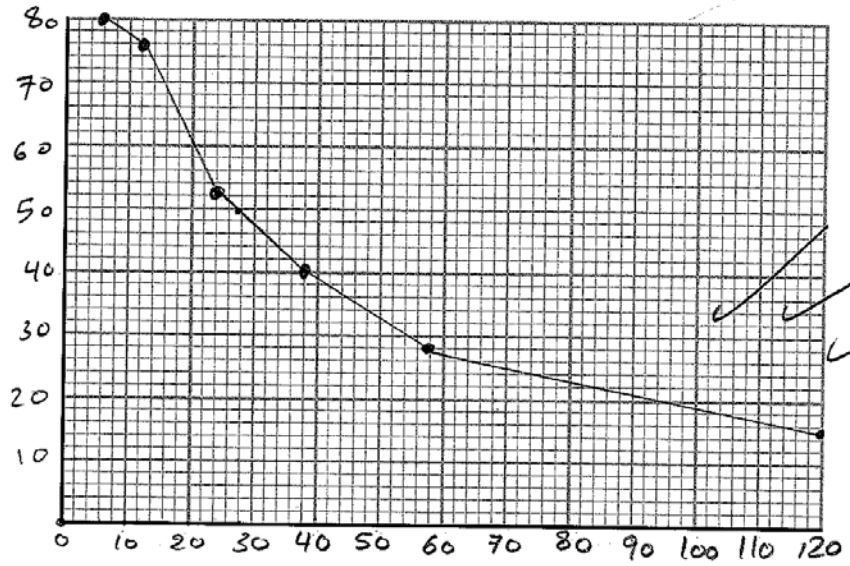
(1)

(b) Cloning experiments have been carried out with frogs at early stages of development. These experiments showed that the age of the donor cells used to provide the nuclei had an effect on the number of offspring that survived. The results of one experiment are shown in the table.

Age of donor cells in hours	Percentage of offspring that survived
6	80
12	76
24	52
38	40
58	28
120	15

Leave blank

(i) Plot the data in the table on the grid below. Join the points with straight lines.



(3)

(ii) At what age did the donor cells produce 50% of offspring that survived?

28

(1)

(iii) Describe the relationship between the age of donor cells and the percentage of offspring that survive.

As the Age of donor cells increase, the Percentage of offspring survived decrease.

(1)

(c) The process described in (a) can be used to make clones of transgenic animals.

What is meant by the term **transgenic**?

Transgenic animals are Animals which are cloned or Produced by the Human control or The transfer of gene of animal to another animal.

(2) **Q10**

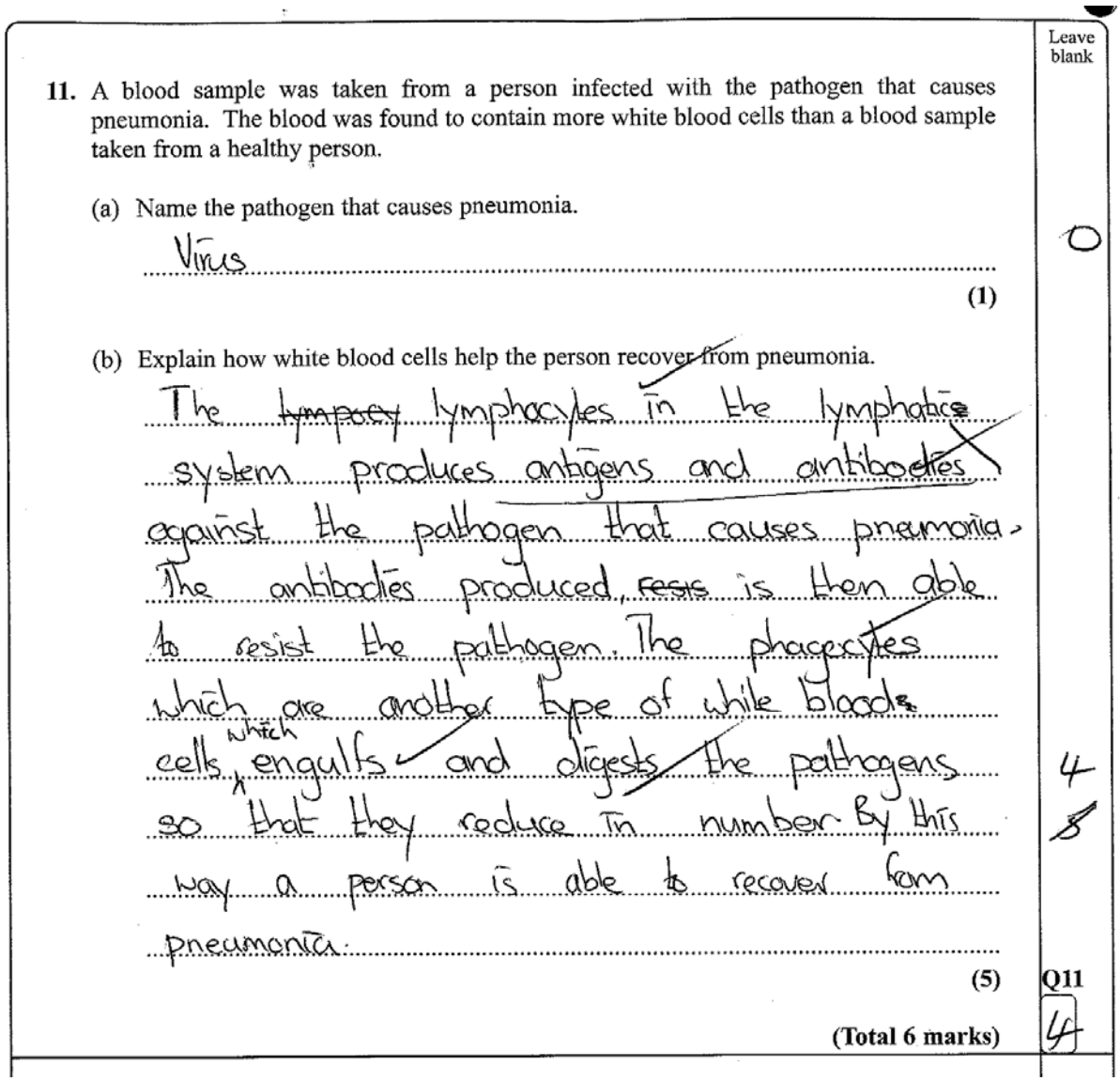
(Total 8 marks)

Question 10 (out of 8)

This question tested knowledge of genetic terms and the ability to draw a graph from which to interpret information. The terms haploid and diploid are not understood by many candidates and only the more able deduced that the nucleus in the original egg cell was haploid and that it had been replaced by a diploid nucleus. Graphs were well drawn, though many ignored the request to join the points with straight lines. A common error in (a) (ii) was to take 50 hour old donor cells and give the answer in the 30's, that is, taking the starting point from the independent axis rather than the dependent axis. Almost all candidates appreciated the pattern in the data showing that the older the donor cell the lower the percentage of offspring that survived. Defining the term transgenic was challenging for most. The idea of DNA or a gene being transferred was credited, as was the idea that the transfer took place from one organism to another.

Sample 1 (score 7) **A*/A standard**
This candidate was unable to interpret the information in order to identify the correct status of each nucleus. Linear scales had been used in the graph and they covered more than half each axis. This gained one mark. The points were plotted accurately and this gained one mark. Finally, the line was drawn through the points and was deemed to be tidy enough to gain another mark. In part (b) (ii), credit was given by reading from the graph plotted by the student and so the mark was awarded in this case. This candidate knew that transgenic animals have had genetic material transferred into them and so gained one mark. The second mark was awarded for appreciating that the gene came from a different animal. It would have been better to have stated a different species, but the mark scheme was generous on this point.

Question 11, sample 1



Leave blank

11. A blood sample was taken from a person infected with the pathogen that causes pneumonia. The blood was found to contain more white blood cells than a blood sample taken from a healthy person.

(a) Name the pathogen that causes pneumonia.

Virus

(1)

0

(b) Explain how white blood cells help the person recover from pneumonia.

The ~~lympacy~~ lymphocytes in the lymphatics system produces antigens and antibodies against the pathogen that causes pneumonia. The antibodies produced, ~~resis~~ is then able to resist the pathogen. The phagocytes which are another type of white blood cells, which engulfs and digests the pathogens so that they reduce in number. By this way a person is able to recover from pneumonia.

(5)

4

5

Q11

4

(Total 6 marks)

Question 11 (out of 6)

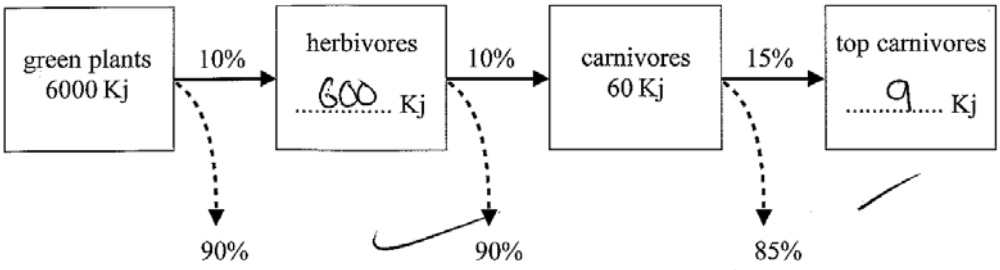
This question tested knowledge and understanding of the way in which white blood cells protect humans from disease. Once again, candidates were expected to fulfil the task by writing continuous prose. It is appreciated that pneumonia can be caused by bacteria or by a virus. However, the specification clearly states that Pneumococcus is the name of the pathogen that candidates are expected to know. There was evidence of many excellent answers, though weaker candidates referred to white blood cells "fighting" bacteria whilst the good candidates named the white blood cells involved and gave detailed explanations of how they helped to destroy pathogens.

Sample 1 (score 4) **B standard**
Although antibodies are mentioned in the answer no credit was given because the prior use of the term antigen negates. Candidates who write in this way by 'hedging their bets' will be penalised.

Question 12, sample 1

Leave blank

12. The boxes in the diagram show the amount of energy in different trophic levels of a food chain. The numbers on the solid arrows show the percentage of energy transferred between the organisms in the different trophic levels. The numbers on the dotted arrows show the percentage of energy not transferred from one trophic level to the next.



(a) Complete the diagram by showing the amount of energy in the box for the herbivores and in the box for the top carnivores.

(2)

(b) All organisms respire. One reason why 90% of the energy is not transferred from the herbivores to the carnivores is because of respiration by the herbivores.

(i) Give the balanced chemical symbol equation for respiration.

$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

(3)

(ii) Give **two** reasons, other than respiration, why 90% of the energy in herbivores is not transferred to the carnivores.

1 Some energy is lost as heat.

2 Some energy is lost as ~~excreation~~ excreatory waste products.

(2)

(c) Which group of organisms shown in this food chain are secondary consumers?

Carnivores

(1)

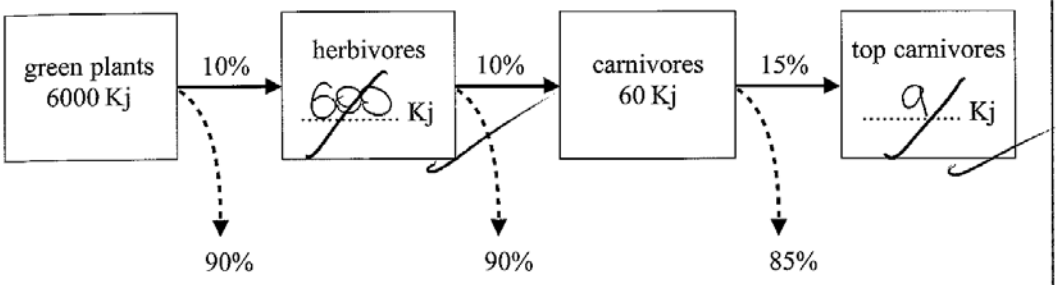
(Total 8 marks)

Q12

Question 12 sample 2

Leave blank

12. The boxes in the diagram show the amount of energy in different trophic levels of a food chain. The numbers on the solid arrows show the percentage of energy transferred between the organisms in the different trophic levels. The numbers on the dotted arrows show the percentage of energy not transferred from one trophic level to the next.



(a) Complete the diagram by showing the amount of energy in the box for the herbivores and in the box for the top carnivores.

(2)

(b) All organisms respire. One reason why 90% of the energy is not transferred from the herbivores to the carnivores is because of respiration by the herbivores.

(i) Give the balanced chemical symbol equation for respiration.

glucose + oxygen → carbon dioxide + water + energy

$+ O_2 \longrightarrow CO_2 + H_2O$ + energy

(3)

(ii) Give **two** reasons, other than respiration, why 90% of the energy in herbivores is not transferred to the carnivores.

1 growth

2 ~~reason~~ movement

(2)

(c) Which group of organisms shown in this food chain are secondary consumers?

carnivores

(1)

(Total 8 marks)

Q12

Question 12 (out of 8)

This question tested understanding of energy flow and involved some calculations. Candidates were able to calculate that 600 Kj of energy should be in the herbivore box and better candidates calculated 9 Kj for the top carnivores. Those who failed to appreciate that the 15% of the energy in the carnivores was transferred to the top carnivores calculated a range of incorrect answers, the most common being 4 (15 goes into 60 four times), 6 (10% of 60) and 10 (10% was being transferred in the first two links of the food chain). The weaker candidates struggled to produce a balanced chemical equation for respiration. A pleasing number of candidates were aware of reasons why energy transfer is not very efficient, most making reference to movement, excretion and egestion. Only the weaker candidates failed to recognise that the carnivores were the secondary consumers in the food chain.

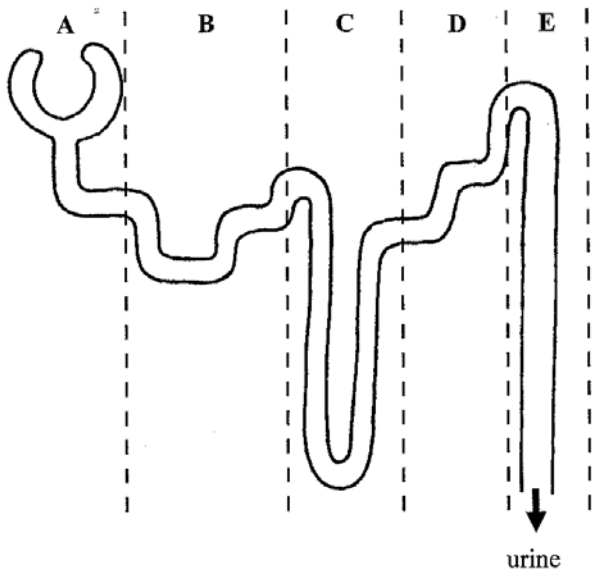
Sample 1 (score 8) **A* standard**
All parts of the question are answered correctly in a succinct manner.

Sample 2 (score 5) **B standard**
The calculations are correct but one mark is lost in the equation because it is not balanced. There was an extensive list of acceptable responses for (b) (ii) and growth was not listed.

Question 13, sample 1

Leave blank

13. The diagram shows a kidney nephron divided into five regions labelled **A**, **B**, **C**, **D** and **E**.



(a) Choose the correct letter to complete the following sentences. Each letter may be used once, more than once, or not at all.

The Bowman's capsule is in region ..... A .....

Ultrafiltration occurs in region ..... ~~C~~ A .....

ADH has its effect in region ..... C ~~B D~~ .....

Selective reabsorption of glucose occurs in region ..... B .....

(4)

3

(b) (i) Normal urine that leaves part **E** contains salts. Name **two** other substances contained in normal urine.

1 ..... Urea .....

2 ..... Water .....

(2)

2

(ii) A person cannot make insulin. Explain why this person's urine may be different from normal urine.

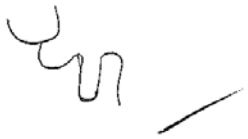
A person who cannot ~~make~~ make insulin means that the level of glucose is high. Therefore the concentration of glucose in the ~~urine~~ of the person who cannot make insulin is high. Therefores urine would be different.

(2)

2

Leave blank

(c) In a nephron, the longer the tube is in region **C**, the more water can be reabsorbed. Look at the information in the table and then draw a nephron for a beaver.

Animal	Description of habitat	Diagram of nephron
kangaroo rat	hot deserts with little water available	
human	on land with enough water available	
beaver	rivers with lots of water available	

1

(1)

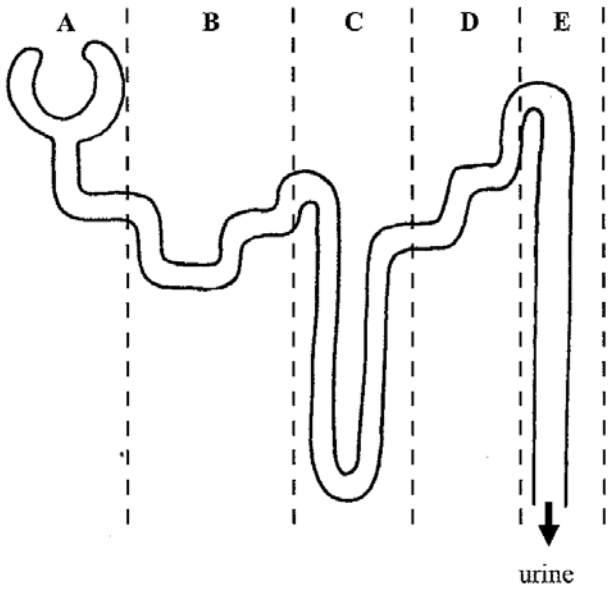
Q13

(Total 9 marks)

Question 13, sample 2

Leave blank

13. The diagram shows a kidney nephron divided into five regions labelled **A**, **B**, **C**, **D** and **E**.



(a) Choose the correct letter to complete the following sentences. Each letter may be used once, more than once, or not at all.

The Bowman's capsule is in region ..A..

Ultrafiltration occurs in region ..B..

ADH has its effect in region ..E..

Selective reabsorption of glucose occurs in region ..C..

(4) 2

(b) (i) Normal urine that leaves part **E** contains salts. Name **two** other substances contained in normal urine.

1 water

2 fatty acids

(2) 1 1

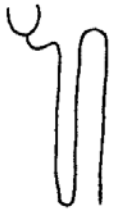
(ii) A person cannot make insulin. Explain why this person's urine may be different from normal urine.

because in region E it goes straight of down where it should go straight and the slightly go down.

(2) 0 0

Leave blank

(c) In a nephron, the longer the tube is in region **C**, the more water can be reabsorbed. Look at the information in the table and then draw a nephron for a beaver.

Animal	Description of habitat	Diagram of nephron
kangaroo rat	hot deserts with little water available	
human	on land with enough water available	
beaver	rivers with lots of water available	

1

1

(1)

Q13

4

(Total 9 marks)

Question 13 (out of 9)

This question tested knowledge and understanding of kidney structure and function. The better candidates appreciated that the Bowman's capsule is in region A, and that ultrafiltration occurs in the same region. A large number of candidates believed that ADH has its effect on the loop of Henle, rather than the collecting duct, and many were unaware that selective reabsorption of glucose occurs at the proximal convoluted tubule. In part (b) (i), water and urea were the anticipated answers, though other acceptable responses were rewarded. The role of insulin in lowering blood glucose levels was understood by many who were able to link this idea to the fact that the abnormal urine might contain glucose. Candidates who used the term glucose were rewarded in preference to those who used the term sugar. Almost all candidates appreciated that beavers would have the shortest loop of Henle.

Sample 1 (score 8) **A*/A standard**
The only mark lost was because the candidate incorrectly chose C rather than E as the part of the nephron where ADH has its effect.

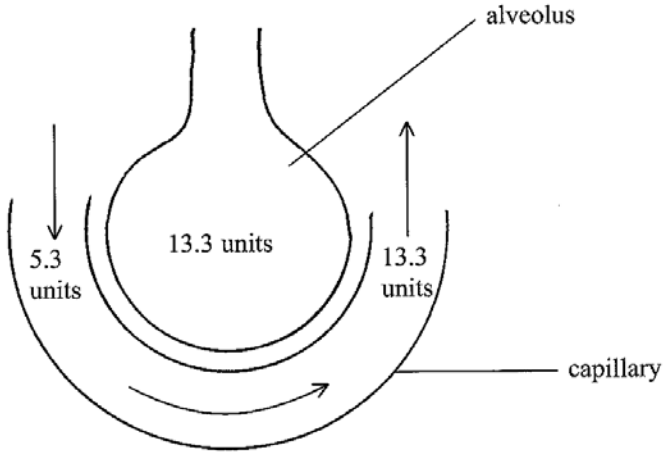
Sample 2 (score 4) **C/D standard**
This candidate could not recall where ultrafiltration occurs or where selective reabsorption of glucose occurs. Nor could the candidate recall that urea is another substance contained in normal urine. Lack of knowledge about insulin resulted in no marks being credited for part (b) (ii).

Question 14, sample 1

Leave blank

14. Gas exchange takes place in the lungs.

The diagram shows an alveolus and a capillary. The numbers on the diagram represent the concentration of oxygen (in arbitrary units) in the alveolus and at different places in the capillary. The arrows show the direction of blood flow in the capillary.



(a) Explain why the concentration of oxygen in the blood changes as it travels along the capillary.

The concentration of oxygen increases when oxygen is absorbed through alveolus into bloodstream.

(2)

(b) The formula shows how to calculate a value that represents oxygen uptake between the lung and the blood.

$$\text{oxygen uptake} = \frac{\text{SA} \times \text{oxygen difference}}{\text{distance}}$$

SA = total surface area of alveoli in m^2 120m^2

oxygen difference = difference in oxygen concentration between the alveoli and the blood entering the capillary in arbitrary units

distance = distance gas molecules travel from the alveoli into the blood in mm 0·1mm

Leave blank

(i) The total surface area in a normal human lung is 120 m^2. The distance between an alveolus and the blood is 0.1 mm.

Use this information, the information in the diagram, and the formula, to calculate the value for oxygen uptake in a normal lung.

Show your working.

Oxygen difference = 13·3 − 5·3 = 8

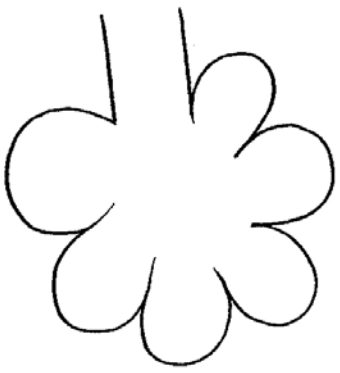
$$\text{Oxygen uptake} = \frac{\text{SA} \times \text{Oxygen difference}}{\text{distance}}$$

$$\text{oxygen uptake} = \frac{120 \times 8}{0.1} \qquad \text{Oxygen uptake} = 9600$$

(2)

2

(ii) Emphysema is a lung disease caused by smoking cigarettes. The diagrams below show the alveoli in a normal lung and the alveoli in the lung of a person with emphysema.



alveoli in normal lung

alveoli in the lung of a person with emphysema

What effect would emphysema have on the value for oxygen uptake?

Less surface area in alveoli, less oxygen taken in.

(1)

1

(iii) Suggest how the air this person breathes can be altered to relieve the symptoms of emphysema.

Breathing rate faster.

(1)

0

Q14

(Total 6 marks)

4

Question 14 (out of 6)

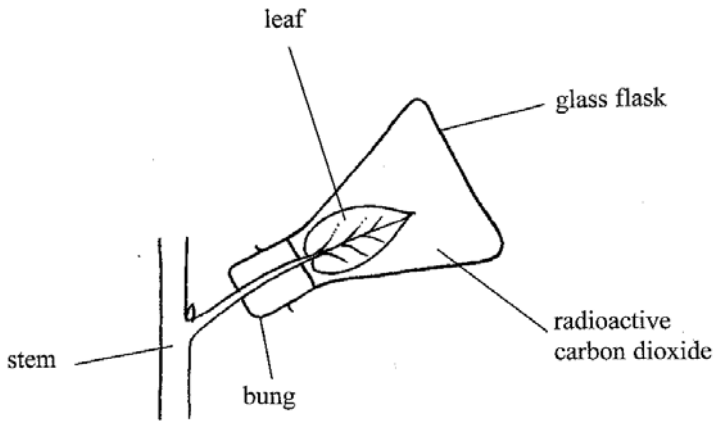
This question tested knowledge and understanding of gas exchange in the lung and involved some mathematical interpretation. Diffusion of oxygen from a high concentration in the alveoli to a low concentration in the capillary was a concept that most candidates appreciated. In part (b), most candidates were able to calculate the correct value for oxygen uptake as 9600. Candidates were not expected to add units to their calculated value. Almost all realised that emphysema would reduce the value for oxygen intake, but only the better candidates understood that treatment for emphysema involved increasing the oxygen concentration of the air breathed in. Answers referring to carbon monoxide levels or other substances were not in the context of the question.

Sample 1 (score 4) **B standard**
A mark was lost in (a) because the term diffusion was not used. Thereafter full marks were given for excellent answers until (b) (iii). Here no mark was awarded because a faster breathing rate was deemed not be a sensible way of treating emphysema.

Question 15, sample 1

Leave blank

15. A plant leaf was exposed to radioactive carbon dioxide as shown in the diagram below.



When the plant leaf is placed in the light and exposed to radioactive carbon dioxide, the carbohydrate it makes is radioactive.

(a) (i) Describe how carbon dioxide gets into the leaf.

Since the leaf is thin and broad, the carbon dioxide gets into the leaf through the stomata since # (stomata) is open in the presence of light.

(2) 1

(ii) Name the process that uses carbon dioxide to make the carbohydrate.

Photosynthesis

(1) 1

(b) The amount of carbohydrate transported to other parts of the plant can be found by measuring the amount of radioactivity.

(i) Name the tissue that transports the carbohydrate.

Phloem.

(1) 1

(ii) Name the carbohydrate that is transported in this tissue.

Starch

(1) 0

Leave blank

(c) The table below shows the amount of radioactivity in different parts of the plant after 24 hours.

Part of plant	Amount of radioactivity in counts per minute
shoot tip	1 123
leaf exposed to radioactive carbon dioxide	11 325
other leaves	234
stem	819
seeds	9 055
roots	842

(i) What evidence in the table shows that carbohydrate is transported both up and down the plant?

Shoot tip (top) and roots (bottom) both show that carbohydrate was transported. **(1)**

(ii) Suggest why the "other leaves" contain only small amounts of radioactive carbohydrate.

Because the other leaves made their food without any radioactive carbon dioxide. **(1)**

(iii) Ignoring the leaf that was exposed, calculate how much more radioactive carbohydrate was found in the seeds than in all the other plant parts added together.

9055 - 3018 = 6037 counts per minute **(1)**

(iv) Explain why a supply of carbohydrate is needed for the uptake of minerals by roots.

Roots needs carbohydrates so ~~that they~~ they can respire, and ~~carry out its functio~~ Root also needs carbohydrates because it anchors the plant and transports minerals to the rest of the plant. **(3)**

(Total 11 marks)

Q15

6 7

Question 15 (out of 11)

This question tested knowledge of photosynthesis, assimilate transport and mineral ion uptake, and involved some data analysis. A pleasing number of candidates recalled that carbon dioxide diffuses into the leaf through the stomata and that photosynthesis makes carbohydrate that is transported in the phloem. The xylem was incorrectly named by some candidates, but the most common error was to name glucose, or more surprisingly starch, as the carbohydrate transported in the phloem. Many candidates understood that the presence of radioactivity in the shoot tip and the root tip provided evidence of translocation up and down the phloem. Part (c) (ii) was more challenging, though some did appreciate that these leaves synthesise their own carbohydrate. Most correctly calculated 6037 counts per minute, and many gave good answers to part (iv), with the best candidates fully understanding the need for respiration to release the energy needed for active uptake of mineral ions.

Sample 1 (score 7) **B/C standard**
Candidates are encouraged to use correct terminology. This candidate uses the phrase 'gets into' rather that the correct term 'diffuses' and lost a mark as a result. Starch is insoluble and is not transported in phloem. The analysis of the data was excellent but the account explaining the link between need for carbohydrate and ion uptake was poor, lacking in the detail expected.

Question 16, sample 1

Leave blank

16. The table gives descriptions of some biological processes.

Complete the table by giving **one** word for the correct name of each process. The first one has been done for you.

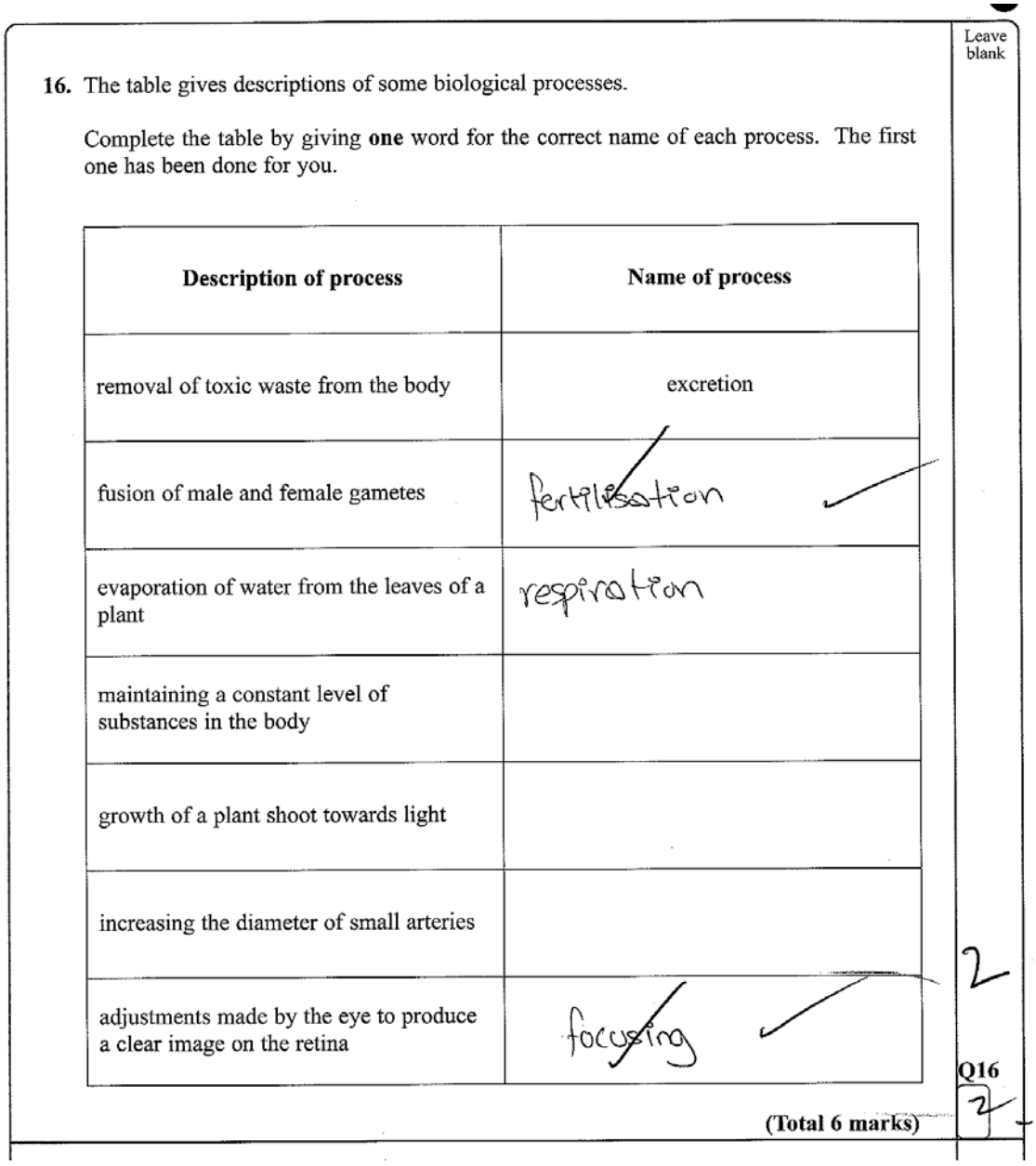
Description of process	Name of process
removal of toxic waste from the body	excretion
fusion of male and female gametes	Fertilization ✓
evaporation of water from the leaves of a plant	Transpiration ✓
maintaining a constant level of substances in the body	Homeostasis ✓
growth of a plant shoot towards light	Phototropism (positive) ✓
increasing the diameter of small arteries	Vasodilation ✓
adjustments made by the eye to produce a clear image on the retina	Accomodation ✓

6

Q16 6

(Total 6 marks)

Question 16, sample 2



Leave blank

16. The table gives descriptions of some biological processes.

Complete the table by giving **one** word for the correct name of each process. The first one has been done for you.

Description of process	Name of process
removal of toxic waste from the body	excretion
fusion of male and female gametes	fertilisation ✓
evaporation of water from the leaves of a plant	respiration
maintaining a constant level of substances in the body	
growth of a plant shoot towards light	
increasing the diameter of small arteries	
adjustments made by the eye to produce a clear image on the retina	focusing ✓

2

Q16

2

(Total 6 marks)

Question 16 (out of 6)

This question was designed to aid full specification coverage and to test understanding of some fundamental biological processes. The question was well answered by many candidates. The consistent errors were to confuse fertilisation with sexual reproduction, homeostasis with osmoregulation and vasodilation with vasoconstriction.

Sample 1 (score 6) **A* standard**
This is the quality of answer expected from the best candidates.

Sample 2 (score 2) **D standard**
It is odd that this candidate could recall a very easy and a very difficult process, but failed to recall any of the others.

Question 17, sample 1

Leave blank

17. DNA is a double helix with each strand linked by a series of paired bases. There are four bases in DNA.

The table below shows the percentage of each base found in a sample of DNA taken from a mammal. Only two of the bases have been named in the table.

(a) Complete the table to give the names of the other two bases.

Percentage of base in DNA sample	Name of base
30	thymine (T)
20	guanine (G)
30	~~Cyto Adenine~~ → Adenine (A)
20	Cytosine (C)

(2) 2

(b) The sample of DNA contained 2000 bases. How many thymine bases would the DNA sample contain?

~~60~~ 30 X 2000 = 60 000 thymine bases.

(1) 0

(c) Human DNA contains the gene to make insulin. Bacteria can be modified to contain this gene. Describe the steps used to do this.

Human DNA which contains the gene to make insulin is cut using restriction enzymes. The plasmid from the bacteria is also cut using the same restriction enzyme. The human DNA is joined with the plasmid of the DNA by ligase enzymes. The recombinant DNA is placed back in the bacteria. ~~The~~ In the bacteria cell, the human DNA continues to produce insulin as in ~~previous~~ previously did. The plasmid is known to be a vector.

(5) 5

Q17 7

(Total 8 marks)

TOTAL FOR PAPER: 120 MARKS

END

Question 17, sample 2

Leave blank

17. DNA is a double helix with each strand linked by a series of paired bases. There are four bases in DNA.

The table below shows the percentage of each base found in a sample of DNA taken from a mammal. Only two of the bases have been named in the table.

(a) Complete the table to give the names of the other two bases.

Percentage of base in DNA sample	Name of base
30	thymine (T)
20	guanine (G)
30	B
20	C

(2)

1 1

(b) The sample of DNA contained 2000 bases. How many thymine bases would the DNA sample contain?

600

(1)

1 1

(c) Human DNA contains the gene to make insulin. Bacteria can be modified to contain this gene. Describe the steps used to do this.

The bacteria is taken out, it is then surrounded with loops of DNA, a piece of it then cut of it, and the insulin is put in instead. The bacteria is then put back into its place.

1

1

(5)

Q17

3

(Total 8 marks)

TOTAL FOR PAPER: 120 MARKS

END

Question 17 (out of 8)

This question tested understanding about the structure of DNA and also how DNA is used in genetic modification. Many understood that adenine was 30% of the DNA sample and that cytosine was 20%. However, the spelling of these important terms left a lot to be desired. Credit was given for correct use of the letters A and C. Most were able to calculate 600 as the correct number of thymine bases contained in the DNA sample. Many candidates were unable to give an accurate account describing the procedures used to genetically modify bacteria.

Sample 1(score 7) **A*/A standard**
An excellent, clear account of genetic modification is given with no ambiguities or errors. The only error in this question was a miscalculation of the number of thymine bases.

Sample 2 (score 3) **C standard**
The name of one base was recalled correctly and the calculation was also correct. The account of genetic modification was poor. The name 'plasmid' was required rather than the term 'loops of DNA' and this candidate believes that insulin is inserted into the opened plasmid which is incorrect.