Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education

CYD-BWYLLGOR ADDYSG CYMRU

Tystysgrif Gyffredinol Addysg Uwchradd

117/02

SCIENCE: BIOLOGY

HIGHER TIER (Grades D - A*)

P.M. WEDNESDAY, 7 June 2006

(2 ½ hours)

For Examiner's use only	
Total Marks	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator.

INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

Question 2 includes a mark for the quality of written communication.

You are reminded of the necessity for good English and orderly presentation in your answers.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

Answer **all** *the questions*

1. Use YES or NO to complete the following table, to show the structures present in animal and plant cells.

The first one has been done for you. [5]

Structure	*Plant cell*	*Animal cell*
Nucleus	YES	YES
Cell wall		
Cytoplasm		
Cell membrane		
Chloroplast		
Vacuole containing cell sap		

2. The following article appeared in the February 2005 issue of BBC Wildlife Magazine.

The Po'o-uli is a small brown bird first identified in 1973 on the island of Hawaii. Then there were fewer than 200 left. By 1997 this was down to 3. One was caught in 2004 for a captive breeding programme. It died from bird malaria. The Po'o-uli belongs to a group of birds called honeycreepers. They are threatened by habitat loss, predators introduced by man and mosquitos which spread bird malaria.

Po'o-uli

(US Fish and Wildlife Service)

(a) Explain what is meant by a captive breeding programme. [2 + 1]

.....

.....

.....

(b) Give **one** natural cause of the decreased numbers of Po'o-uli mentioned in the article. [1]

.....

(c) Suggest the name of **one** predator introduced by man into Hawaii. [1]

.....

(d) The habitat loss that has occurred on the Hawaiian Islands is due to the action of man. State **two** reasons why man destroys habitats. [2]

(i) .....

(ii) .....

(e) Apart from captive breeding programmes state **three** ways in which endangered species can be protected. [3]

(i) .....

(ii) .....

(iii) .....

3. The English Elm, introduced into Britain by the Romans, can only reproduce asexually. This means that all English Elms are genetically identical. They reproduce from shoots that sprout from the roots. Cuttings can be taken from these shoots.

English Elm

(a) What name is given to a group of genetically identical organisms. [1]

.....

(b) Genetically identical organisms are often produced on a commercial basis by tissue culture. Briefly explain how tissue culture is carried out and give an example of a plant that is produced by this method.

Explanation .....

.....

.....

[2]

Example ..... [1]

(c) Give **two** advantages of producing plants by tissue culture. [2]

(i) .....

(ii) .....

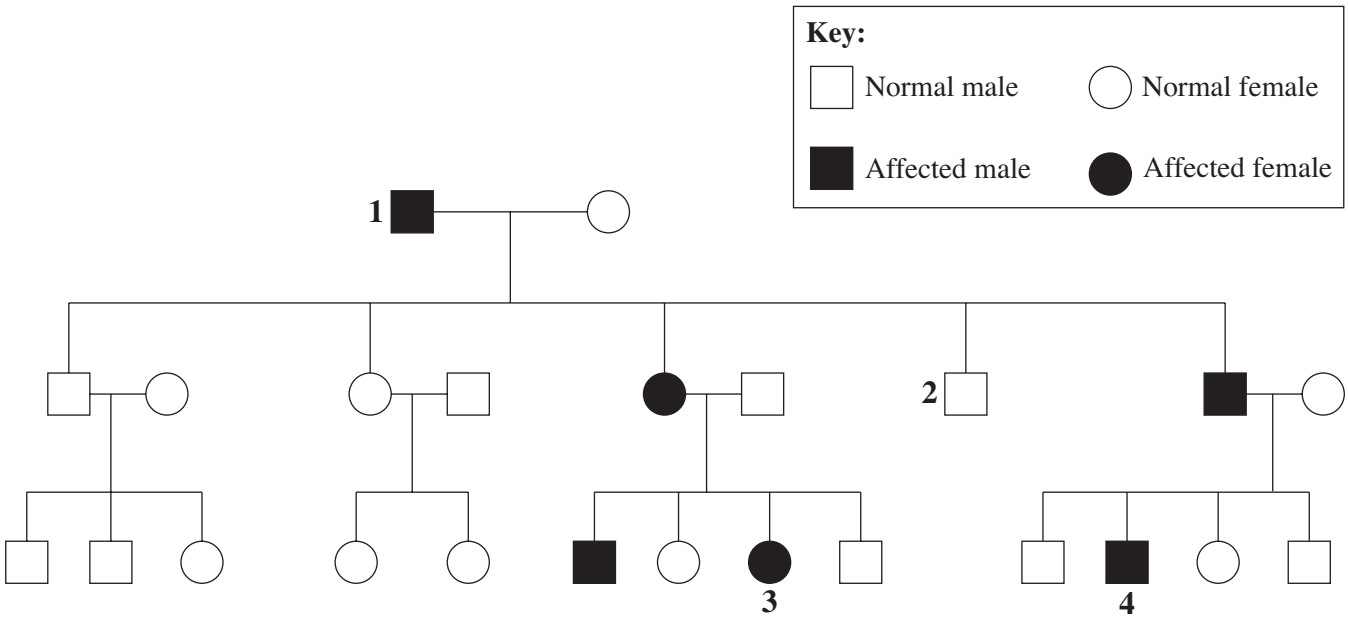
(d) Give **one** difference between asexual reproduction and sexual reproduction. [1]

.....

BLANK PAGE

Turn over.

4. The family tree below shows the inheritance of webbed toes in a human family.
The presence of webbed toes is due to a dominant allele **R**.
The recessive allele, **r**, gives normal toes.



(a) Write down the possible genotypes which could exist. [1]

....

(b) (i) Write down the genotype of the affected male number **1**. [1]

.....

(ii) Give a reason for your answer [1]

.....

.....

(c) (i) Write down the genotype of male number **2**. [1]

.....

(ii) Give a reason for your answer. [1]

.....

.....

(d) (i) In the space below construct a Punnett square to show a cross between woman **3** and man **4**. [2]

(ii) What is the probability of the appearance of webbed toes in the children from the above cross? [1]

.....

5. The following **Waste Factfile** gives some information about the amount of household waste produced in the UK.

- Each household produces about 1.39 tonnes of waste each year.
- Up to 80% ($\frac{4}{5}$) of our waste can be reused, recovered or recycled.
- Every tonne of glass recycled saves 1.2 tonnes of raw materials and the equivalent of 150 litres of fuel oil.
- One tonne of paper made from recycled paper saves:
  - 17 trees;
  - 3 cubic metres of landfill space;
  - 7000 gallons of water;
  - 4200 kWh of electricity;
  - 2000 litres of fuel oil;
  - 28 kg of air pollutants.
- The collection of recyclable materials is financially high.
- The collection of recyclable materials from households involves the use of more transport.

(a) Using the information in the **Waste Factfile**:

(i) State **two** ways in which recycling of household waste can help to conserve fossil fuels. [2]

(I) .....

(II) .....

(ii) State **one** way in which the recycling of household waste increases the consumption of fossil fuels. [1]

.....

(iii) Apart from the saving on fossil fuels, state **two** other environmental benefits of recycling household waste. [2]

(I) .....

(II) .....

(iv) What is the mass of waste that a household could reuse, recover or recycle per year? Show your working. [2]

Answer ..... tonnes

(b) Suggest how manufacturers could reduce the amount of household waste produced. [1]

.....

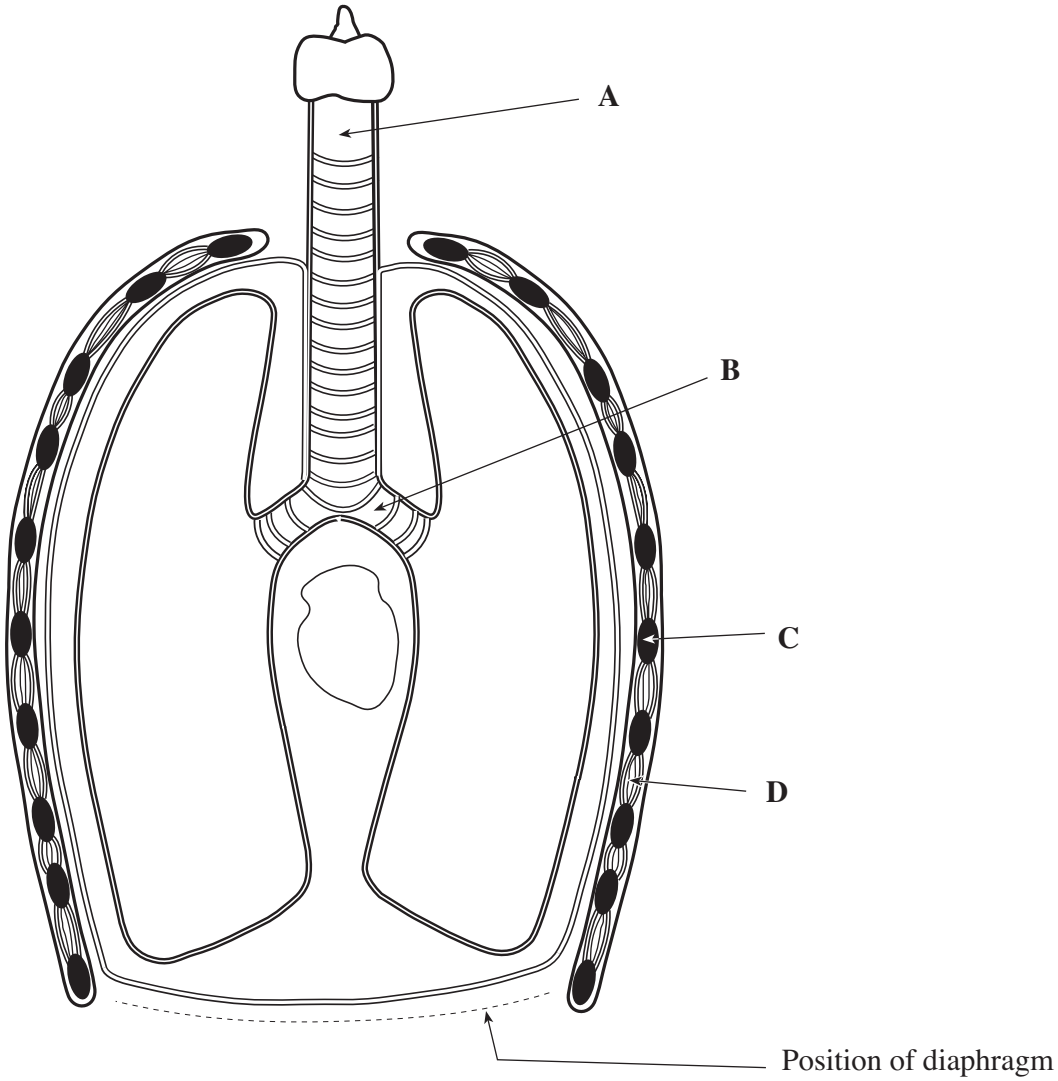
(c) Some supermarkets run recycling schemes in their car parks. Suggest how using this type of scheme is an environmental advantage over doorstep collections. [2]

.....

.....

.....

6. The diagram shows a section through the human thorax during breathing in (inspiration).



(a) (i) Name the structures labelled **A**, **B**, **C** and **D**. [4]

A .....

B .....

C .....

D .....

(ii) State **one** difference that you would see if the diagram had been drawn after breathing out (expiration). [1]

.....

(b) The table below shows some differences between inspired and expired air.

Gas	*% in inspired air*	*% in expired air*
Oxygen	20.7	14.69
Water vapour	1.25	6.27
Carbon dioxide	0.04	3.88

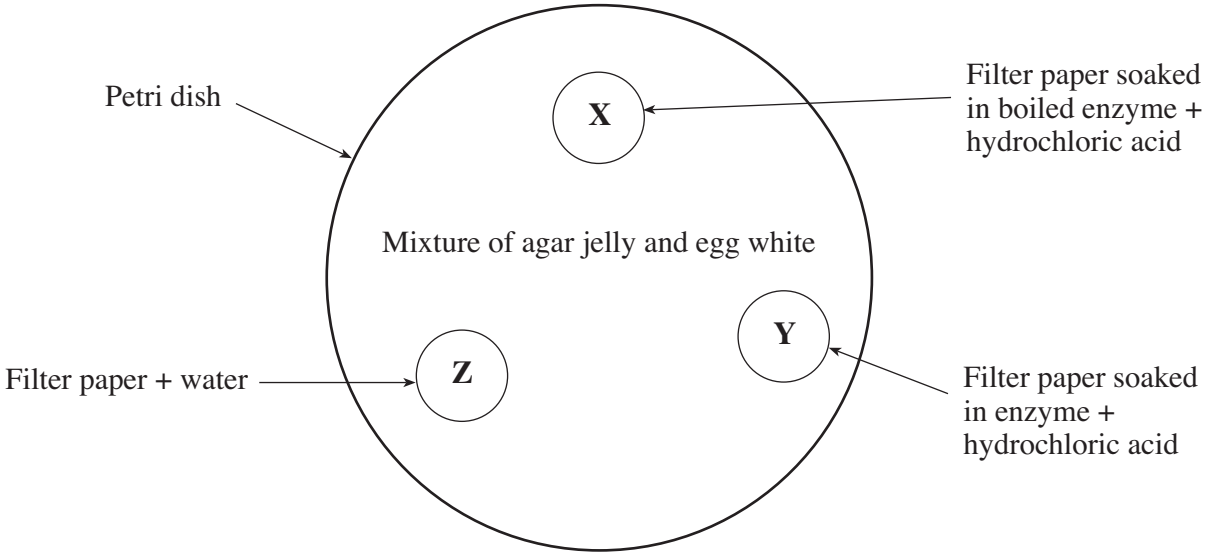
Explain the decrease of oxygen in the expired air. [1]

.....

.....

1

7. Three discs of filter paper, treated as shown below, were placed on agar jelly containing egg white.



After 30 minutes the area under each disc was tested for amino acids, glucose and fatty acids. The results are shown in the table below.

Filter paper disc	*Amino acids*	*Glucose*	*Fatty acids*
X	–	–	–
Y	+	–	–
Z	–	–	–

Key:

+ = present

– = absent

(a) Suggest, with a reason, the name of the enzyme. [2]

Name .....

Reason .....

.....

(b) On which class of food is the enzyme acting? [1]

.....

(c) Why is disc **Z** included in the experiment? [1]

.....

.....

(d) In which part of the alimentary canal does this enzyme normally work? [1]

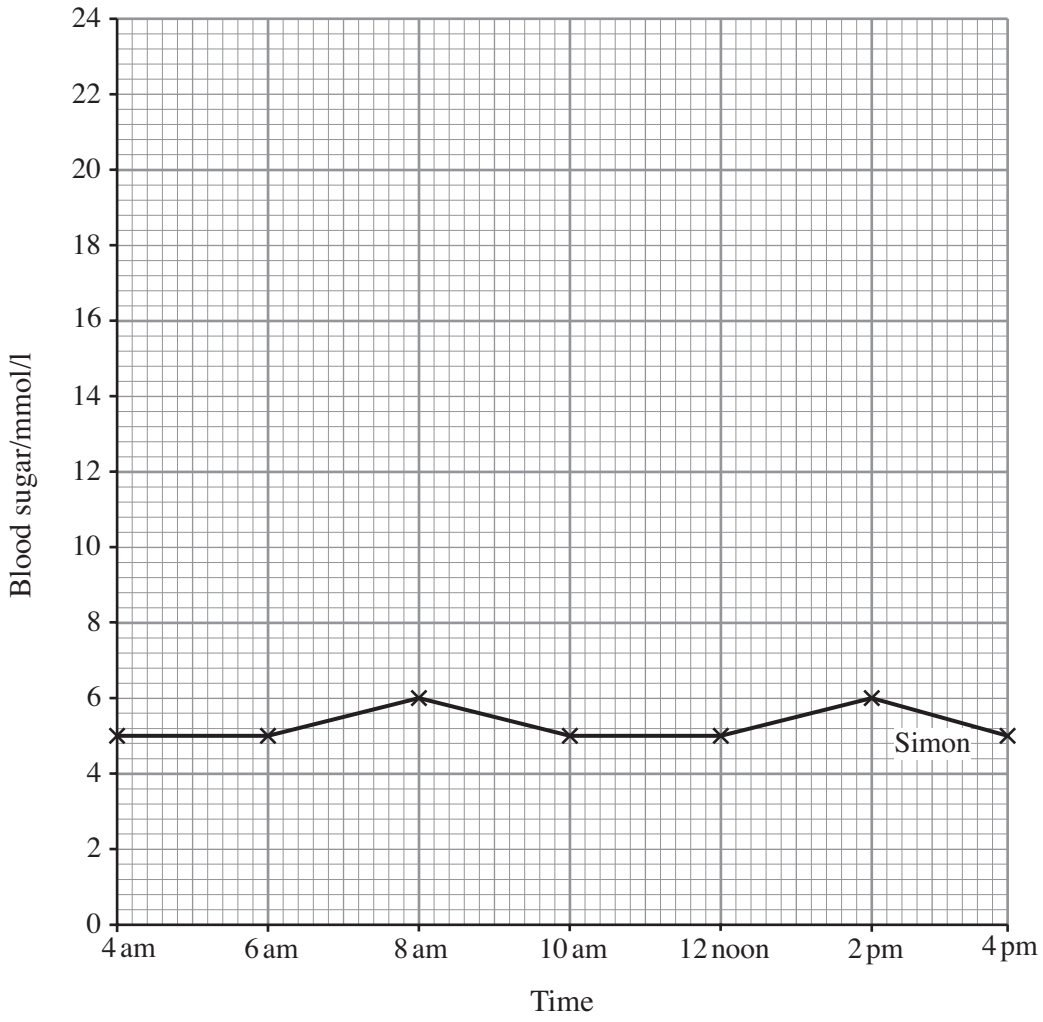
.....

BLANK PAGE

8. The table below shows the blood sugar readings of two school pupils, John and Simon, over a 12 hour period.

	Blood sugar / mmol / l	
Time	*John*	*Simon*
4 am	7	5
6 am	6	5
8 am	18	6
10 am	2	5
12 noon	9	5
2 pm	22	6
4 pm	20	5

(a) (i) Complete the chart below by plotting the data for John.
The data for Simon has been plotted for you. [2]
Join the plots with ruler and label the line John. [1]



(ii) John is a diabetic, the blood sugar control mechanism doesn't work.
Suggest what could have caused John's blood sugar level to rise at 8 am and 12 noon. [1]

.....

(iii) If a persons blood sugar level falls below 4 mmol/l then they may suffer a "hypo" (they become hypoglycaemic). This can be very dangerous.

(I) At what time did John suffer a "hypo"? [1]

.....

(II) Suggest what could have caused his blood sugar level to drop so low that a "hypo" occurred. [1]

.....

(III) What should John do to quickly recover from this "hypo"? [1]

.....

(b) State **two** possible ways by which John could control his diabetes. [2]

(i) .....

(ii) .....

9. *(a)* The table gives some examples of selective breeding and natural selection.

Decide if each example illustrates selective breeding (S) or natural selection (N) by writing S or N in the spaces in the table. [5]

Example	*Letter S or N*
The production of sheep which are able to withstand cold winters.	
The increased resistance to a particular antibiotic by bacteria.	
The development of a type of wheat which is more resistant to disease.	
The evolution of a type of grass to grow in soil containing high amounts of heavy metals.	
The similarity between a snail's shell colour and its habitat background, making it less easy for birds to see.	

(b) The table shows the mass of prize-winning turkeys over a period of 30 years. The mass of food eaten and other environmental factors remained the same and no growth hormones were given to the turkeys.

Year	*Mass of prize-winning turkey (kg)*
1955	18
1960	22
1965	28
1970	29
1975	33
1980	35
1985	36

(i) Describe how turkey farmers have caused this trend to occur. [3]

.....

.....

.....

.....

.....

(ii) Besides giving the turkeys enough food and water, state **two** other environmental factors that could be controlled by the farmer to keep meat production at a high level.

(I) .....

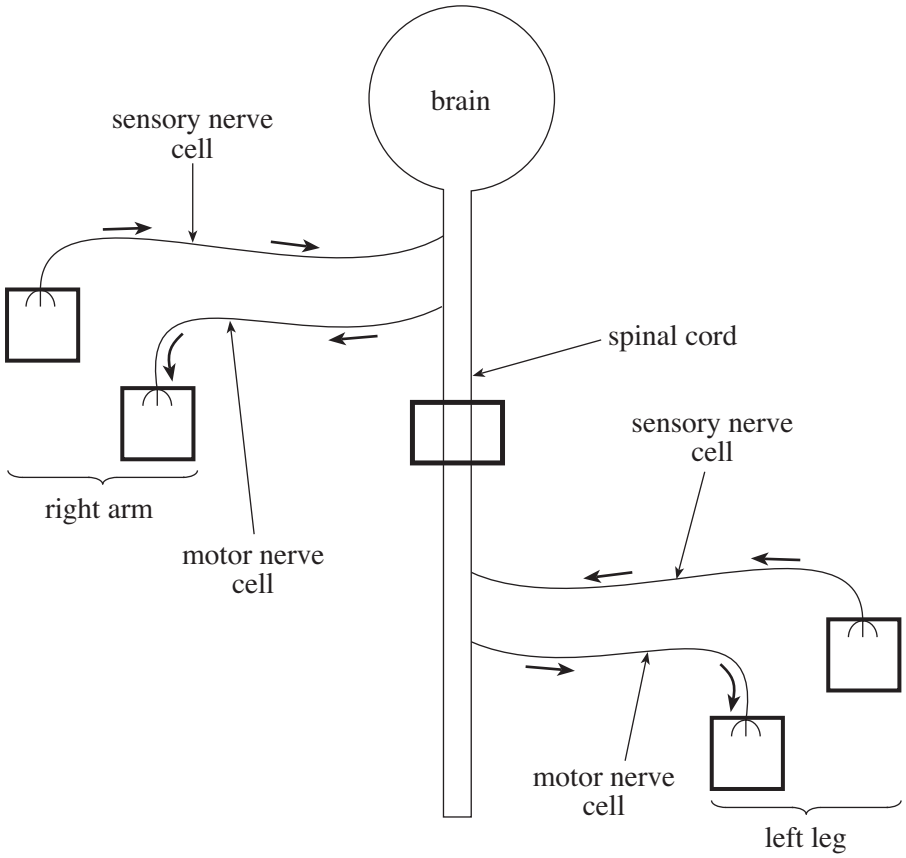
(II) .....

[2]

10. *(a)* Below is a brief summary of the route taken by a nerve impulse during a reflex action involving the eye. Complete the summary by filling in the blank spaces.

Light stimulates receptors in the ..... of the eye. Nerve impulses are sent through the sensory nerve cell of the ..... nerve to the brain which is the ..... in this reflex. The impulse then travels along the motor nerve cell to the effector which is the ..... of the eye. On its way around this reflex arc the impulse has to cross small gaps called ..... . [5]

(b) The diagram shows part of the nervous system.



Sense organs are receptors and are linked to the brain by nerves. Four different people had some of their nerves blocked with a chemical so that their responses were affected as set out below, **A – E**.

A. The person can feel a pinprick in his arm and he can move the arm but there is no feeling or movement in his legs.

B. The person can feel a pinprick in his leg but cannot move it.

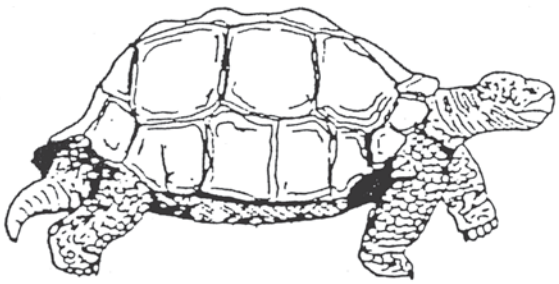
C. The person can move his arm but cannot feel a pinprick in his arm.

D. The person can move his leg but cannot feel a pinprick in his leg.

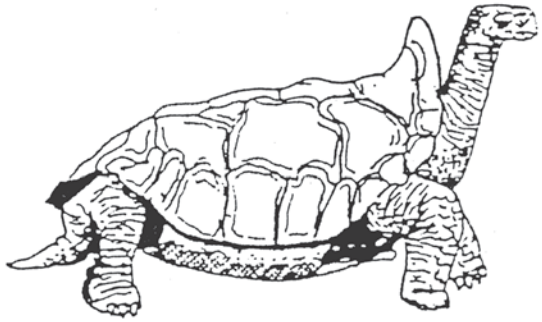
E. The person can feel a pinprick in his arm but cannot move it.

Mark the letter in each one of the boxes in the diagram, to show where the chemical would have to be applied in order to explain each response. [5]

11. Charles Darwin formed many of his ideas for his theory of natural selection when he visited the Galapagos Islands in the Pacific Ocean, 600 miles west of the mainland of South America. Each island has its own particular form of the giant tortoise. They are of two main types, shown as **A** and **B** in the diagrams below.



Type **A**
Feeds on grass and other low growing plants.



Type **B**
Feeds on bushes

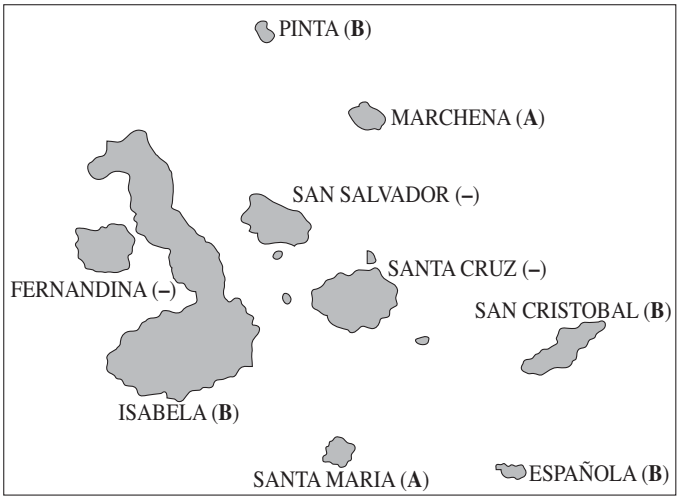
(a) List **two** features shown by type **B** which would help it survive on islands with only bushes and no low growing plants.

(i) .....

(ii) .....

[2]

(b) The map below shows the Galapagos islands and the type of tortoises found on them. The symbols (**A**) or (**B**) show the type of tortoises and (**–**) shows where there are no tortoises.



On which islands would you expect to find low growing plants? [1]

.....

(c) Since goats were introduced to the islands, the numbers of tortoises have decreased. Suggest why this has happened. [1]

.....

.....

.....

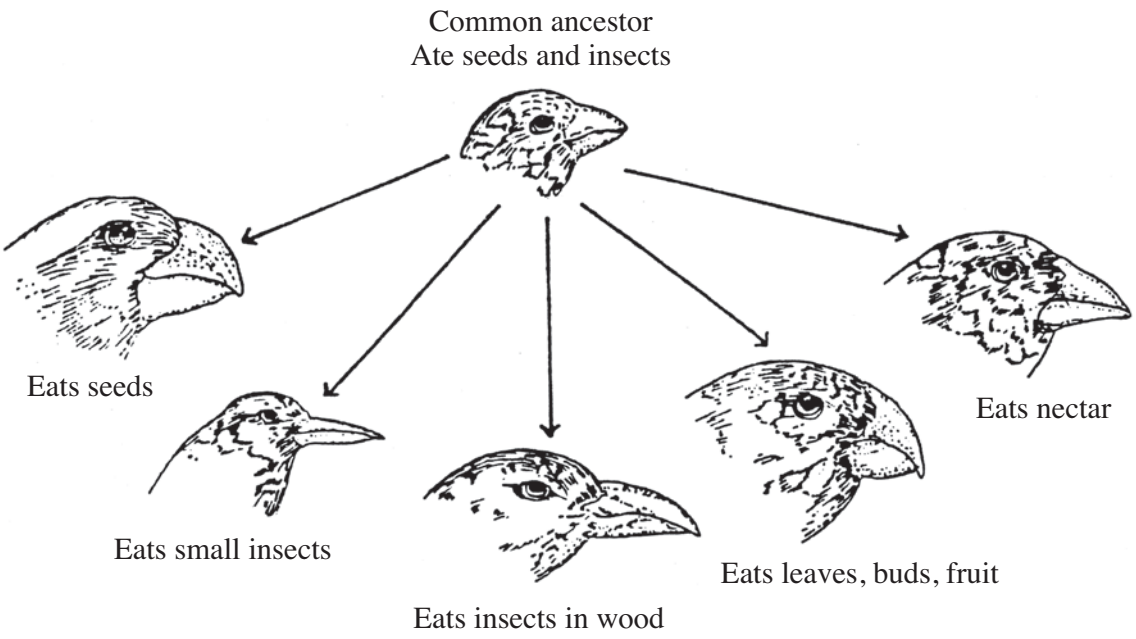
(d) (i) Type **B** probably evolved from a type like **A** by mutation. What is meant by the word, mutation? [1]

.....

(ii) Name **one** factor in the environment which increases the rate of mutations. [1]

.....

(e) The diagram below shows finches found on the Galapagos Islands. The beaks of the finches show how they are adapted to eating various types of food. The common ancestor of all these birds was found on the mainland of South America.



Explain the evolution of the various types of finches in terms of natural selection. [3]

.....

.....

.....

.....

.....

(f) Suggest why some types of finches can be found in all parts of the world, but the giant tortoises living on the Galapagos Islands are not found to occur naturally anywhere else. [1]

.....

.....

.....

12. The table shows the compostition of four fluids from the kidney.

Substance/cells	*Fluid in kidney*				*Dialysis fluid*
	P	**Q**	**R**	**S**	
salts	+	+	+	+	
urea	+	+	+		
glucose	+	+		+	
proteins		+		+	
water	+	+	+	+	+
blood cells		+		+	

Key: + = present.

Use the information in the table and your knowledge to answer the questions which follow.

(a) In a healthy person, which of the columns **P**, **Q**, **R** or **S** could represent the contents of

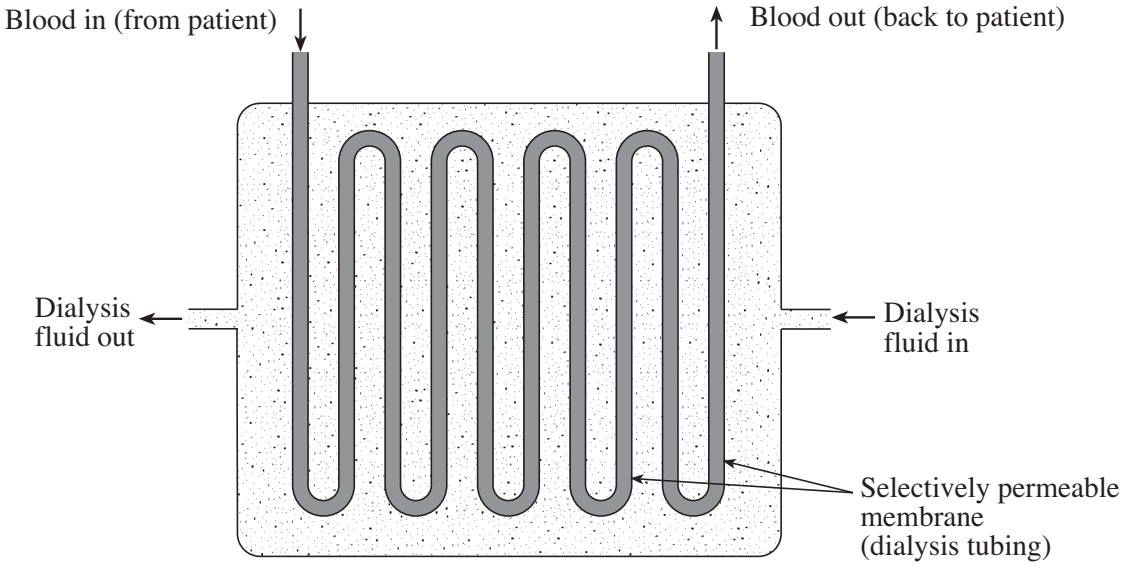
(i) the bladder, ...

(ii) the renal artery, ...

(iii) the renal vein, ...

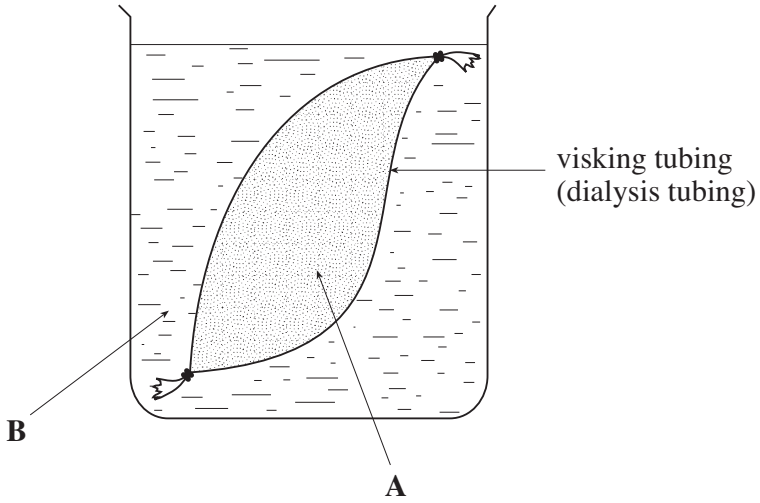
(iv) the Bowman's capsule. ..... [4]

(b) (i) The diagram below shows the principle of a kidney dialysis machine.



There are three substances which are present in dialysis fluid so that substances valuable to the body are not lost. One is water. Complete the dialysis fluid column in the table to show the other two. [2]

(ii) The following apparatus can be used to demonstrate dialysis.



Choose letters from the *Fluid in kidney* columns in the table which represent fluid **A** and **B** shown in the apparatus.

A = ...

B = ... [2]

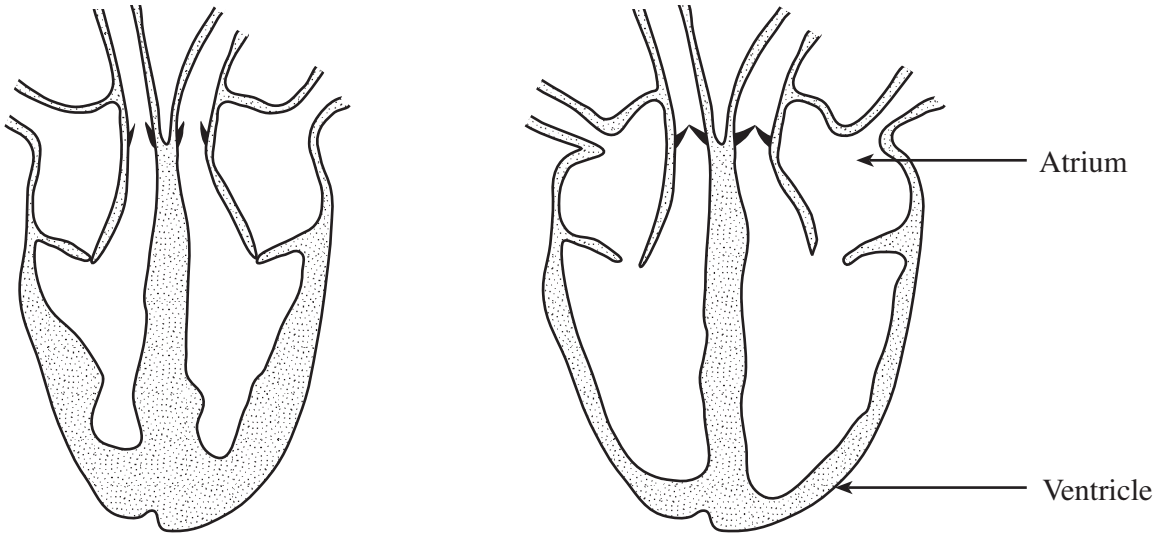
(c) State **one** advantage and **one** disadvantage of a kidney transplant compared with the use of a kidney dialysis machine for a person with kidney failure.

Advantage .....

Disadvantage .....

[2]

13. *(a)* The diagrams **A** and **B** show vertical sections through the heart in two stages of beating



A **B**

Complete the table by using the letters **A** or **B**.

Actions happening during the heartbeat.	*Shown in diagram* **A** *or* **B**
Contraction of the ventricles.	
Blood entering the atria.	
Blood entering the ventricles.	
Blood leaving the ventricles.	
Contraction of the atria.	

[5]

(b) The table shows the compostition of blood from three patients in hospital.

Patient	*Red blood cells per mm^3*	*White blood cells per mm^3*	*Platelets per mm^3*
Rhian	6 500 000	56 000	250 000
Lucy	5 100 000	8 100	260 000
Anita	2 200 000	5 000	5 000

Use the information in the table and your knowledge to answer the following.

Suggest which patient:

(i) had difficulty in transporting oxygen in her blood;

Patient .....

Reason .....

[2]

(ii) had blood which took a long time to clot;

Patient .....

Reason .....

[2]

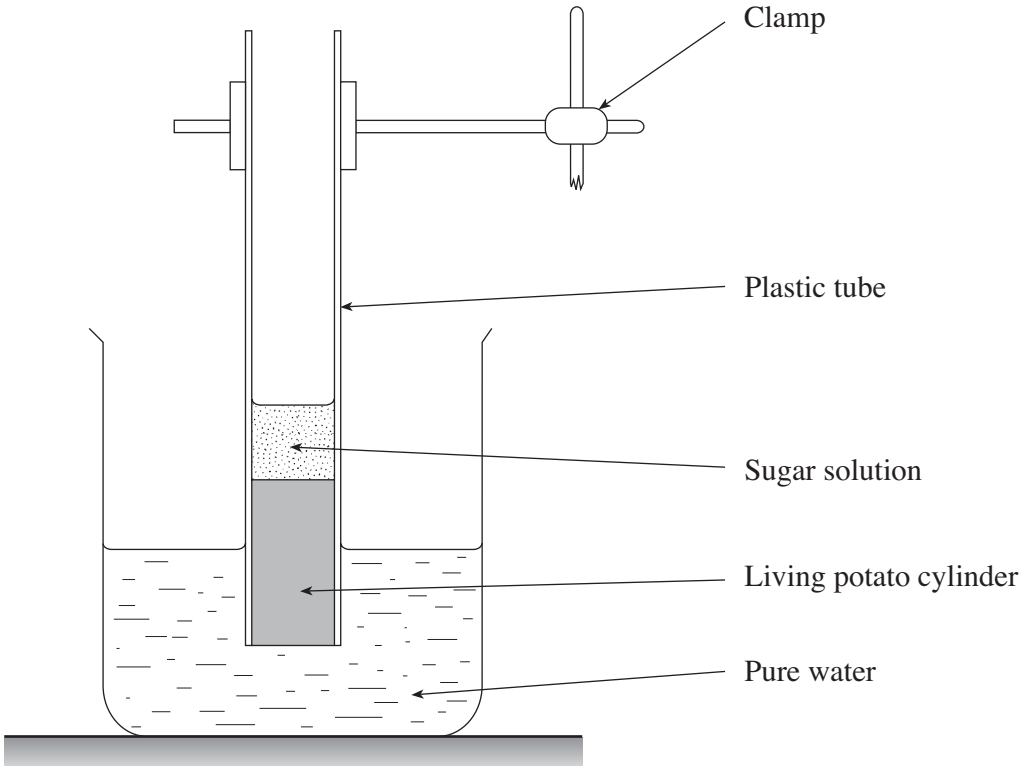
(iii) had an infection.

Patient .....

Reason .....

[2]

14. A cylinder of peeled potato was placed in a clear plastic tube as shown in the diagram. The tube was clamped with its end in a beaker of pure water, so that the exposed end of the potato cylinder was in contact with the water. A 15% sugar solution was poured into the plastic tube above the potato cylinder as shown.



(a) Describe the changes that are likely to occur in the levels of the liquid in the apparatus after two hours.

Change in level of

sugar solution, ...

pure water. .....

[1]

(b) Give a complete explanation of your answer to *(a)*. [5]

.....

.....

.....

.....

.....

.....

(c) Describe any changes that you would expect to occur in the level of sugar solution if the fresh potato cylinder was replaced by a cylinder of boiled potato. [1]

.....

(d) Explain your answer to *(c)*. [1]

.....

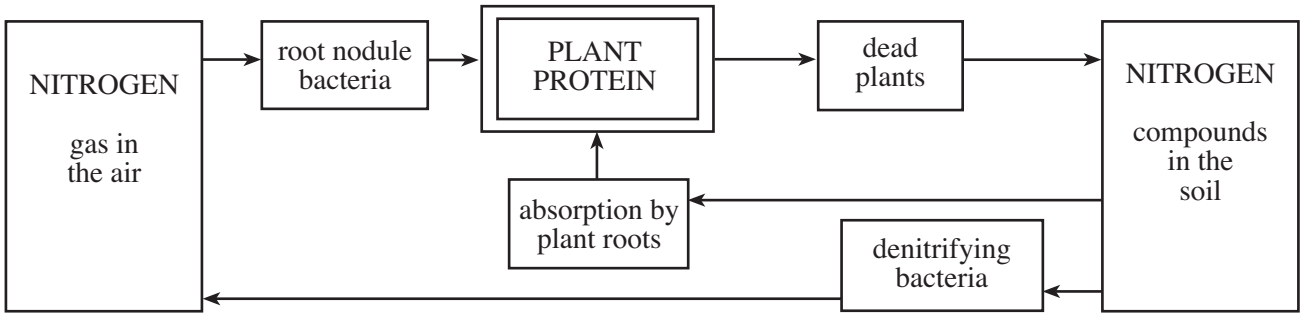
.....

.....

(e) This process is also involved in the absorption of water by roots.
Name the specialised cell involved. [1]

.....

15. The following diagram illustrates part of the nitrogen cycle.



(a) Which nitrogen compound do plant roots absorb from the soil? [1]

.....

(b) What is the function of root nodule bacteria in the nitrogen cycle? [1]

.....

(c) When a farmer harvests crops nitrogen is removed from the soil. How do farmers replace the nitrogen? [1]

.....

(d) What part do denitrifying bacteria play in the nitrogen cycle? [1]

.....

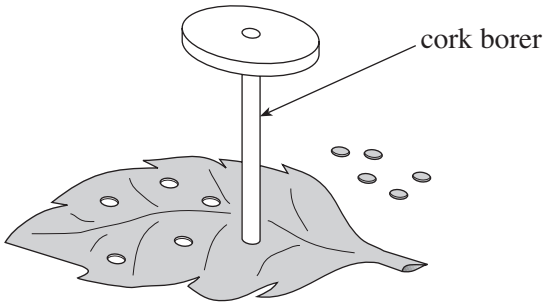
(e) How do animals obtain nitrogen compounds from which to make proteins? [1]

.....

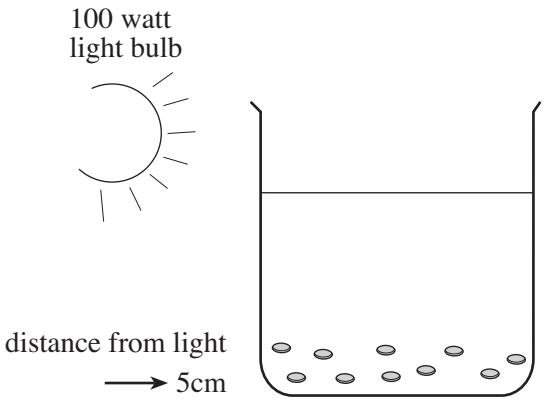
(f) What type of bacteria carry out the same function in the nitrogen cycle and the carbon cycle? [1]

.....

16. Students investigating the effect of changing light intensity on the rate of photosynthesis, cut discs from a leaf using a cork borer. The discs sank when put in beakers of sodium hydrogen carbonate solution then began to rise to the surface. The beakers were placed at different distances from a source of light.



cutting leaf discs



discs placed in beaker

The time taken for the discs to rise to the surface of the solution was recorded and is shown below.

	Distance from light (cm)				
	5	*25*	*50*	*75*	*100*
Average time taken for all discs to rise (mins)	5	20	27	55	97

(a) Explain why the discs rose to the surface of the solution. [1]

.....

.....

(b) Sodium hydrogen carbonate provides a gas which is essential for photosynthesis to take place. Name this gas. [1]

.....

(c) What do you conclude from the results in the table above? [1]

.....

.....

(d) Name **one** source of experimental error that could have affected the discs in the beaker nearest to the light. [1]

.....

17. Different types of vaccines are used to protect people against diseases.
The vaccines are often made using the microbes which cause the disease.

(a) Complete the table by adding the name of the microbe which is used to make each type of vaccine. Choose your answers from the list.

Tuberculosis microbe

Whooping cough microbe

Influenza microbe

Type of vaccine	*Microbe used to make the vaccine*
Vaccines which contain dead microbes.	
Vaccines which contain weakened microbes.	
Vaccines made from antigens separated from microbes.	

[3]

(b) "The total extinction of tuberculosis has not been possible because the microbe which causes tuberculosis can change its coat very often."

Explain this statement using the following words.

antibodies, antigens, mutation, protein, variation, lymphocytes.

Credit will be given for each word when it is **explained** in its correct context and in a logical sequence. [6]

.....

.....

.....

.....

.....

.....

.....

.....

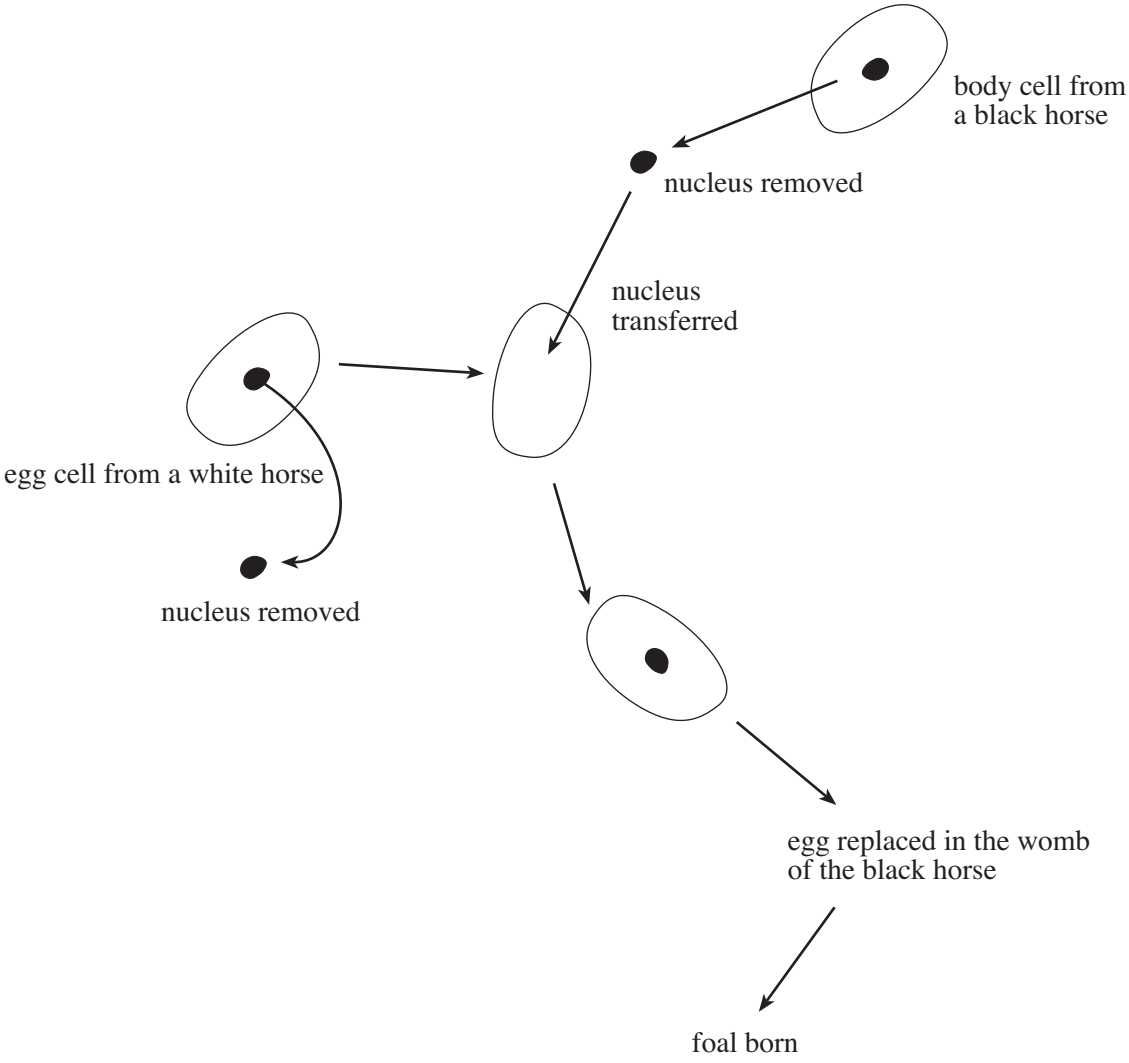
BLANK PAGE

18. Scientists have discovered that they can produce animals by cloning. One way to do this is to remove the nucleus from an unfertilised egg cell and replace it with a nucleus from a body cell. The egg cell with its new nucleus can then be treated so that it can grow into a new individual.

(a) Give the main difference in the amount of genetic material between the nucleus which has been removed and the one which has replaced it. [1]

.....

(b) Recent experiments have resulted in cloning race horses. The following diagram shows the main stages in the process.



(i) What would be the colour of the foal? [1]

Underline the correct answer.

Black

White

Black and white.

(ii) Explain your answer. [1]

.....

.....

.....

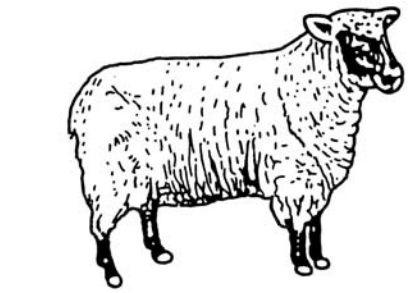
(c) (i) What is meant by the term *genome*? [1]

.....

(ii) What part of a cell contains the genome? [1]

.....

(d) Cloning is used to improve the qualities of sheep. The following flow diagram shows the main stages in the process. Complete the five boxes to briefly describe stages **2**, **3**, **4**, **5** and **6**.



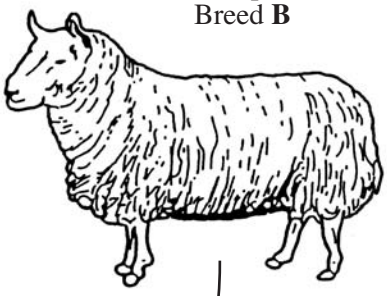
Sheep
Breed **A**

Stage 6

Stage 1

Egg cell taken
from sheep (Breed **A**)

Sheep
Breed **B**



Stage 2

Stage 3

Stage 4

Stage 5

[5]

(e) Give an exampe of how a transgenic sheep has been used successfully in medical technology. [1]

.....

.....