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, 6 June 2007

(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.

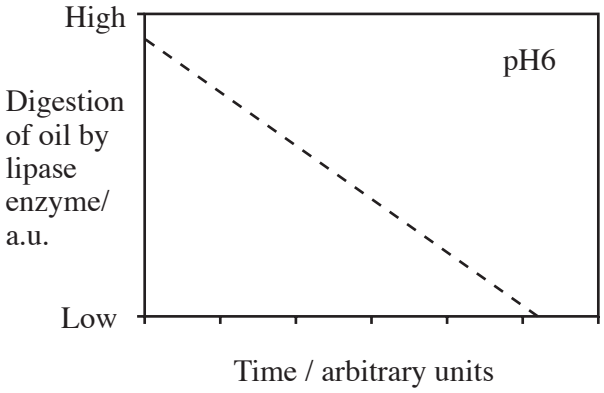
Answer **all** *the questions*

1. *(a)* Complete the following table about digestion in the alimentary canal. [3]

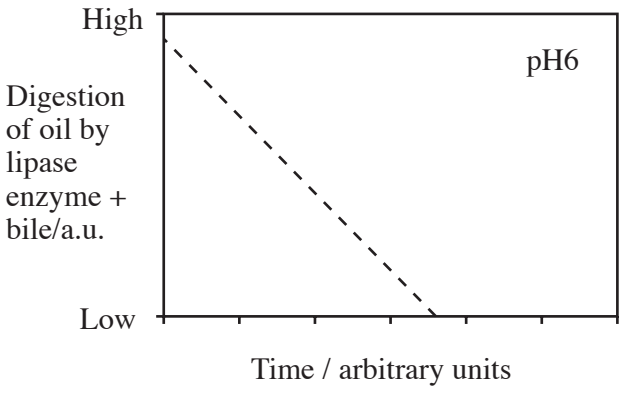
Region of alimentary canal	*Enzyme produced*	*Action of enzyme*
small intestine	protease	....
.....	lipase	digests fats to fatty acids and glycerol
mouth	.....	digests starch to simple sugar (glucose)

(b) The graphs below show the rate of digestion of oil (fat) by lipase enzyme, at pH6, in the absence and presence of bile.

Graph A – bile absent



Graph B – bile present



(i) Explain why adding bile to the oil and lipase mixture increased the rate of digestion. [2]

.....

.....

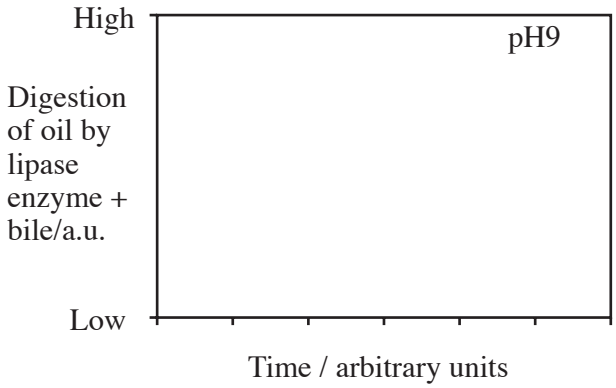
.....

(ii) State where bile is

I. made; ..... [1]

II. stored. ..... [1]

(iii) The pH in the intestine is pH9. Complete the following graph, by drawing a single straight line, to show how the rate of digestion would differ from that shown in *graph B*, if the pH used in the experiment was changed to pH9. [1]



(iv) Name **one** *other* factor that affects the rate of enzyme action. [1]

.....

(c) Name the chemical reagent used to test for the presence of protein in food. [1]

.....

2. *(a)* Oestrogen causes the development of the secondary sexual characteristics in females. State **four** of the female secondary sexual characteristics. [4]

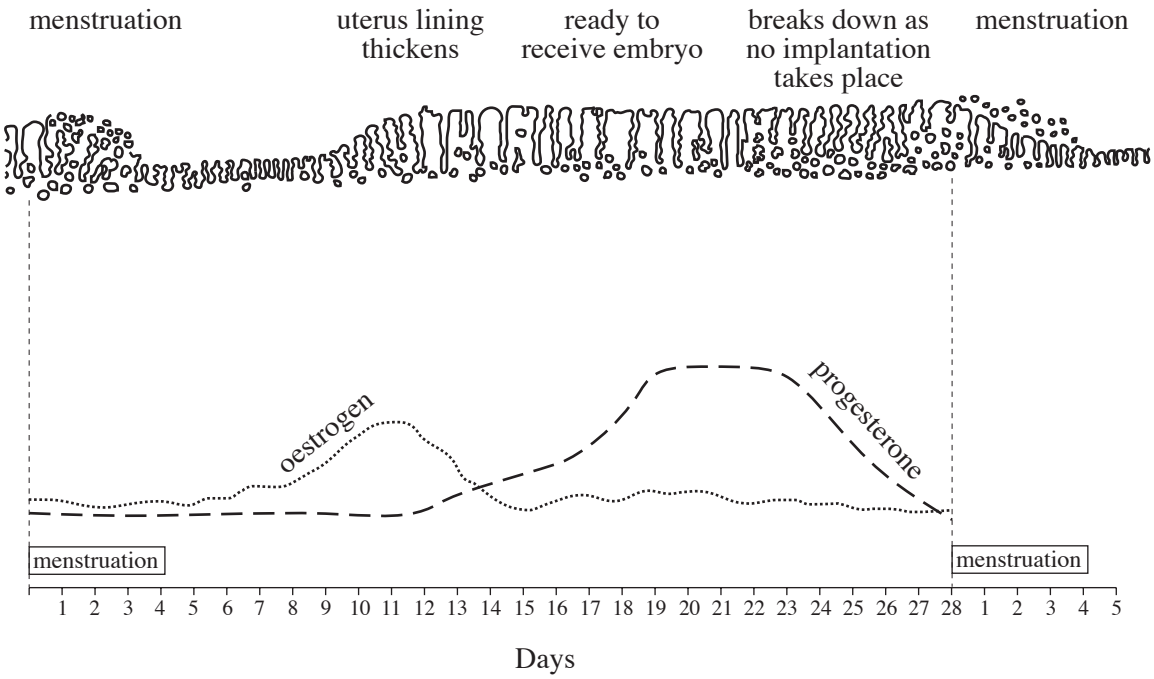
(i) .....

(ii) .....

(iii) .....

(iv) .....

(b) The diagram below shows the change in thickness of the uterus lining during the menstrual cycle. It also shows the levels of the hormones oestrogen and progesterone in the blood.



(i) Use the information in the diagram to answer the following questions.

I. How long does the menstrual cycle last? [1]

.....

II. State what happens during menstruation (the period) and explain what causes it to happen. [3 + 1]

.....

.....

.....

.....

.....

III. State **one** effect, shown in the diagram, of the increasing level of oestrogen between days **8 and 12**. [1]

.....

(ii) State **one** *other* effect that the high level of oestrogen has on the body of a woman. [1]

.....

3. The leopard is a large cat that exists in two different forms, the normal spotted form and a black mutant form. The allele for spotted, **N**, is dominant to the allele for black, **n**.
When a spotted leopard was mated with a black mutant all the **F1** were spotted.

(a) Complete the following to show the genotypes of the parents.

Genotypes ..... X ..... [1]

(b) (i) State the genotype of the **F1**. [1]

.....

(ii) Complete the Punnett square below to show the **F2** genotypes if two **F1** leopards are mated together. [2]

gametes		

(iii) State the phenotypic ratio of the **F2** offspring. [1]

..... : .....

(c) Construct a Punnett square in the space below to show how two leopards when mated together could produce 50% spotted and 50% black offspring. [2]

4. Red Kite

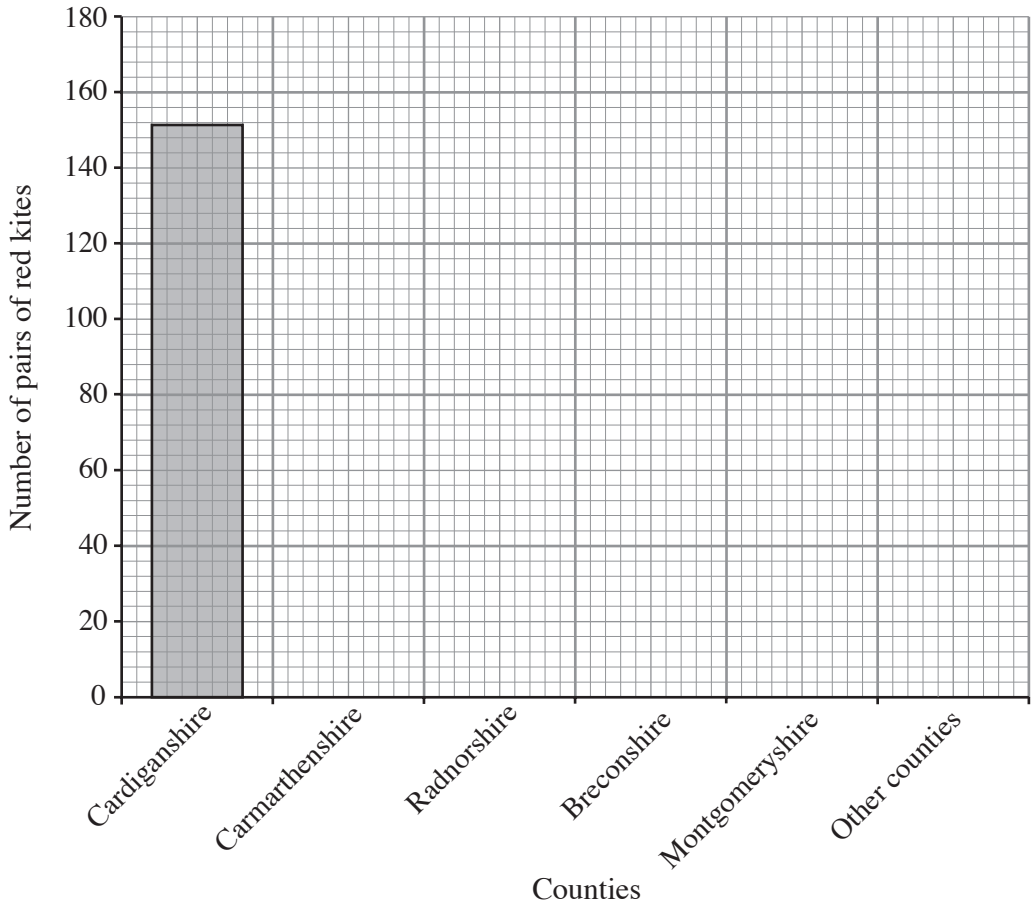
Red kites are large birds of prey that eat mainly dead animals (carrion). Their feet are too weak to kill any prey bigger than a small rabbit. They disappeared from England and Scotland by the end of the 19th century because humans killed them believing that they attacked lambs. A few pairs of red kites survived in Wales.
In 1904 a red kite committee was set up to protect these Welsh birds. Slowly the Welsh population started to recover. By 1992 there were 79 nesting pairs and by 2004 this number had risen to over 350 pairs.

The table below shows the numbers of pairs of red kites present in Wales in 2004.

County	*Number of pairs of red kites*
Cardiganshire	153
Carmarthenshire	67
Radnorshire	51
Breconshire	41
Montgomeryshire	29
Other counties	27

(Distribution of known occupied territories by Watsonian Vice County
The Welsh Kite Trust 2004)

(a) (i) Complete the chart below by plotting the data as a bar graph. One has been done for you. [3]



(ii) I. Using the information above, suggest which county contained the small number of red kites that were present in Wales in 1904 and which gave rise to the present Welsh population. [1]

.....

II. Give a reason for your answer. [1]

.....

.....

(iii) State why red kites pose no threat to sheep farming. [1]

.....

.....

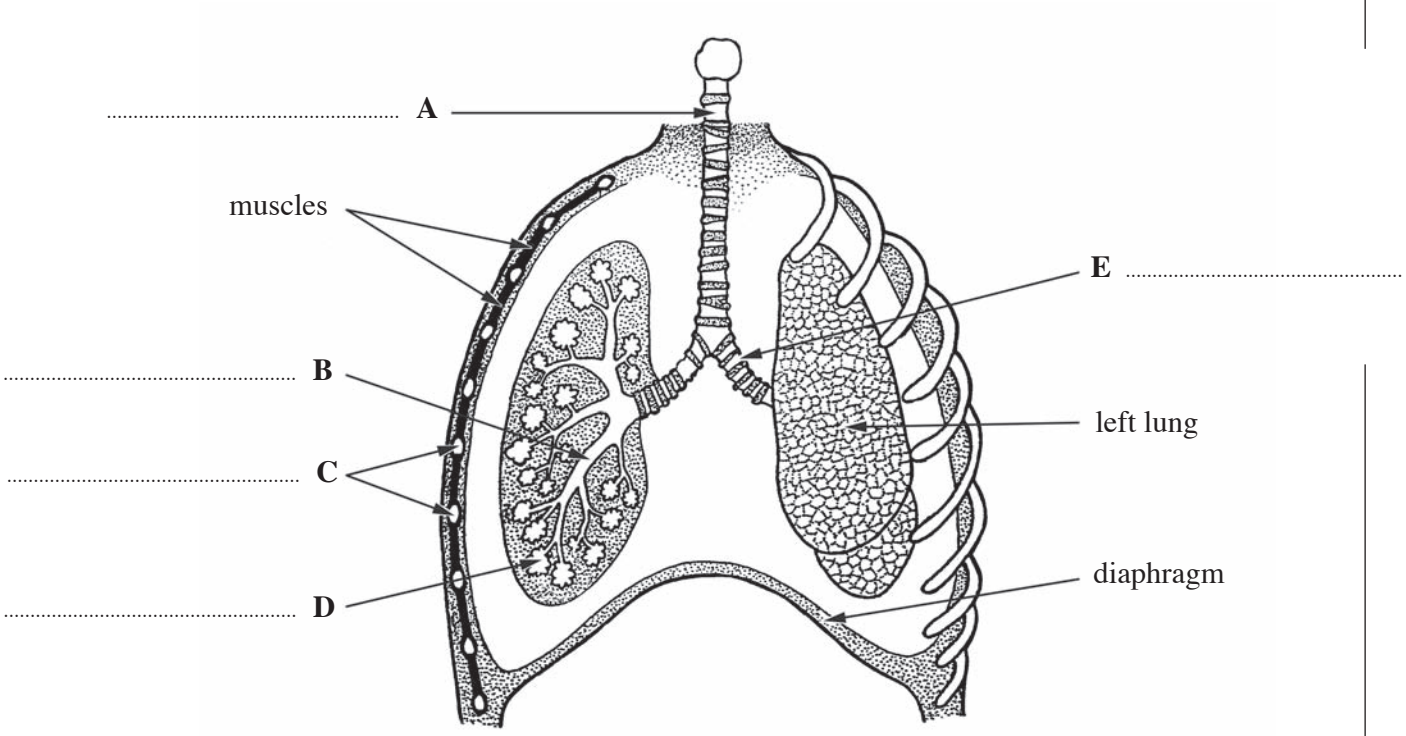
(b) State **two** ways in which other endangered species can be protected. [2]

(i) .....

(ii) .....

5. The diagram below shows a section through the chest.

(a) Label the parts **A** to **E** on the diagram. [5]



(b) Fill in the blank spaces by using the following words to complete the sentences about the mechanism of breathing: [4]

up, down, increases, decreases, inflate, deflate.

During inspiration the diaphragm moves ..... and the rib cage moves up and out. This ..... the volume of the chest cavity and ..... the pressure. This causes the lungs to ..... .

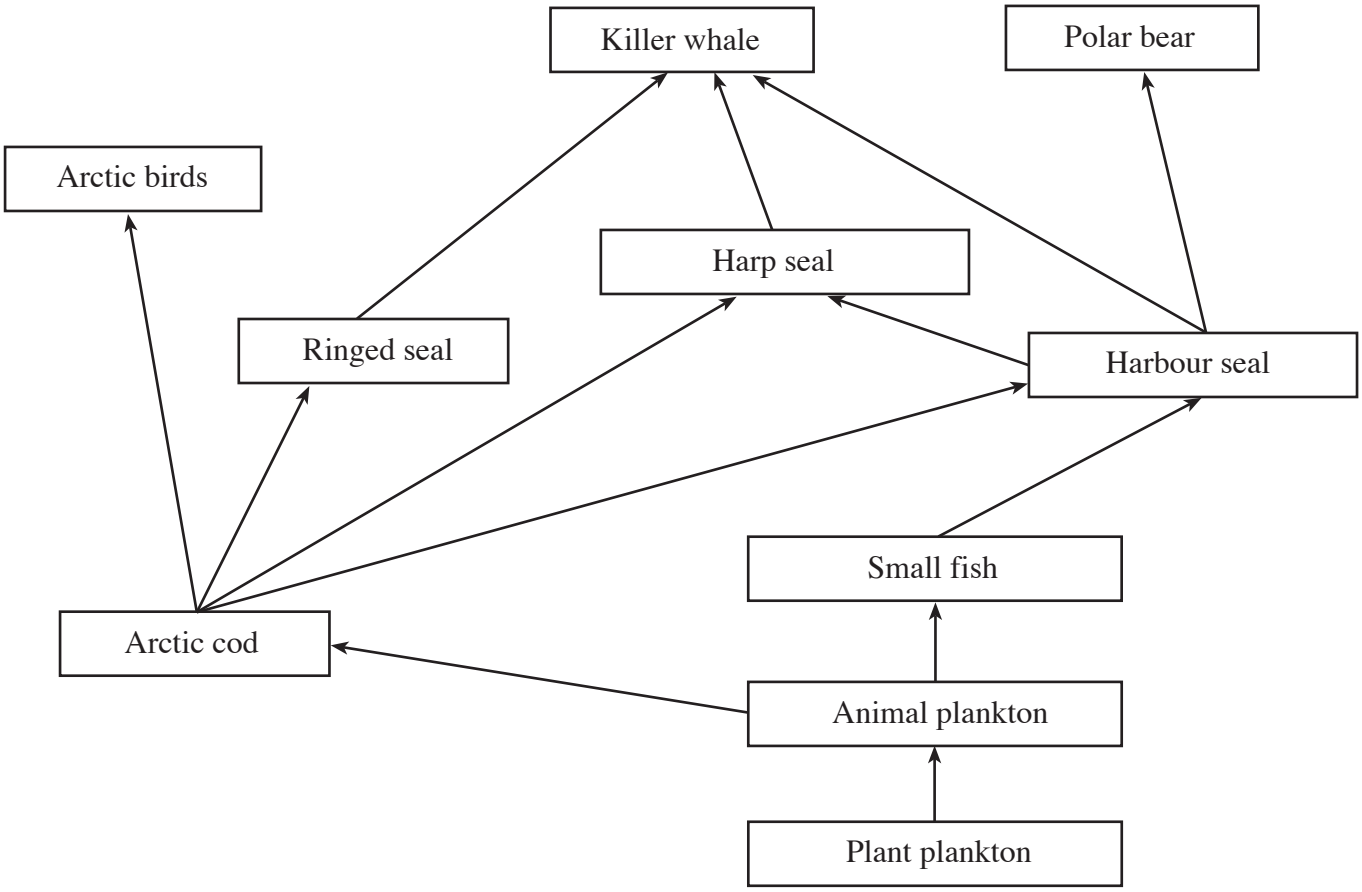
(c) Name the type of respiration represented by the following word equation: [1]

glucose ⟶ lactic acid + energy

.....

6. The Arctic has a severe problem with persistent organic pollutants (POPs). POPs are chemical substances which are produced as a result of many industrial processes. They are carried in air currents from North America, Europe and Asia and pollute the Arctic air, snow and water. Dangerously high levels of POPs have been found in Arctic wildlife, especially those higher up the food chain.

The following diagram shows a food web in the arctic ecosystem.



(a) (i) Which organisms would contain the lowest concentration of POPs? [1]

.....

(ii) Name the **three** animals which would contain the highest concentration of POPs. [3]

I. .....

II. .....

III. .....

(b) Explain why the animals higher up the food chain contain the largest concentration of POPs. [2]

.....

.....

.....

7. The following information appeared in a magazine.

> **Obesity**
> **The greatest health threat facing mankind**
>
> Many European states, including the UK, are in the grip of an epidemic. In 1997, the problem was already so great that the World Health Organisation (WHO) declared that it was the greatest health threat facing mankind. In the UK, in 2000, approximately the same number of people died as a result of obesity as died from lung cancer.

Biologist, IOB, February 2003

Obese people carry around excessive amounts of body fat. The 'big six' food groups responsible for obesity are: sweets, some breakfast cereals, soft drinks, crisps, fast food and 'ready meals'.

The body mass index (BMI) is used to measure whether a person is overweight or obese.
The BMI is calculated using the following formula:

$$\text{BMI} = \frac{W}{h^2}$$

where W = weight in kilogrammes (kg)
h = height in metres (m)

The BMI categories are shown in the table below.

Body mass index	*Category*
Less than 20	underweight
20 – 25	normal weight
25.1 – 29.9	overweight
30 and over	obese

(a) (i) Calculate the BMI of John who is 25 years of age.
His height is 1.7 m and his weight is 98 kg. [2]

John's BMI .....

(ii) Which category does this BMI put John into? [1]

.....

(iii) I. State **one** way in which John could change his diet to reduce his BMI. [1]

.....

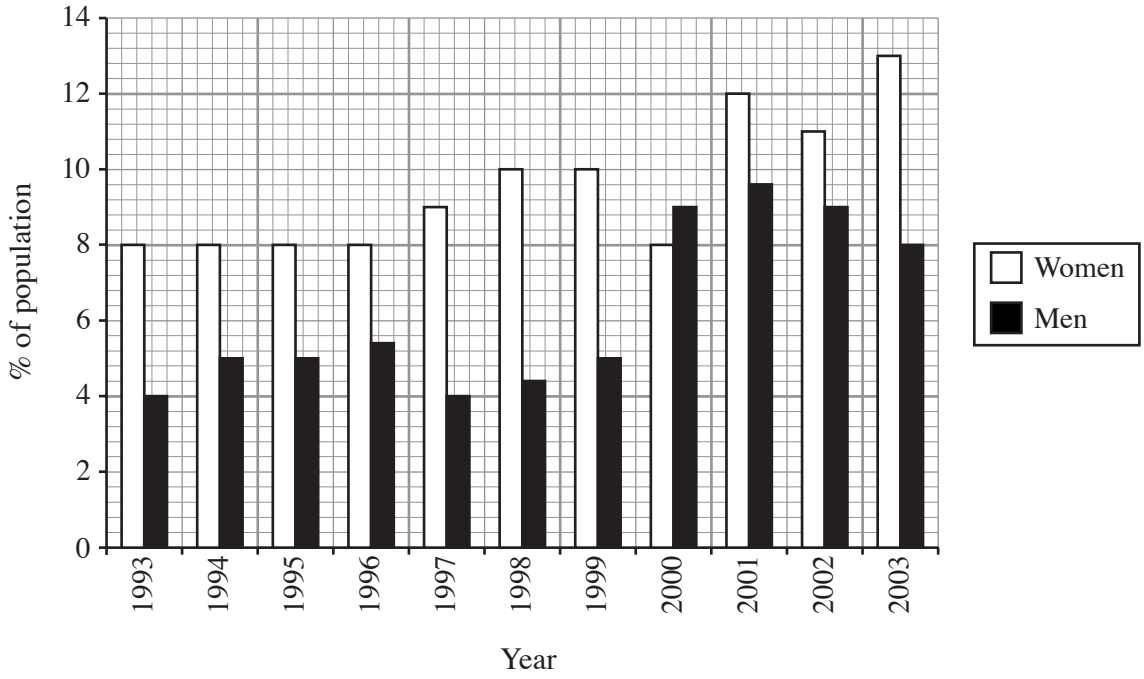
II. Apart from changing his diet, suggest **one** *other* way in which John could help to reduce his BMI. [1]

.....

(b) Suggest a reason why the BMI could be an unreliable measure when used with 12 - 15 year old children. [1]

.....

(c) The graph below shows the BMI for women and men aged 16 - 24 in the obese category, in the UK, between 1993 and 2003.



(i) Describe the overall trend for women shown in the graph. [1]

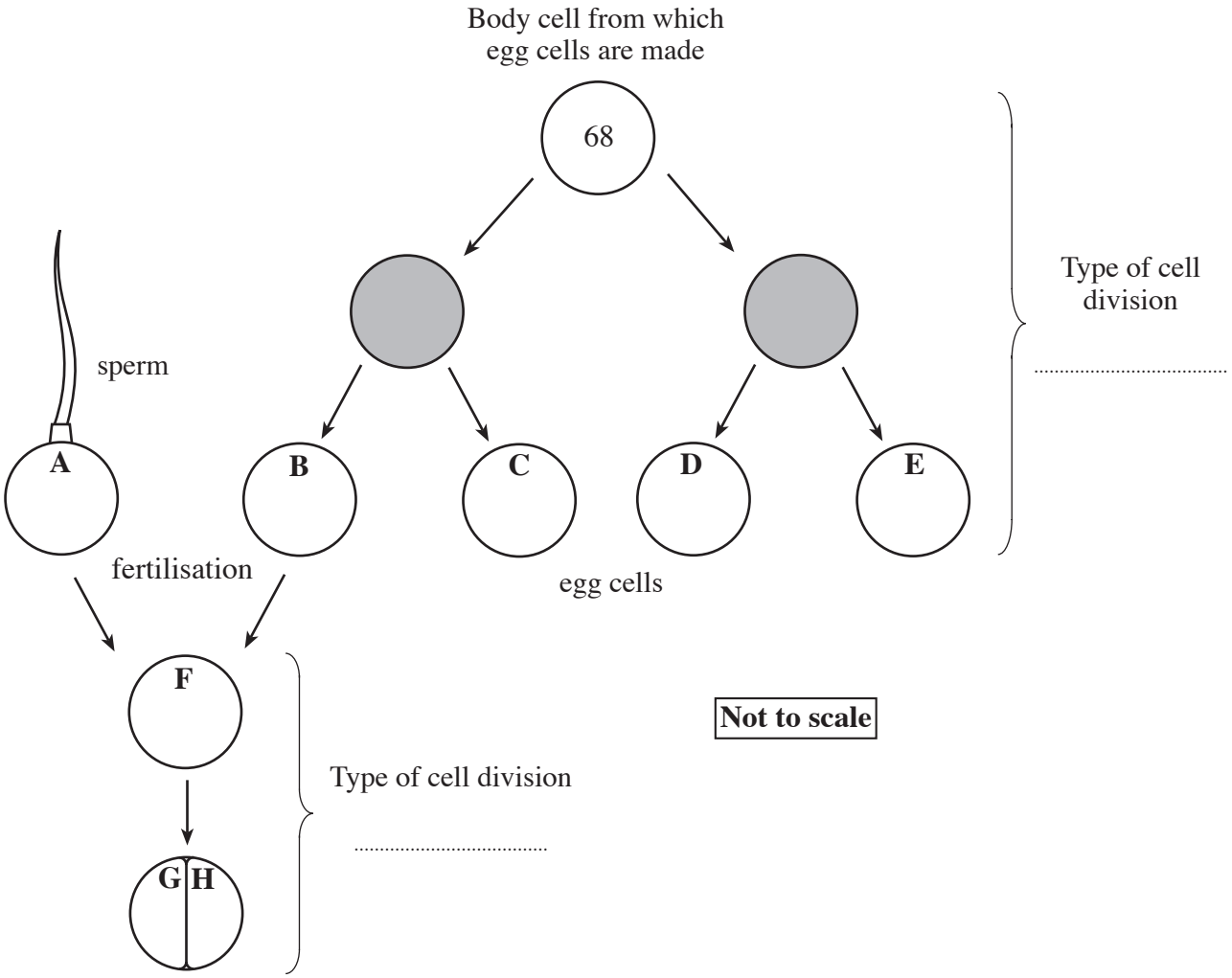
.....

.....

(ii) What percentage of the population were in the obese category in 2003? [1]

..... %

8. Red deer have 68 chromosomes in their body cells.
The diagram below shows the cell divisions which take place in red deer before and after an egg cell is fertilised.



(a) Write numbers in **each** of the cells labelled **A** to **H** to show the number of chromosomes. [4]

(b) Name the types of cell division by completing the spaces given on the diagram. [2]

(c) Which part of a cell contains chromosomes? [1]

.....

(d) Use the letters on the diagram to state the stage at which it would be possible to produce genetically identical animals. [1]

.....

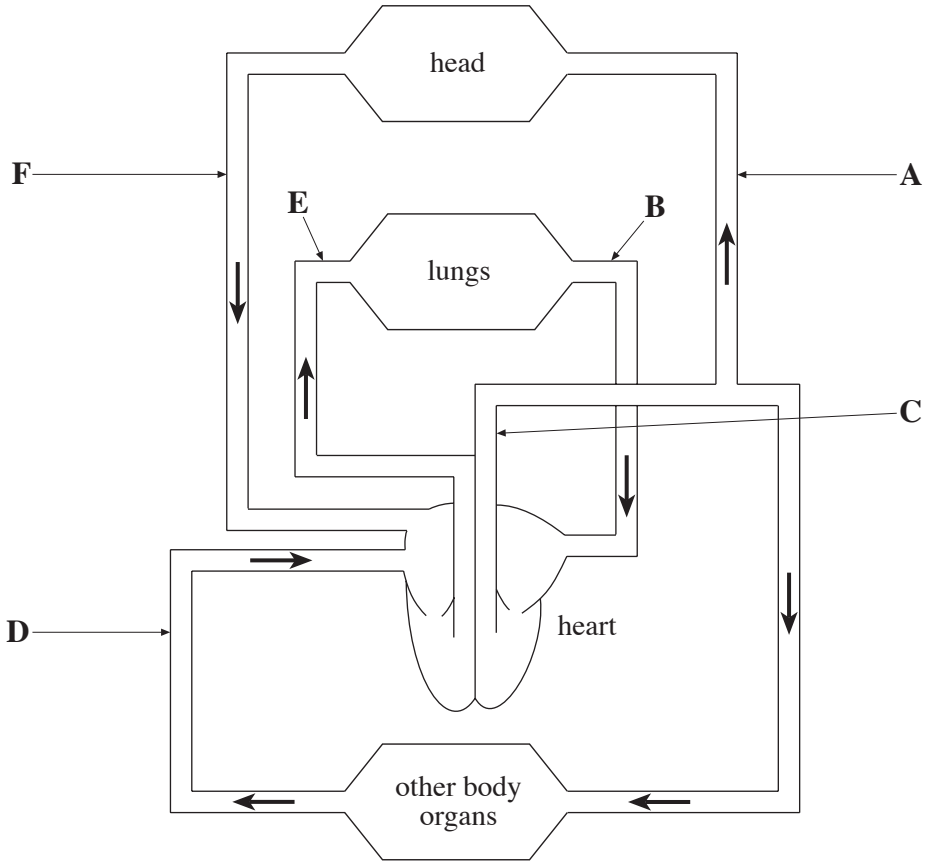
(e) What name is given to a group of genetically identical organisms? [1]

.....

(f) Which type of cell division results in variation? [1]

.....

9. The diagram below shows a plan of the circulatory system in a human. The blood vessels are labelled with letters.



(a) Complete the table below using letters from the diagram. You may use a letter more than once. [4]

Blood vessel	*Letter*
Aorta	
Carrying most oxygen	
Pulmonary artery	
At highest pressure	

(b) Blood vessels are of three types, arteries, veins and capillaries.
Which type of blood vessel is shown by letter

(i) **A**, ... [1]

(ii) **F**? ..... [1]

10. In 1490, Spanish explorers returning from the Canary Islands in the Atlantic Ocean, brought home some yellow-green song birds that they called canaries. Some were more yellow than others. They soon became valuable pets in the palaces of Europe. By 1677 German bird keepers had produced bright yellow canaries.

(a) There was a range of colour in the canaries that were brought from the Canary Islands. **Underline** the term which best describes this range of colour. [1]

(i) Evolution;

(ii) Selection;

(iii) Variation;

(iv) Competition.

(b) Name and describe the process by which the bird keepers succeeded in producing bright yellow canaries from the yellow-green ones. [4]

.....

.....

.....

.....

.....

(c) State **three** factors that control the size of the population of wild canaries on the Canary Islands. [3]

(i) .....

(ii) .....

(iii) .....

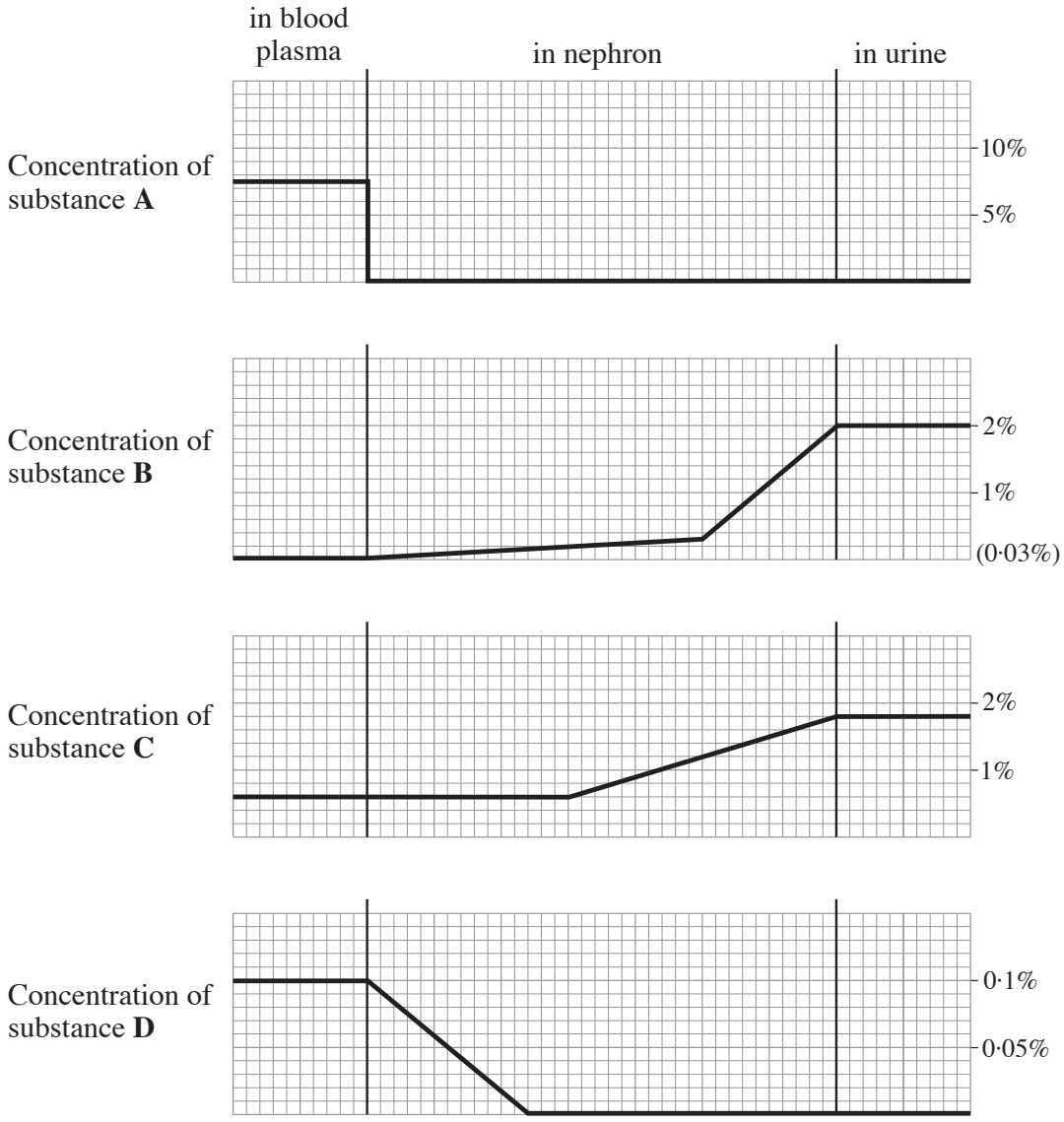
(d) In the wild population of canaries, individuals survive to breed because of natural selection. Who was the first biologist to suggest the idea of natural selection? [1]

.....

(e) What is the name of the process by which genes can change? [1]

.....

11. The graphs below show the concentration of four substances (**A**, **B**, **C** and **D**) in blood plasma. They also show the concentration of these substances as they pass along a nephron (kidney tubule) and their final concentration in urine.



(a) Use the information from the graphs to identify **each** substance. Write the correct letter for **each** substance in the table below. One has been done for you.

Substance	*Letter*
glucose	
protein	
salts	**C**
urea	

[3]

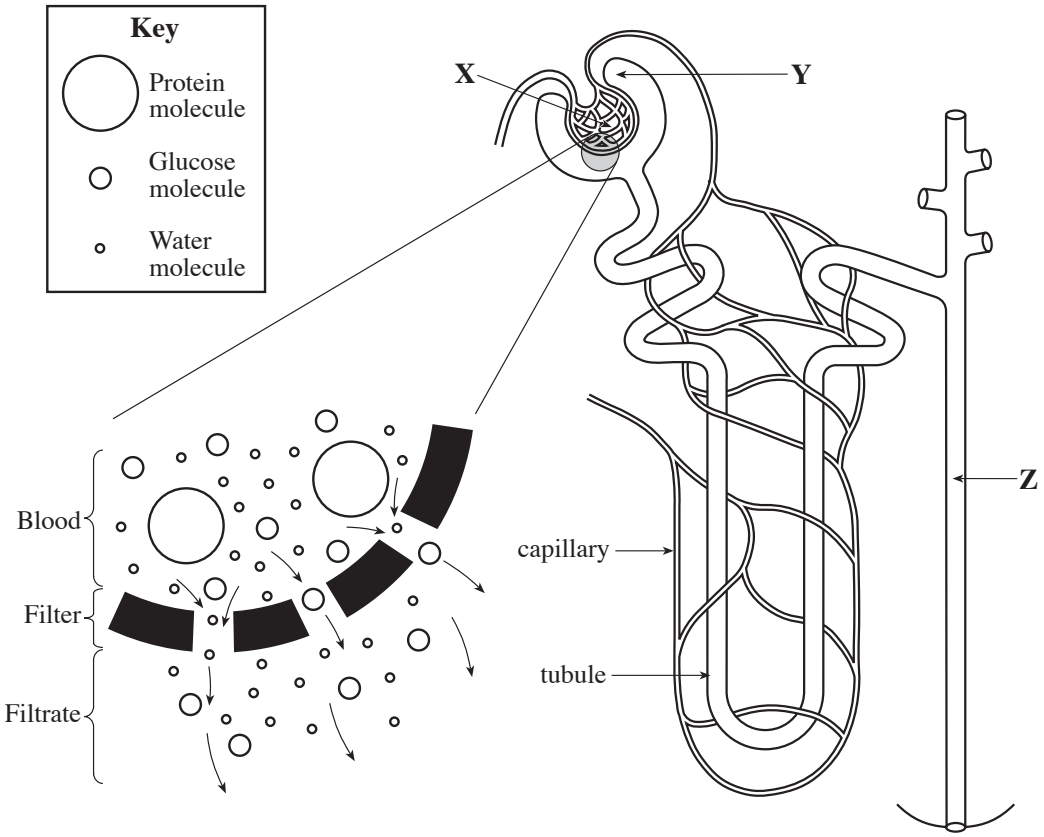
(b) State why the concentration of substance **B** increases in the nephron. [1]

.....

.....

4

(c) The diagram below shows the structure of a nephron. Part of the diagram is magnified to show the process of filtration.



(i) Name the structures labelled [3]

X; .....

Y; .....

Z. .....

(ii) Using the information in the graphs in part *(a)* and the diagram, explain the processes of filtration and selective reabsorption in the functioning of the kidney. [6]

Filtration.

.....

.....

.....

.....

Selective reabsorption.

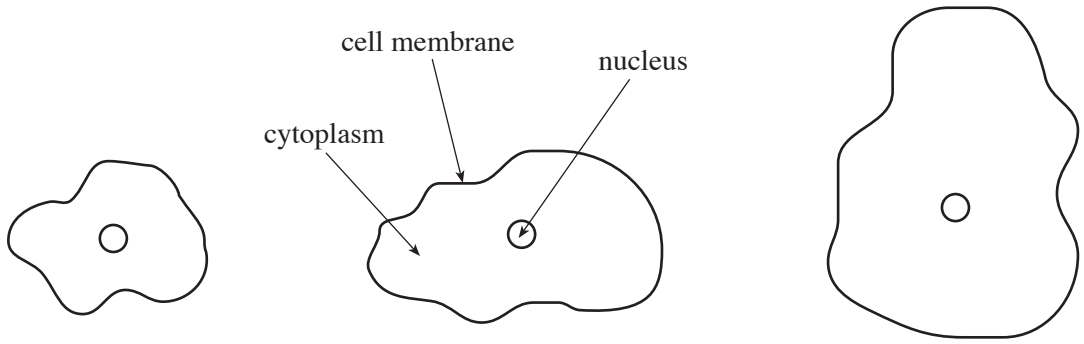
.....

.....

.....

.....

12. A single-celled animal is found living in the water of an estuary (a place where a river enters the sea). Here, the concentration of salt in the water is constantly changing from being very high to very low.
The changes in the salt concentration cause changes in the size of the single-celled animal as shown in the diagrams, drawn to the same scale.



Size when in a concentrated salt solution.

Normal size.

Size when in a dilute salt solution.

(a) Explain why the size of the single-celled animal changes when it is in a dilute salt solution. [4]

.....

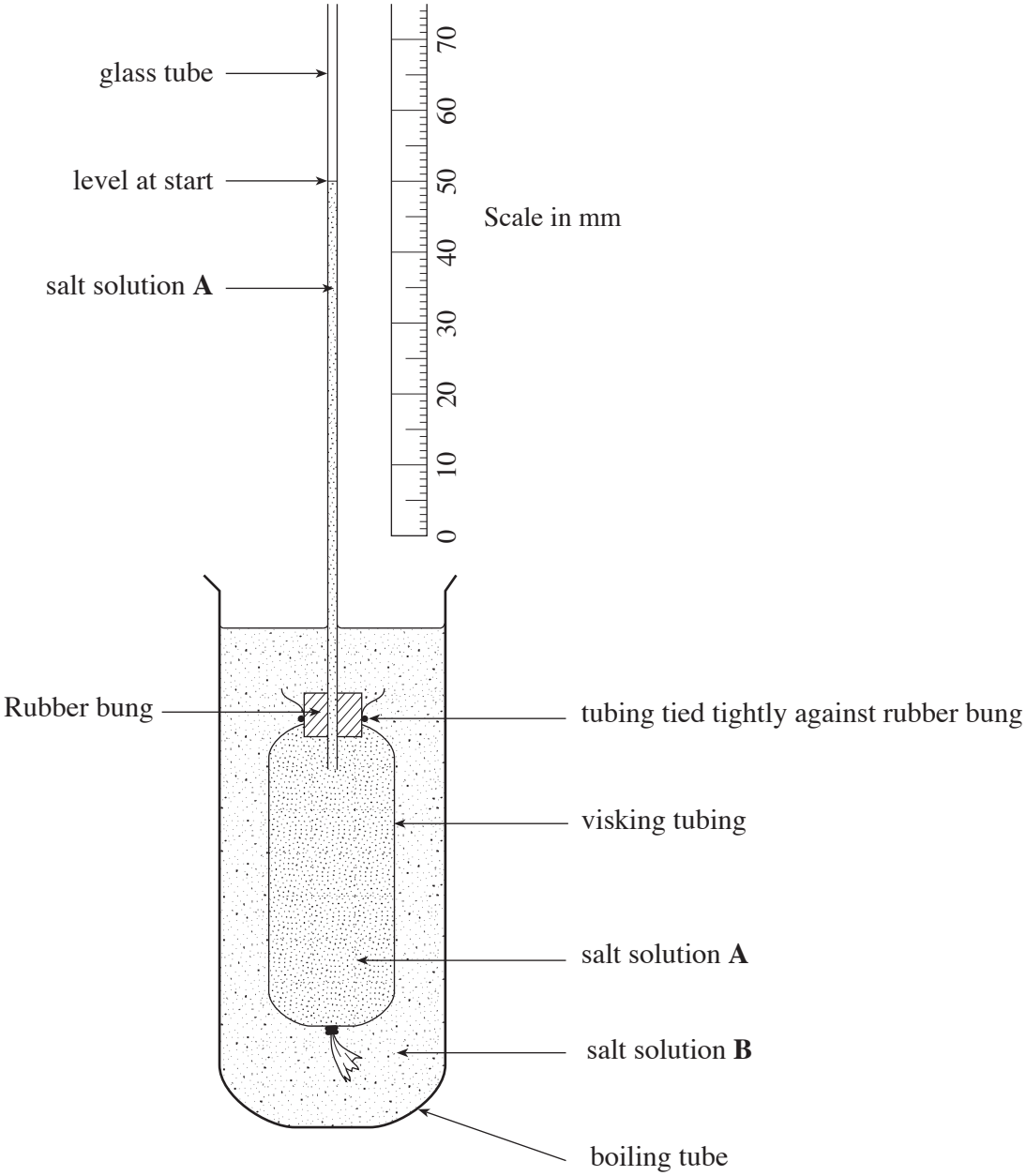
.....

.....

.....

.....

(b) A student set up the following apparatus to act as a model to investigate the effect of salt water on the single-celled animal.



(i) Which part of the single-celled animal is represented by the visking tubing? [1]

.....

(ii) Where, in the apparatus, is the solution representing the estuary? [1]

.....

(c) When the concentration of salt solutions **A** and **B** are the same, the level in the glass tube stops moving.

(i) Explain what is happening in the apparatus when this point is reached. [1]

.....

.....

.....

(ii) What would you expect to happen to the level of the solution in the glass tube if salt solution **A** was more concentrated than salt solution **B**? [1]

.....

(d) Nowhere in the world do frogs or other amphibians live in the sea. Frogs have a skin which acts like visking tubing when they are in water.
Use the evidence provided by the above investigation to suggest why there are no frogs living in the sea. [1]

.....

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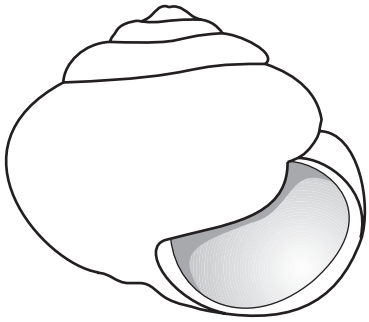
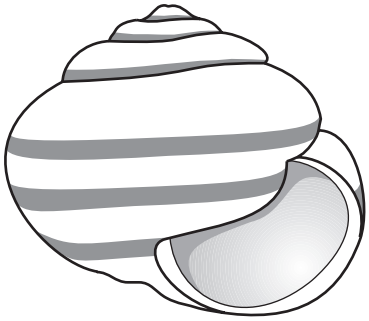
13. There is a type of snail with two different types of shell as shown in the drawings.



Unbanded



Banded

(a) (i) A scientist made the following observations when she studied a group of these snails.

1. Snails produce a large number of offspring.
2. The snails are eaten by thrushes.
3. Unbanded snails always produce unbanded young.
4. In hot conditions, banded snails are more likely to die of heat shock.

The table gives **three** statements about the theory of evolution by natural selection.

Write the correct numbers in the table to match the following statements with the observations made by the scientist.

Statement	*Number of matching observation*
Some variations are inherited.	
A change in environment can affect chance of survival.	
Populations over-reproduce.	

[3]

(ii) Samples of these snails were collected from two different sites and the numbers recorded as shown in the table below.

Site	*Number of snails*	
	Banded	*Unbanded*
Beech forest (little undergrowth, allows sunlight through)	29	70
Hedgerows (with undergrowth, very little sunlight)	89	10

Use the information in part *(a)*(i) and the table to suggest **three** reasons to explain the numbers shown. [3]

I. .....

II. .....

III. .....

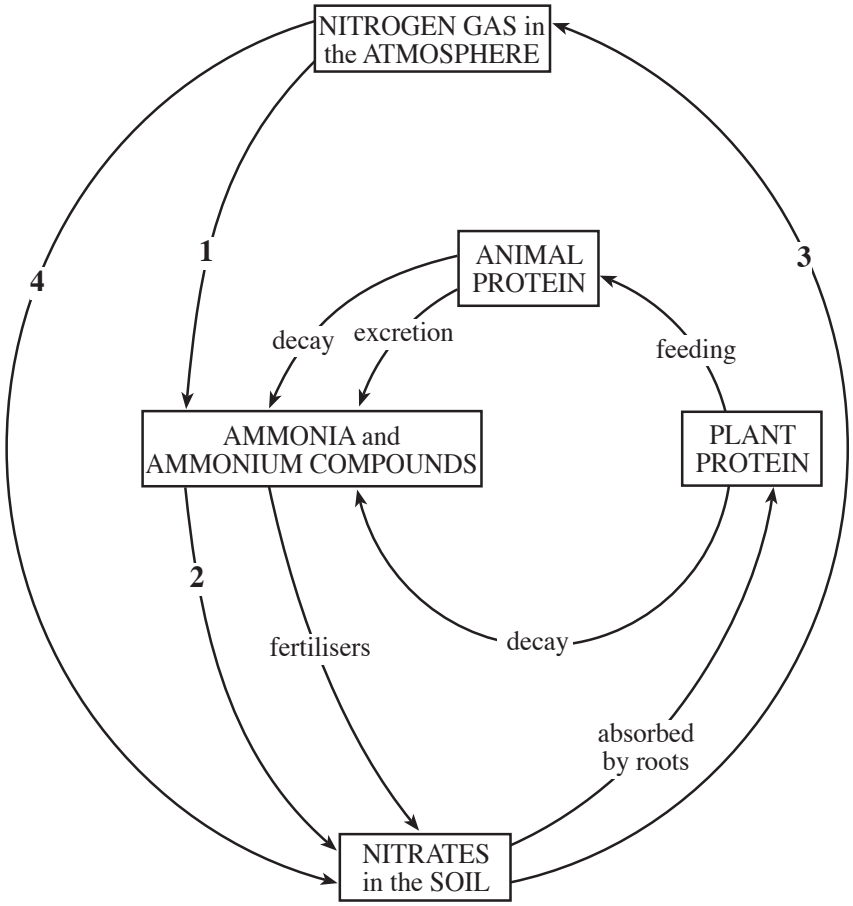
(iii) In order for the sampling to be a fair comparison, state **one** factor which should be constant. [1]

.....

(b) During the millions of years of evolution, the shapes of the shells of many types of snails have changed. What evidence do scientists have of this change of shell shape? [1]

.....

14. The diagram below shows part of the nitrogen cycle.



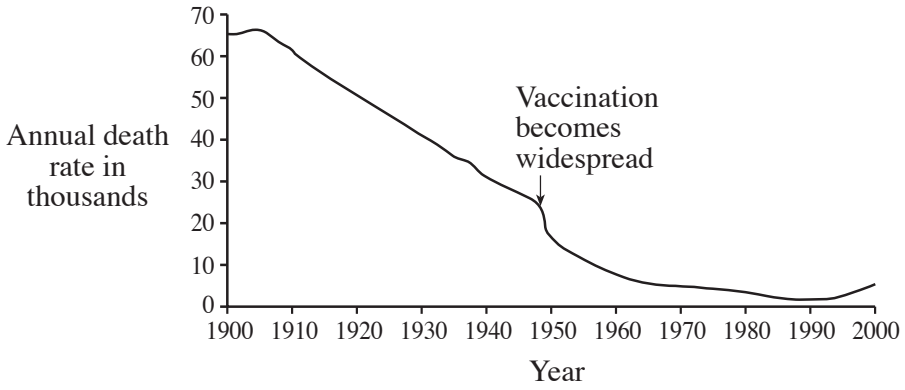
(a) The numbers in the diagram show the positions of different types of bacteria involved in the cycle. Use the information in the diagram to complete the following table. [5]

Type of bacteria	*Function*	*Number in cycle*
Denitrifying	....	.....
Nitrogen fixing	Change nitrogen into a compound that can be used by plants.	.....
.....	Builds up nitrogen into ammonium compounds.	.....

(b) In which part of a plant are nitrogen fixing bacteria found? [1]

.....

15. The graph shows the numbers of deaths from tuberculosis in England and Wales during the 20th Century. Tuberculosis is caused by a bacterium.



(a) (i) Use your knowledge of the discoveries made by Edward Jenner and Alexander Fleming to explain the trend shown in the graph from 1900 to 1990. [2]

Jenner .....

.....

Fleming .....

.....

(ii) Explain how the overuse of antibiotics has resulted in the trend shown from 1990 to 2000. [2]

.....

.....

.....

.....

(b) Vaccines are used to protect people from developing diseases such as whooping cough and rubella.

(i) Describe how vaccination gives a person protection from disease. [4]

.....

.....

.....

.....

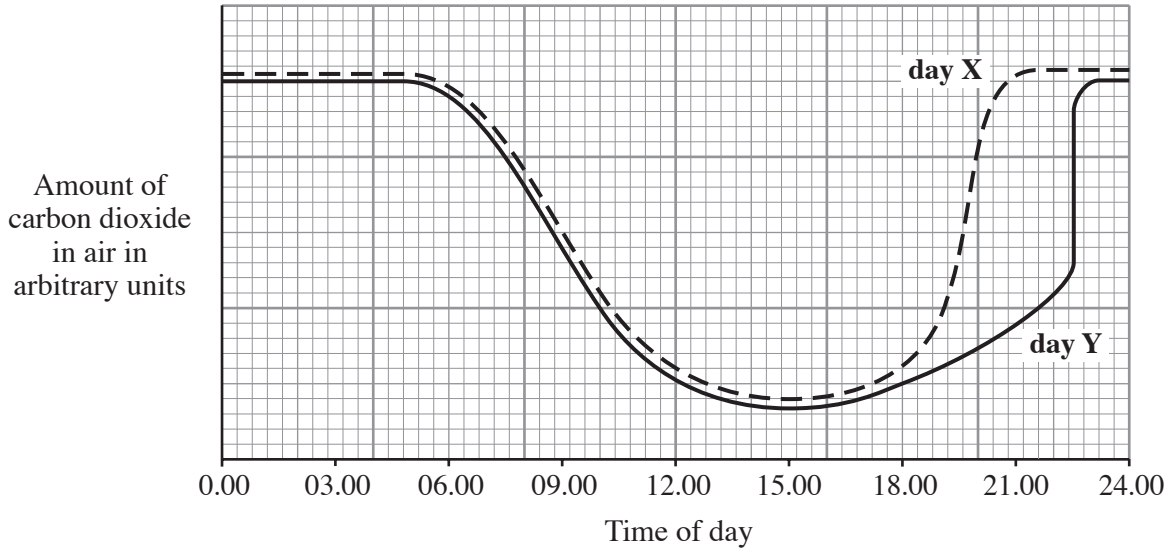
.....

(ii) How does the way of producing a vaccine against rubella differ from that used to produce a vaccine against whooping cough? [1]

.....

.....

16. Strawberries are sometimes grown in fields under transparent polythene. The concentration of carbon dioxide in the air surrounding a crop of strawberries grown under polythene was measured during two different days (**X** and **Y** on the graph below).



(a) (i) During day **Y**, at what time of day did the plants give out most *oxygen*? [1]

.....

(ii) Which day was the sunnier? Give a reason for your answer. [1]

.....

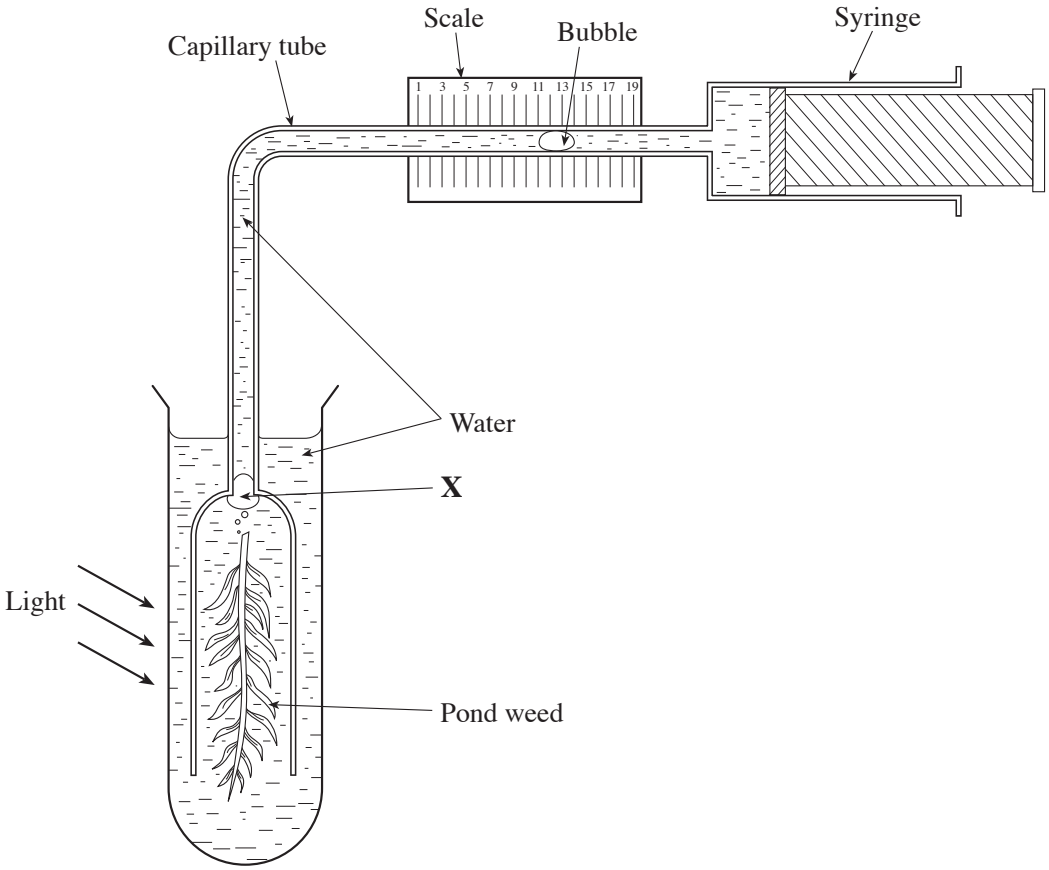
.....

(b) The farmer noted poor quality bud growth and leaf growth on the strawberries. What chemical should be added to the soil to improve [2]

(i) bud growth; .....

(ii) leaf growth? .....

(c) The following apparatus can be used to show how light affects photosynthesis.



(i) State the name of the gas at **X**. [1]

.....

(ii) If you were given a lamp, a metre rule and a stop watch, explain how you would use the apparatus shown in the diagram to investigate the effect of light on the rate of photosynthesis.
Do not make any drawings as part of your answer. [4]

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17. In some forms of genetic engineering, sections of DNA can be moved from one organism to another. In the production of BST (bovine somatotrophin), the section of DNA which codes for this particular protein can be inserted into bacteria. The bacteria can then produce large quantities of the protein.

(a) (i) What type of substance is the protein called BST? [1]

.....

(ii) For what purpose is BST used in some countries in farming technology? [1]

.....

(b) During the production of BST by genetic engineering, the section of DNA which codes for BST is cut out of chromosomes.

(i) Where in the cell are these chromosomes found? [1]

.....

(ii) What chemicals are used to cut out the section of DNA? [1]

.....

(c) Describe how similar technology can be used to produce sheep which can help treat people suffering from haemophilia. [4]

.....

.....

.....

.....

(d) In 1999 over 50% of the soya bean harvest in the U.S.A. was genetically modified to be herbicide resistant.
Explain why (i) this would be an advantage; (ii) it has the potential to affect the environment.

(i) An advantage of herbicide resistant soya. [1]

.....

.....

(ii) A potential danger to the environment. [1]

.....

.....