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G

KU PS

Total Marks

0300/401

NATIONAL
QUALIFICATIONS
2004

WEDNESDAY, 19 MAY
9.00 AM – 10.30 AM

BIOLOGY
STANDARD GRADE
General Level

Fill in these boxes and read what is printed below.

Full name of centre

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Town

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Forename(s)

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Surname

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Date of birth

Day Month Year

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Scottish candidate number

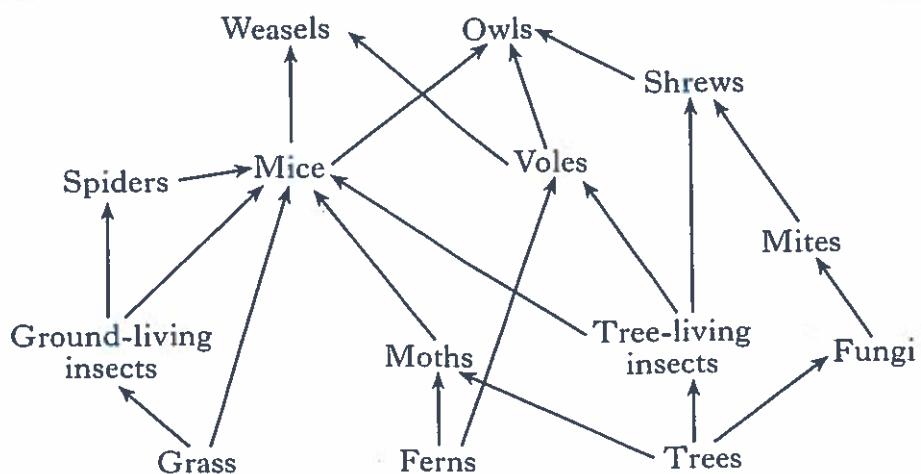
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Number of seat

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|--|

- 1 All questions should be attempted.
- 2 The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, and must be written clearly and legibly in ink.
- 3 Rough work, if any should be necessary, as well as the fair copy, is to be written in this book. Additional spaces for answers and for rough work will be found at the end of the book. Rough work should be scored through when the fair copy has been written.
- 4 Before leaving the examination room you must give this book to the invigilator. If you do not, you may lose all the marks for this paper.

1. (a) The diagram below shows a food web from a woodland ecosystem.



- (i) Complete the table below to show each consumer from the food web and its diet.

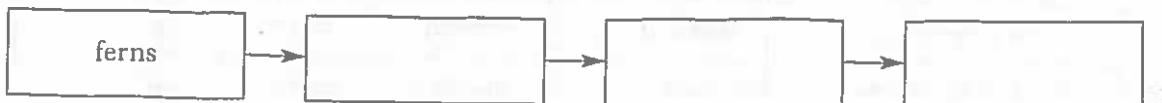
| Consumer | Diet |
|---------------------|---|
| Mice | spiders, ground-living insects, grass, moths, tree-living insects |
| Moths | |
| | grass |
| Voles | |
| Weasels | mice, voles |
| Tree-living insects | trees |
| | tree-living insects, mites |
| Fungi | trees |
| Mites | |
| | ground-living insects |
| Owls | |

1. (a) (continued)

Marks

KU PS

- (ii) Use the food web to complete the food chain below, consisting of four organisms.



1

- (b) Trees are producers and mice are consumers.
What is the meaning of the terms producer and consumer?

Producer _____

1

Consumer _____

1

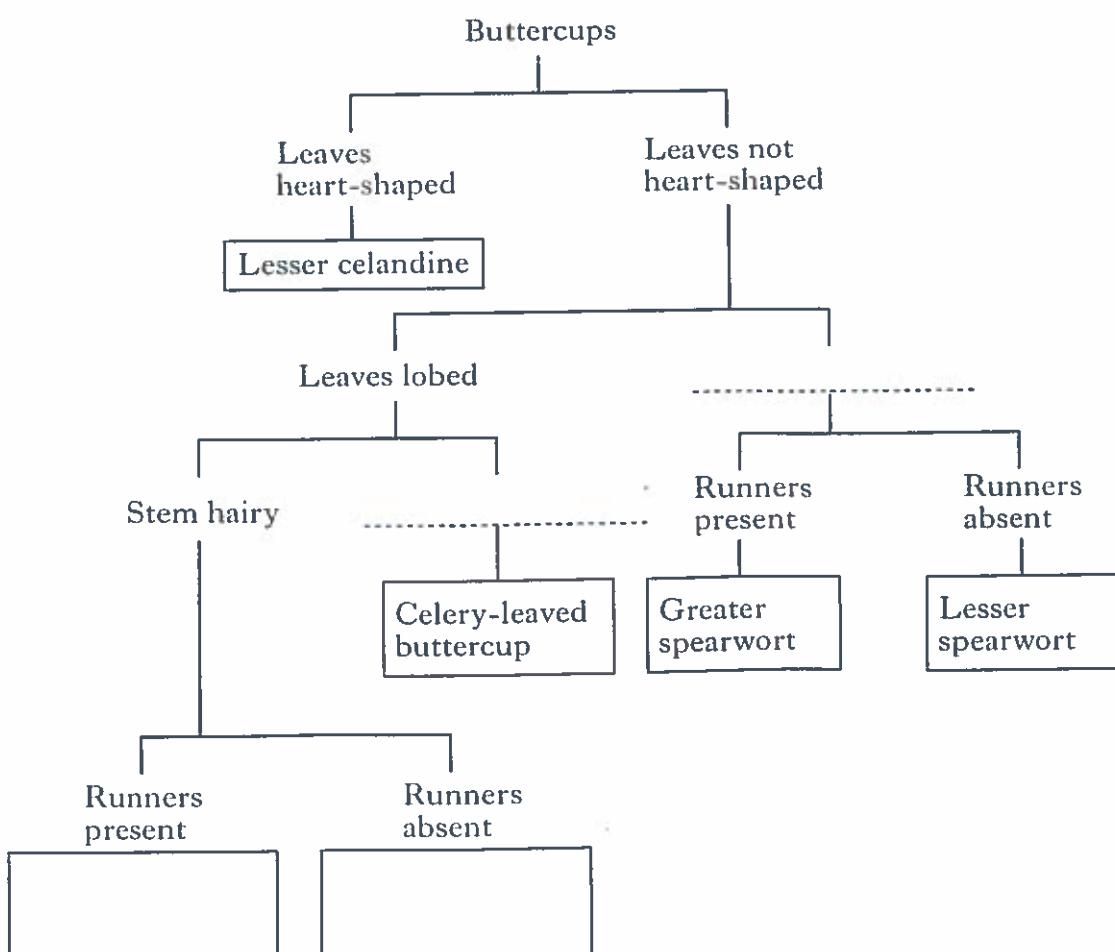
[Turn over

2. Some features of six species of the buttercup family are shown in the table below.

| Species name | Leaves | Runners | Stem |
|-------------------------|--------------|---------|----------|
| Greater spearwort | toothed | present | hairy |
| Meadow buttercup | lobed | absent | hairy |
| Lesser celandine | heart-shaped | absent | hairless |
| Creeping buttercup | lobed | present | hairy |
| Lesser spearwort | toothed | absent | hairless |
| Celery-leaved buttercup | lobed | absent | hairless |

- (a) Use the information in the table to complete the key below.

Write the correct feature on each dotted line and the correct names in the empty boxes.



2. (continued)

- (b) Which feature could be used to distinguish between a Lesser celandine and a Lesser spearwort?

1

- (c) Which features do the Meadow buttercup and the Celery-leaved buttercup have in common?

1

[Turn over

3. (a) A population survey of barnacles and mussels between the high and low tide marks of a rocky shore was carried out using quadrats.

The results are shown in the table below.

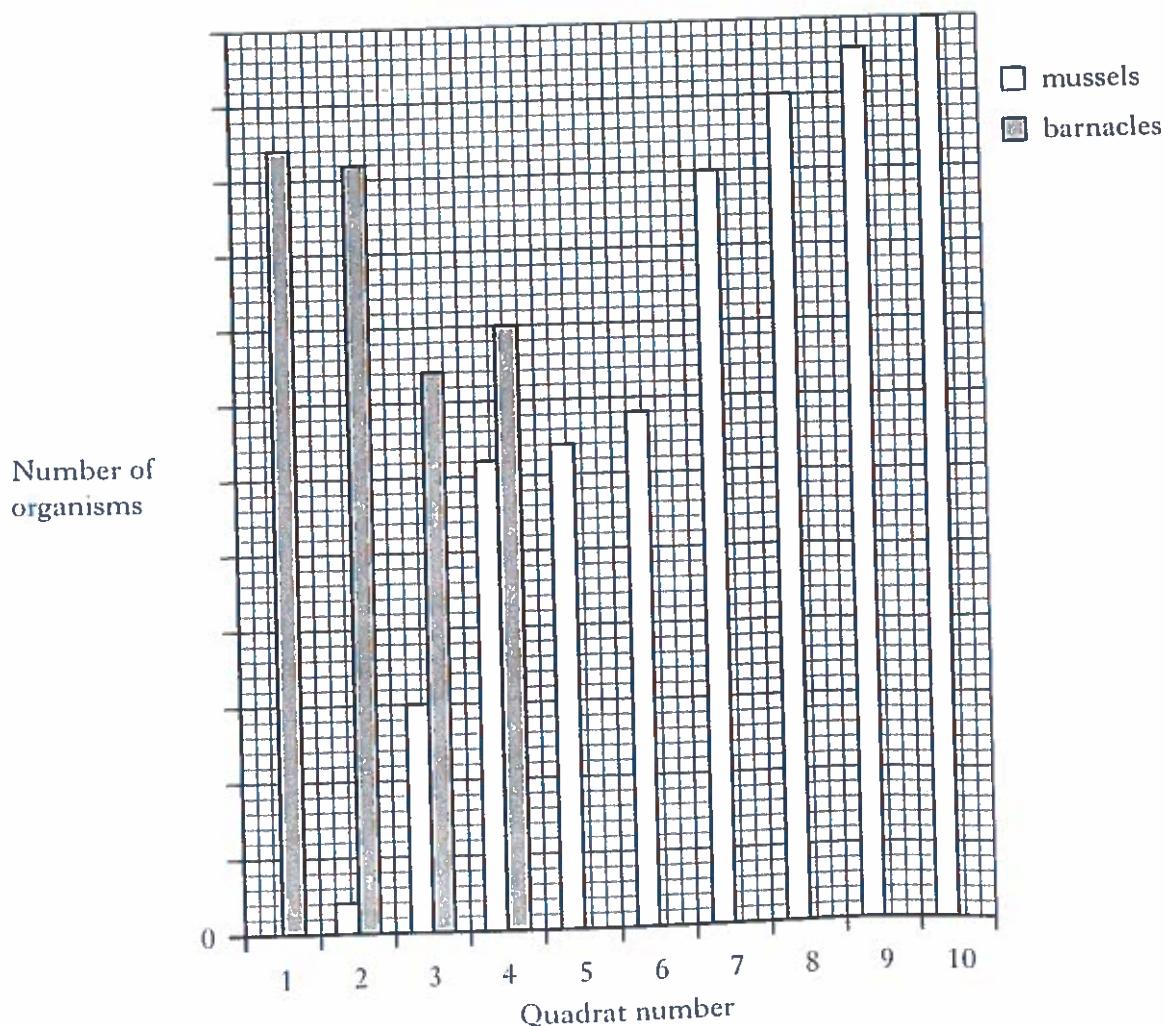
| Tide mark | High → Low | | | | | | | | | |
|---------------------|------------|----|----|----|----|----|----|----|----|----|
| Quadrat number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Number of mussels | 0 | 2 | 15 | 31 | 32 | 34 | 50 | 55 | 58 | 60 |
| Number of barnacles | 52 | 51 | 37 | 40 | 40 | 23 | 15 | 17 | 15 | 10 |

- (i) On the grid below, complete the bar chart by

1. adding a scale to the vertical axis

2. plotting the bars for the barnacles in quadrats 5–10

(An additional grid, if needed, will be found on page 27.)



3. (a) (continued)

- (ii) Calculate the average number of barnacles per quadrat.

Space for calculation

Average number _____

1

- (iii) What is the trend shown by the number of mussels from the high to the low tide marks?

1

- (b) The mussels and the barnacles are in competition with each other.

State **one** possible effect on the mussel population of **reduced competition** from barnacles.

1

- (c) The following factors affect populations of barnacles and mussels.

Underline **two** abiotic factors from the list.

List of factors water temperature
 disease
 predators
 salt concentration
 food supply

1

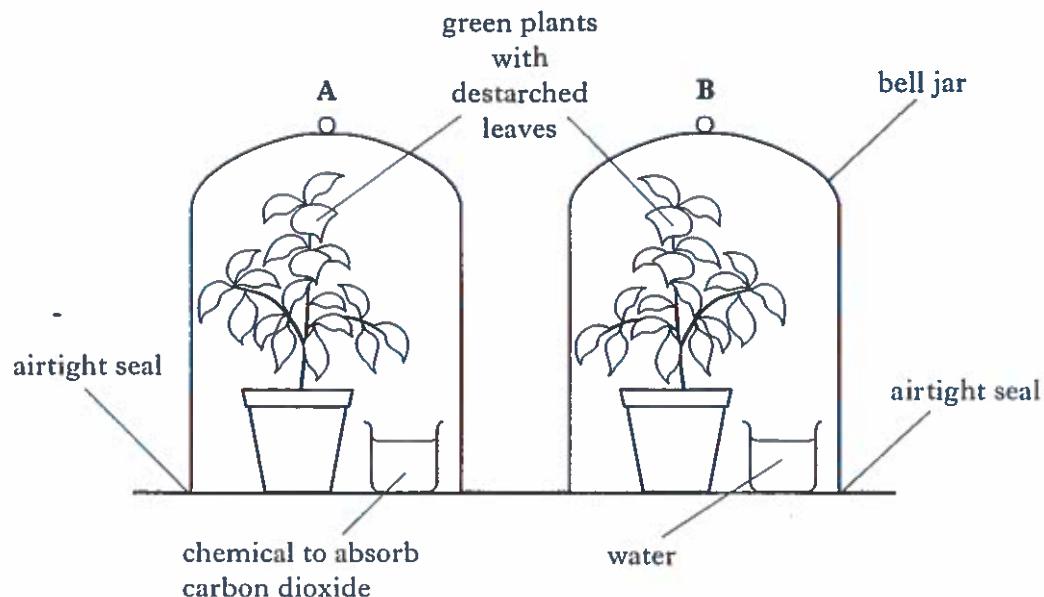
- (d) A rocky shore ecosystem consists of a community of organisms and one other part.

Name the other part.

1

[Turn over

4. (a) In an investigation on photosynthesis, two bell jars were set up as shown below and left in bright light.



After 48 hours a leaf was removed from each plant and tested for starch.

- (i) In which plant would photosynthesis take place? Give a reason for your answer.

Plant _____

Reason _____

1

- (ii) Name a product of photosynthesis, other than carbohydrate.

1

- (iii) Why were the plants destarched before being used in the investigation?

1

- (iv) Give **one** feature of the plants that would have to be kept the same to allow a fair comparison in the investigation.

1

4. (continued)

- (b) Name the structures in a leaf through which gases can pass.

Marks KU PS

1

- (c) Name the chemical found in leaves that converts light energy into chemical energy during photosynthesis.

1

- (d) The grid below refers to parts of a flower.

| | | | | | | | |
|---|--------|---|-------|---|---------|---|--------|
| A | sepal | B | petal | C | stamen | D | anther |
| E | stigma | F | ovary | G | nectary | H | ovule |

Use letters from the grid to answer the following questions.

- (i) Which structure protects the flower bud?

1

- (ii) Which structure receives pollen grains?

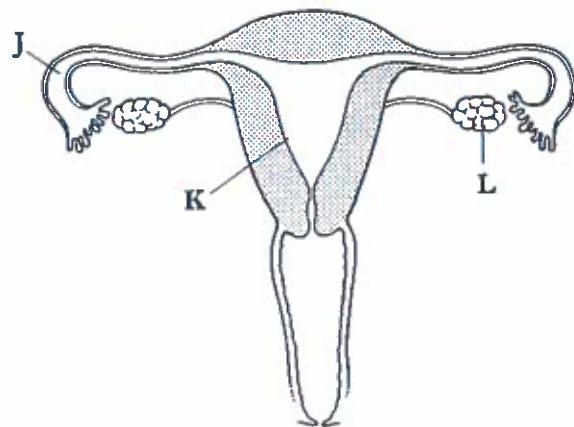
1

- (iii) Which structure develops into a fruit after fertilisation?

1

[Turn over

5. (a) The diagram represents the reproductive system of a human female.



- (i) Name the parts labelled on the diagram.

J _____

K _____

L _____

2

- (ii) In the table below, match each letter from the diagram to its correct function.

| Function | Letter |
|---------------------------------|--------|
| Eggs produced | |
| Fertilisation takes place | |
| Fertilised egg becomes attached | |

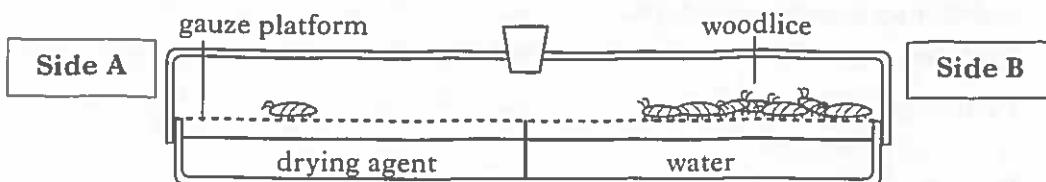
2

- (b) Tick (✓) boxes in the table to indicate whether each of the following statements is true for eggs, sperm, or both.

| Statement | Eggs | Sperm |
|--|------|-------|
| Contain a food store for developing fetus | | |
| Swim using a tail | | |
| Produced in testes | | |
| In most fish, are deposited into the water | | |
| Are gametes | | |

2

6. The apparatus shown was set up to investigate the behaviour of woodlice.



At the start of the investigation 20 woodlice were placed in the centre of the chamber. After 10 minutes there were 2 on side A and 18 on side B.

- (a) What environmental factor was being investigated?

1

- (b) Describe the response of the woodlice in the investigation.

1

- (c) Why were the woodlice left for ten minutes before the results were taken?

1

- (d) Why were 20 woodlice used, rather than one?

1

- (e) Name **one** abiotic factor which should be kept constant during the investigation.

1

- (f) Suggest **two** changes which could be made to the apparatus in order to investigate the response of woodlice to light.

1 _____

1

2 _____

1

Marks KU PS

7. (a) Complete the table by using all the letters from the list to identify the parts found in each type of cell.

Each part may be used once or more than once.

Parts of cells

- A cell membrane
- B cell wall
- C chloroplast
- D cytoplasm
- E nucleus

| <i>Leaf cell</i> | <i>Cheek cell</i> |
|------------------|-------------------|
| | |

2

- (b) Use the information in the table below to answer the questions about liquids used in preparing microscope slides.

| <i>Type of cell</i> | <i>Liquid used</i> | <i>Effect</i> |
|----------------------|--------------------|----------------------|
| human cheek cell | methylene blue | nucleus turns blue |
| onion epidermal cell | iodine solution | nucleus turns yellow |
| human skin cell | eosin | cytoplasm turns pink |
| onion root cell | acetic orcein | chromosomes turn red |

- (i) Name two liquids used to prepare plant cells.

1 _____

2 _____

1

- (ii) What effect does eosin have on skin cells?

1

- (iii) Which liquid could be used to show stages of mitosis?

1

| Marks | KU | PS |
|-------|----|----|
| | | |
| 1 | | |

7. (continued)

- (c) What name is given to a liquid that is used to make the parts of a cell clearer when viewed under a microscope?

- (d) The magnification of a microscope is calculated using the following formula.

$$\text{Total magnification} = \frac{\text{eyepiece lens magnification}}{\text{objective lens magnification}}$$

Use the formula to complete the following table.

The same eyepiece was used each time.

| Power | Eyepiece lens magnification | Objective lens magnification | Total magnification |
|--------|-----------------------------|------------------------------|---------------------|
| Low | × 12 | × 4 | |
| Medium | | × 10 | |
| High | × 12 | | × 480 |

2

[Turn over

8. (a) The statements in the table describe the movement of substances into or out of cells.

| Number | Statement |
|--------|---|
| 1 | glucose moves from the small intestine into the blood |
| 2 | water enters root cells from the soil |
| 3 | carbon dioxide passes from the blood into the lungs |

- (i) Which statement is an example of osmosis?

Statement number _____

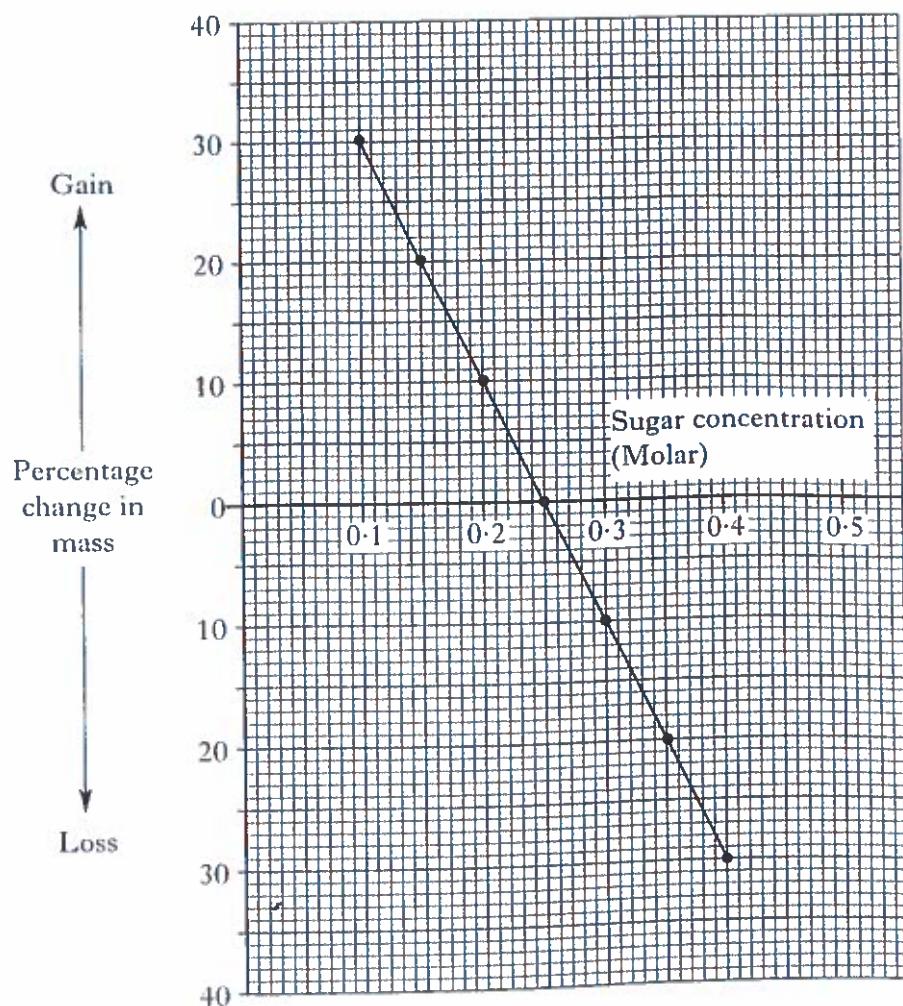
1

- (ii) What term could be used to describe the movement of substances in all of the examples?

1

- (b) Pieces of potato were weighed, placed in sugar solutions of different concentrations for one hour, then reweighed.

The graph below shows the percentage change in mass at each concentration.



8. (b) (continued)

- (i) The movement of what substance is responsible for the change in mass?

1

- (ii) What was the percentage change in mass of the piece of potato placed in the 0.15 Molar solution?

_____ %

1

- (iii) What was the concentration of the solution which caused the potato to lose 30% of its original mass?

_____ Molar

1

- (iv) At what concentration was there no change in mass of the potato?

_____ Molar

1

[Turn over

Marks KU PS

9. Read the following passage carefully.

Adapted from "Stirring Stuff's in the bag", The Herald, April 2002.

Pausing for a cup of tea is a good way to take time out in a busy day. About 135 million cups are consumed in Britain daily.

Favourite "cuppas" include first thing in the morning before getting ready for work, during a busy day and at the end of the day to relax. Relaxation is the most common mood when taking a tea break.

As well as relieving stress, tea can also be a life-saver. Research has shown that the great British "cuppa" has disease-fighting capabilities. A cup of tea can have protective effects against cancer and heart disease. A mixture of green tea and black tea rubbed on cancerous areas reduced cell growth. Tests show that tea slows the development of lung cancers and some bowel cancers. It is also thought to decrease the risk of cancer of the digestive system. Red tea from South Africa is rich in antioxidants and free from tannin and caffeine which are found in many other teas.

The three basic types of tea, black, green and oolong, give rise to more than 3000 varieties, each having its own distinct character. People are now trying different styles of teas such as organic, Chai spice, decaffeinated, herbal and iced tea.

Answer the following questions, based on the above passage.

- (a) How much tea is drunk in Britain daily?

1

- (b) What is the most common mood whilst drinking tea?

1

- (c) Apart from cancer, what disease can tea help prevent?

1

- (d) Name **three** types of cancer that tea may help prevent.

1 _____ 2 _____ 3 _____

1

- (e) What **two** substances are not present in South African red tea?

1

- (f) Name **three** styles of tea, mentioned in the passage, that people are now trying.

1 _____ 2 _____ 3 _____

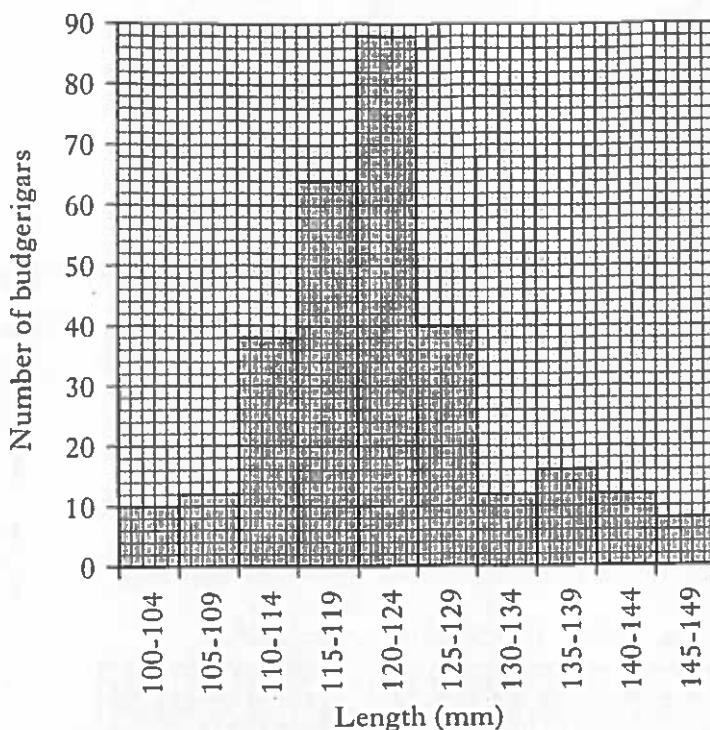
1

Marks

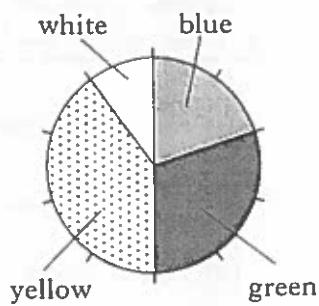
KU

PS

10. The bar graph shows the body lengths in a population of 300 budgerigars. The pie chart shows the colours in the same population.



Colour of budgerigars



- (a) How many budgerigars are in the range 110 to 119 mm long?
Space for calculation

1

- (b) Which of the two characteristics is an example of discontinuous variation?

1

- (c) What percentage of the budgerigars are blue?
Space for calculation

%

1

[Turn over

11. (a) An investigation was carried out into the growth of a bacterial culture. The numbers of bacteria were counted every 30 minutes and the results are shown in the table below.

| Time (minutes) | 0 | 30 | 60 | 90 | 120 | 150 |
|---|---|----|----|----|-----|-----|
| Number of bacteria (thousands per mm ³) | 3 | 6 | 12 | 24 | 48 | 96 |

- (i) What happens to the number of bacteria every 30 minutes?

1

- (ii) Complete the line graph below by

- 1 adding a suitable scale to the y-axis
- 2 adding a label to the x-axis
- 3 plotting the graph.

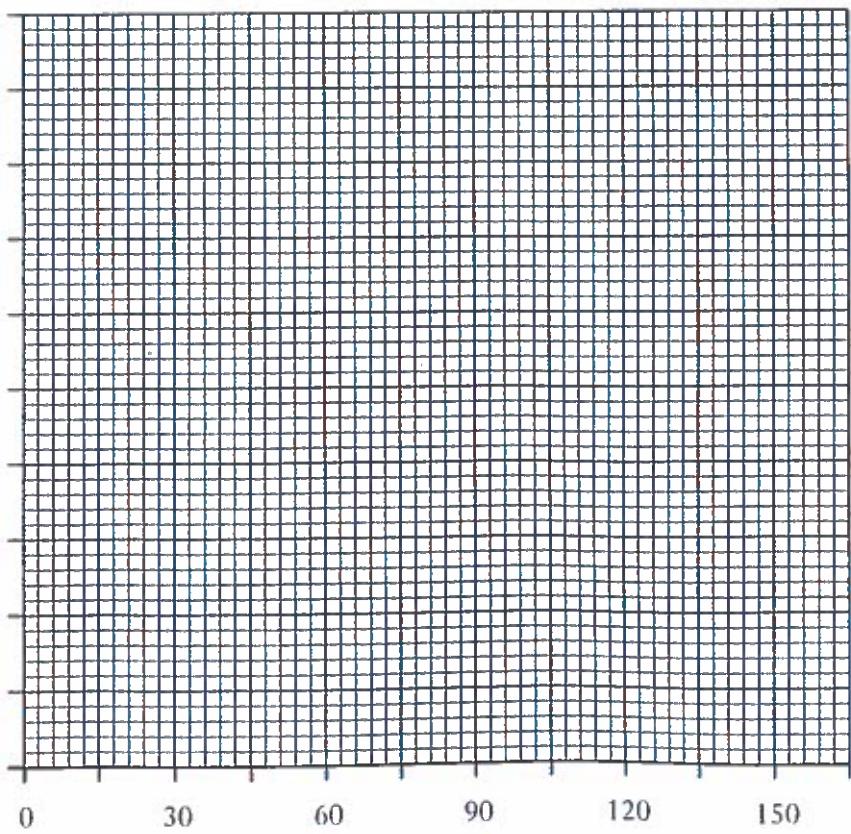
1

1

1

(An additional grid, if needed, will be found on page 28.)

Number of
bacteria
(thousands
per mm³)



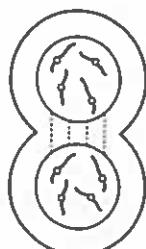
- (iii) Assuming no change in conditions, how many bacteria cells would be present after 240 minutes?

Space for calculation

1

11. (continued)

- (b) The following diagrams show four stages of mitotic cell division but not in the correct order.



A



B



C



D

Arrange the letters from the diagrams to put the stages into the correct order. The first stage has been given.

1st stage C

2nd stage _____

3rd stage _____

4th stage _____

1

- (c) Complete the following sentence by underlining the correct option in each group.

In comparison with the original cell, the number of chromosomes present in a cell produced by mitosis is

| | |
|----------|----------|
| greater | smaller |
| the same | the same |

 and it contains

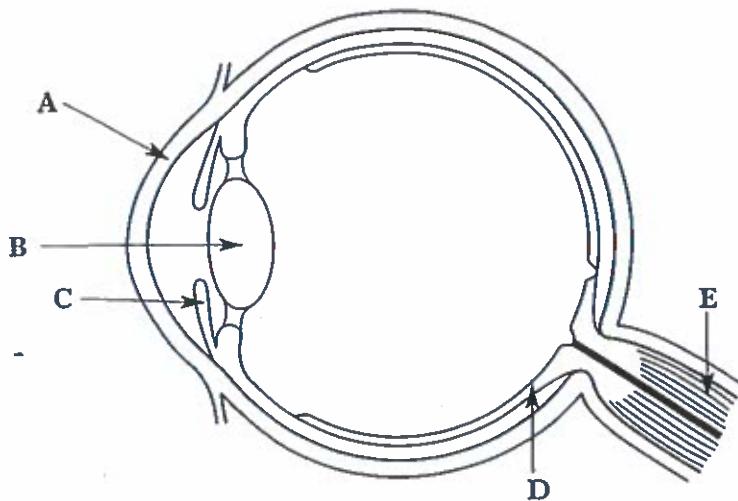
| | |
|-----------|----------|
| different | the same |
| the same | the same |

 information.

1

[Turn over

12. (a) The diagram shows some of the structures of the human eye.



Complete the table to show the names and functions of the structures labelled.

| Letter | Name of structure | Function |
|--------|-------------------|---|
| A | | Allows light to enter the eye |
| B | | |
| C | Iris | |
| D | | Converts light into electrical impulses |
| E | Optic nerve | |

- (b) Humans have two eyes and two ears. What does this contribute to their sight and hearing?

Sight _____

Hearing _____

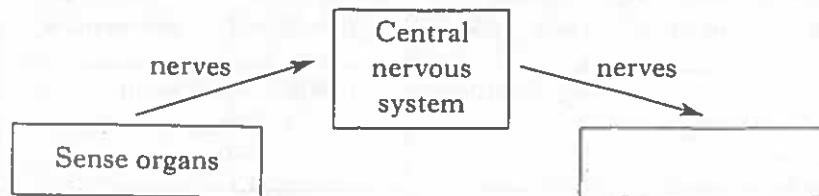
3

1

1

12. (continued)

- (c) The diagram represents the flow of information in the human nervous system.



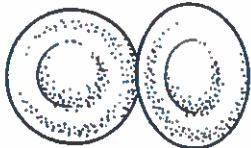
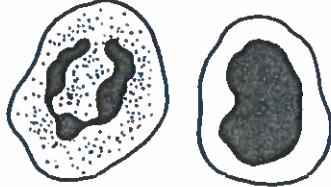
- (i) Complete the diagram by writing the missing word in the box. 1

- (ii) Name the two main parts of the central nervous system. 1

1 _____ 2 _____

[Turn over

13. (a) The table gives information about components of the blood.
Use the information provided to answer the questions which follow.

| <i>Appearance under a microscope (not drawn to the same scale)</i> | <i>Number per mm³ of blood</i> | <i>Diameter in millimetres</i> | <i>Additional information</i> |
|---|---|------------------------------------|--|
|  Red blood cells | 5.5 million | 0.008 | Made in marrow of bones. Iron essential. 2 million made each second. Last for about 4 months. |
|  White blood cells | 8000 | 0.02 | Made in marrow of bones or in lymph nodes. Fight infection by engulfing bacteria or producing antibodies. |
|  Platelets | 400,000 | 0.003 | Made in marrow. Contain proteins which form blood clots. |

- (i) Name **two** places where blood cells are made.

1 _____ 2 _____

1

- (ii) Which cells are the largest?

1

- (iii) Which component is present in the greatest numbers?

1

- (iv) What type of substance is needed to form blood clots?

1

Marks

KU PS

13. (a) (continued)

- (v) Describe two ways in which white blood cells fight infection.

1 _____

2 _____

1

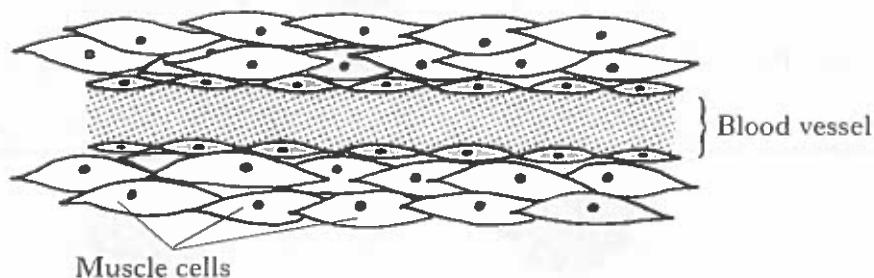
- (vi) On average, how many red blood cells are made in an hour?

Space for calculation

_____ million

1

- (b) The diagram below represents the site of gas exchange between a blood vessel and the muscle cells of a mammal.



- (i) Name the type of blood vessel shown.

1

- (ii) On the diagram, write the letter H to indicate an area where the oxygen concentration is relatively high and the letter L to indicate where it is relatively low.

- (c) In which component of blood is most of the oxygen carried?

1

[Turn over

13. (a) The table gives information about a *Leishmania* infection. Use the information provided in the table to answer the questions in this section.

Key. In what way does this provide about

| Appearance under a microscope (not drawn to the same scale) | | | Marks |
|--|----|--|-------|
| KU | PS | | |
| 1 | | | |



Generation B

all Red
Generation B onions self-crossed



Generation C

36 Red



9 White

- (i) Which onion colour is dominant?

1

- (ii) Complete the table with the correct symbols to identify each of the generations shown in the diagram.

| Generation | Symbol |
|------------|--------|
| A | P |
| B | |
| C | |

1

- (iii) Calculate the simple whole number ratio of red onions to white onions produced in Generation C.

Space for calculation

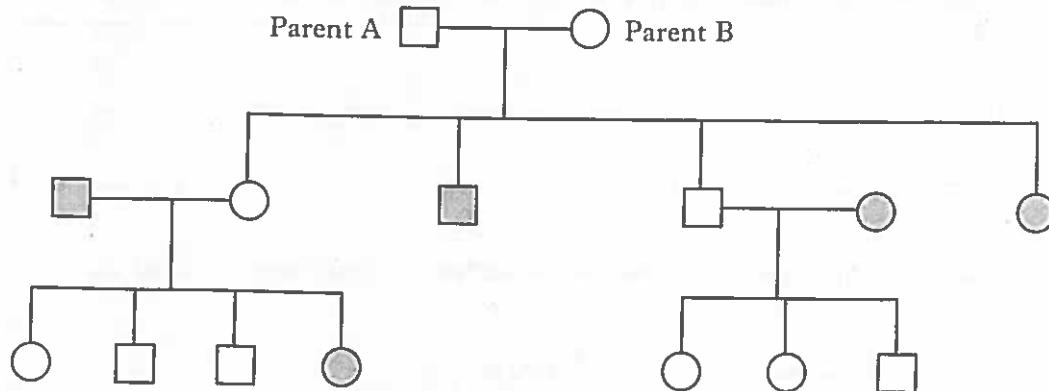
1

Red onions : White onions

Marks KU PS

15. Thalassaemia is an inherited disease which prevents people producing blood cells. The family tree shows inheritance of thalassaemia.

Unaffected male Thalassaemic male
 Unaffected female Thalassaemic female



- (a) (i) Which of the following statements about Parents A and B is true?

Tick (✓) the correct box.

Both have the thalassaemic gene.

One has the thalassaemic gene.

Neither has the thalassaemic gene.

- (ii) Give a reason for your answer.

1

- (b) What proportion of the children of Parents A and B were thalassaemic?

1

- (c) Doctors can test for thalassaemia by examining the cells of a fetus. The cells are obtained by inserting a needle into the mother's uterus and withdrawing fluid from around the fetus.

What name is given to this procedure?

1

[Turn over

Marks KU PS

16. Yeast is a micro-organism which carries out fermentation.

(a) Complete the following word equation for fermentation in yeast.



1

(b) Name **two** manufacturing processes which depend on fermentation by yeast.

1 _____

2 _____

(c) Complete the following sentence by underlining the correct word in each group.

Yeast is a $\left\{ \begin{array}{l} \text{fungus} \\ \text{bacterium} \end{array} \right\}$ and is $\left\{ \begin{array}{l} \text{single-} \\ \text{multi-} \end{array} \right\}$ celled.

1

(d) Describe the precautions which should be taken with each of the following items when working with micro-organisms.

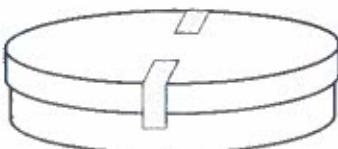
1 Bench surfaces _____

1

2 Wire loops for inoculating a plate _____

1

(e) Petri dishes half-filled with agar gel are used to grow micro-organisms.



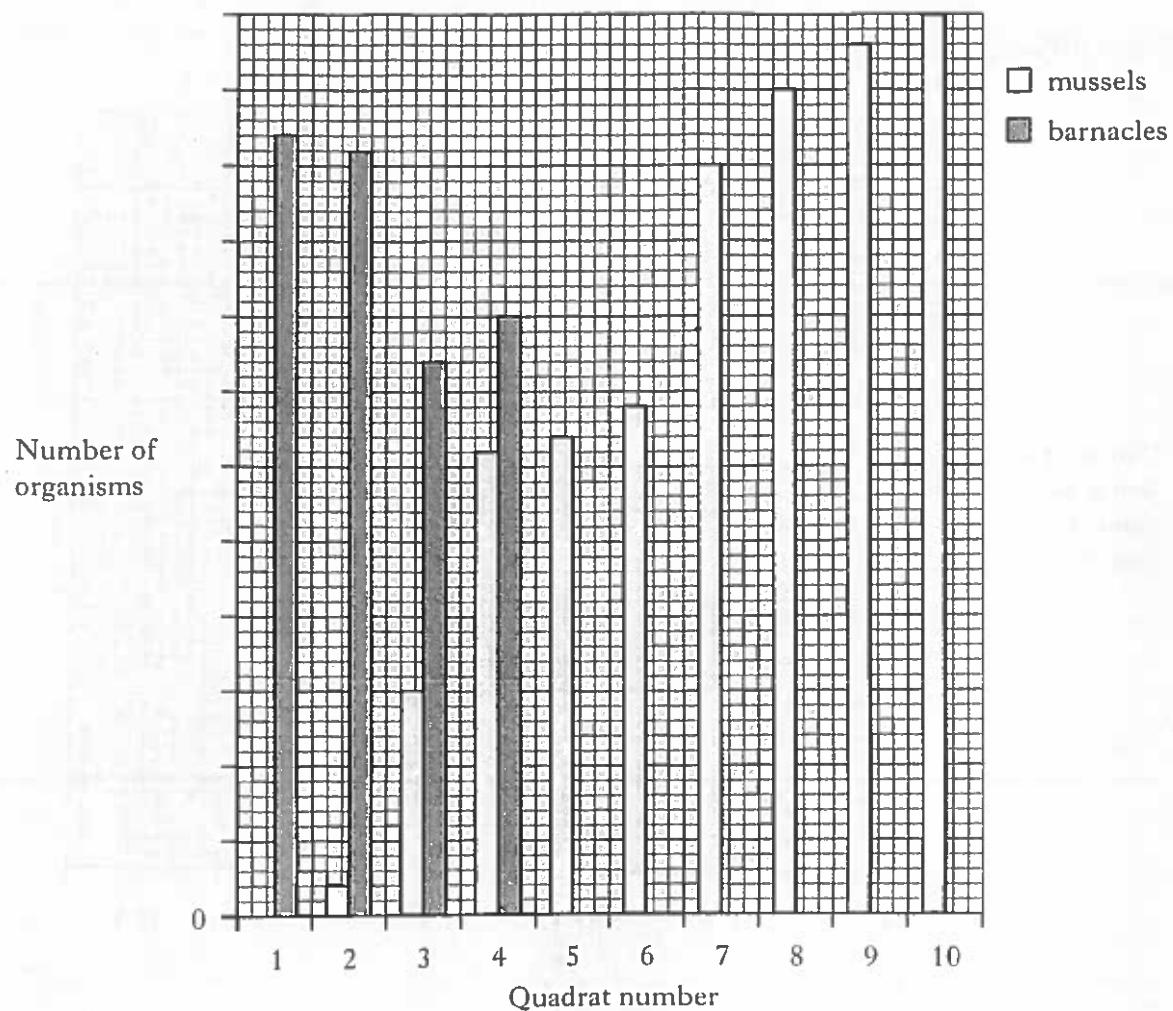
Explain why Petri dishes containing micro-organisms must be kept closed.

1

[END OF QUESTION PAPER]

SPACE FOR ANSWERS
AND FOR ROUGH WORKING

ADDITIONAL GRID FOR QUESTION 3(a)(i)



SPACE FOR ANSWERS
AND FOR ROUGH WORKING

ADDITIONAL GRID FOR QUESTION 11(a)(ii)

