

FOR OFFICIAL USE

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| Centre No. | Subject No. | Level | Paper No. | Group No. | Marker's No. |
|------------|-------------|-------|-----------|-----------|--------------|

Total

[C007/SQP004]

Higher
Biology
Specimen Question Paper

Time: 2 hours 30 minutes

NATIONAL
QUALIFICATIONS

Fill in these boxes and read what is printed below.

Full name of centre

Town

First name and initials

Surname

Date of birth

Day Month Year

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Number of seat

SECTION A

Instructions for completion of Section A are given on page two.

SECTIONS B AND C

- (a) All questions should be attempted.
(b) It should be noted that in **Section C** questions 1 and 2 each contain a choice.
- 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.
- Additional space for answers and rough work will be found at the end of the book. If further space is required, supplementary sheets may be obtained from the invigilator and should be inserted inside the **front** cover of this book.
- The numbers of questions must be clearly inserted with any answers written in the additional space.
- Rough work, if any should be necessary, should be written in this book and then scored through when the fair copy has been written.
- 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.

SECTION A

Read carefully

- 1 Check that the answer sheet provided is for Higher Biology (Section A).
- 2 Fill in the details required on the answer sheet.
- 3 In this section a question is answered by indicating the choice A, B, C or D by a stroke made in **ink** in the appropriate place in the answer sheet—see the sample question below.
- 4 For each question there is only **one** correct answer.
- 5 Rough working, if required, should be done only on this question paper—or on the rough working sheet provided—**not** on the answer sheet.
- 6 At the end of the examination the answer sheet for Section A **must not** be placed inside this answer book, but should be handed separately to the invigilator.

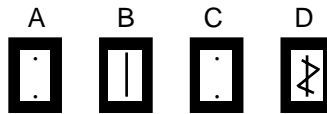
Sample Question

Which of the following molecules contains six carbon atoms?

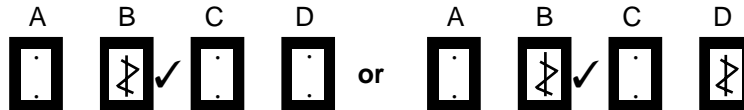
- A Pyruvic acid
- B Glucose
- C Ribulose biphosphate
- D Acetyl co-enzyme A

The correct answer is **B**—glucose. A **heavy** vertical line should be drawn joining the two dots in the appropriate box in the column headed **B** as shown in the example on the answer sheet.

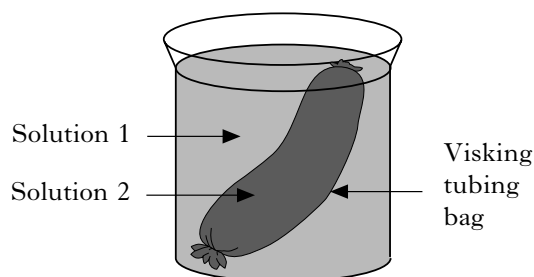
If, after you have recorded your answer, you decide that you have made an error and wish to make a change, you should cancel the original answer and put a vertical stroke in the box you now consider to be correct. Thus, if you want to change an answer D to an answer B, your answer sheet would look like this:



If you want to change back to an answer which has already been scored out, you should enter a tick (✓) to the **right** of the box of your choice, thus:



1. The diagram below shows apparatus used to investigate osmosis.



Which line of the table shows a correct result for the solutions used in the investigation?

| | <i>Solution 1</i> | <i>Solution 2</i> | <i>Change of volume in visking tubing bag</i> |
|---|-------------------|-------------------|---|
| A | water | 5% sucrose | decrease |
| B | 10% sucrose | water | increase |
| C | 10% sucrose | 5% sucrose | increase |
| D | 10% sucrose | 15% sucrose | increase |

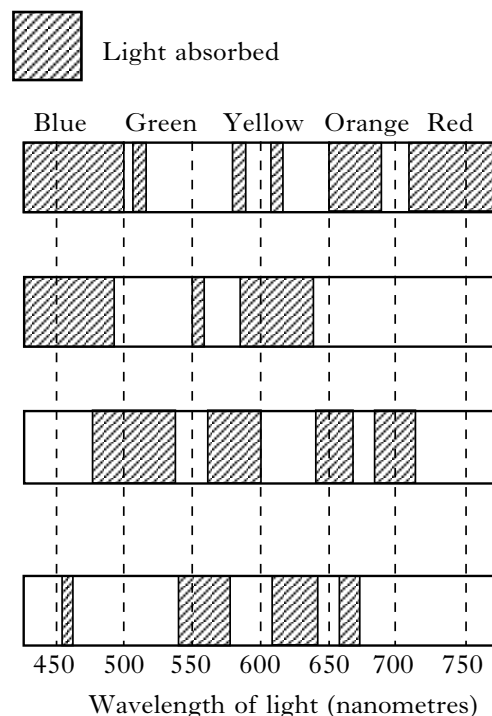
2. Amino acids were introduced into a cell which produces an enzyme. During the next five minutes, the following structures were tested for the presence of the amino acids.

- 1 Golgi apparatus
- 2 Ribosomes
- 3 Plasma membrane
- 4 Endoplasmic reticulum

Identify the sequence in which the amino acids would be detected in these structures.

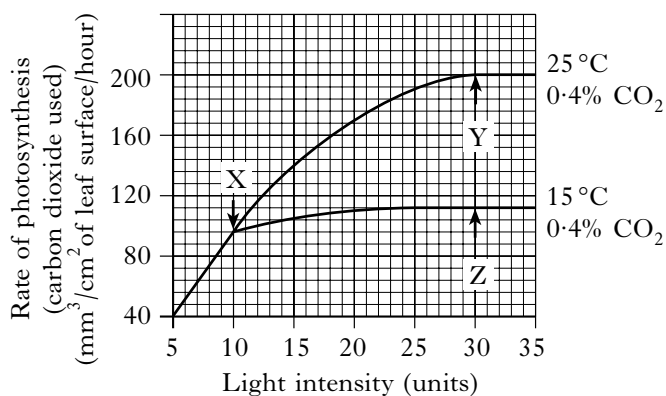
- A 1 2 4 3
- B 2 4 1 3
- C 3 4 1 2
- D 4 2 3 1

3. The following absorption spectra were obtained from four different plant extracts. Shaded areas indicate those wavelengths of light which have been absorbed by the extracts.



Which extract contains chlorophyll?

4. The graph below shows the effect of light intensity on the rate of photosynthesis at different temperatures.



Which of the following conclusions can be made from the graph above?

- A At point Y, the rate of photosynthesis is limited by temperature.
- B At point Y, the rate of photosynthesis is limited by light intensity.
- C At point Z, the rate of photosynthesis is limited by the temperature.
- D At point X, the rate of photosynthesis is limited by a lack of carbon dioxide.

5. What percentage of adenine molecules is present in a DNA molecule of 2000 bases, if 400 of the base molecules are cytosine?

- A 20%
- B 30%
- C 40%
- D 60%

6. The following events occur during protein synthesis.

- 1 Bonds form between amino acids.
- 2 m-RNA attaches to a ribosome.
- 3 Codons and anti-codons link.
- 4 t-RNAs bring amino acids to the ribosome.

The correct sequence of these events is

- A 1, 2, 3, 4
- B 2, 3, 4, 1
- C 2, 4, 3, 1
- D 4, 2, 1, 3.

7. Which of the following statements correctly describes antibodies?

- A They are foreign protein molecules.
- B They are made by phagocytes.
- C They are specific in their action.
- D They contain lysosomes.

8. Which of the following compounds can be produced by some plants as a defence against grazing?

- A Acetyl co-enzyme A
- B Cyanide
- C Antibodies
- D Antigens

9. The wall of a cambium cell is composed chiefly of

- A carbohydrates
- B phospholipids
- C nucleotides
- D lipids and proteins.

10. The role of ribulose bisphosphate (RuBP) in photosynthesis is to

- A make ATP
- B split water
- C absorb light energy
- D combine with carbon dioxide.

11. Which of the following descriptions does **not** relate to the process of meiosis?

- A Diploid cells are formed.
- B Two successive divisions occur.
- C Chiasmata often appear.
- D Homologous chromosomes pair.

12. In guinea pigs, black fur (B) is dominant to white fur (b) and rough coat (R) is dominant to smooth coat (r).

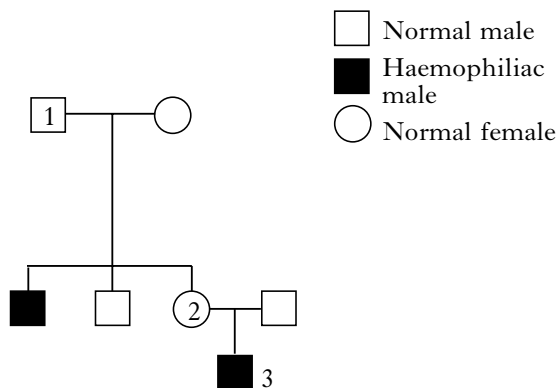
Two heterozygous individuals are crossed and the possible genotypes of the offspring can be found using the Punnett square shown below.

| | | | | |
|----|----|----|----|----|
| | BR | Br | bR | br |
| BR | 1 | | | |
| Br | | 2 | | |
| bR | | | 3 | |
| br | | | | 4 |

What are the genotypes of the individuals in the numbered boxes?

- A Heterozygous for both gene pairs
- B Homozygous for coat colour only
- C Heterozygous for coat colour only
- D Homozygous for both gene pairs

13. Haemophilia is caused by a recessive allele carried on the X chromosome. The diagram below shows the occurrence of haemophilia in a family.



The genotypes of individuals 1, 2 and 3 are

- | | 1 | 2 | 3 |
|---|---------|-----------|---------|
| A | $X^H Y$ | $X^H X^h$ | $X^H Y$ |
| B | $X^h Y$ | $X^H X^H$ | $X^H Y$ |
| C | $X^H Y$ | $X^H X^h$ | $X^h Y$ |
| D | $X^H Y$ | $X^H X^H$ | $X^h Y$ |
14. A genetic disorder results in some males having the sex chromosomes XXY. This is caused by
- a sex-linked recessive allele
 - non-disjunction
 - two sperm cells fertilising one ovum
 - crossing-over and recombination.
15. Which of the following statements regarding polyploidy is correct?
- It is more common in animals than in plants.
 - It is the term used to describe the four haploid cells formed at the end of meiosis.
 - It results from crossing over of genes at chiasmata.
 - It can result from the non-disjunction of chromosomes.

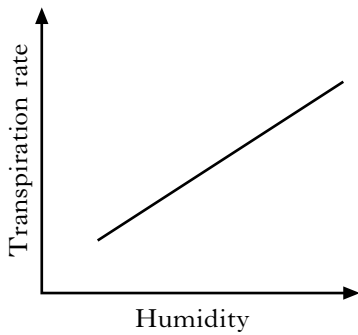
16. Two closely related plants, with diploid chromosome numbers of 16 and 20 respectively, are crossed. The infertile offspring are treated to produce fertile polyploid F_2 plants.

What is the most likely chromosome number of the F_2 plants?

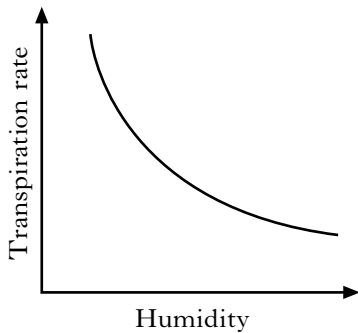
- 18
 - 36
 - 52
 - 56
17. Which of the following results from artificial selection?
- Increased milk yield in dairy cattle
 - DDT resistance in mosquitoes
 - Industrial melanism in moths
 - Decreasing effect of antibiotics on bacteria
18. Which of the following is the best definition of a species?
- A population of similar animals which can interbreed.
 - A population of organisms which breed to produce fertile offspring.
 - A community of organisms which can interbreed.
 - A population of organisms with similar characteristics.
19. The base sequence of a short piece of DNA is shown below.
- A G C T T A C G
- During replication, an inversion mutation occurs on the complementary strand synthesised on this piece of DNA.
- Which of the following is the mutated complementary strand?
- T C G A A T G A
 - A G C T T A G C
 - T C G A A T C G
 - U C G A A G U C

20. Which of the following graphs best represents the relationship between humidity of the air and the transpiration rate of a plant?

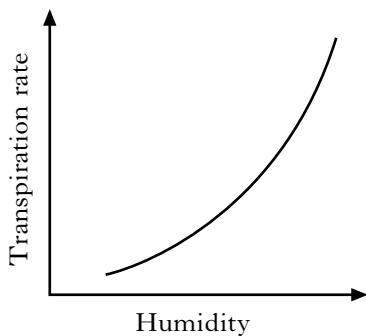
A



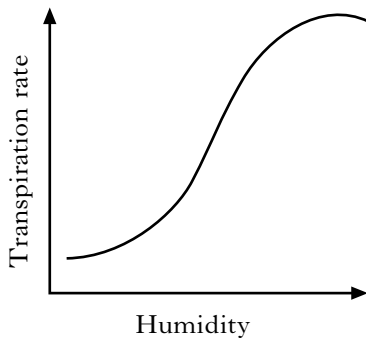
B



C



D



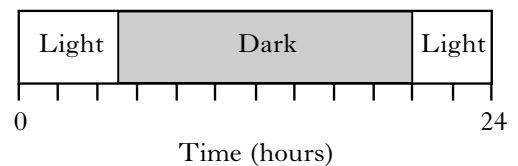
21. Which line of the table correctly describes the effect of light and dark on the condition of guard cells and stomatal pores of a flowering plant?

| | <i>Light conditions: Light/dark</i> | <i>Guard cells: turgid/flaccid</i> | <i>Stomatal pores open/closed</i> |
|---|---|--|---------------------------------------|
| A | light | turgid | open |
| B | light | flaccid | open |
| C | dark | turgid | closed |
| D | dark | flaccid | open |

22. Which of the following describe adaptations of fresh water bony fish to their osmotic environment?

- A Kidneys contain many large glomeruli; salt actively excreted by chloride secretory cells
- B Kidneys contain many large glomeruli; salt actively taken into blood by chloride secretory cells
- C Kidneys contain few small glomeruli; salt actively excreted by chloride secretory cells
- D Kidneys contain few small glomeruli; salt actively taken into blood by chloride secretory cells

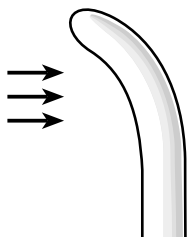
23. If a “short day” plant with a critical photoperiod of 10 hours and a “long day” plant with a critical photoperiod of 14 hours were exposed daily to the following photoperiod, what would be the likely outcome?



- A Neither plant would flower.
- B Both plants would flower.
- C Only the long day plant would flower.
- D Only the short day plant would flower.

24. The function of apical meristems in plants is to produce
- A xylem vessels
 - B root hairs
 - C sieve tubes
 - D new cells.

25. The diagram shows the effect of light coming from one direction on the growth of a young shoot.

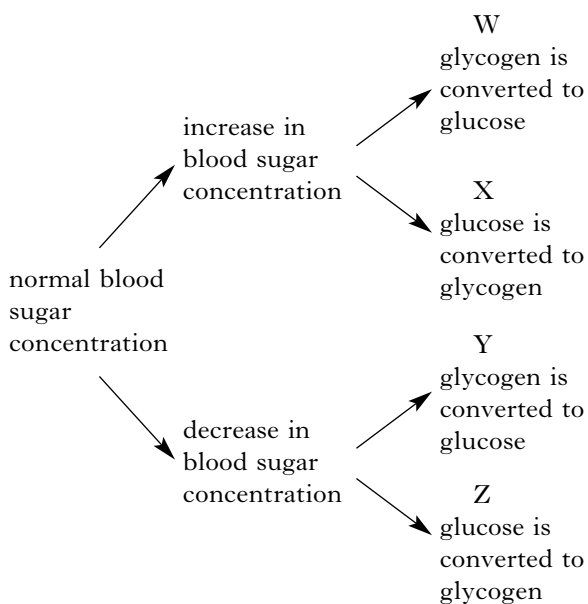


What term is used to describe this response?

- A Apical dominance
 - B Photoperiodism
 - C Phototropism
 - D Etiolation
26. Which of the following hormones is **not** secreted by the pituitary gland?
- A Anti-diuretic hormone (ADH)
 - B Growth hormone
 - C Thyroid stimulating hormone (TSH)
 - D Thyroxine
27. In the Jacob-Monod hypothesis of gene action in *E.coli*, the sugar lactose binds to
- A the repressor protein
 - B the operator
 - C the structural gene
 - D the regulator gene.

28. Cell differentiation is a result of
- A gene mutation
 - B mitotic division
 - C DNA replication
 - D gene action.

29. The diagram below refers to the homeostatic control of blood sugar concentration.



Which letters indicate homeostatic control of blood sugar concentration?

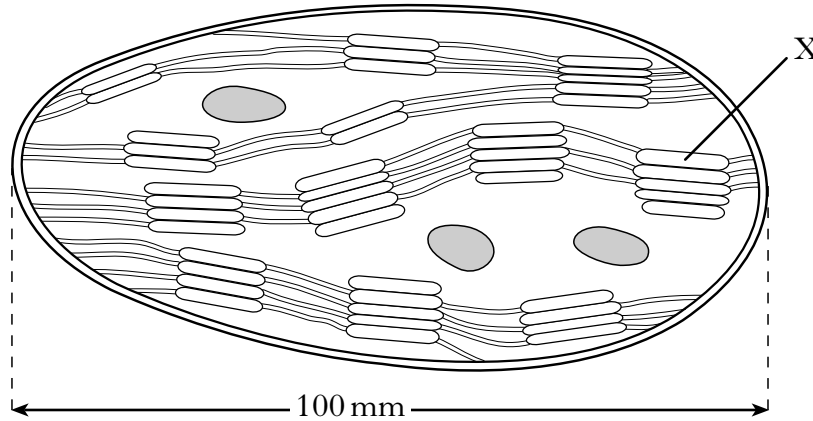
- A W and Y
 - B W and Z
 - C X and Y
 - D X and Z
30. Which of the following is a density-independent factor affecting population size?
- A Drought
 - B Competition
 - C Disease
 - D Predation

Candidates are reminded that the answer sheet **MUST NOT** be returned inside this answer book.

SECTION B

All questions in this section should be attempted.

1. The diagram below shows a chloroplast magnified twenty thousand times ($\times 20\,000$).



[1 millimetre = $1000\ \mu\text{m}$]

- (a) (i) Name the stack of membranes labelled X.

(1)

- (ii) Name **two** pigments which could be found at point X.

_____ and _____

(1)

- (iii) Name a technique used to separate chlorophyll pigments.

(1)

- (iv) Give **one** reason why plants often have more than one photosynthetic pigment.

(1)

- (b) Using the information given above, calculate the length of the chloroplast in microns (μm).

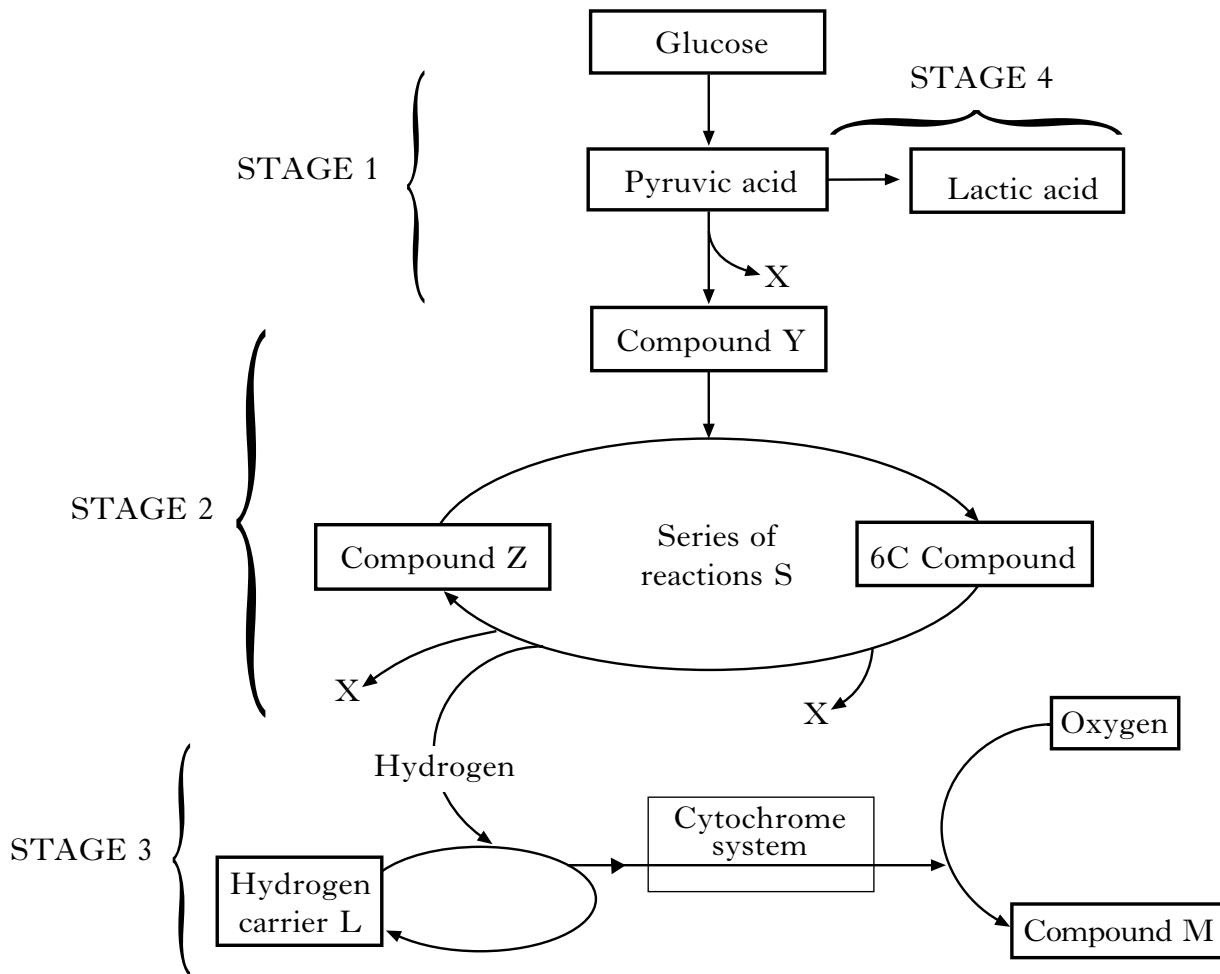
Space for calculation

_____ μm

(1)

2. The diagram below represents an outline of four stages of respiration in muscle cells.

Marks



(a) State the number of carbon atoms in compounds X, Y and Z.

X _____ Y _____ Z _____

(1)

(b) Name hydrogen carrier L and compound M.

L _____ M _____

(2)

(c) Identify which **two** stages occur during anaerobic respiration.

_____ and _____

(1)

(d) Name the compound, not shown in the diagram, which is synthesised during the passage of hydrogen through the cytochrome system.

(1)

(e) Name the series of reactions S and state their exact location within the mitochondrion.

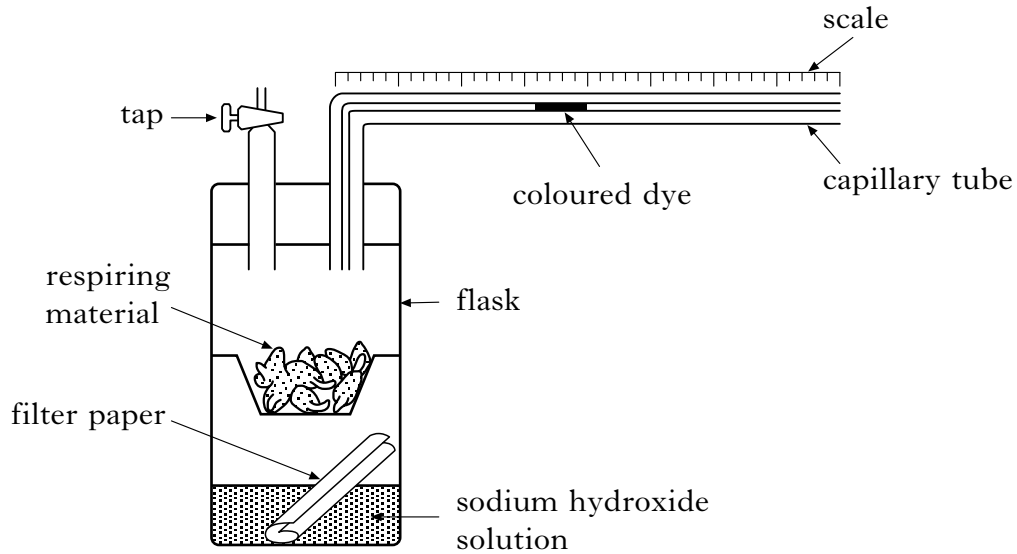
Reactions S _____

Location _____

(2)

Marks

3. The diagram below shows a simple respirometer. This apparatus, with a suitable control, was used to compare the rates of respiration of various living materials at 20°C.



The living material was placed in the flask with the tap open. After ten minutes the tap was closed. The apparatus was left on a bench in the light for five hours, during which the rate of respiration was measured.

The results obtained are shown in the table below.

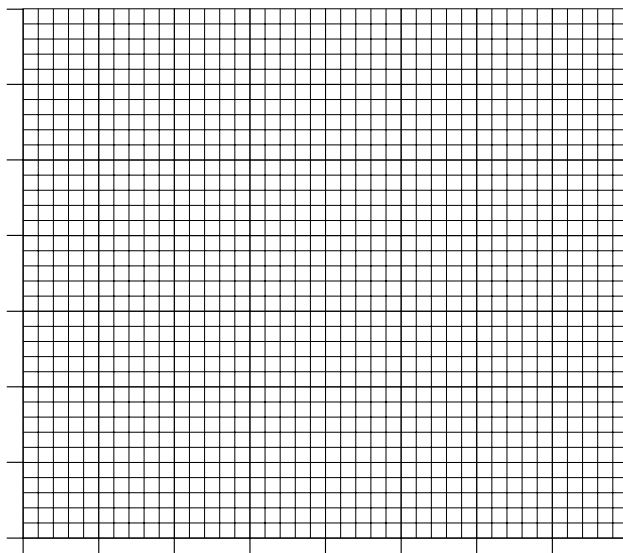
| <i>Respiring material</i> | <i>Relative oxygen uptake (mm per hour)</i> |
|---------------------------|---|
| Germinating seeds | 2 |
| Earthworms | 8 |
| Woodlice | 11 |
| Meal worms | 7 |

Marks

3. (continued)

(a) Present the results of the experiment in a suitable form on the graph paper below.

(Additional graph paper, if required, will be found on page 12.)



(3)

(b) Describe a control for this experiment.

(1)

(c) State the reason for leaving the tap open for ten minutes before starting the measurements.

(1)

(d) The sodium hydroxide solution absorbs carbon dioxide. Suggest a reason for the inclusion of the filter paper in the flask.

(1)

Marks

3. (continued)

(e) (i) Draw an arrow beside the capillary tube on page 10 to show the direction in which you would expect the coloured dye to move during the investigation.

(1)

(ii) Give a reason for your answer.

(2)

(f) Suggest **two** variables, other than temperature or time, which would have to be kept constant during the investigation.

1 _____

2 _____

(1)

(g) What modification would have to be made to the apparatus when measuring the rate of respiration of the green leaves of a daisy? Give a reason for your answer.

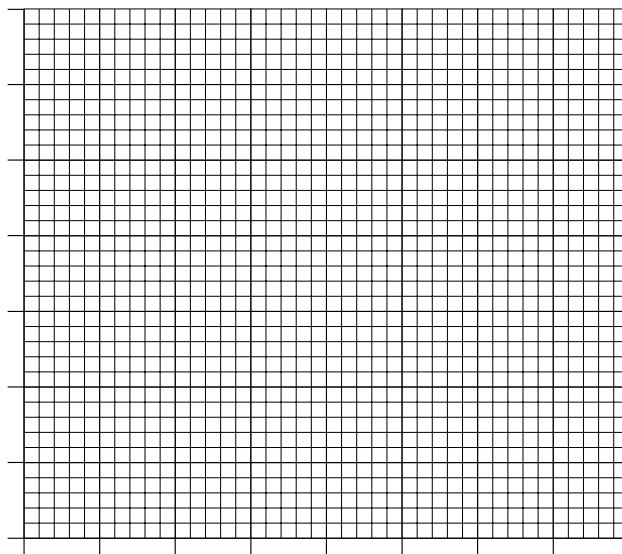
Modification _____

(1)

Reason _____

(1)

Additional graph paper for Question 3(a).



Marks

4. The table below shows the mass of DNA in cells found in the testes of a mammal before and after meiosis.

| <i>Type of cell</i> | <i>Relative mass of DNA (units)</i> |
|---------------------|-------------------------------------|
| mature body cell | 2 |
| sperm mother cell | 4 |
| sperm cell | 1 |

- (a) Account for the increased mass of DNA in the sperm mother cell before meiosis.

(1)

- (b) Account for mass of DNA in a sperm cell compared to a sperm mother cell.

(1)

Marks

5. (a) Decide whether each of the following statements about nucleic acids is **TRUE** or **FALSE** and **tick the appropriate box**.

If you decide the statement is **FALSE**, you should then write the **correct word** in the right hand box to replace the word **underlined in the statement**.

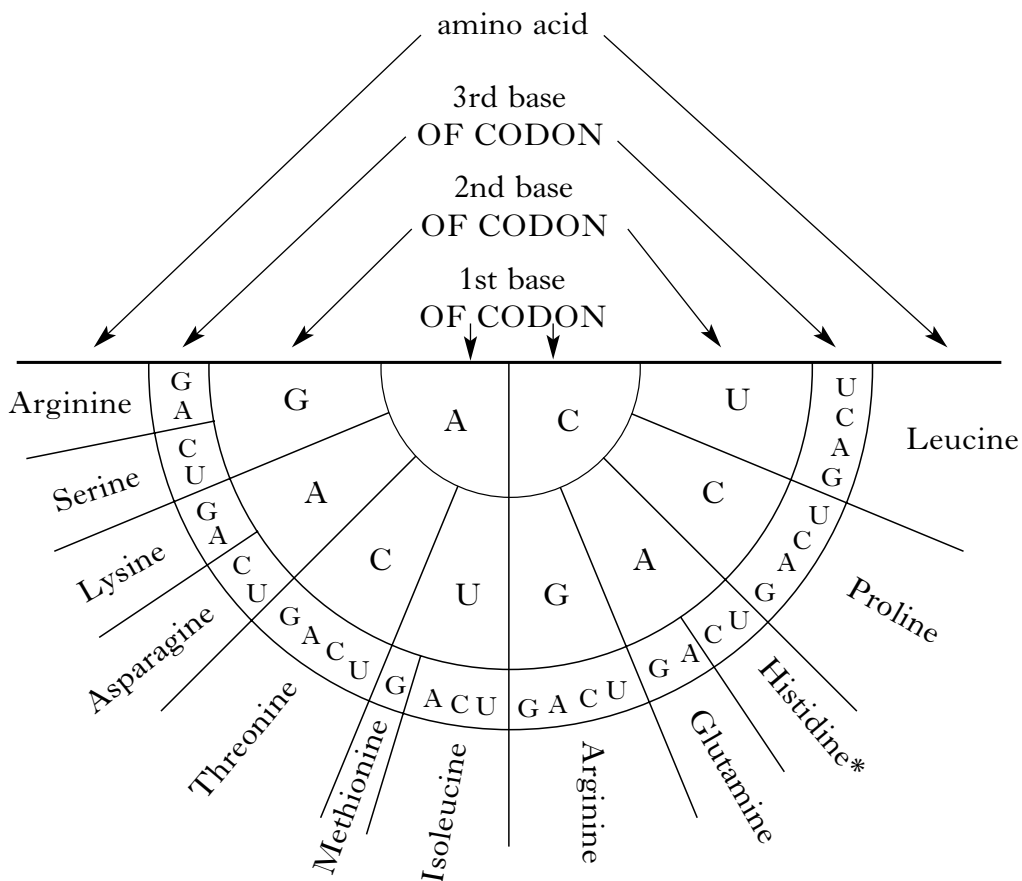
| Statements | True | False | Correct word |
|--|------|-------|--------------|
| During the formation of a new DNA molecule, base pairing is followed by bonding between deoxyribose and <u>bases</u> | | | |
| Synthesis of m-RNA takes place in the <u>nucleus</u> | | | |
| m-RNA consists of many <u>codons</u> , each consisting of a base, ribose and phosphate | | | |

(3)

- (b) m-RNA codes for the amino acids which bond to form a protein chain.

The diagram below can be used to identify the amino acids which are coded for by some m-RNA codons.

For example, the m-RNA codons with base sequences CAU and CAC both code for the amino acid histidine*.



Marks

5. (b) (continued)

Use the information from the diagram to answer the following questions.

- (i) State the **two** mRNA codons for the amino acid serine.

_____ and _____

(1)

- (ii) Which base sequence on a strand of DNA would code for the amino acid methionine?

(1)

- (iii) Which amino acid is carried by a tRNA molecule which has the anticodon GAC?

(1)

Marks

6. (a) The coat colour in mice is controlled by two genes located on different chromosomes.

Each gene has two alleles. **A** is dominant to **a**, and **B** is dominant to **b**. The presence of the allele **A** always produces **grey** coat colour.

The other possible genotypes and their phenotypes are shown in the table below.

| <i>Genotype</i> | <i>Phenotype</i> |
|-----------------|------------------|
| aaBB | Black coat |
| aaBb | Black coat |
| aabb | Brown coat |

Male mice heterozygous for both genes were crossed with female brown-coated mice.

- (i) Complete the table below for this cross.

| | <i>Male</i> | <i>Female</i> |
|---------------------|-------------|---------------|
| Parental phenotype | | Brown coat |
| Parental genotype | | |
| Genotype of gametes | | |

(1)

(1)

(1)

- (ii) What are the possible F₁ genotypes?

Space for working

F₁ genotypes: _____

(1)

- (iii) State the expected F₁ phenotype ratio.

Space for calculation

Ratio _____ Grey: _____ Black: _____ Brown

(1)

Marks

6. (continued)

(b) In *Drosophila*, the genes for wing length (W), eye colour (E), body colour (B) and presence of bristles (P) are linked.

The table below gives the frequency of recombination obtained in crosses involving different pairs of linked genes.

| <i>Gene pair in cross</i> | <i>Frequency of recombination</i> |
|------------------------------------|-----------------------------------|
| Wing length × Eye colour | 12 % |
| Wing length × Body colour | 18 % |
| Wing length × Presence of bristles | 15 % |
| Eye colour × Body colour | 6 % |
| Body colour × Presence of bristles | 3 % |

Use the information to show the position of these genes in relation to each other on the chromosome diagram below.

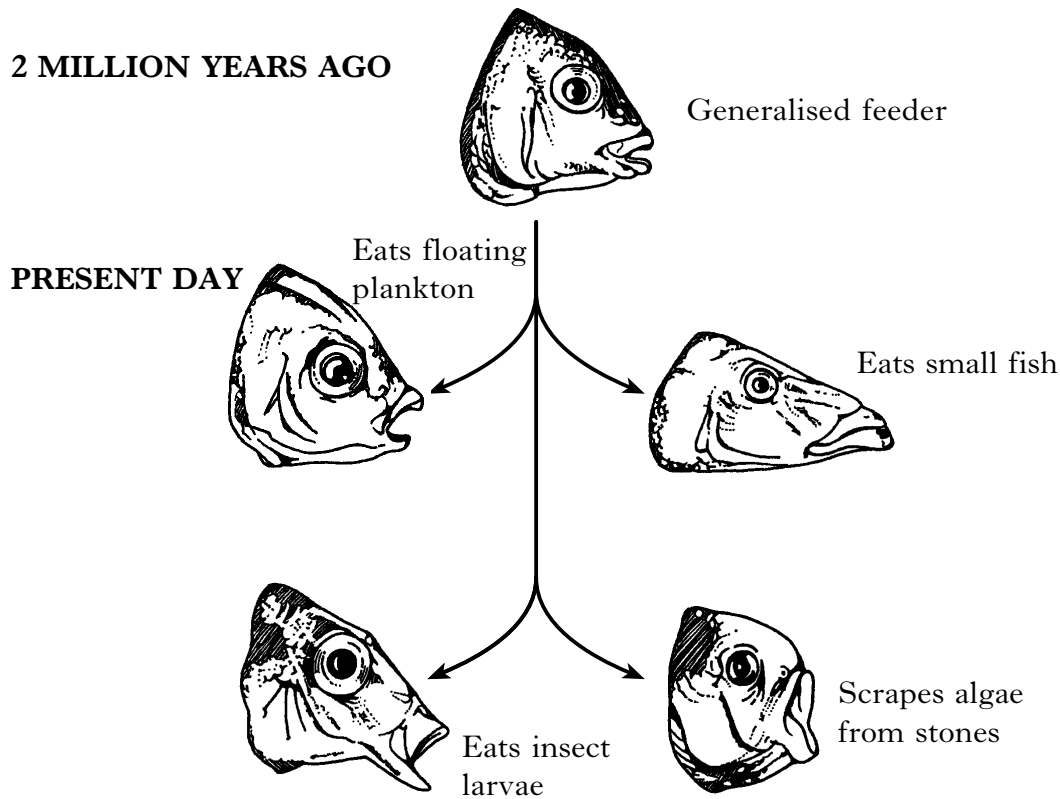
Use the letters W, E, B and P to identify the position of each gene on the chromosome.

Chromosome _____

(1)

Marks

7. Today, a part of East Africa contains a variety of *Cichlid* fish species. The drawings show the evolution of a group of these *Cichlid* species together with information on their food sources.



- (a) Explain how the information above illustrates adaptive radiation.

(1)

- (b) What advantage does each *Cichlid* species gain from being a specialised feeder?

(1)

- (c) Name **two** events which would have to occur to allow the speciation of the *Cichlid* fish to take place.

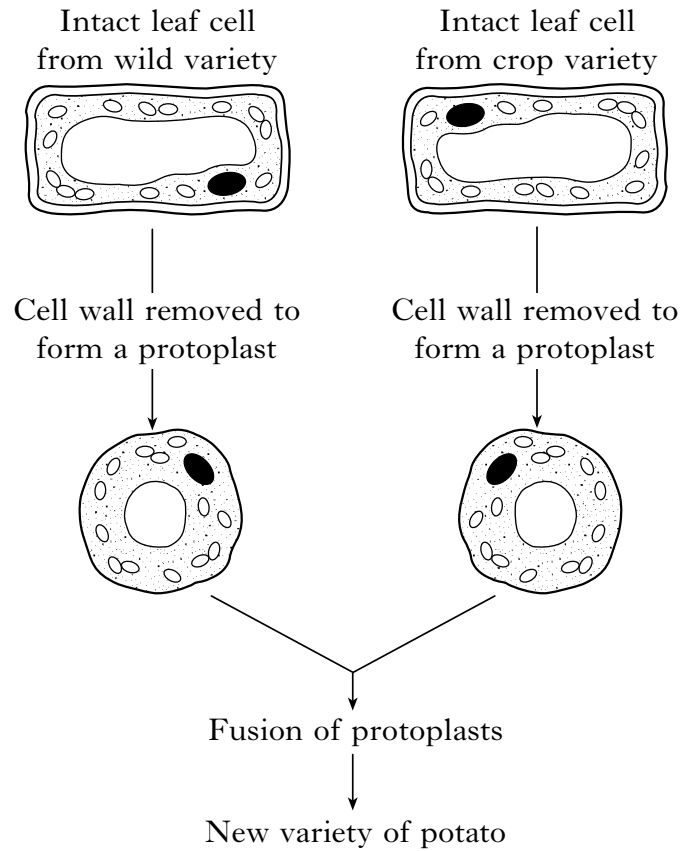
1 _____

2 _____

(2)

Marks

8. The diagram below represents stages in somatic fusion, a method used to produce a new crop variety of a plant species such as potato.



- (a) Explain why protoplasts have to be kept in a salt solution of the same concentration as the cell sap and not in distilled water.

(2)

- (b) What problem in plant breeding has been overcome by the use of somatic fusion?

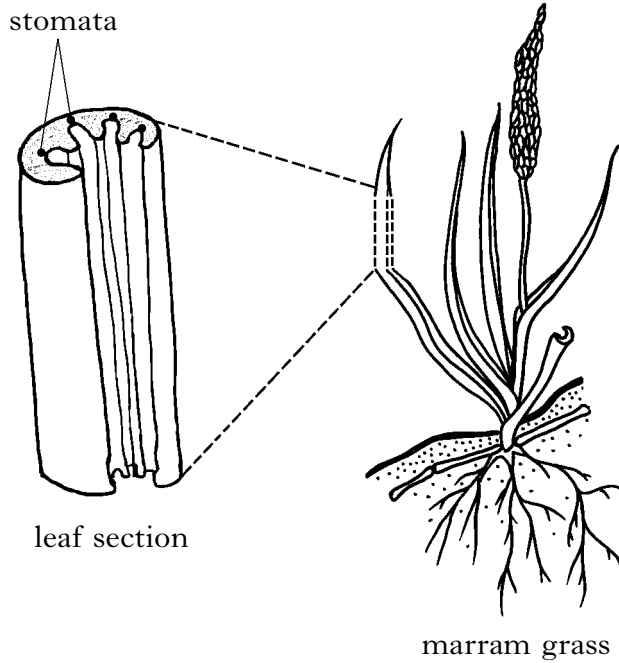
(1)

- (c) State **one** way in which a crop variety might be improved by fusion with a wild variety.

(1)

Marks

9. The diagram below shows marram grass (*Ammophila arenaria*) and a magnified view of a leaf section.



(a) Marram grass shows some typical features of xerophytes.

- (i) In what types of conditions are xerophytes adapted to grow?

(1)

- (ii) Select **one** xerophytic adaptation shown in the leaf section and explain how it functions.

Feature _____

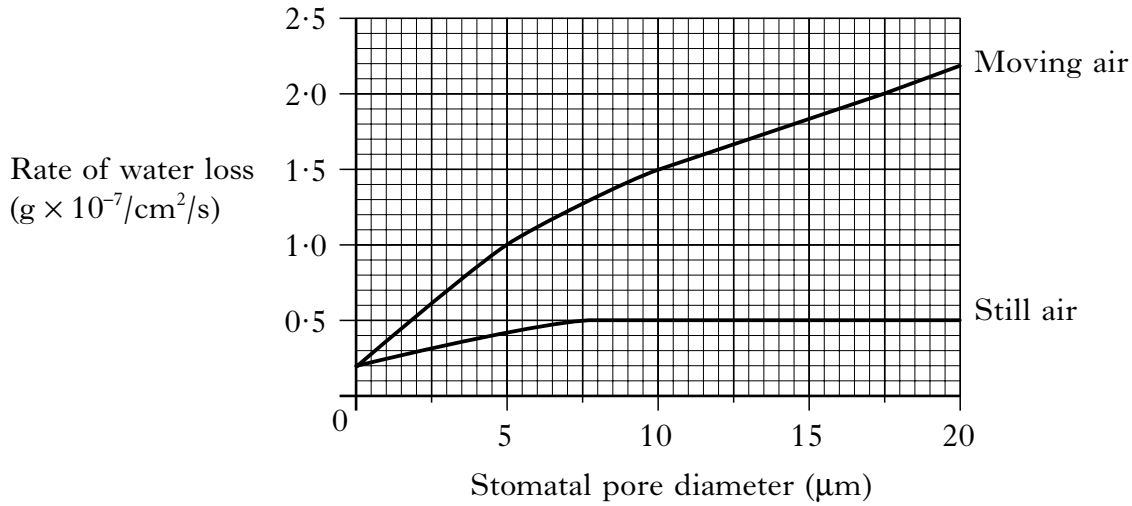
Function _____

(1)

Marks

9. (continued)

- (b) The graph shows the rate of water loss from the leaves of the plant *Zebrina pendula* at different stomatal pore diameters in still air and in moving air.



- (i) When stomatal pore width is $10\mu\text{m}$, what is the percentage increase in the rate of water loss when the conditions change from still to moving air?

Space for calculation

_____ % **(1)**

- (ii) What effect would a decrease in atmospheric pressure have on the rate of evaporation from the leaves?

_____ **(1)**

Marks

10. Hens living in groups frequently peck each other.

In order to investigate the significance of this behaviour, each hen in a group of six was given a leg ring with a different code.

The number of occasions each hen pecked another hen was recorded over a period of time.

The results are shown in the table below.

| | | <i>Number of pecks given by each bird</i> | | | | | |
|--|----------|---|----------|----------|----------|----------|----------|
| | | <i>Code of leg ring</i> | <i>A</i> | <i>B</i> | <i>C</i> | <i>D</i> | <i>E</i> |
| <i>Number of pecks received by each bird</i> | <i>A</i> | – | 2 | – | – | 10 | – |
| | <i>B</i> | 17 | – | 5 | 6 | 12 | 9 |
| | <i>C</i> | 2 | – | – | – | 13 | – |
| | <i>D</i> | 6 | – | 8 | – | 7 | – |
| | <i>E</i> | – | – | – | – | – | – |
| | <i>F</i> | 11 | – | 10 | 5 | 4 | – |

(a) From the results, give the pecking order of the hens starting from the most dominant hen.

□ → □ → □ → □ → □ → □

(1)

(b) (i) Many mammals which form social groups demonstrate dominance hierarchies.

What is meant by the term “dominance hierarchy”?

(1)

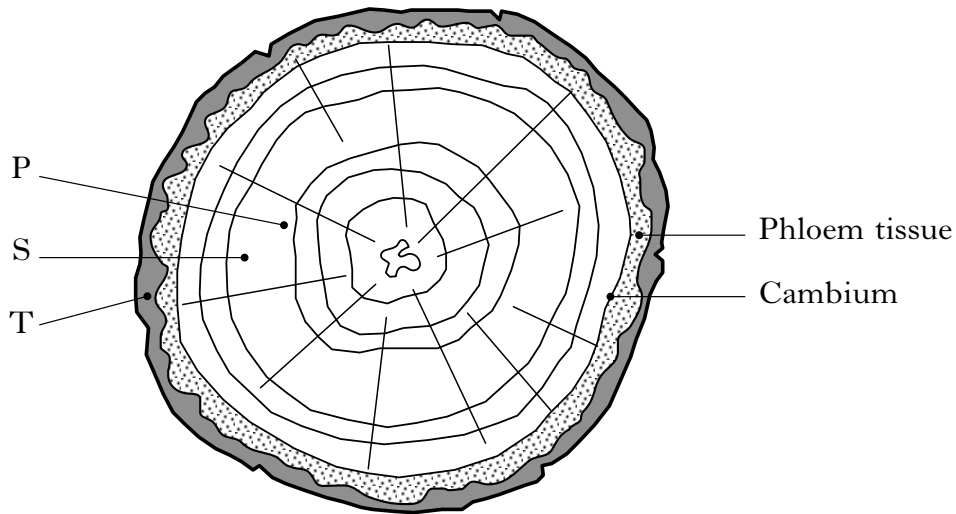
(ii) Give **one** advantage of a dominance hierarchy in a social organisation.

(1)

Marks

11. **Diagram A** below shows a cross section of a stem of a young tree.

Diagram A



(a) How old is the tree?

_____ years

(1)

(b) How old was the tree when there was a particularly good growing season?

_____ years

(1)

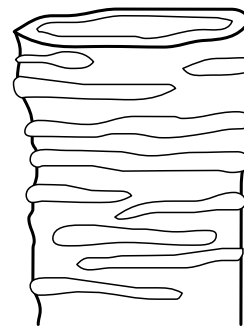
(c) **Diagram B** shows two xylem vessels drawn to scale.

Using the labels, P, S or T from **Diagram A**, state where each vessel is most likely to be found.

Diagram B



Label _____



Label _____

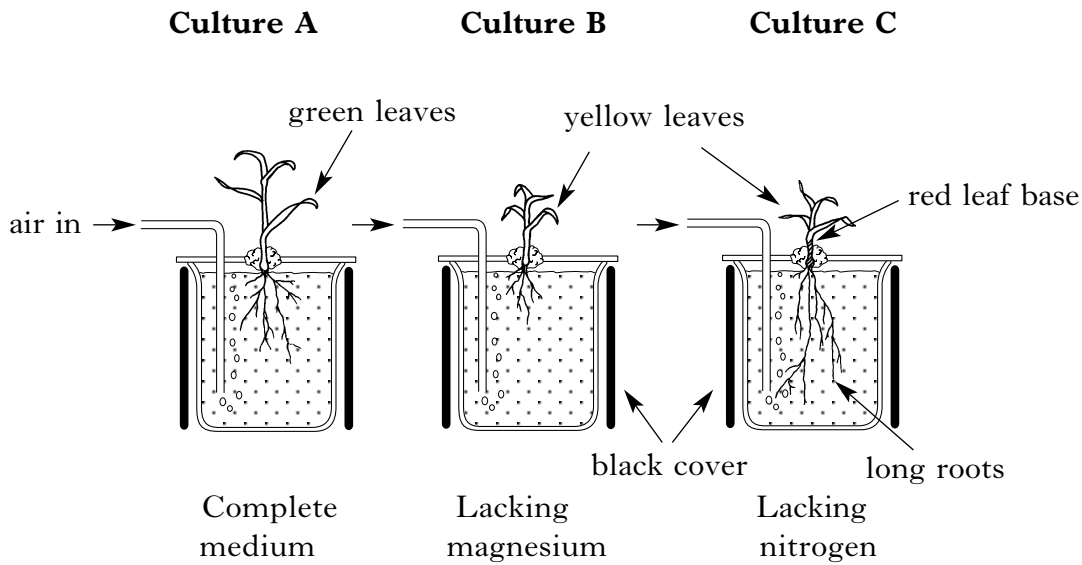
(1)

(d) State **one** structural difference between a xylem vessel and a phloem sieve tube.

(1)

Marks

12. The diagrams below show three seedlings which have been grown in water culture solutions that differ in the chemical elements they contain.



(a) Account for

(i) the yellow leaves in culture B

(1)

(ii) the reduced shoot growth in culture C.

(1)

(b) If water culture solutions are not aerated, the rate of uptake of elements is often reduced. Give an explanation for this.

(2)

(c) Young plants rarely show deficiency symptoms until they are a few weeks old. Suggest a reason for this.

(1)

(d) Which of the following compounds contain the element phosphorus? Underline the correct answers.

ATP NAD DNA RuBP

(2)

Marks

12. (continued)

(e) Many substances affect growth and development in humans.

Insert the appropriate letter from the list of chemical substances into each of the boxes below to match its role in, or effect on, growth and development.

Each letter can be used **once, more than once** or **not at all**.

List of Substances

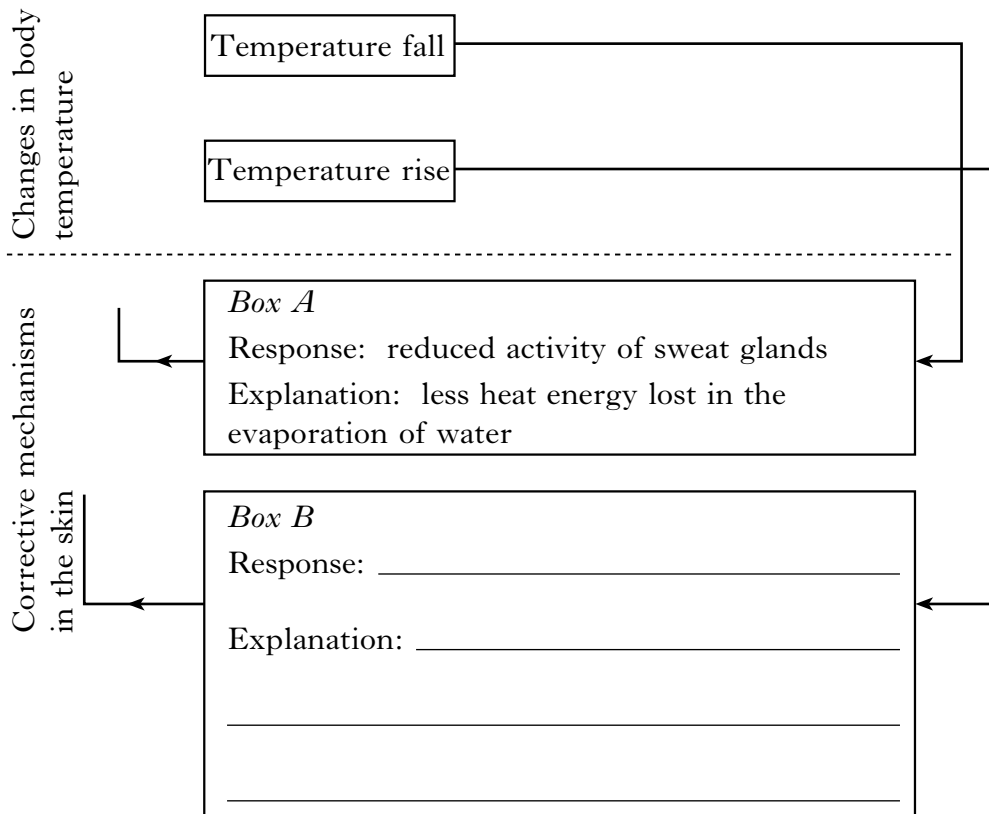
| <i>Name</i> | <i>Letter</i> |
|-------------|---------------|
| Calcium | A |
| Nicotine | B |
| Alcohol | C |
| Vitamin D | D |
| Thalidomide | E |
| Magnesium | F |
| Iron | G |

| <i>Role in, or effect on, growth and development</i> | <i>Letter(s)</i> | |
|--|------------------|--|
| Required for normal growth of teeth and bones | | |
| Required for the manufacture of haemoglobin | | |
| Retards mental development in young humans | | |

(2)

Marks

13. (a) The diagram below shows mechanisms involved in the control of temperature in the human body.



- (i) Box A shows and explains a response to a fall in body temperature.

In Box B, state and explain an appropriate response to a rise in temperature, other than a change in the activity of sweat glands.

(2)

- (ii) Complete the lines to link Box A and Box B to the correct temperature change.

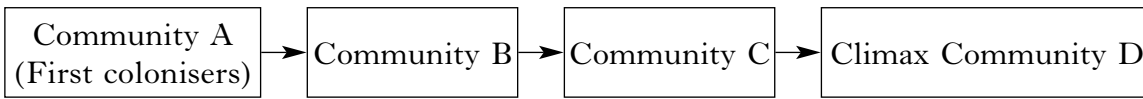
(1)

- (b) What change in blood glucose concentration results from an increase in adrenaline secretion?

(1)

Marks

14. If a habitat is stripped of its original vegetation, the area is recolonised by plants. The diagram below represents a sequence of plant communities over a period of time in an area where the vegetation had previously been totally destroyed by fire.



(a) What term is used to describe such a sequence of colonisation?

(1)

(b) State **two** ways in which the climax community D would be expected to differ from community A.

1 _____

2 _____

(2)

(c) Give **one** reason to explain why community C could be established only after the area had been colonised previously by community B.

(1)

Marks

15. Many species of moth lay their eggs on oak leaves. When the larvae (caterpillars) hatch out, they start to feed.

Graph 1 shows changes in the number of moth species feeding as larvae on oak leaves in Britain from April to October. Changes in the tannin content of the oak leaves during this period are also shown. Toughness of oak leaves increases with age.

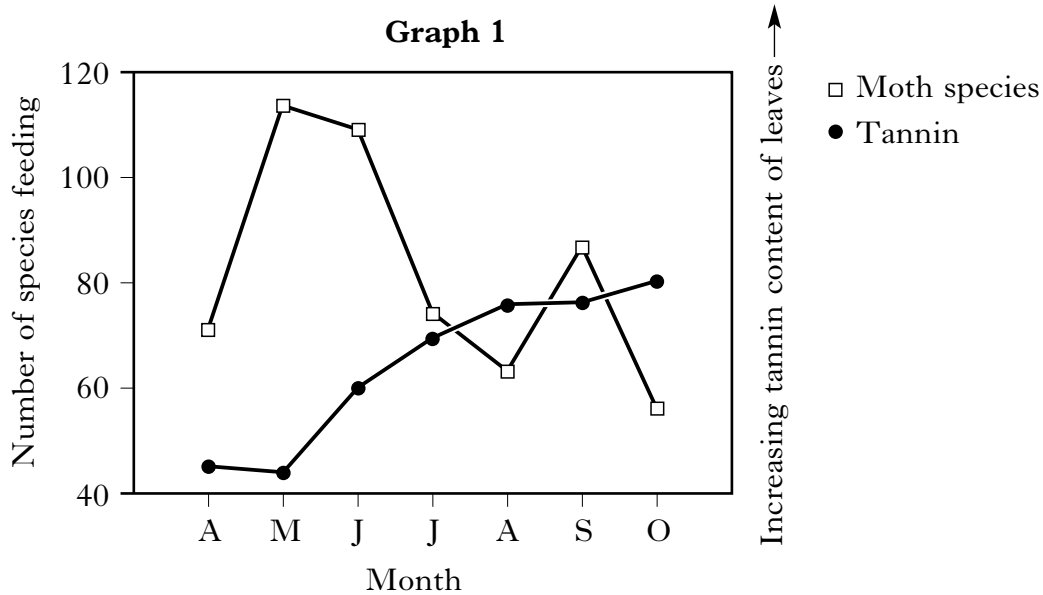


Table 1 shows the growth of larvae of one moth species fed on oak leaves collected in May and June. A known mass of larvae were fed on whole leaves, while an equal mass were fed on leaves which had been ground up. The groups of larvae were re-weighed at the end of the investigation.

Table 1

| <i>Month leaves were collected</i> | <i>Average final mass of larvae (mg) fed on whole leaves</i> | <i>Average final mass of larvae (mg) fed on ground leaves</i> |
|------------------------------------|--|---|
| May (young leaves) | 45 | 44 |
| June (older leaves) | 18 | 42 |

- (a) Describe the change in the number of moth species feeding on oak leaves from April to October.

(2)

Marks

15. (continued)

- (b) What evidence from the graph suggests that tannins may play a role in protecting oak leaves from attack by some species of moth larvae?

(1)

- (c) The average mass of larvae fed on whole leaves dropped by 60% from May to June. It was suggested that this reduction may result from the high tannin content of the June leaves being toxic to the larvae.

Explain how the data in **Table 1** contradict this hypothesis.

(2)

- (d) Give a possible explanation for the reduced growth of larvae feeding on whole June leaves.

(1)

SECTION C

Both questions in this section should be attempted.

Note that each question contains a choice.

Questions 1 and 2 should be attempted on the blank pages which follow.

Supplementary sheets, if required, may be obtained from the invigilator.

Labelled diagrams may be used where appropriate.

Marks

1. Answer either A or B.

A. Give an account of the effect of light on growth and development under the following headings:

- | | |
|---|---|
| (a) phototropism and etiolation; | 5 |
| (b) flowering in long-day and short-day plants; | 3 |
| (c) breeding in birds and mammals. | 2 |

(10)

OR

B. Give an account of proteins under the following headings:

- | | |
|--|---|
| (a) structure and classification; | 3 |
| (b) functions; | 5 |
| (c) packaging and secretion from a cell. | 2 |

(10)

2. Answer either A or B.

A. Give an account of transpiration and the transpiration stream. **(10)**

OR

B. Give an account of how animals and plants cope with dangers. **(10)**

[END OF QUESTION PAPER]

Candidates
must not
write in this
margin

SPACE FOR ANSWERS

Candidates
must not
write in this
margin

SPACE FOR ANSWERS

[C007/SQP004]

Higher
Biology
Specimen Marking Instructions

NATIONAL
QUALIFICATIONS

Marking Guidelines for Biology

General information for marking unit tests and course examinations in Biology

Mark schemes are rarely definitive. Some reasonable interpretation is always necessary and professional judgement must be applied.

1. In Biology, no half marks are given. Where three answers are needed for two marks, normally one or two correct answers gain one mark.
2. Spelling should be correct, but where minor errors do not affect phonetics, marks can be given, eg chlorophyll, protien, pestiside.
However, care should be taken with words which can be easily confused.
ureter and urethra, meiosis and mitosis, glycogen and glucagon
3. If a numerical answer is required and units are not given in the stem of the question or in the answer space, then candidates must supply the units to gain the mark. However, if units are required on more than one occasion, candidates should not be penalised repeatedly.
4. Where questions on data are in two parts, if the second part of the question is correct in relation to an incorrect answer given in the first part, then a mark can often be given. The general rule is that candidates should not be penalised twice for one error.
5. When marking graphs, credit can be given for:
Choosing the correct form of graph: bar chart, histogram or line graph.
Labelling the axes correctly
Using the x axis for the independent variable
Plotting the points
Joining the points either with straight lines or curves as appropriate (best fit rarely used)
Using more than around 50% of the graph paper. (graph paper provided will always allow for maximum use of the paper)
6. If a description or explanation is asked for, a one-word answer is not acceptable.
7. Where a description or explanation is required, it is often good practice to offer three or four acceptable answers and accept any two or three of these for marks.
8. If two answers are given which contradict one another, the first answer should be taken. However, there are occasions where the second answer negates the first and no marks are given. There is no hard and fast rule here and professional judgement must be applied. Good marking schemes often cover these eventualities.
9. Where data is read off a graph, it is often good practice to allow for acceptable minor error. So an answer may be given 7.3 – 0.1.
10. Words not required in the syllabus can still be given credit if used appropriately.
eg *metaphase* of meiosis, *denaturing* of enzymes.
11. Abbreviations which are in common usage are acceptable: eg NADP ATP DNA ADH RuBP FSH.

HIGHER BIOLOGY

Section A

| | | | | | |
|----|---|----|---|----|---|
| 1 | D | 11 | A | 21 | A |
| 2 | B | 12 | D | 22 | B |
| 3 | A | 13 | C | 23 | D |
| 4 | C | 14 | B | 24 | D |
| 5 | B | 15 | D | 25 | C |
| 6 | C | 16 | B | 26 | D |
| 7 | C | 17 | A | 27 | A |
| 8 | B | 18 | B | 28 | D |
| 9 | A | 19 | C | 29 | C |
| 10 | D | 20 | B | 30 | A |

Answers to Higher Biology Specimen Paper

(words in brackets not essential)

- 1a (i) granum
(ii) chlorophyll a/b/carotene/xanthophyll
(iii) chromatography
(iv) Different pigments can make use of different wavelengths of light
- 1b 5 m
- 2a (i) X — 1 Y — 2 Z — 4
(ii) L — NAD M — water
(iii) Stages 1 and 4
(iv) ATP (*letters sufficient*)
(v) Krebs cycle in the matrix (of the mitochondrion)
- 3a *1 mark if both axes correctly labelled*
1 mark for choice of bar chart
1 mark for bars drawn to correct height
- 3b Identical/same but with no organisms/with inert replacement.
- 3c To allow time for the organisms/apparatus to stabilise.
To allow time apparatus to come to same temperature as surroundings.
- 3d increases effectiveness of CO₂ absorption
increases area exposed to gas/air/CO₂
- 3e *Arrow drawn pointing left*
Carbon dioxide given off by organisms is absorbed (1)
Reduction in pressure/volume is due to oxygen being absorbed by organisms (1)
- 3f The mass of material used/the volume of the flask/any feature of the capillary tube/any feature relating to the sodium hydroxide.
- 3g Any treatment which cuts out light.
To prevent photosynthesis occurring.
- 4a DNA replication has occurred (which doubles DNA content)
- 4b Two divisions have occurred, which results in four cells. (so cells have one quarter original mass of DNA)
- 5a False — phosphate
True
False — nucleotides

- 5b (i) AGC and AGU
(ii) TAC
(iii) leucine
- 6a (i) Male is grey
Parental genotypes are AaBb and aabb
Gametes are (AB) (Ab) (aB) (ab) and (ab)
(ii) AaBb Aabb aaBb aabb
(iii) 2 : 1 : 1
- 6b W --- E-P-B
- 7a New species have arisen from a common ancestor, each adapted to different ways of feeding/niches
- 7b This reduces interspecific competition/competition for the same food.
- 7c mutation/isolation/natural selection (*any two*)
- 8a Water would enter cell by osmosis (1)
Protoplasts would rupture without cell wall. (1)
- 8b Inability of different species to interbreed.
- 8c Greater resistance to disease/drought/frost/wind
Improved colour/flavour (*any other reasonable answer*)
- 9a (i) dry conditions/low water availability
(ii) Inrolled leaf traps moist/humid air or reduces rate of diffusion
Sunken stomata/stomata in pits retain moist/humid air or slow rate of diffusion
No stomata on outer surface of leaves so evaporation reduced
- 9b (i) 200%
(ii) It would increase the rate of evaporation
- 10a E → A → C → D → F → B
- 10b (i) Each animal has a rank/status within a group.
(ii) Best adapted/strongest/fittest pass their genes to next generation

- 11a 6 years
- 11b 4 years
- 11c S and P
- 11d xylem — no cytoplasm/no nucleus/no end walls/lignified.
phloem — cytoplasm/nucleus/perforated end walls/not lignified (*any matching pair*)
- 12a (i) Mg required for manufacture of chlorophyll (because magnesium is part of molecule)
- (ii) N required for synthesis of protein (for enzyme reactions/cell structure)
N required for synthesis of DNA/RNA (for cell division)
- 12b Oxygen needed for respiration/ATP formation (1) ATP needed for active transport /uptake (1)
- 12c They have some minerals stored/in their seeds/food stores
- 12d ATP NAD DNA RuBP (*Any single error — 1 mark only. Two or more errors — no marks*)
- 12e A and D
G
B and C (*One or two errors — 1 mark. Three or more errors — no marks*)
- 13a (i) Response: vasodilation/blood diverted closer to skin surface
Explanation: increases heat loss by radiation
- OR
- Response: relaxation of hair erector muscles/hair lies flat on skin
Explanation: reduces insulation effect of hair/reduces trapped air
- (ii) Box A to temperature rise. Box B to temperature fall.
- 13b An increase
- 14a A succession
- 14b Increased biomass/increased complexity of foodwebs/increased species diversity
- 14c The presence of community B would alter habitat
(eg increased humus/food/cover/protection from wind or light)
(*any other reasonable answer*)

- 15 a increases from April to May
decreases from May to August
increases from August to September
decreases from September to October (*3 or 2 correct — 1 mark*)
- 15 b As tannin levels increase the number of species of moth decreases
- 15 c No similar reduction in mass of larvae fed on ground leaves (1)
Yet tannin content of ground leaves is likely to be the same as whole leaves (1)
- 15 d Old/June leaves may be tougher/more lignified/more difficult to digest

Section C

1. A (a)
1. Light from one side/directional 1 mark
 2. Auxin transported to dark side 1 mark
 3. Greater cell elongation/growth on dark side 1 mark
 4. Shoot curves/grows toward the light 1 mark
 5. Shoots of plants grown in darkness show etiolation 1 mark
 6. Characteristics of shoot include: small leaves; yellow leaves; long internodes **Any TWO correct** 2 marks
 7. Etiolation increases chances of shoot reaching light and thus surviving/photosynthesising 1 mark

Maximum 5

- (b)
8. Flowering is initiated by a change in the length of the photoperiod 1 mark
 9. Long-day plants flower when hours of light are above a critical level in each day/hours of darkness below a critical level 1 mark
 10. Short-day plants flower when hours of light are below a critical level in each day/hours of darkness above a critical level 1 mark
 11. Long-day plants flower from spring to late summer 1 mark
 12. Short-day plants flower in autumn 1 mark

Maximum 3

- (c)
13. Breeding is affected by change in photoperiod 1 mark
 14. Birds and small mammals breed in spring as the photoperiod increases 1 mark
 15. Large mammals breed in late autumn as the photoperiod decreases 1 mark

For either or both:-

16. This ensures that young are born when much food is available/when it is warmer 1 mark
17. This ensures that young have a long period of growth before the onset of winter. 1 mark

Maximum 2

Total 10 marks

1. B (a)
1. 20 different types of amino acid are used in synthesis 1 mark
 2. Amino acids bonded by peptide bonds 1 mark
 3. Proteins differ due to amino acid sequence/length of chain 1 mark
 4. Proteins are classified as fibrous or globular 1 mark
 5. eg of each; fibrous :- collagen/keratin; globular :- enzymes hormones/antibodies 1 mark

Maximum 3

- (b)
6. Protein in cell membrane can control exchange of substances 1 mark
 7. Enzymes bring about chemical reactions OR suitable example 1 mark
 8. Hormones control growth and development OR suitable example 1 mark
 9. Proteins in muscle tissue give rise to movement 1 mark
 10. Haemoglobin for transport of oxygen 1 mark
 11. Antibodies to destroy antigens 1 mark
 12. Any other correct function 1 mark

Maximum 5

- | | | | |
|-----|-----|--|--------|
| (c) | 13. | Packaging/Processing within Golgi body | 1 mark |
| | 14. | Protein enclosed in a vesicle/vacuole | 1 mark |
| | 15. | Vesicle/vacuole fuses with membrane | 1 mark |
| | 16. | Protein passed out/secreted from cell | 1 mark |

Maximum 2

Total 10

- | | | | |
|------|-----|---|--------|
| 2. A | 1. | Water enters root hairs by osmosis | 1 mark |
| | 2. | Water concentration gradient across cortex/root | 1 mark |
| | 3. | Water moves through cell walls/intercellular spaces | 1 mark |
| | 4. | Forces of adhesion between water and wall of vessels | 1 mark |
| | 5. | Forces of cohesion between the water molecules | 1 mark |
| | 6. | Root pressure helps move water upwards | 1 mark |
| | 7. | Water evaporates into air spaces of leaves | 1 mark |
| | 8. | Water vapour diffuses out through stomata | 1 mark |
| | 9. | Water concentration gradient between leaf cells and xylem | 1 mark |
| | 10. | Transpiration has cooling effect on leaves | 1 mark |
| | 11. | Transpiration allows transport of mineral salts to leaf | 1 mark |

Maximum 8

Coherence Mark 1 or 0

Relevance Mark 1 or 0

Total 10 marks

- | | | | |
|------|-----|---|---------|
| 2. B | 1. | Animals learn to avoid unpleasant stimuli | 1 mark |
| | 2. | Habituation is when an animal no longer responds to harmless stimuli | 1 mark |
| | 3. | This behaviour has survival value | 1 mark |
| | 4. | Animals have developed methods for defence | 1 mark |
| | 5. | Examples of individual methods of defence:- | |
| | | - poisonous bristles, etc | |
| | | - camouflage | |
| | | - feigning death | |
| | | - obnoxious secretions | |
| | | - OR suitable example | |
| | | 2 X 1 Mark Maximum | 2 marks |
| | 6. | Examples of social mechanisms:- | |
| | | - warning signals in herds | |
| | | - flocks of birds/shoals of fish confuse predators | |
| | | - musk ox form circle to protect young from wolves | |
| | | - young baboons protected by troop | |
| | | - OR suitable example | |
| | | 2 X 1 Mark Maximum | 2 marks |
| | 7. | Plants are sessile and must adopt different strategies from animals | 1 mark |
| | 8. | Presence of stings/thorns/spines/production of chemicals such as cyanide to discourage herbivores | |
| | | 2 examples = 1 mark 3 examples = 2 marks | |
| | 9. | Many plants can tolerate grazing by herbivores | |
| | 10. | Leaf meristem is close to the soil and growth recovers after grazing | |

Maximum 8

Coherence 1 or 0

Relevance 1 or 0

Total 10 Marks

[END OF MARKING INSTRUCTIONS]

BIOLHIHG.DOC