SECTION A

Read carefully

1 Check that the answer sheet provided is for Biology Higher (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** be placed inside the front cover of this answer book.

Sample Question

The apparatus used to determine the energy stored in a foodstuff is a

A respirometer.

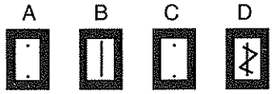
B calorimeter

C klinostat

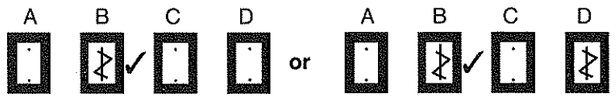
D gas burette.

The correct answer is **B**—calorimeter. 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:



SECTION A

All questions in this section should be attempted.

Answers should be given on the separate answer sheet provided.

1. When an animal cell is immersed in a hypotonic solution it will

A burst

B become turgid

C shrink

D become flaccid.

2. In photosynthesis, the function of the pigment carotene is to

A receive light energy from chlorophyll for photolysis of water

B allow the plant to absorb a wider range of wavelengths of light

C allow photosynthesis to take place in light of low intensity

D increase the capacity of chlorophyll to absorb light.

3. On Earth, the energy input from sunlight is around $2{\cdot}0 \times 10^{12}$ kilojoules per hectare per annum. The energy captured by photosynthesising plants is around $2{\cdot}0 \times 10^{10}$ kilojoules per hectare per annum. (A hectare is a measurement of area.)

What is the percentage efficiency of photosynthesis of these plants?

A 1%

B 2%

C 17%

D 200%

4. Three different strains of yeast each lacked a different respiratory enzyme involved in the complete breakdown of glucose.

Strain X – cannot produce carbon dioxide from pyruvic acid.

Strain Y – cannot form pyruvic acid.

Strain Z – cannot reduce oxygen to form water.

Which of the strains could produce ethanol?

A Strains X and Y

B Strains X and Z

C Strain Y only

D Strain Z only

5. Which of the following proteins has a fibrous structure?

A Pepsin

B Amylase

C Insulin

D Collagen

6. Insulin synthesised in a pancreatic cell is secreted from the cell. Its route from synthesis to secretion includes

A Golgi apparatus → endoplasmic reticulum → ribosome

B ribosome → Golgi apparatus → endoplasmic reticulum

C endoplasmic reticulum → ribosome → Golgi apparatus

D ribosome → endoplasmic reticulum → Golgi apparatus.

7. If a living tissue is transplanted from one person to another, there is a risk of rejection because the recipient reacts against the foreign

A antibodies

B antigens

C DNA

D RNA.

[Turn over

8. Which of the following cells are responsible for producing antibodies?

A Monocytes

B Lymphocytes

C Phagocytes

D Red blood cells

9. Viruses consist of a

A lipid coat enclosing DNA or RNA

B protein coat enclosing DNA only

C protein coat enclosing DNA or RNA

D lipid coat enclosing DNA only.

10. What is the significance of chiasma formation?

A It results in the halving of the chromosome number.

B It results in the pairing of homologous chromosomes.

C It permits gene exchange between homologous chromosomes.

D It results in the independent assortment of chromosomes.

11. The table below shows some genotypes and phenotypes associated with forms of sickle-cell anaemia.

Genotype	*Phenotype*
$Hb^A\ Hb^A$	normal
$Hb^A\ Hb^S$	sickle-cell trait
$Hb^S\ Hb^S$	acute sickle-cell anaemia

A normal man marries a woman with the sickle-cell trait. What are the chances that any child born to them will have acute sickle-cell anaemia?

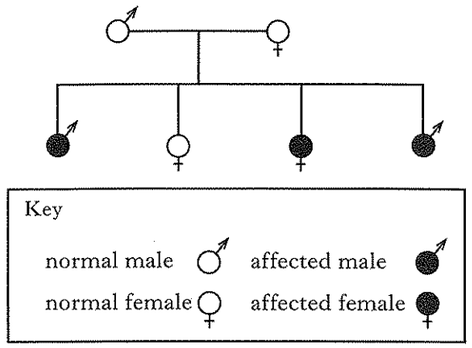
A None

B 1 in 1

C 1 in 2

D 1 in 4

12. The diagram shows the transmission of the gene for albinism.



This condition is inherited as a characteristic which is

A dominant and not sex-linked

B recessive and not sex-linked

C dominant and sex-linked

D recessive and sex-linked.

13. In *Drosophila*, the long-winged condition (L) is dominant to the vestigial-winged condition (l) and broad abdomen (B) is dominant to narrow abdomen (b).

When parent flies, heterozygous for both wing shape and abdomen width, were crossed with flies having vestigial wings and narrow abdomens, the results were as shown in the table below.

	Number of male offspring	*Number of female offspring*
Long wings, broad abdomen	230	227
Long wings, narrow abdomen	4	3
Vestigial wings, broad abdomen	3	3
Vestigial wings, narrow abdomen	238	240

These results indicate

A crossing over

B independent assortment

C a mutation

D sex-linkage.

14. Colour blindness is a recessive, sex-linked characteristic controlled by the allele b.

Two parents with normal vision have a colour-blind boy.

The genotypes of the parents are

A X^BY and X^BX^b

B X^bY and X^BX^B

C X^bY and X^BX^b

D X^BY and X^bX^b.

15. Which of the following mutations would cause a change in chromosome number?

A Translocation

B Non-disjunction

C Inversion

D Insertion

16. Genes **a** to **j** occur on part of a chromosome.

a b c d e f g h i j

After cell division, this part of the chromosome had the following sequence of genes:

a b c d e f g d e f g h i j

This change is called a

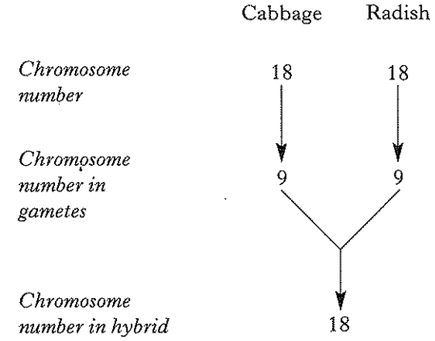
A repetition

B translocation

C duplication

D replication.

17. Cabbage and radish each have a diploid number of 18. These plants can be crossed to produce a hybrid.



Which of the following statements is true?

A The hybrid contains 9 pairs of homologous chromosomes.

B The chromosomes in the hybrid cannot pair during meiosis.

C The hybrid can produce gametes with a haploid number of 9.

D The hybrid can interbreed successfully with either parent.

18. In the formation of protoplasts, plant cells are treated with

A amylase

B lipase

C restriction enzymes

D cellulase.

19. Which of the following is an example of intraspecific competition?

A Plants of the same species competing for the same growth requirements.

B Plants of the same species competing for different growth requirements.

C Plants of a different species competing for the same growth requirements.

D Plants of a different species competing for different growth requirements.

[Turn over

20. In an animal, habituation has taken place when a

A harmful stimulus ceases to produce a response

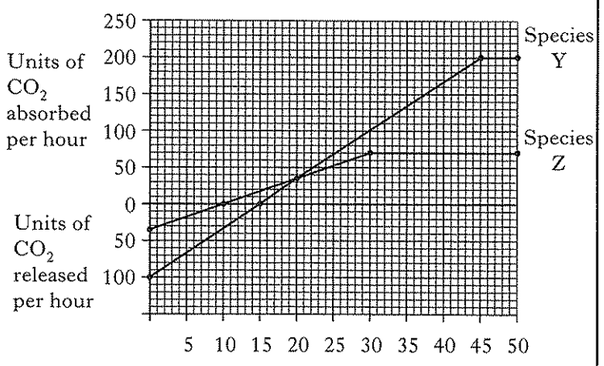
B harmful stimulus always produces an identical response

C harmless stimulus always produces an identical response

D harmless stimulus ceases to produce a response.

21. The rates of carbon dioxide exchange by the leaves of two species of plants were measured at different light intensities.

The results are shown in the graph below.



What are the light intensities at which species Z and Y reach their compensation points?

	Light Intensity (kilolux)	
	Z	Y
A	10	15
B	20	20
C	20	30
D	30	45

22. Which of the following statements explains the structural differences between cells in different tissues of an organism?

A Cells in some tissues have more genes than cells in other tissues.

B As different tissues develop, different genes are lost from their cells.

C Different cell types have the same genes but different genes are active.

D Some tissues have genes from one parent while some have genes from the other.

23. The thyroid gland is involved in the control of metabolic rate.

Which of the following shows the correct sequence for metabolic control.

A Pituitary → thyroxine → thyroid → TSH

B Pituitary → TSH → thyroid → thyroxine

C TSH → thyroxine → pituitary → thyroid

D Thyroid → TSH → thyroxine → pituitary

24. Which of the following is the correct sequence of events that occurs in control of the concentration of blood sugar?

	Concentration of blood sugar	*Glucagon secretion*	*Insulin secretion*	*Glycogen stored in liver*
A	increases	decreases	increases	increases
B	increases	decreases	increases	decreases
C	decreases	increases	decreases	increases
D	decreases	decreases	increases	decreases

25. Which of the following is **not** the result of a magnesium deficiency in flowering plants?

A Curling of the leaves

B Yellowing of the leaves

C Reduction in shoot growth

D Reduction in root growth

26. A 30 g serving of breakfast cereal with 125 cm^3 of semi-skimmed milk contains 1·5 mg of iron. Only 25% of this iron is absorbed into the bloodstream.

If a woman in late pregnancy requires a daily intake of 6 mg of iron, how much cereal and milk would have to be eaten to meet this requirement?

	Cereal (g)	*Milk* (cm^3)
A	60	250
B	120	500
C	240	1000
D	480	2000

27. In humans, vitamin D plays an essential role in the absorption of

A glucose

B calcium

C iron

D lipids.

28. Which one of the following factors affecting a population of rabbits is density independent?

A Viral disease

B The population of foxes

C The biomass of the grass

D Rainfall

29. The diagram shows the average lifespan of people in Britain between 1900 and 1990.

What is the percentage increase in lifespan during this period?

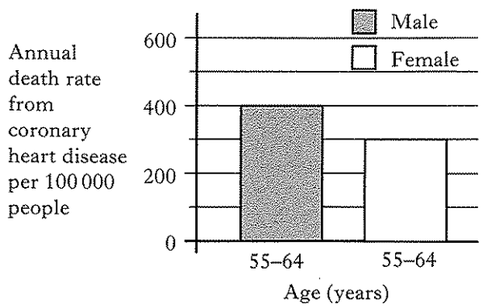
A 25%

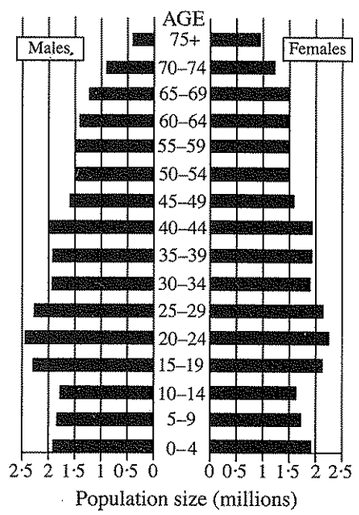
B 45%

C 50%

D 75%

30. The graphs below contain information about the population of Britain.





How many British women between 55 and 64 years of age die from coronary heart disease annually?

A 300

B 4500

C 9000

D 21 000

Candidates are reminded that the answer sheet MUST be returned INSIDE the front cover of this answer book.

[Turn over for Section B on *Page ten*

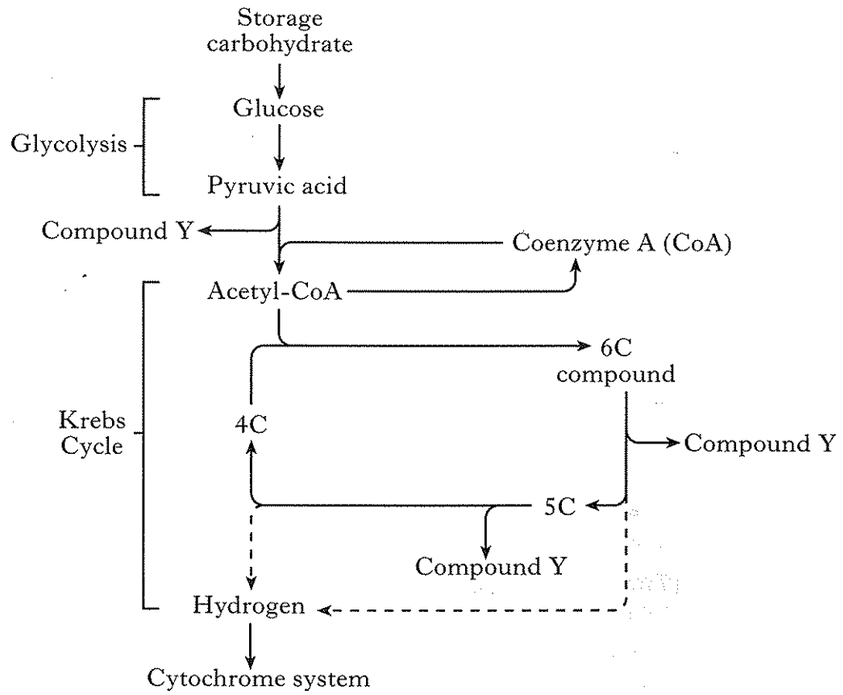
DO NOT WRITE IN THIS MARGIN

SECTION B

All questions in this section should be attempted.

Marks

1. The diagram below represents stages in aerobic respiration in mammalian liver cells.



(*a*) Name the storage carbohydrate in liver cells.

_____ **1**

(*b*) Other than carbohydrate, name an alternative respiratory substrate.

_____ **1**

(*c*) State the exact location within a liver cell of:

1 Glycolysis _____

2 Krebs cycle _____ **2**

(*d*) State the net gain of ATP molecules from the breakdown of a glucose molecule to pyruvic acid.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

1. (continued)

(*e*) Name the 6 carbon compound and compound Y shown in the Krebs cycle.

6C compound _____

Compound Y _____ **2**

(*f*) Name the chemical that transports hydrogen from the Krebs cycle to the cytochrome system.

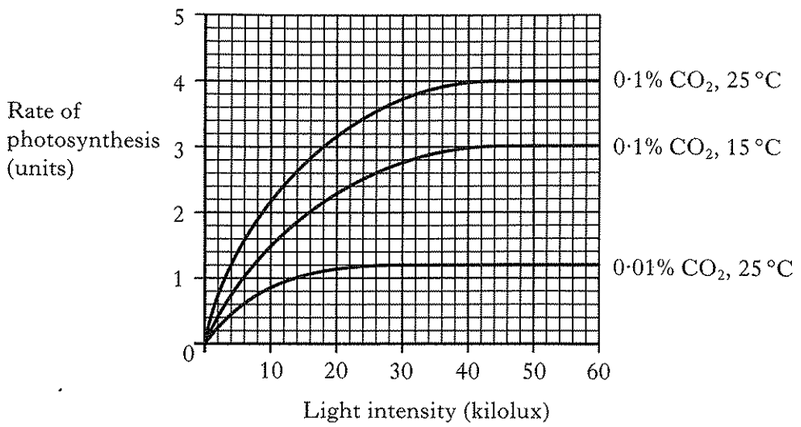
_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

2. (*a*) The graph below shows the effects of varying light intensity, carbon dioxide concentration and temperature on the rate of photosynthesis in a plant.



(i) At a light intensity of 60 kilolux, identify which factor, as shown in the graph, has the greater effect in increasing the rate of photosynthesis. Justify your answer.

Factor _____

Justification _____

_____

_____ **1**

_____ **1**

(ii) The experiment was repeated at a carbon dioxide concentration of 0·01% and a temperature of 15 °C. **Onto the graph above**, draw a curve to show the predicted results of this experiment. **1**

(iii) The rate of photosynthesis can be calculated by measuring a change in dry mass with time.
State **one** other method that can be used to calculate the rate of photosynthesis.

_____

_____ **1**

(*b*) Other than being absorbed for use in photosynthesis, give **two** possible fates of the light energy that shines onto the leaves of plants.

1 _____

2 _____ **1**

(*c*) Within which region of a chloroplast does the absorption of light take place?

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

2. (continued)

(*d*) Name the **two** chemical compounds produced in the light dependent stage that are essential for the conversion of GP to glucose.

Compound 1 _____

Compound 2 _____ **1**

(*e*) Complete the table below by inserting the number of carbon atoms present in each of the chemical compounds.

Compound	*Number of carbon atoms*
GP	
RuBP	
Glucose	

1

(*f*) What would be the effect on the RuBP concentration if conditions were changed from light with carbon dioxide present to light with carbon dioxide absent.
Explain your answer.

Effect _____

Explanation _____

_____

_____ **2**

(*g*) The list below shows terms which refer to the role of light in the growth and development of plants and animals.

List of terms
Phototropism
Compensation point
Etiolation
Photoperiodism

In the table below insert the term that is described by each statement.

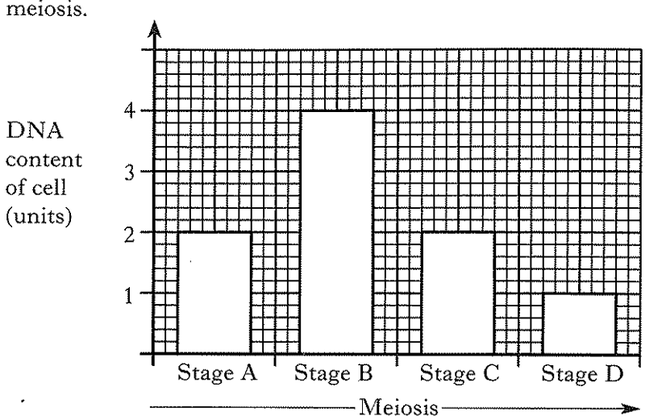
Statement	*Term*
The rate of respiration equals the rate of photosynthesis at a certain light intensity.	
If germinated in darkness, a seedling has long internodes and small yellow leaves.	
Plants respond to directional light by a growth curvature.	
A change in the number of hours of light in the day can affect growth and development in many plants and animals.	

2

DO NOT WRITE IN THIS MARGIN

Marks

4. (*a*) A gamete mother cell undergoes meiosis to form gametes.
The bar graph below shows the DNA content per cell at different stages in meiosis.



Describe what happens during meiosis to account for the change in the DNA content per cell between the following stages.

1 Stages A and B _____

_____ **1**

2 Stages B and C _____

_____ **1**

3 Stages C and D _____

_____ **1**

(*b*) The table below shows the percentage recombination frequencies for four genes present on the same chromosome.

Gene pairs	*% recombination frequency*
P and Q	16
P and R	8
R and S	12
Q and S	4

(i) What term is used to describe genes present on the same chromosome?

_____ **1**

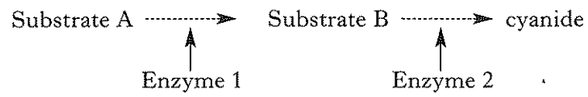
(ii) Use the information to identify the order in which these genes lie on the chromosome.
Space for calculation

Order _____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

5. (*a*) Cyanogenic clover plants produce cyanide when their tissues are damaged.
Cyanide is toxic and its production defends plants against herbivores.
The diagram below shows the metabolic pathway which produces cyanide.



The genes which code for Enzymes 1 and 2 have alleles with properties shown in the table below.

Gene coding for Enzyme 1		*Gene coding for Enzyme 2*	
Allele R	Synthesises Enzyme 1	Allele T	Synthesises Enzyme 2
Allele r	Cannot synthesise Enzyme 1	Allele t	Cannot synthesise Enzyme 2

(i) Complete the cross below by:

1 inserting the genotype of the gametes of the individual with the genotype RrTt;

2 showing the possible genotypes of the offspring.

Parental phenotypes Cyanogenic X Non-cyanogenic
Parental genotypes RrTt X rrtt

Gamete(s) → ↓				
(rt)				

1

1

(ii) Express the expected number of cyanogenic to non-cyanogenic plants as the simplest whole number ratio.

Ratio cyanogenic _____ : non-cyanogenic _____ **1**

(*b*) Give **two** examples of adaptions which allow plants to tolerate grazing.

Example 1 _____

Example 2 _____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

6. (*a*) The following statements refer to the Hawaiian islands and species which inhabit them.

Statements

1. The Hawaiian islands are of volcanic origin.
2. The islands are far from any continental mainland.
3. 91% of the plant species and 81% of the bird species are found only on these islands.
4. Hawaiian honeycreepers are species of birds which are descended from a seed-eating ancestral species.
5. Honeycreeper species show a wide range of beak shapes for eating the seeds, fruits, nectar and insects available.
6. Estimates of the present number of honeycreeper species range from 29 to 33 with many extinctions having occurred after the arrival of man on the islands.

(i) Name the isolation mechanism illustrated in Statement 2.

_____ **1**

(ii) State the importance of isolating mechanisms in the evolution of new species.

_____

_____

_____ **1**

_____ **1**

(iii) Identify the **two** statements which suggest that the evolution of the honeycreeper species is an example of adaptive radiation.

Statement numbers _____ and _____ **1**

(iv) Name **two** methods used to conserve species and prevent their extinction. (Statement 6)

_____

_____

_____ **2**

DO NOT WRITE IN THIS MARGIN

Marks

6. (continued)

(*b*) Populations may be monitored to provide data for a wide variety of purposes.

The table below shows the sulphur dioxide concentrations within various areas and the number of lichen species present.

Sulphur dioxide concentration in area (ppm)	*Number of lichen species present*
32	0
17	4
8	11
0	17

From the table explain how lichen can be used as indicator species.

_____

_____

_____ **1**

(*c*) Explain the need to monitor populations of fish such as cod.

_____

_____

_____

_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

7. The bacterium *Bacillus thuringiensis* produces a substance called T-toxin that is harmful to leaf-eating insects.

The information below shows some of the procedures used by genetic engineers to insert the gene for the production of T-toxin into crop plants.

Procedure 1 — Chromosome extracted from bacterial cells

↓

Procedure 2 — Position of T-toxin gene located

↓

Procedure 3 — T-toxin gene cut out from bacterial chromosome

↓

Procedure 4 — T-toxin gene transferred into nucleus of host plant cell

↓

Procedure 5 — Plant cells containing T-toxin gene grown into plantlets

(*a*) Name a technique that could be used in Procedure 2 to locate the position of the T-toxin gene.

_____ **1**

(*b*) Name the enzyme used in procedure 3.

_____ **1**

(*c*) Explain why such genetically engineered crop plants would grow better than unmodified crop plants.

_____

_____

_____ **2**

(*d*) These crops were commercially successful for several years. However, they have since become susceptible to attack by some members of a particular insect species.
Suggest a reason that would account for this observation.

_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

8. The flowchart represents the control system involved in returning body temperature to normal after an increase.

Increase in body temperature

↓

Increase detected by temperature-monitoring centre

↓

Corrective mechanisms switched on

↓

Return to normal body temperature

↓

Decrease detected by temperature-monitoring centre

↓

Corrective mechanisms switched off

(*a*) State the exact location of the temperature-monitoring centre

_____ **1**

(*b*) In the following sentence **underline** one of the alternatives in each pair to describe a corrective mechanism that is switched on when body temperature increases.

In this corrective mechanism { vasoconstriction / vasodilation } results in { increased / decreased } blood flow to the skin and therefore, { increased / decreased } heat loss from the skin by radiation. **1**

(*c*) Describe another corrective mechanism that would reduce body temperature.

_____

_____ **1**

(*d*) How is the message carried from the temperature-monitoring centre to effectors?

_____ **1**

(*e*) What is the importance of body temperature in humans to metabolic processes?

_____

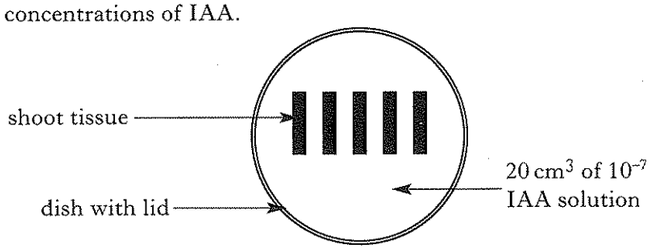
_____ **1**

DO NOT WRITE IN THIS MARGIN

9. An investigation was carried out into the effect of different concentrations of indole-acetic acid (IAA) on growth of shoot tips.

The method used in the investigation is outlined below.

1. 10 mm lengths of shoot tissue were cut from behind the shoot tip meristem.
2. Five lengths of shoot tissue were used in each experiment.
3. Shoot tissues were immersed in solutions containing different concentrations of IAA.
4. The diagram below shows the experimental set up at one of the concentrations of IAA.



5. A control experiment was set up with five 10 mm lengths of intact shoot tip tissue immersed in distilled water.
6. The experiments were left in the dark for 48 hours.
7. The length of each shoot tip tissue was measured.
8. For each IAA concentration, the average length of shoot tip tissue was compared with the control experiment.

Key

\+ Growth greater than control

– Growth less than control

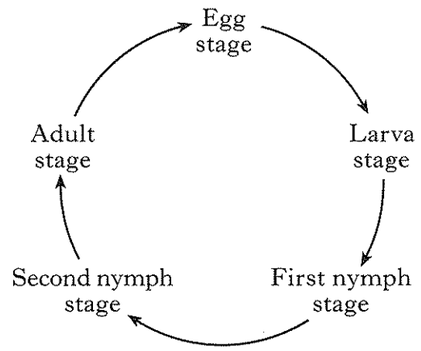
The results are shown in the table below.

Concentration of IAA solution (molar)	*Difference between the average length of shoot tissue and the control* (mm)
10^{-7}	+4
10^{-6}	+8
10^{-5}	+5
10^{-4}	+3
10^{-3}	0
10^{-2}	–2
10^{-1}	–4

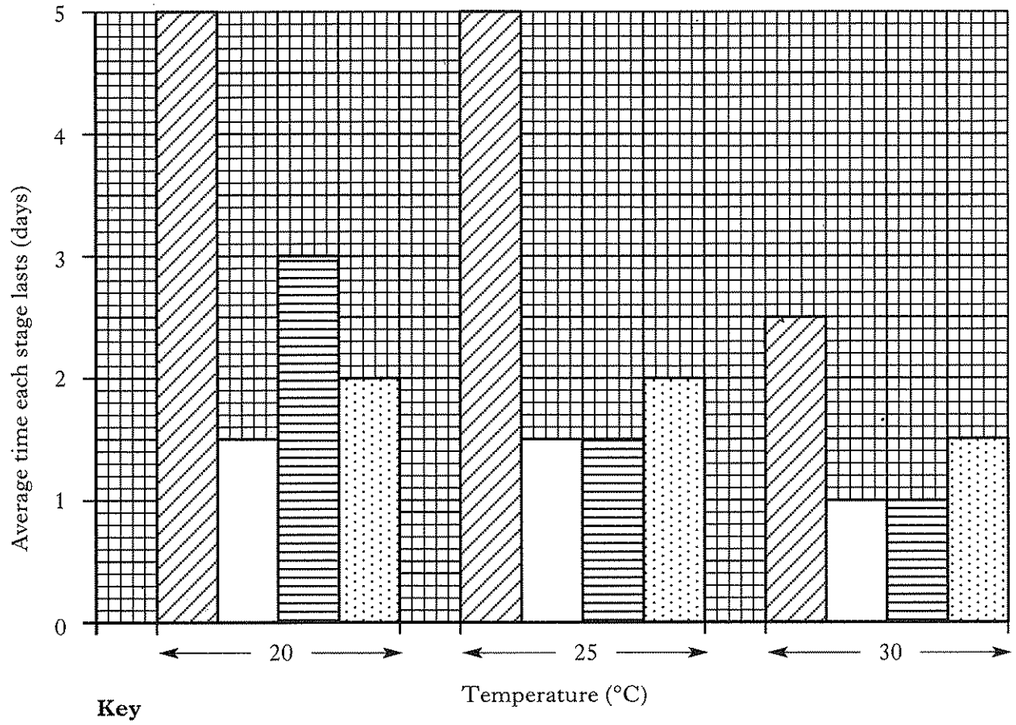
[Question 9 continues on *Page twenty-three* and fold-out *Page twenty-four*

DO NOT WRITE IN THIS MARGIN

10. The red spider mite is a pest of crop plants. Stages in its life-cycle are shown in the diagram below.



An investigation was carried out into the effects of temperature on the time each of the early stages lasts. The results are shown in the bar graph below.



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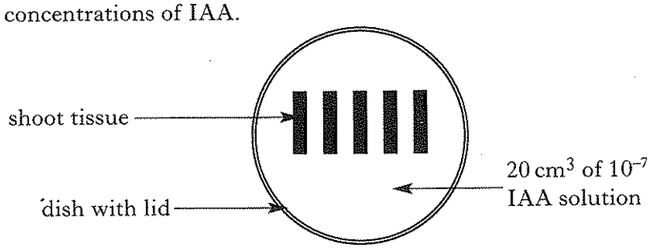

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10^{-4}	+3
10^{-3}	0
10^{-2}	–2
10^{-1}	–4

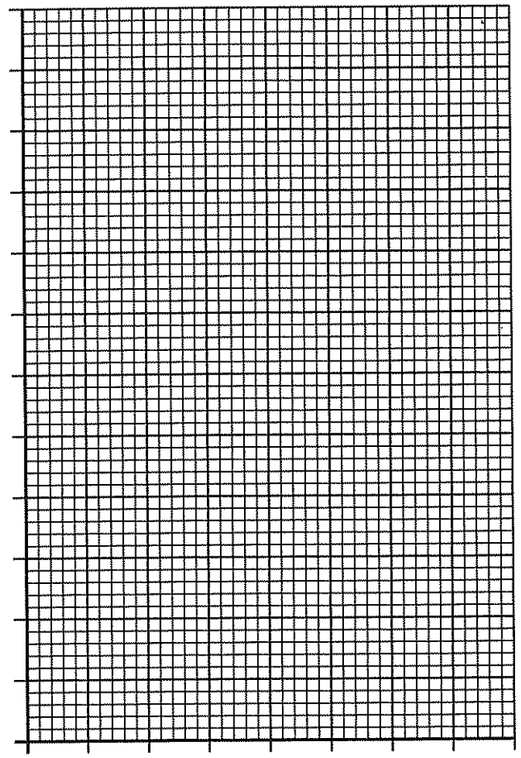
[Question 9 continues on *Page twenty-three* and fold-out *Page twenty-four*

DO NOT WRITE IN THIS MARGIN

Marks

9. (continued)

(*a*) On the grid below, using a suitable scale, plot a line graph of difference between the average length of shoot tissue and the control against concentration of IAA solution.
(Additional graph paper, if required, can be found on *Page thirty-six*.)



2

(*b*) Describe the pattern of growth of shoot tissue over the range of IAA concentrations used in the investigation.

_____

_____

_____ 2

(*c*) Why is it considered good experimental procedure to leave the shoot tissues in the solutions for 48 hours?

_____

_____ 1

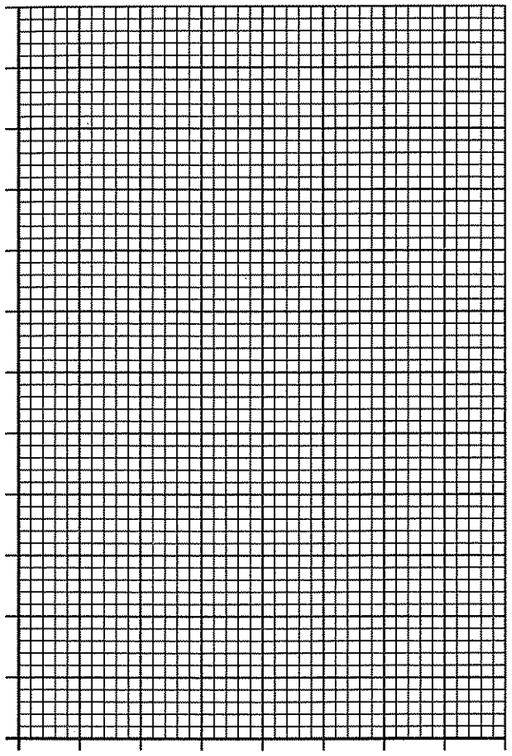
[Question 9 continues on *Page twenty-four*

DO NOT WRITE IN THIS MARGIN

Marks

9. (continued)

(*a*) On the grid below, using a suitable scale, plot a line graph of difference between the average length of shoot tissue and the control against concentration of IAA solution.
(Additional graph paper, if required, can be found on *Page thirty-six*.)



2

(*b*) Describe the pattern of growth of shoot tissue over the range of IAA concentrations used in the investigation.

_____

_____

_____ 2

(*c*) Why is it considered good experimental procedure to leave the shoot tissues in the solutions for 48 hours?

_____

_____ 1

[Question 9 continues on *Page twenty-four*

DO NOT WRITE IN THIS MARGIN

Marks

9. (continued)

(*d*) All the IAA solutions were measured using the same syringe. What precaution should be taken to minimise experimental error?

_____

_____ 1

(*e*) In this investigation what would appear to be the naturally occurring concentration of IAA within the shoot tip?

_____

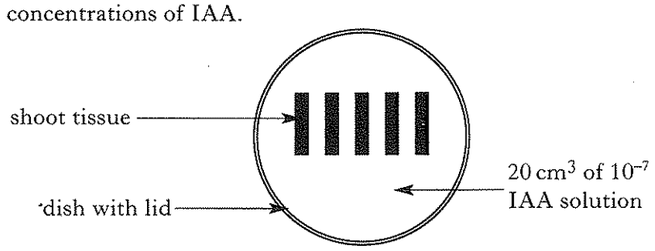
_____ 1

[Question 10 begins on fold-out *Page twenty-five*

9. An investigation was carried out into the effect of different concentrations of indole-acetic acid (IAA) on growth of shoot tips.

The method used in the investigation is outlined below.

1. 10 mm lengths of shoot tissue were cut from behind the shoot tip meristem.
2. Five lengths of shoot tissue were used in each experiment.
3. Shoot tissues were immersed in solutions containing different concentrations of IAA.
4. The diagram below shows the experimental set up at one of the concentrations of IAA.



5. A control experiment was set up with five 10 mm lengths of intact shoot tip tissue immersed in distilled water.
6. The experiments were left in the dark for 48 hours.
7. The length of each shoot tip tissue was measured.
8. For each IAA concentration, the average length of shoot tip tissue was compared with the control experiment.

Key

\+ Growth greater than control

– Growth less than control

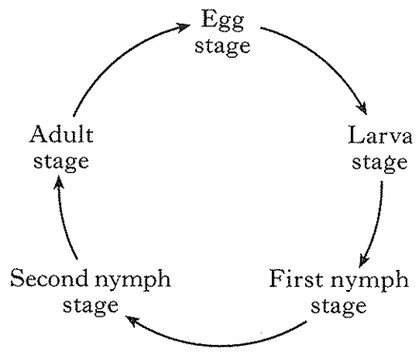
The results are shown in the table below.

Concentration of IAA solution (molar)	*Difference between the average length of shoot tissue and the control* (mm)
10^{-7}	+4
10^{-6}	+8
10^{-5}	+5
10^{-4}	+3
10^{-3}	0
10^{-2}	–2
10^{-1}	–4

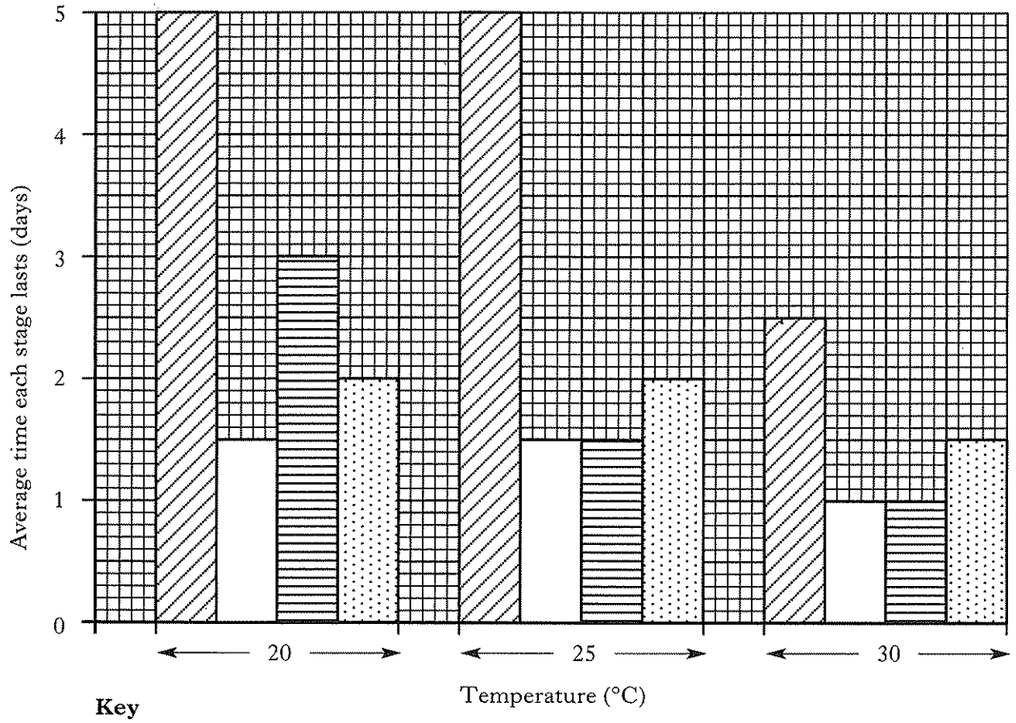
[Question 9 continues on *Page twenty-three* and fold-out *Page twenty-four*

DO NOT WRITE IN THIS MARGIN

10. The red spider mite is a pest of crop plants. Stages in its life-cycle are shown in the diagram below.



An investigation was carried out into the effects of temperature on the time each of the early stages lasts. The results are shown in the bar graph below.



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Marks

10. (continued)

(*a*) From the bar graph, calculate the difference in average time for development through the egg stage to the start of the adult stage at 20 °C and 30 °C.

Space for calculation

Difference _____ days **1**

Table 1 below shows the effect of temperature on features of egg laying in adult red spider mites.

Table 1

Features	*Temperature (°C)*		
	20 °C	*25 °C*	*30 °C*
Average time spent as an adult before first egg laid (days)	2·20	1·60	1·00
Average length of egg laying period (days)	18·40	14·80	10·36
Average number of eggs laid per female during egg laying period	92·00	88·80	62·16

(*b*) From Table 1, describe the relationship between temperature and each feature of egg-laying in adult female red spider mites.

_____

_____

_____

_____

_____ **2**

(*c*) From Table 1, calculate the average number of eggs laid per female per day during the egg laying period at 20 °C.

Space for calculation

Average number of eggs laid per female per day _____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

10. (continued)

(*d*) From Table 1, calculate the percentage decrease in the average number of eggs laid per female during the egg laying period when the temperature is increased from 25 °C to 30 °C.

Space for calculation

% decrease _____ **1**

(*e*) From the information in the bar graph and Table 1, complete the table below by writing **True** or **False** in each of the spaces provided.

Statement	*True/False*
The time for the length of the first nymph stage is shortest at 30 °C.	
The egg stage lasts twice as long at 30 °C as at 25 °C.	
Only the first nymph stage is affected by a change from 20 °C to 25 °C.	
At 20 °C some adults may take more than 2·2 days to start laying eggs.	

2

(*f*) From the bar graph and Table 1, calculate the average time that it takes for development from the egg stage to the laying of the first egg at 25 °C.

Space for calculation

Average time _____ days **1**

[Turn over

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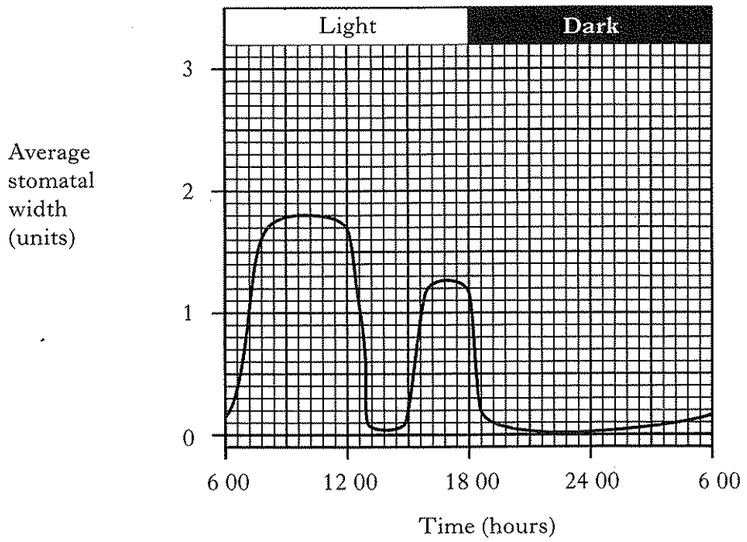
Marks

11. (*a*) The graph below shows changes in stomatal width over a 24-hour period of a plant species that is adapted to live in a hot climate.



(i) State the change in turgor that takes place in the guard cells to cause stomatal closure.

_____ **1**

(ii) 1 Explain how the pattern of change in stomatal width between 11 00 and 16 00 may benefit a plant that lives in a hot climate.

_____

_____

_____ **2**

2 Suggest a possible disadvantage to the plant of this pattern of change in stomatal width.

_____

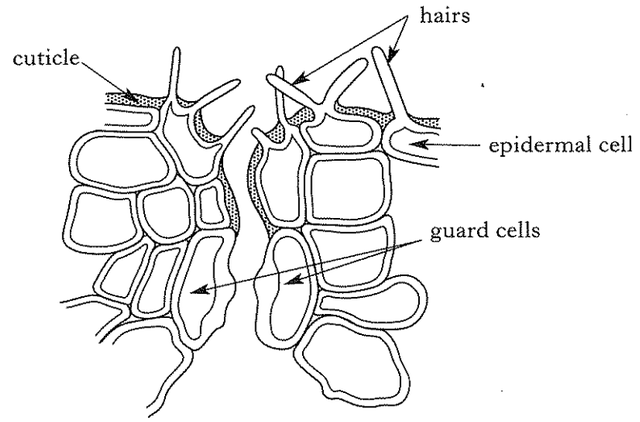
_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

11. (continued)

(*b*) Plants that live in desert conditions have adaptations which reduce water loss. The diagram below shows part of a leaf section of a desert plant.



Complete the table below which shows leaf adaptations and explanations of how these reduce water loss.

Description of adaptation	*Explanation for reduction in water loss*
Presence of hairs on the leaf surface	
	Longer distance for water vapour to diffuse out of the leaf.

2

(*c*) Salmon and eels have adaptations associated with migration between freshwater and seawater.

(i) State the change that takes place in the glomerular filtration rate of these fish when they return to the sea.

_____ **1**

(ii) Describe the role of the chloride secretory cells when these fish are in seawater.

_____ **1**

(*d*) Describe **one** behavioural and **one** physiological adaptation shown by the desert rat to reduce water loss.

Behavioural _____

_____ **1**

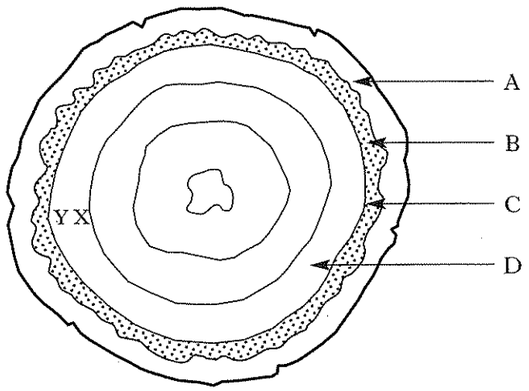
Physiological _____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

12. (*a*) The diagram below represents a section through a woody stem.



(i) Name the lateral meristem in a woody stem.

_____ **1**

(ii) Which letter identifies this tissue?

Letter _____ **1**

(*b*) State whether the average diameter of the vessels in area X would be larger or smaller than those in area Y. Give a reason for your choice.

Average diameter of vessels in area X compared to area Y _____

Reason _____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

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.

1. Answer **either** A **or** B.

A. Write notes on each of the following:

(i) the structure of the plasma membrane; **3**

(ii) the structure and function of the cell wall; **3**

(iii) phagocytosis. **4**

(10)

OR

B. Write notes on each of the following:

(i) mRNA synthesis; **5**

(ii) the role of mRNA in protein synthesis. **5**

(10)

In question 2, ONE mark is available for coherence and ONE mark is available for relevance.

2. Answer **either** A **or** B.

A. Give an account of the Jacob-Monod hypothesis of lactose metabolism in Escherichia coli and the part played by genes in the condition of phenylketonuria. **(10)**

OR

B. Give an account of the effects of IAA on plant growth and the role of gibberellic acid in α-amylase induction in barley grains. **(10)**

[END OF QUESTION PAPER]

[Turn over