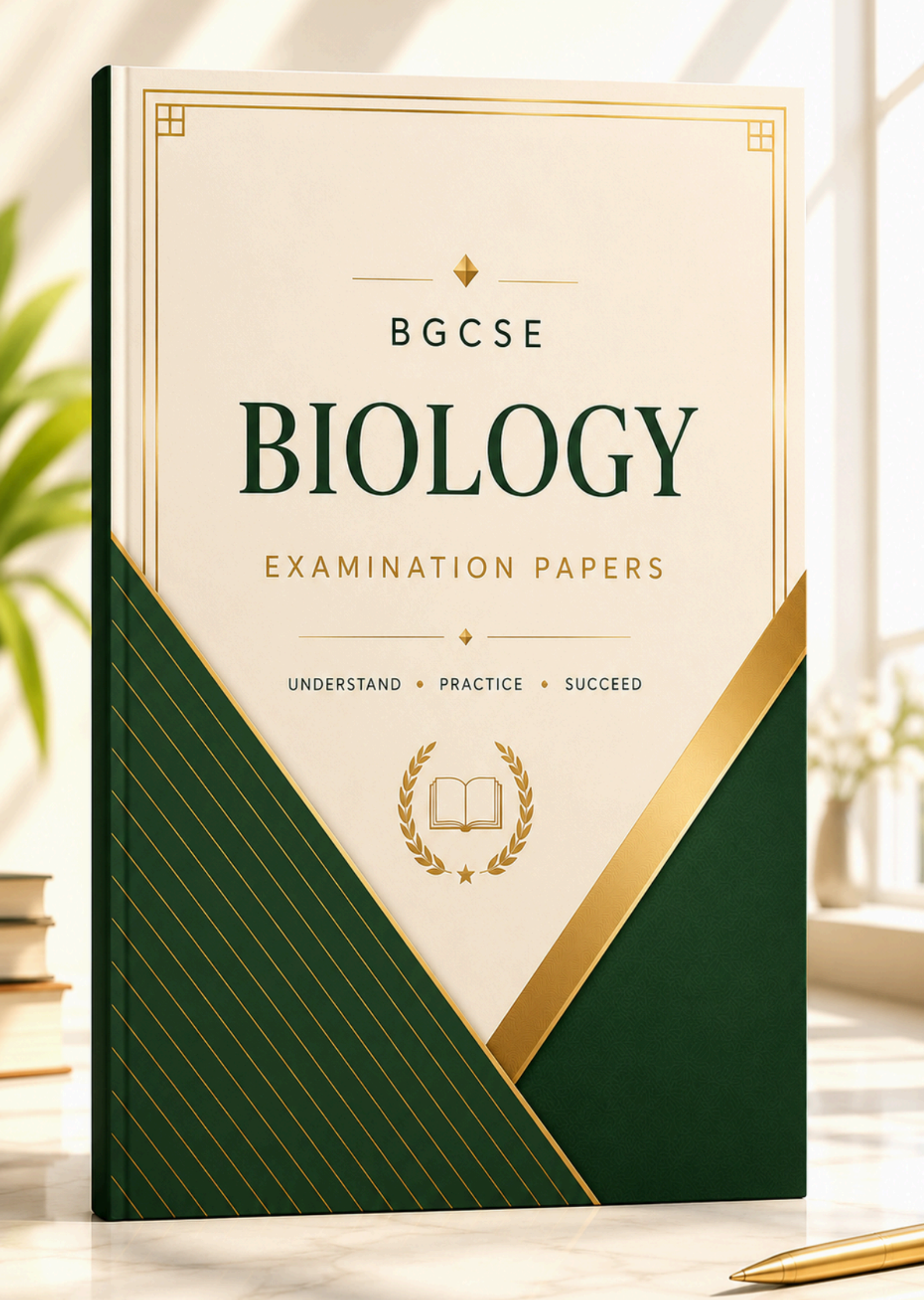
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BIOLOGY

PAPER 3 3009/3

Monday 22 MAY 2023 12:30 P.M.–2:00 P.M. (1hr. 30 mins.)

MINISTRY OF EDUCATION
NATIONAL EXAMINATIONS

BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

INSTRUCTIONS AND INFORMATION FOR CANDIDATES

Do not open this booklet until you are told to do so.

Write your school number, candidate number, surname and initials in the spaces provided above.

Answer **ALL** questions in **Section A** in the space provided.

Answer **TWO** out of **THREE** questions in **Section B** in the spaces in the question booklet.

Candidates are advised to spend no more than 35 minutes on **Section A**.

The mark for each part question is given in brackets [ ].

Calculators are permitted. However, **NO** graphing calculators are allowed.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
TOTAL	

This question paper consists of 20 printed pages.

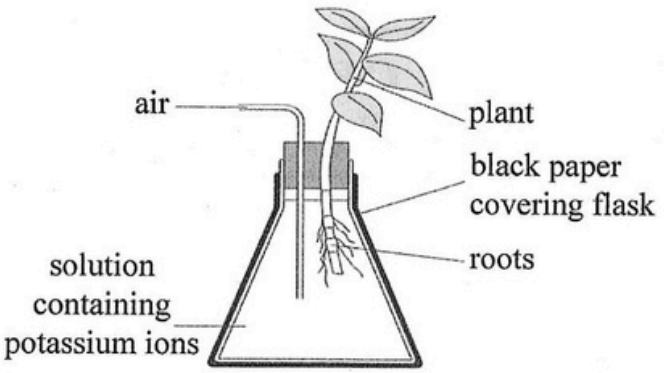
SECTION A

Answer **ALL** questions in this section.

1. A student carried out an experiment to investigate how different sources and concentrations of potassium ions affect the growth of roots.

Five stem cuttings of the same size were removed from a plant and each was placed into a flask containing distilled water to which different sources and concentrations of potassium ions had been added.

Each of the five flasks was set up as shown in the diagram below.



All other conditions were kept the same. After 20 days, the length of any roots that had grown were measured.

(a) State the name of the process used for the uptake of ions by plant roots.

_____ [1]

(b) Potassium ions are important for the growth of roots.

State **ONE OTHER** reason why potassium ions are important in plant growth.

_____

_____ [1]

(c) In the experiment, suggest a reason for supplying the solution containing potassium ions with air.

_____

_____

_____ [2]

(d) The student carried out five trials of the experiment using solutions containing different sources and concentrations of potassium ions.

After 20 days, the student measured the length of the roots in each trial and calculated the average length.

The results are shown in the table.

source of potassium ions	**concentration/g per dm^3**	**average root length/cm**
Control solution (pure water)	0.00	11.00
Potassium humate	4.00	11.00
Potassium humate	8.00	13.00
Potassium silicate	4.00	12.00
Potassium silicate	8.00	14.00

(i) Which solution of potassium ions (source and concentration) was most effective at increasing root growth?

Give a reason for your answer.

solution _____

reason _____

_____ [2]

(ii) Which solution of potassium ions (source and concentration) had no effect on root growth?

Give a reason for your answer.

solution _____

reason _____

_____

_____ [2]

(e) For healthy plant growth, several other mineral ions should be added to the solution.

(i) Name **ONE** mineral ion that should be added to the solution so that the plant can produce chlorophyll.

_____ [1]

(ii) Name **ONE** mineral ion that should be added to the solution so that the plant can produce DNA.

_____ [1]

TOTAL MARKS [10]

2. A farmer added nitrate-containing fertiliser to his crops. The table shows how crop yield is affected by the mass of nitrate-containing fertiliser added.

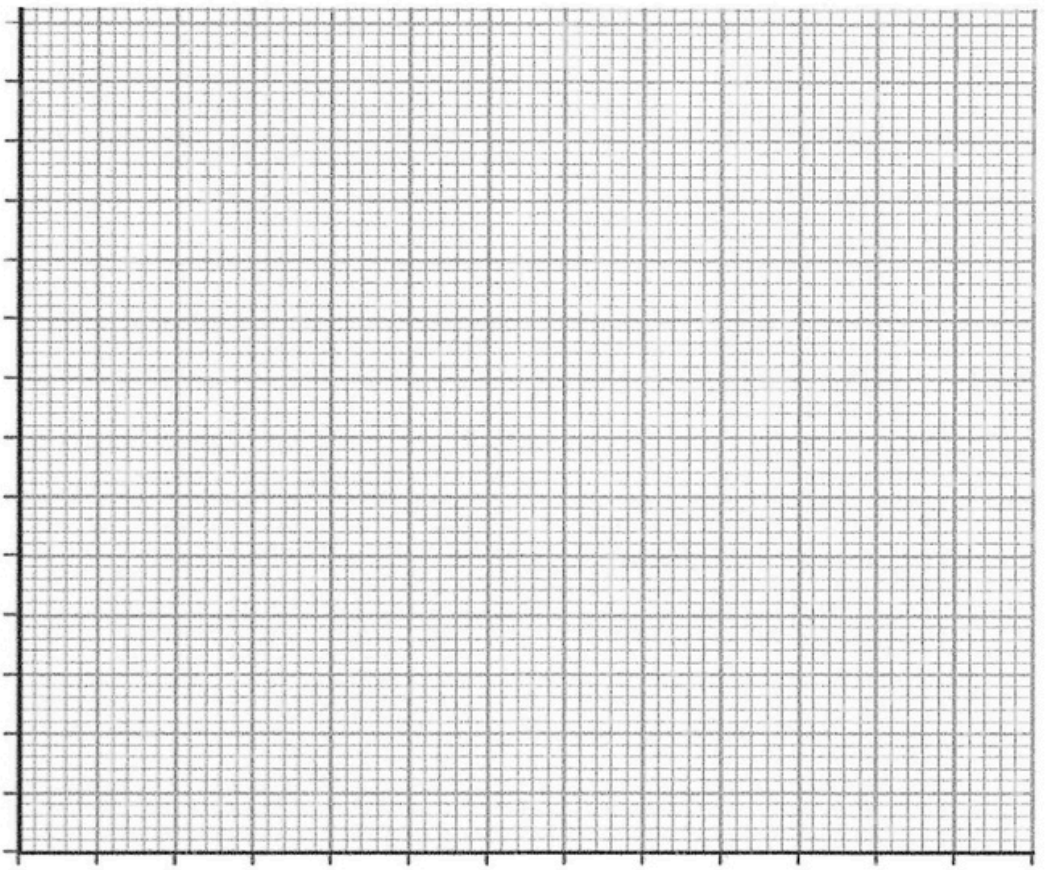
mass of fertiliser/ kg per hectare	**crop yield/ tonnes per hectare**
0	15
50	18
100	22
150	32
200	32
250	32

(a) Explain why farmers add nitrate-containing fertiliser to their crops.

_____

_____ [1]

(b) Plot a line graph of the data shown in the table. [4]



(c) What mass of fertiliser would you advise farmers to use on their crops?

Suggest a reason for your answer.

_____

_____

_____ [2]

(d) Identify **ONE** environmental problem that may result from using excess nitrate-containing fertilisers on crops and explain **TWO** effects of this problem.

_____

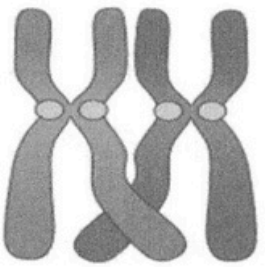
_____

_____

_____ [3]

TOTAL MARKS [10]

3. The diagram shows a process that takes place between non-sister chromatids of homologous chromosomes.



(a) (i) What is this process called?

_____ [1]

(ii) During which stage of meiosis does this process take place?

_____ [1]

(iii) Describe what happens during this process?

_____

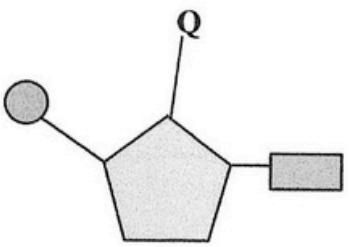
_____

_____ [2]

(iv) State how the cells produced are affected by the above process.

_____ [1]

(b) The structure below represents the basic unit of a DNA molecule.



(i) Name the basic unit of a DNA molecule.

_____ [1]

(ii) Identify the part labelled **Q** on the diagram above.

_____ [1]

Random changes may occur in the DNA molecule.

(iii) What term describes these random change to DNA molecules?

_____ [1]

(iv) Some of these random changes only affect a single basic unit of a DNA molecule.

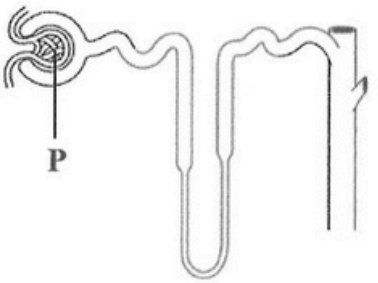
Put an **X** on the diagram of a basic unit of a DNA molecule to identify the part that will be different as a result of this type of change. [1]

(v) Name **ONE** factor that increases the occurrence of these random changes.

_____ [1]

TOTAL MARKS [10]

4. The diagram shows a kidney nephron.



(a) Name part **P** and state its role in the formation of urine.

Name of part **P** _____ [1]

Role _____

_____

_____ [2]

(b) Some useful substances are reabsorbed by the kidneys.

On the diagram, place an **X** where reabsorption of glucose takes place. [1]

(c) The table shows the concentration of some of the substances found in samples of blood plasma, kidney filtrate and urine collected from a person.

substance	concentration/g per dm^3		
	blood plasma	**filtrate**	**urine**
water	930.0	930.0	920.0
protein	78.0	0.0	0.0
urea	0.3	0.3	20.0
sodium ions	2.8	2.8	3.5

(i) Explain why there is a difference in the concentration of protein in the blood plasma and protein in the filtrate in the nephron.

_____

_____ [1]

(ii) Suggest a reason why the concentration of urea and sodium ions is higher in the urine than in the blood plasma and filtrate.

_____

_____

_____ [1]

(d) ADH (antidiuretic hormone) affects water balance in the body.

State the name of the gland that release ADH into the blood and what change in the blood plasma would cause an increase in the release of ADH.

Name of gland _____

State what changes in the blood plasma _____

_____ [2]

(e) If both kidneys of an individual become infected they may fail to function temporarily.

(i) Name the type of treatment this individual has to undergo.

_____ [1]

(ii) State **one** limitation of this treatment.

_____

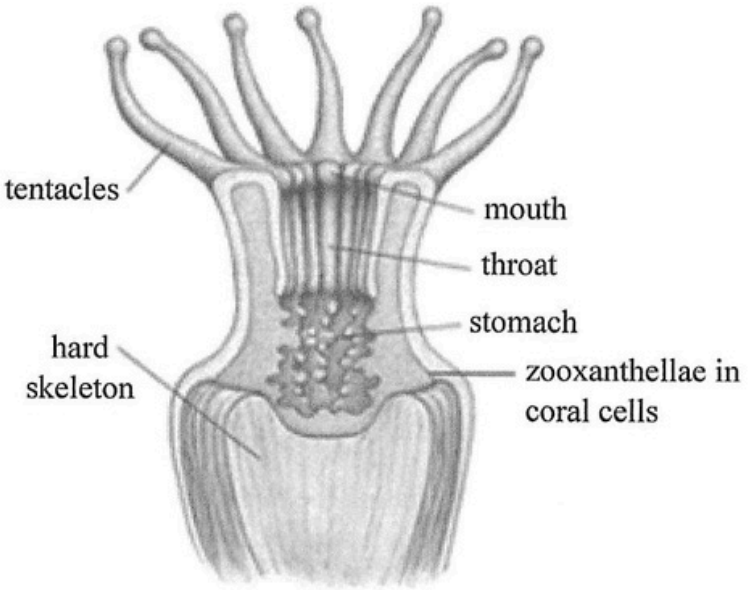
_____ [1]

TOTAL MARKS [10]

SECTION B

Answer **TWO** of three questions in the spaces in this booklet.

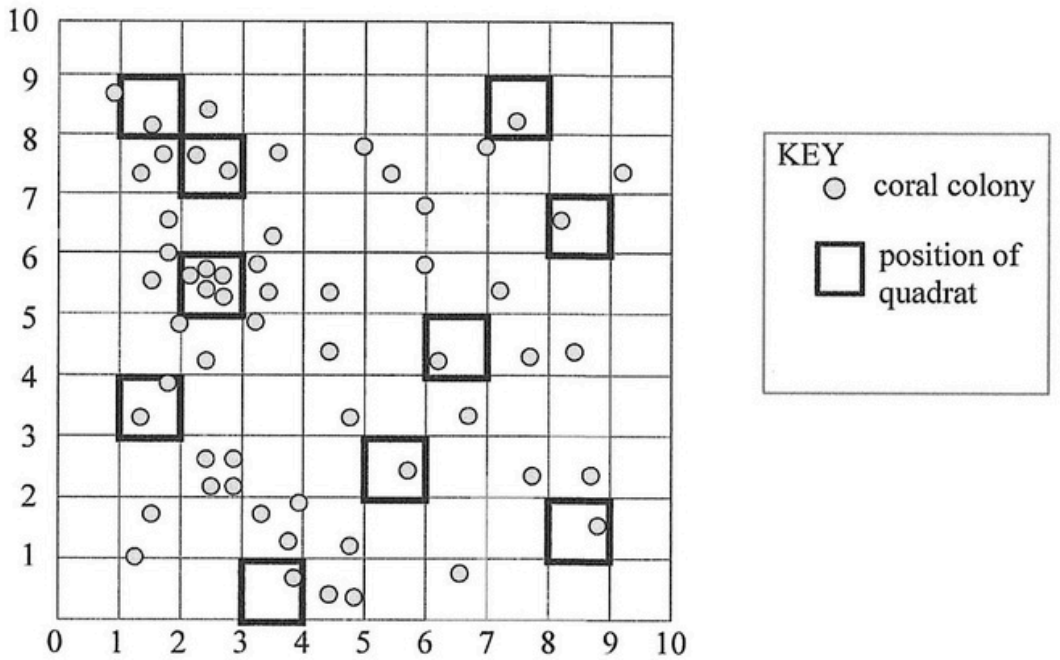
5. The diagram represents a coral polyp.



(a) (i) Describe how a coral polyp obtains its food by filter feeding. [4]

(ii) Name and describe the relationship between the coral polyp and the zooxanthellae. [3]

(b) A survey was carried out by a group of marine biologists to determine the population of a coral species on a reef in Eleuthera. The diagram below represents the sample area for the 10 quadrats taken on the coral reef.



The data collected was recorded in the table below from the area sampled.

quadrat co-ordinates	number of coral colonies
2,2	1
2,8	1
3,3	**P** _____
4,9	1
5,3	5
6,7	**Q** _____
7,2	2
8,6	**R** _____
9,9	1
10,4	1

(i) Complete the table by stating the number of coral colonies present in quadrats **P**, **Q** and **R**. [1]

(ii) Calculate the average number of coral colonies per quadrat. [2]

(iii) Suggest **TWO** ways that this investigation could be improved. [2]

(c) A more recent survey of the same reef shows that there was a decrease in the coral colonies.

Name **ONE** natural and **THREE** man-made threats to the coral reef and for each threat describe specifically how it would cause a decrease in the coral colonies. [8]

TOTAL MARKS [20]

6. This question is about the human respiratory system.

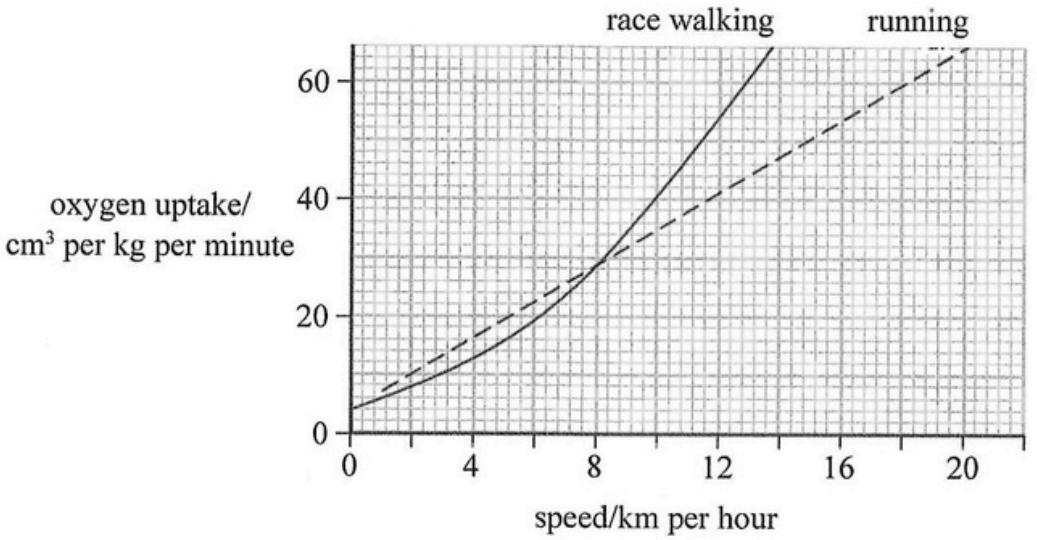
(a) Air is drawn into the lungs through the trachea and bronchi.

Describe how the trachea and bronchi aid in protecting the lungs from pathogens. [5]

(b) Describe the actions of the ribs, intercostal muscles and diaphragm during inspiration. [3]

(c) Race walking is a competitive athletic event in which at least one foot must be in contact with the ground at all times. In running events, both feet may be off the ground at the same time.

The graph shows how the oxygen uptake of an athlete varies with their speed when race walking and running.



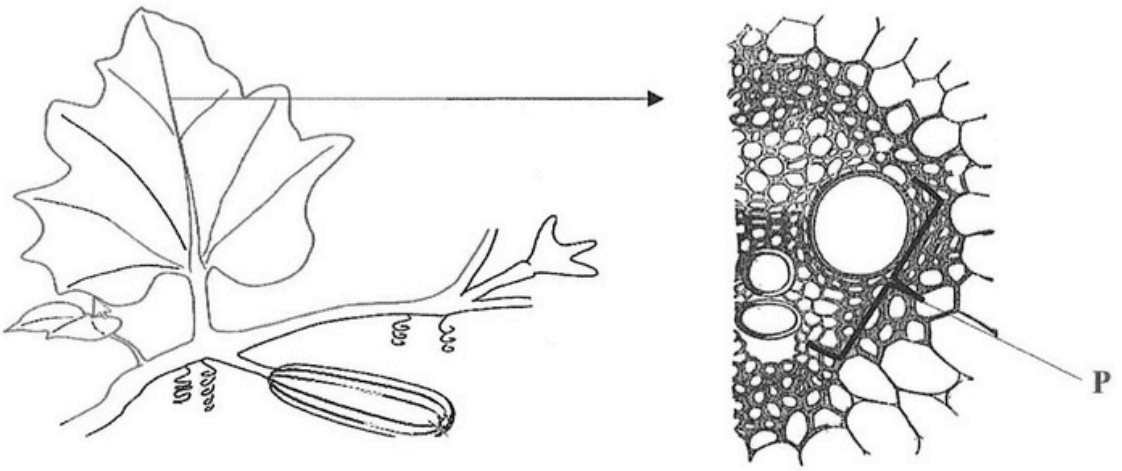
(i) Calculate the difference in the individual's minimum and maximum oxygen uptake when race walking. [2]

(ii) Describe the trends and patterns in the oxygen uptake of the athlete shown in the graph. [4]

(d) Describe **THREE** adaptations of gas exchange surfaces. [6]

TOTAL MARKS [20]

7. The diagram shows the external view of a leaf from a plant and a cross-section plant and a cross-section through part of a vascular bundle from the same leaf.



(a) (i) State the type of leaf shown in the diagram. Using the diagram, give **TWO** reasons for your choice. [3]

(ii) State the name of tissue **P** in the diagram and give its function. [2]

(iii) Describe **THREE** adaptations of tissue **P**. [3]

(b) The table shows the transpiration rate from the leaf over a 12-hour period, on a hot, clear, windy day with low humidity.

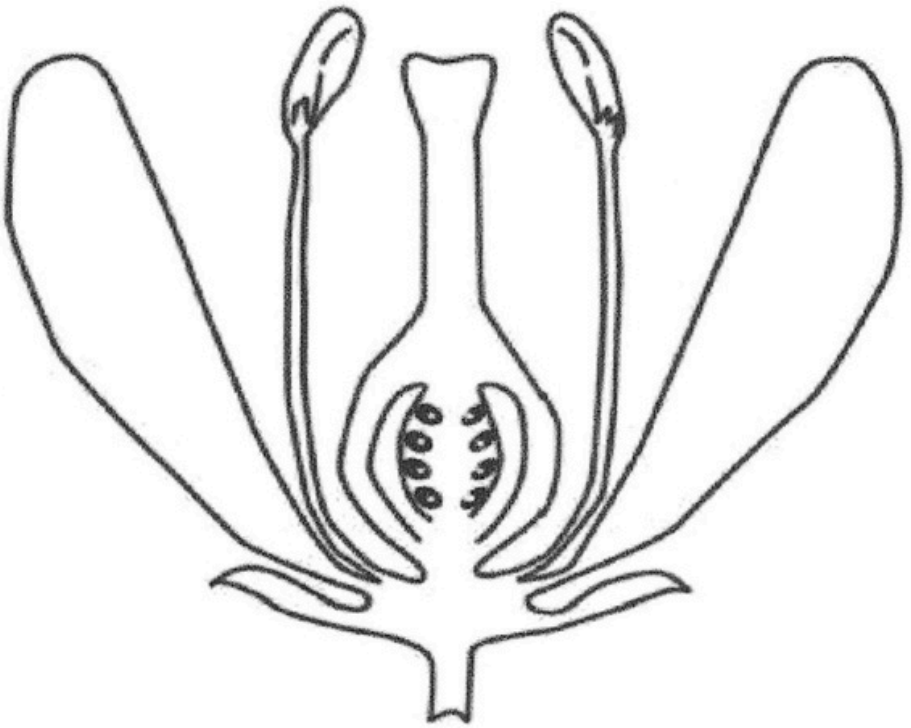
time of reading	**transpiration rate/cm^3 per hour**
8 a.m.	0.19
2 p.m.	0.35
5 p.m.	0.28
8 p.m.	0.15

State and explain the changes in transpiration rate from 8 a.m. to 2 p.m. and from 2 p.m. to 8 p.m. [4]

(c) Sexual reproduction in flowering plants involves pollination followed by fertilisation.

(i) Describe fully the events after pollination which results in fertilisation. [4]

(ii) Add a labelled structure to the diagram to show how fertilisation occurs after pollination. [2]



(iii) State **TWO** changes that occur in a flower following fertilisation. [2]

TOTAL MARKS [20]

Question .....
Write on both sides of the paper

Question .....
Write on both sides of the paper

Question .....
Write on both sides of the paper

Question .....
Write on both sides of the paper

Question .....
Write on both sides of the paper

End]