FOR OFFICIAL USE

Mark

NATIONAL QUALIFICATIONS 2014

BIOLOGY
INTERMEDIATE 2

FRIDAY, 16 MAY
9.00 AM – 11.00 AM

X007/11/02

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth
Day Month Year

Scottish candidate number

SECTION A (25 marks)

Instructions for completion of Section A are given on *Page two*.
For this section of the examination you must use an **HB pencil**.

SECTIONS B AND C (75 marks)

1 (a) All questions should be attempted.
(b) It should be noted that in **Section C** questions 1 and 2 each contain a choice.
2 The questions may be answered in any order but all answers are to be written in the spaces provided in this answer book, **and must be written clearly and legibly in ink**.
3 Additional space for answers 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.
4 The numbers of questions must be clearly inserted with any answers written in the additional space.
5 Rough work, if any should be necessary, should be written in this book and then scored through when the fair copy has been written. If further space is required, a supplementary sheet for rough work may be obtained from the Invigilator.
6 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.

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Read carefully

1 Check that the answer sheet provided is for **Biology Intermediate 2 (Section A)**.

2 For this section of the examination you must use an **HB pencil**, and where necessary, an eraser.

3 Check that the answer sheet you have been given has **your name**, **date of birth**, **SCN** (Scottish Candidate Number) and **Centre Name** printed on it.

Do not change any of these details.

4 If any of this information is wrong, tell the Invigilator immediately.

5 If this information is correct, **print** your name and seat number in the boxes provided.

6 The answer to each question is **either** A, B, C or D. Decide what your answer is, then, using your pencil, put a horizontal line in the space provided (see sample question below).

7 There is **only one correct** answer to each question.

8 Any rough working should be done on the question paper or the rough working sheet, **not** on your answer sheet.

9 At the end of the examination, put the **answer sheet for Section A inside the front cover of this answer book**.

Sample Question

The thigh bone is called the

A femur

B humerus

C tibia

D fibula.

The correct answer is **A**—femur. The answer **A** has been clearly marked in **pencil** with a horizontal line (see below).

Changing an answer

If you decide to change your answer, carefully erase your first answer and, using your pencil, fill in the answer you want. The answer below has been changed to **D**.

SECTION A

All questions in this Section should be attempted.

1. Which structural feature is found in a plant cell and not in an animal cell?

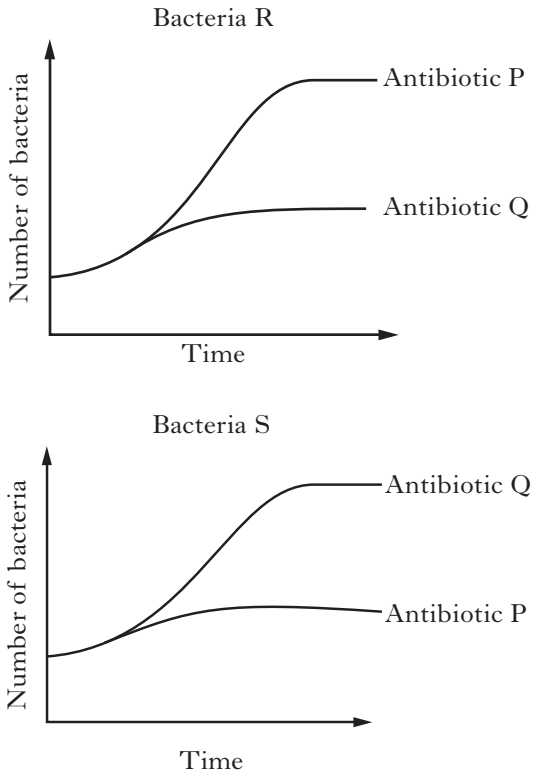
A Nucleus

B Cell wall

C Cell membrane

D Cytoplasm

2. The graphs below show the results of an investigation into the effects of different antibiotics (P and Q) on two different bacteria (R and S).



What conclusion can be drawn from these results?

A R is less resistant to P than Q

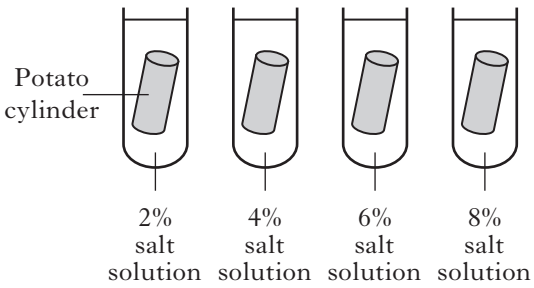
B R is more resistant to P than Q

C S is more resistant to P than Q

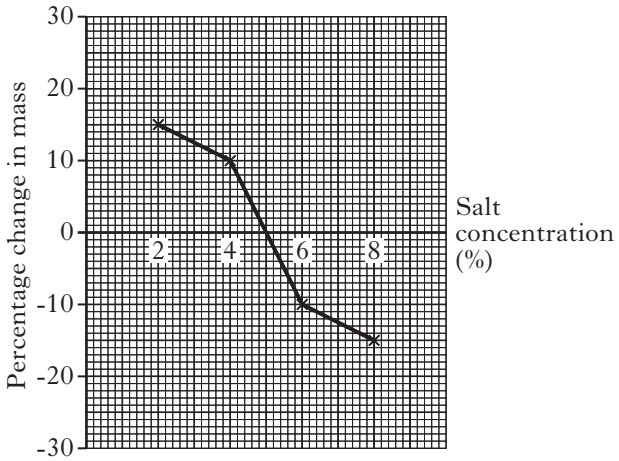
D S is less resistant to Q than P

Questions 3 and 4 refer to the investigation described below.

3. Four potato cylinders of equal mass were placed in four separate test tubes as shown below.



After two hours, the percentage change in mass of each cylinder was calculated and the results plotted on the graph below.



In which concentration of salt would the potato cylinders be most flaccid?

A 8%

B 5%

C 2%

D 0%

4. When the experiment was repeated with 10% salt the initial mass was 20 g and the final mass was 16·8 g.

What was the percentage decrease in mass?

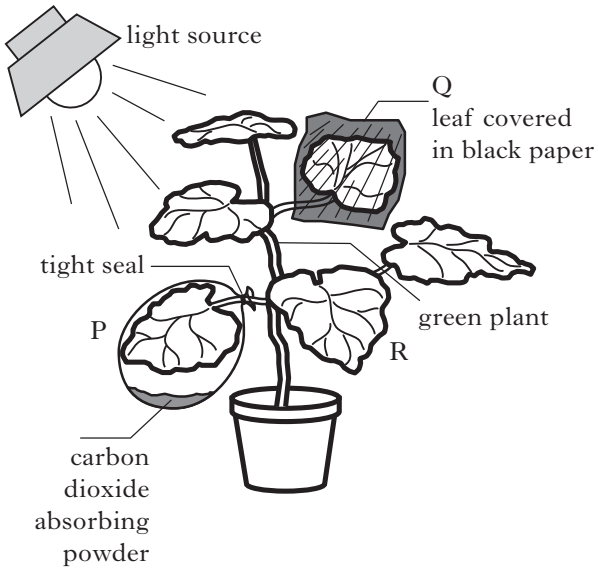
A 3·2%

B 16%

C 20%

D 84%

5. The diagram below shows an investigation into photosynthesis.



Which of the following statements is correct?

A P, Q and R make food

B P and Q make food

C Only Q makes food

D Only R makes food

6. The light energy for photosynthesis is captured by

A water

B hydrogen

C chlorophyll

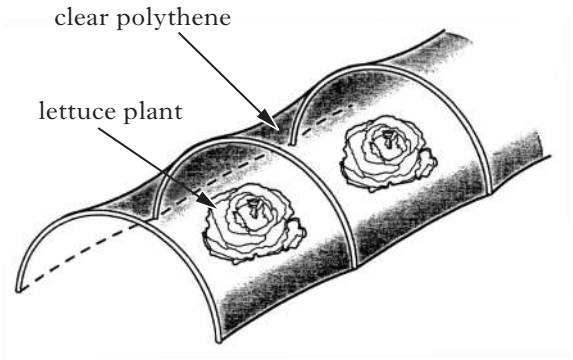
D oxygen.

7. Glucose produced during photosynthesis may be converted into starch or cellulose.

Which line in the table below correctly identifies the use of starch and cellulose?

	Use of carbohydrate	
	Starch	*Cellulose*
A	structural	structural
B	structural	storage
C	storage	structural
D	storage	storage

8. Lettuces may be grown in tunnels covered in clear polythene as shown in the diagram below.



This method of growing produces earlier crops by

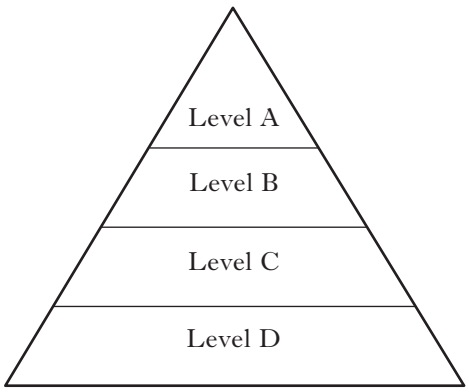
A increasing temperature

B increasing light absorption

C decreasing insect damage

D decreasing water availability.

9. The diagram below shows the levels in a pyramid of numbers.



Which level in the pyramid contains primary consumers?

10. In Scotland, many forests are planted with only a single species of tree such as Douglas fir.

These forests have

A a stable ecosystem

B complex food webs

C high intensity of grazing

D low insect species diversity.

11. When environmental conditions are unfavourable, woodlice increase their rate of movement.

Which of the following sets of conditions are likely to cause woodlice to move about fastest?

A Low humidity and low light intensity

B Low humidity and high light intensity

C High humidity and low light intensity

D High humidity and high light intensity

12. The table below shows the results of an investigation into the effect of temperature on egg laying in adult red spider mites.

Feature	*Temperature* (˚C)		
	20 ˚C	25 ˚C	30 ˚C
Average length of egg laying period (days)	24	18	12
Average number of eggs laid per female during egg laying period	72	72	72

As the temperature increases, the average number of eggs laid per female per day

A increases

B decreases

C stays the same

D halves.

13. The fusion of the nuclei of two gametes is called

A fertilisation

B meiosis

C random assortment

D zygote.

14. Which of the following pairs of human cells have the same number of chromosomes?

A Liver cell and sperm cell

B Kidney cell and sperm cell

C Kidney cell and liver cell

D Liver cell and egg cell

15. Which line in the table below shows the chromosome complement of a normal human sperm that would determine a male offspring?

	Sex chromosome	*Number of other chromosomes*
A	X	22
B	X	23
C	Y	22
D	Y	23

16. Genetically identical seedlings were watered with different solutions each with an element missing. The following results were obtained.

Element missing	*Appearance of seedling*
nitrogen	poor overall growth
magnesium	leaves pale green/yellow
potassium	reduced root growth

What would be a suitable control for the above experiment?

A Take an average of all of the seedlings from each treatment.

B Water the seedlings with a solution with none of the nutrients missing.

C Repeat the experiment several times.

D Water the seedlings at random with all solutions.

[Turn over

17. The table below shows some of the functions and sources of minerals.

Mineral	*Function*	*Food sources*
calcium	hardens bones and teeth; muscle contraction	milk, other dairy products, green vegetables
iron	component of haemoglobin and some enzymes	meat, nuts, cereals, green vegetables
sodium	transmission of nerve impulses; muscle contraction	meat, fish, salt
potassium	transmission of nerve impulses; muscle contraction	fish, meat, green vegetables

Which mineral found in green vegetables is needed for transmission of nerve impulses?

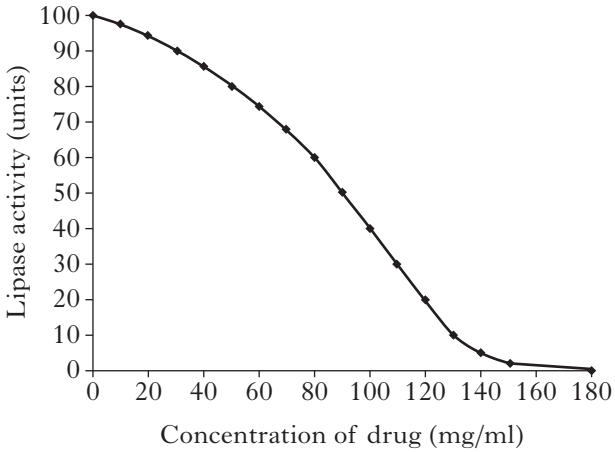
A Calcium

B Iron

C Sodium

D Potassium

18. The graph below shows the effect of a slimming drug on the activity of lipase.



What effect would the drug have on food in the intestine?

A Decrease in fat digestion

B Increase in fat digestion

C Increase in fatty acid production

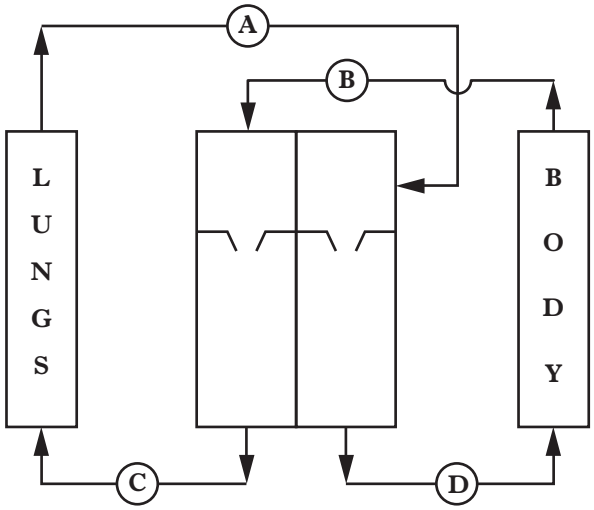
D Decrease in amino acid production

19. Freshwater bony fish have to overcome an osmoregulation problem.

Which line in the table below is true for freshwater bony fish?

	Tissue compared with surroundings	*Concentration of urine produced*
A	hypertonic	concentrated
B	hypertonic	dilute
C	hypotonic	concentrated
D	hypotonic	dilute

20. The diagram below represents the heart and circulation.



Which labelled structure is the aorta?

21. The mesenteric artery carries blood to the

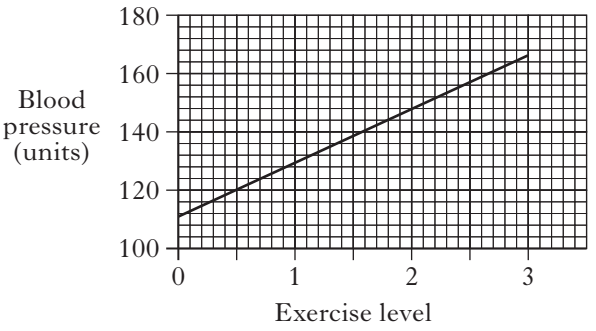
A small intestine

B lung

C kidney

D heart muscle.

22. The graph below shows the results of an investigation on the effect of exercise on blood pressure.



What was the difference between the blood pressure at exercise level 0 and exercise level 3?

A 13 units

B 27 units

C 54 units

D 66 units

23. Which line in the table below correctly identifies the human body's responses to a decrease in body temperature?

	Blood vessels to the skin	*Blood flow to the skin*
A	dilate	increases
B	constrict	increases
C	dilate	decreases
D	constrict	decreases

24. Which part of the brain controls breathing and heart rate?

A Cerebellum

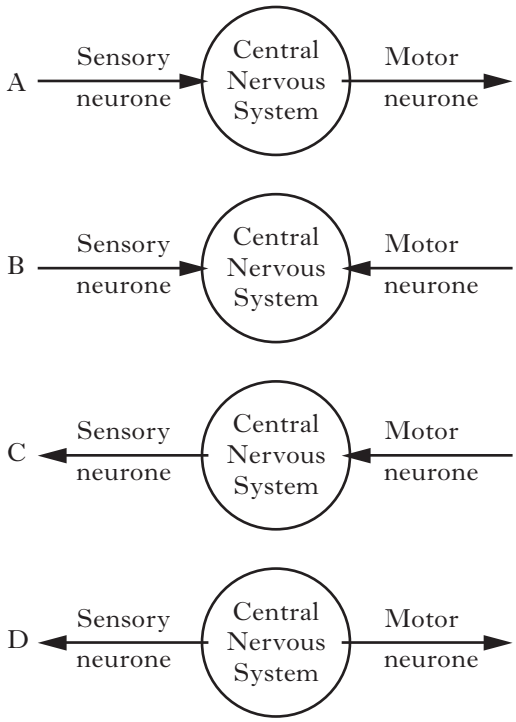
B Cerebrum

C Hypothalamus

D Medulla

[Turn over

25. Which of the diagrams below correctly identifies neurones and the direction of travel of nerve impulses?



Candidates are reminded that the answer sheet for Section A MUST be placed INSIDE the front cover of this answer book.

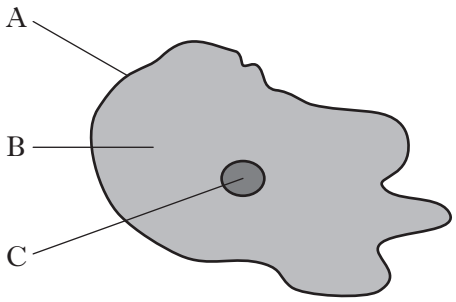
[Turn over for Section B on *Page ten*

SECTION B

All questions in this section must be attempted.
All answers must be written clearly and legibly in ink.

Marks DO NOT WRITE IN THIS MARGIN

1. (*a*) The diagram below represents a single-celled organism called *Amoeba*. This organism carries out respiration to provide energy for cellular activities.



Glycolysis is the first stage of respiration which occurs in the cytoplasm of the *Amoeba* cell.

(i) State which letter in the diagram shows the cytoplasm.

_____ **1**

(ii) Describe what happens during glycolysis.

_____

_____

_____ **2**

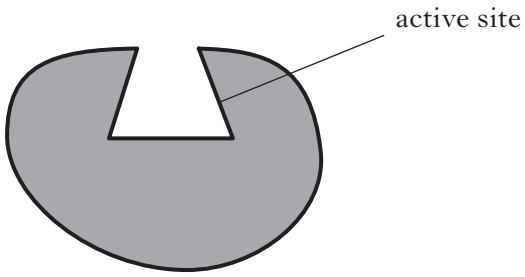
(*b*) State **one** cellular activity that uses the energy released by respiration.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

2. The diagram below represents an enzyme which carries out a synthesis reaction.



(*a*) The sentences below describe some of the properties of enzymes.

Underline **one** option in each set of brackets to make the sentences correct.

Enzymes {lower / raise} the energy input required and

{slow down / speed up} the rate of chemical reactions.

The shape of an enzyme molecule is {complementary to / the same as} its substrate. **2**

(*b*) Describe what is meant by the term "synthesis reaction".

_____

_____ **1**

(*c*) Explain why a denatured enzyme no longer works.

_____

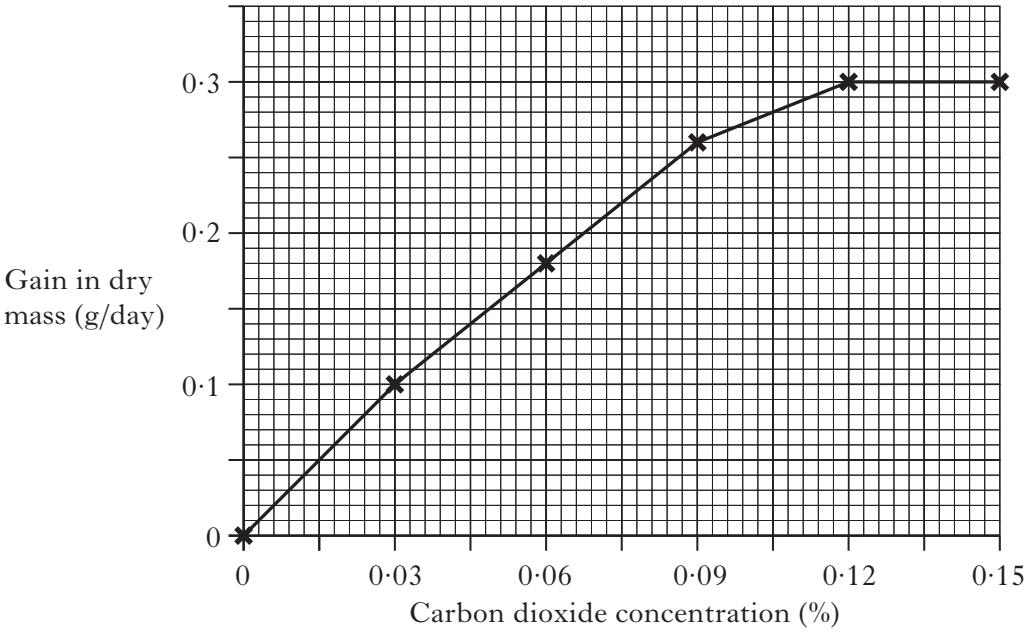
_____

_____ **2**

[Turn over

Marks

3. (*a*) The graph below shows the effect of carbon dioxide concentration on the growth of plants.



(i) How was the growth of plants measured in this investigation?

_____ **1**

(ii) **Use data from the graph** to describe the relationship between carbon dioxide concentration and the growth of plants.

_____

_____

_____ **2**

(*b*) Carbon dioxide concentration is a limiting factor in photosynthesis. Name **one** other limiting factor.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

3. (continued)

(*c*) Photosynthesis uses carbon dioxide for the growth of plants.

(i) Name the stage of photosynthesis which uses carbon dioxide.

_____ **1**

(ii) Name one other substance used in this stage.

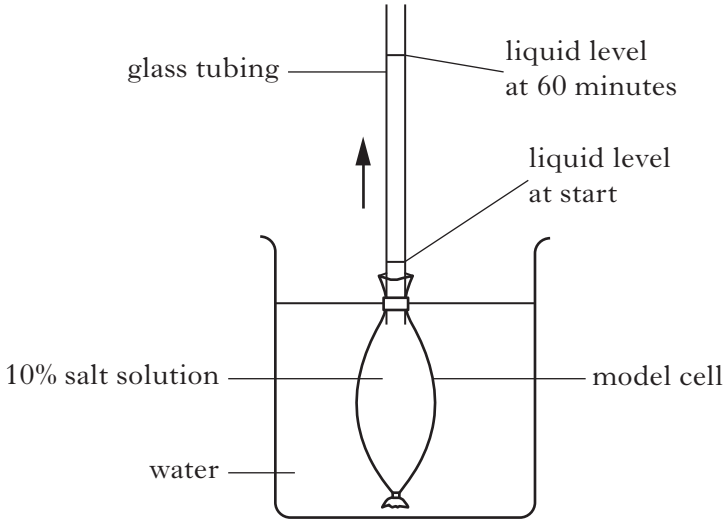
_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

4. The apparatus shown below was used to investigate the movement of water into and out of a model cell. The model cell had a selectively permeable membrane.



The liquid level in the glass tubing was measured every 10 minutes for 60 minutes.

The results are shown in the table below.

Time (minutes)	*Liquid level* (mm)
0	10
10	22
20	32
30	40
40	48
50	56
60	64

(*a*) Name the process which caused the liquid level to rise.

_____ **1**

(*b*) Explain how this process caused the liquid level to rise.

_____

_____

_____ **2**

DO NOT WRITE IN THIS MARGIN

Marks

4. (continued)

(*c*) Calculate the average rate of movement of liquid in the glass tubing.

Space for calculation

_____ mm per minute **1**

(*d*) When the investigation was repeated, the average rate of movement of liquid was slower.

Suggest **one** difference in the way that the investigation was set up that could have caused this change in results.

_____

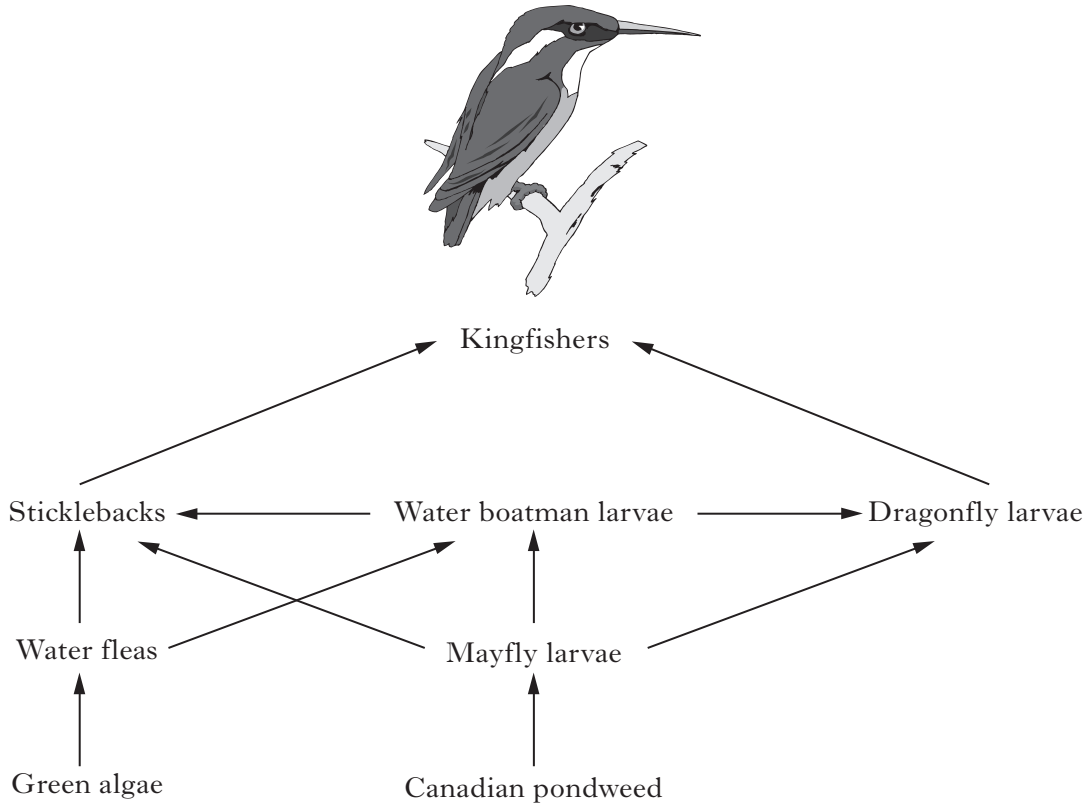
_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

5. The diagram below represents a food web in a freshwater ecosystem.



(*a*) Select organisms from the food web to complete the food chain below.

Canadian Pondweed → _____ → _____ → _____ **1**

(*b*) Name **all** the secondary consumers in this food web.

_____

_____ **1**

(*c*) (i) Explain why the dragonfly larvae and the sticklebacks are in competition with each other.

_____

_____ **1**

(ii) **With reference to this food web**, explain why sticklebacks are likely to be more successful than dragonfly larvae if water boatman larvae are removed.

_____

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

5. (continued)

(*d*) Decide if each of the following statements about the components of an ecosystem is **True** or **False**, and tick (✓) the appropriate box.

If the statement is **False**, write the correct word(s) in the **Correction** box to replace the word underlined in the statement.

Statement	*True*	*False*	*Correction*
A niche is the place where an organism lives.			
A community is all the organisms of the same species in an ecosystem.			
A pyramid of biomass represents the number of organisms at each stage in a food web.			

3

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

6. Border collie dogs can have "stand up" ears, "flop down" ears or "mid way" ears. Ear type is controlled by a single gene which has two alleles.

A true breeding "stand up" ears Border collie was crossed with a true breeding "flop down" ears Border collie.

Patch
"stand up" ears

Flossie
"flop down" ears

All the Border collies in the F_1 generation had "mid way" ears.

(*a*) Using the letter **S** for "stand up" ears and the letter **D** for "flop down" ears, give the genotypes of Patch, shown above, and a Border collie from the F_1 generation.

Patch's genotype _____ **1**

F_1 genotype _____ **1**

(*b*) Calculate the expected phenotype ratio if two Border collies from the F_1 generation were crossed.

Space for working

Phenotype ratio _____ : _____ : _____ **1**
mid way stand up flop down

DO NOT WRITE IN THIS MARGIN

Marks

6. (continued)

(*c*) Suggest why the observed ratio may be different from the expected ratio.

_____

_____ **1**

(*d*) What term is used to describe this form of inheritance?

Tick (✓) the correct box below.

Co-dominant	☐
Environmental impact	☐
Polygenic	☐

1

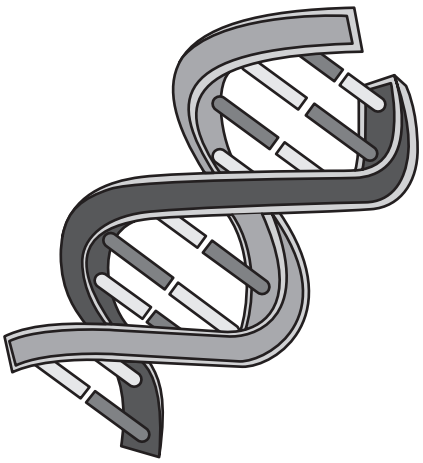
[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

7. (*a*) DNA contains the genetic information which is used to make proteins in a cell.

The diagram below represents part of a DNA double helix.



(i) Describe how the sequence of amino acids in a protein is coded for by DNA.

_____

_____ **1**

(ii) Describe **two** effects that a change in the sequence of amino acids would have on a protein.

_____

_____ **2**

(*b*) Name one protein made in a pancreas cell.

_____ **1**

DO NOT WRITE IN THIS MARGIN

Marks

8. (*a*) Genetic engineering is used to produce growth hormone.

The growth hormone gene is identified and removed from a human chromosome. This gene is then used in the genetic engineering process which involves a number of stages.

The table below shows the stages but they are not in the correct order.

Complete the table, entering a number (2 to 5) in each remaining box, to show the correct order for each stage.

Stages	*Number*
bacterial plasmid cut open	
bacteria multiply and synthesise growth hormone	
growth hormone gene inserted into bacterial plasmid	
bacterial plasmid removed from bacterium	1
bacterial plasmid inserted into bacterium	

1

(*b*) Name another product of genetic engineering.

_____ **1**

(*c*) State the effect of genetic engineering on the rate of production and the range of products.

Rate of production _____

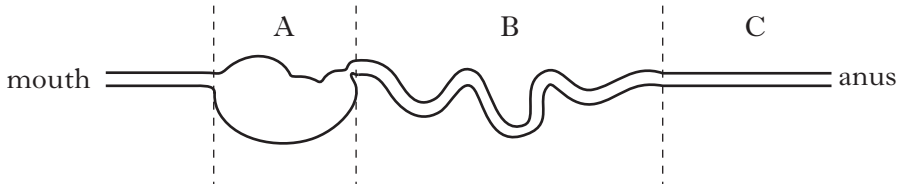
Range of products _____ **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

9. (a) The diagram below represents the alimentary canal from mouth to anus.



(i) Saliva containing salivary amylase is added to food in the mouth.

Name the substrate of salivary amylase.

_____ **1**

(ii) State **one** other function of saliva.

_____ **1**

(iii) Name the process that moves food from A to C.

_____ **1**

(iv) Name the part of the alimentary canal in which bile is added to food and give the letter labelling this part from the above diagram.

Name _____

Letter _____ **1**

(*b*) Amino acids are absorbed from the alimentary canal and transported in the blood. The concentration of amino acids in the blood varies with activity.

Concentration of amino acids in blood (mmol per litre)	
sleeping	*exercising*
1·30	3·25

How many times greater is the amino acid concentration in the blood when exercising than when sleeping?

Space for working

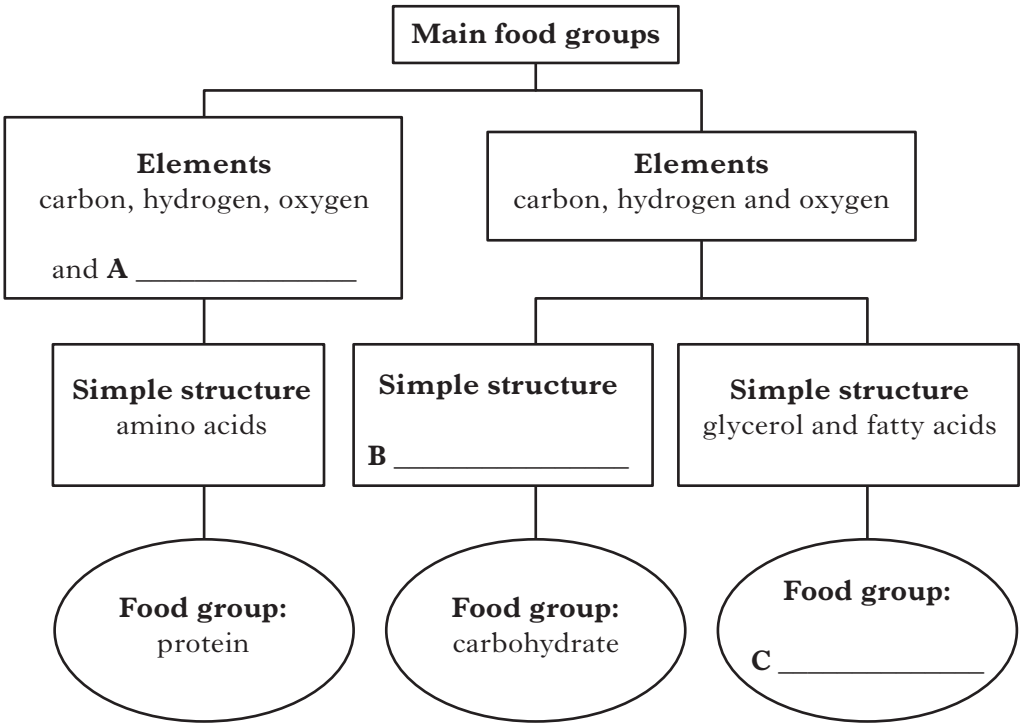
_____ times greater when exercising **1**

Marks

9. (continued)

(*c*) The diagram below can be used to identify the three main food groups.

Complete the diagram by inserting the missing element, simple structure and food group at **A, B and C.**



2

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

10. The following table gives information about concentrations of substances in samples of blood plasma, filtrate from the glomerulus and urine.

Substance	*Concentration in Sample* (g per 100 cm^3)		
	Blood plasma	*Filtrate from the glomerulus*	*Urine*
Glucose	0·10	0·10	0
Protein	8·00	0	0
Salts	0·90	0·90	2·70
Urea	0·03	0·03	1·80

(*a*) Protein is not filtered out of the blood plasma.

(i) Use evidence from the table to support this statement.

_____

_____

_____ **1**

(ii) Explain why protein is not filtered out of the blood plasma.

_____ **1**

(*b*) The table shows that glucose is present in the filtrate from the glomerulus but not in the urine. Explain why glucose is not present in the urine.

_____

_____ **1**

(*c*) Urea is formed by the deamination of excess amino acids. Name the organ in which deamination occurs.

_____ **1**

[Turn over for Question 11 on *Page twenty-six*

DO NOT WRITE IN THIS MARGIN

Marks

11. Two athletes, R and S, carried out a six month training programme in preparation for the 2014 Commonwealth Games in Scotland.

The fitness of the two athletes was tested on the first day of each month by measuring their rate of oxygen absorption.

An increase in fitness is shown by an increase in the rate of oxygen absorption.

The rate of oxygen absorption was measured for each athlete during exercise as shown in the picture below.

The following table shows the results of these fitness tests.

Month of training programme	*Rate of oxygen absorption* (cm^3 per kg per min)	
	Athlete R	*Athlete S*
1	39·0	59·0
2	45·0	62·5
3	50·0	67·5
4	53·0	70·7
5	53·0	70·8
6	53·0	70·8

(*a*) State which athlete has benefitted most from the training programme. Justify your answer.

Athlete _____

Justification _____

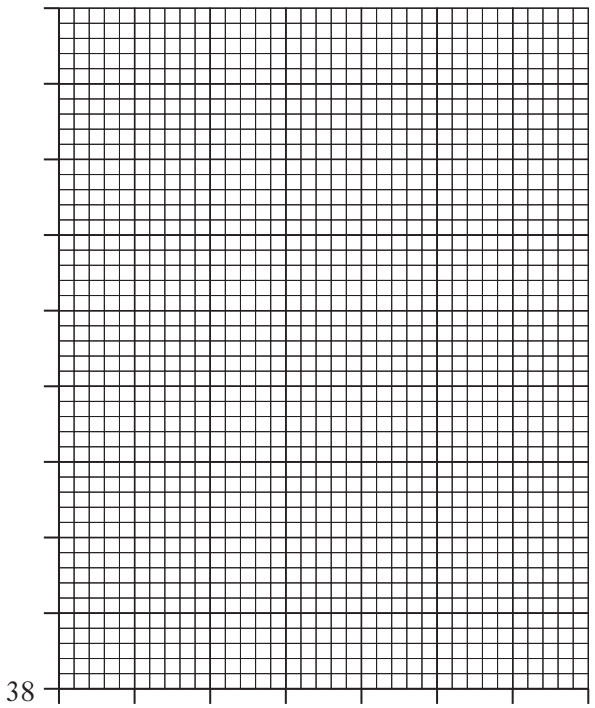
_____ **1**

Marks

11. (continued)

(*b*) Construct a **line graph** to show the results for **athlete R**.

(Additional graph paper, if required, will be found on *Page thirty-six*.)



3

(*c*) Calculate the volume of oxygen absorbed per minute by **athlete R** when tested in month 6.

Athlete R had a mass of 60 kg.

Space for calculation

_____ cm^3 per minute **1**

(*d*) From the results, it was concluded that fitness levels improve in the first months of training and then remain constant. Suggest **one** way in which the reliability of this conclusion could be improved.

_____ **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

11. (continued)

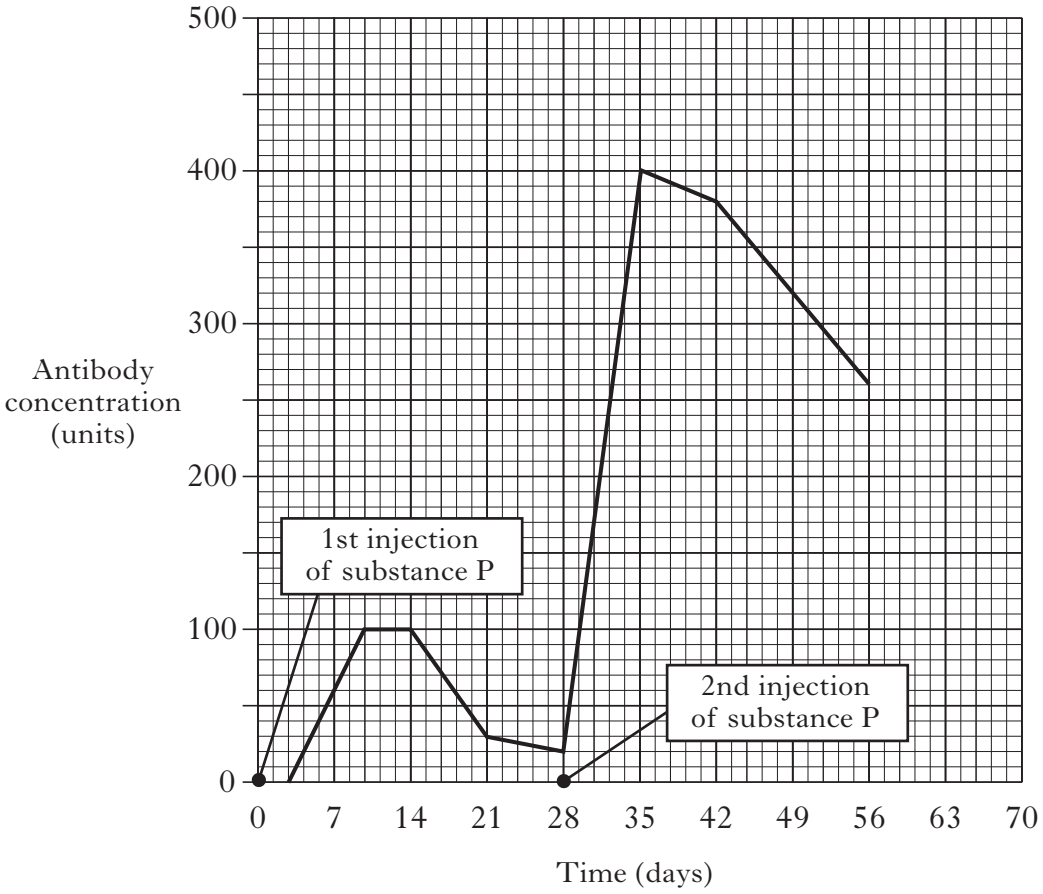
(*e*) The sentences below describe the movement of air into the lungs.

Underline **one** option in each set of brackets to make the following sentences correct.

Air enters each lung through the {bronchus / oesophagus}, which branches into many {bronchioles / trachea}. **2**

Marks DO NOT WRITE IN THIS MARGIN

12. Antibodies are produced as a defence against disease-causing organisms. In an experiment, a volunteer was injected with substance P at the start (day 0) and again on day 28. The substance caused the production of antibodies. The graph below shows antibody concentration in the blood in response to the two injections.



(*a*) (i) The antibody concentration was higher in response to the second injection. **From the graph**, state **one** other difference in response to the second injection.

_____ **1**

(ii) Predict the antibody concentration on day 70.

_____ units **1**

(iii) The results obtained gave a valid comparison of the response to the two injections of substance P. State **one** variable that must have been kept constant in the experiment.

_____ **1**

[Turn over

12. (continued)

(*b*) Name the type of white blood cell that produces antibodies.

_____ **1**

(*c*) Explain what is meant by the term "antibody specificity".

_____

_____ **1**

(*d*) A second method of defence by blood cells is phagocytosis. Describe the process of phagocytosis.

_____

_____ **1**

[Turn over for Section C on *Page thirty-two*

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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.

All answers should be written clearly and legibly in ink.

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

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

A The picture below shows a cactus plant growing in a desert.

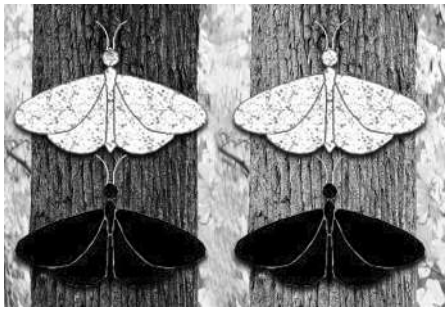
Describe desert plant adaptations which allow them to obtain water and prevent water loss.

Explain how each adaptation helps the plants survive desert conditions. **5**

OR

B The peppered moth (*Biston betularia*) has a dark form and a pale form. Both forms rest on tree trunks during the day. The diagrams below show peppered moths in 1954 and 2014 in the same woodland.

1954 2014



Describe how changes in the environment caused the colour of the tree trunks to get lighter. Explain how this change in tree trunk colour affected the population size of **one form** of peppered moth in the woodland. **5**

Question 2 is on *Page thirty-four*

SPACE FOR ANSWER TO QUESTION 1

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[Turn over for Question 2 on *Page thirty-four*

DO NOT WRITE IN THIS MARGIN

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

Labelled diagrams may be included where appropriate.

A One type of microbial cell is used in the production of yoghurt and a different type of microbial cell is used to produce gasohol.

Name the type of microbial cell used to make each product. Describe how these cells are used in the production of yoghurt and gasohol. **5**

OR

B Gas exchange takes place in the lungs and body cells due to diffusion.

Describe these gas exchanges and explain the importance of these exchanges in the body. **5**

[*END OF QUESTION PAPER*]

SPACE FOR ANSWER TO QUESTION 2

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ADDITIONAL SPACE FOR ANSWERS

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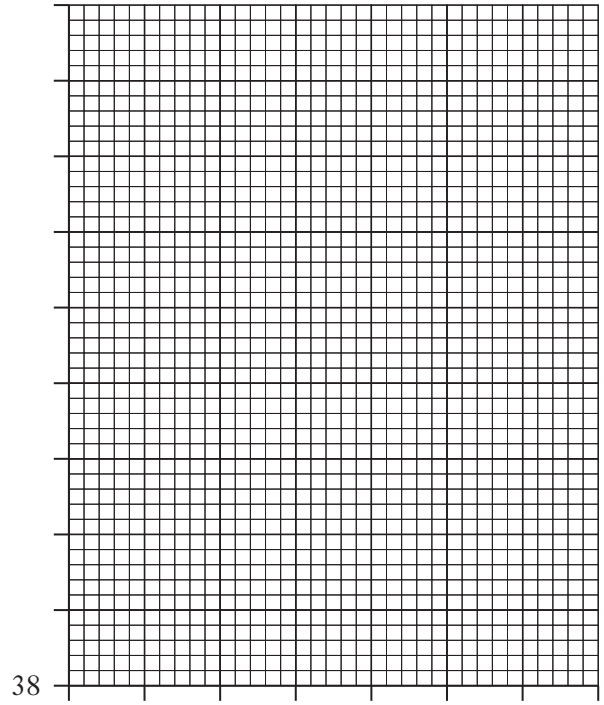
ADDITIONAL GRAPH PAPER FOR QUESTION 11(*b*)



ADDITIONAL SPACE FOR ANSWERS

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ADDITIONAL SPACE FOR ANSWERS

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ACKNOWLEDGEMENTS

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Section C Question 1A – 134963513 Shutterstock.com