N5

National Qualifications 2014

Mark

X707/75/01

FRIDAY, 16 MAY
9:00 AM – 11:00 AM

**Biology
Section 1—Answer Grid
and Section 2**

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

D D   M M   Y Y

Scottish candidate number

Total marks — 80

SECTION 1 — 20 marks

Attempt ALL questions in this section.

Instructions for the completion of Section 1 are given on Page two.

SECTION 2 — 60 marks

Attempt ALL questions in this section.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. You should score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

The questions for Section 1 are contained in the question paper X707/75/02.
Read these and record your answers on the answer grid on Page three opposite.
Do NOT use gel pens.

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then fill in the appropriate bubble (see sample question below).

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

3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

Sample Question

The thigh bone is called the

     A   humerus

     B   femur

     C   tibia

     D   fibula.

The correct answer is **B**—femur. The answer **B** bubble has been clearly filled in (see below).

Changing an answer

If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.

If you then decide to change back to an answer you have already scored out, put a tick (✓) to the **right** of the answer you want, as shown below:

or

	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○

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DO NOT WRITE ON THIS PAGE

[Turn over for Question 1 on *Page six*

1. A group of students carried out an investigation into the variety of cell types.

The types of cell they examined are shown in the box below.

Animal	Plant	Bacterial	Fungal

(a)   (i)   Identify the type(s) of cell which have a cell wall.   **1**

_____

(ii)   Identify the type(s) of cell which have a plasmid.   **1**

_____

(iii)   Some organelles are found in all cells.

Choose one of the following organelles and tick (✓) the appropriate box.

Describe the function of the chosen organelle.   **1**

Ribosome ☐   Mitochondria ☐

Function _____

_____

1. **(continued)**

(b) The students then measured a number of cells and calculated the average cell sizes. The results are shown in the table below.

Type of cell	Average size of cell (μm)
Animal	24
Plant	48
Bacterial	3
Fungal	7

On the graph paper below, complete the vertical axis and draw a bar chart to show the average size of the cells shown in the table. **2**

(Additional graph paper, if required, can be found on *Page twenty-six*)

Animal   Plant   Bacterial   Fungal

Type of cell
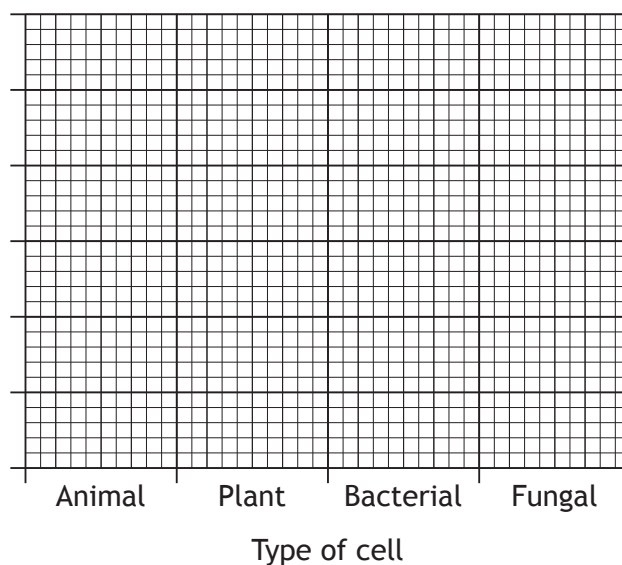
Total marks 5

[Turn over

2. 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.
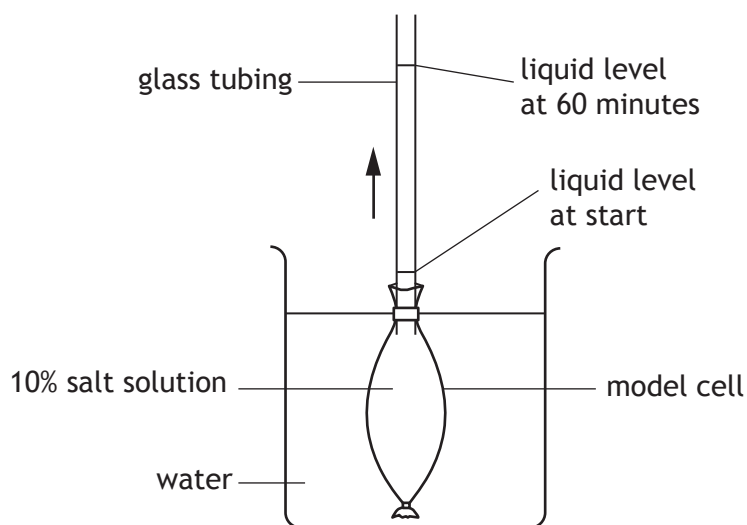
The liquid level in the glass tubing was measured every 10 minutes for 60 minutes.

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**

2. (continued)

(b) Explain how this process caused the liquid level to rise.   **2**

_____

_____

_____

(c) Calculate the average rate of movement of liquid in the glass tubing.   **1**

Space for calculation

_____ mm per minute

(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**

_____

_____

Total marks   5

[Turn over

3. (a) Hydrogen peroxide can damage cells and lead to cell death. Catalase is an enzyme which breaks down hydrogen peroxide into oxygen and water.

Scientists in New Zealand investigated the link between the level of catalase in sheep livers and the fat in their meat. The hypothesis was that the higher the level of liver catalase, the greater the fat content of the meat.

In the investigation, they examined 9 sheep with a high percentage of fat and 15 sheep with a low percentage of fat. The sheep with the high percentage of fat had an average catalase level of 4800 K/g and those with the lower percentage of fat had an average catalase level of 3600 K/g.

The scientists concluded that their hypothesis was correct.

(i) Name the substrate of catalase.

1

_____

(ii) Identify an aspect in the planning of the investigation that would suggest that the hypothesis might not be proven correct.

1

_____

_____

(iii) A further investigation proved that the hypothesis was correct.

Describe how this investigation could help farmers to select only sheep with a low percentage of fat, to provide meat for consumers following a low fat diet.

1

_____

_____

(b) The optimum temperature for the activity of catalase is 37°C.

Predict what would happen to the activity of catalase if the temperature was lowered to 34°C.

1

_____

Total marks   4

4. The following diagram shows a cross-section of some villi in the small intestine.
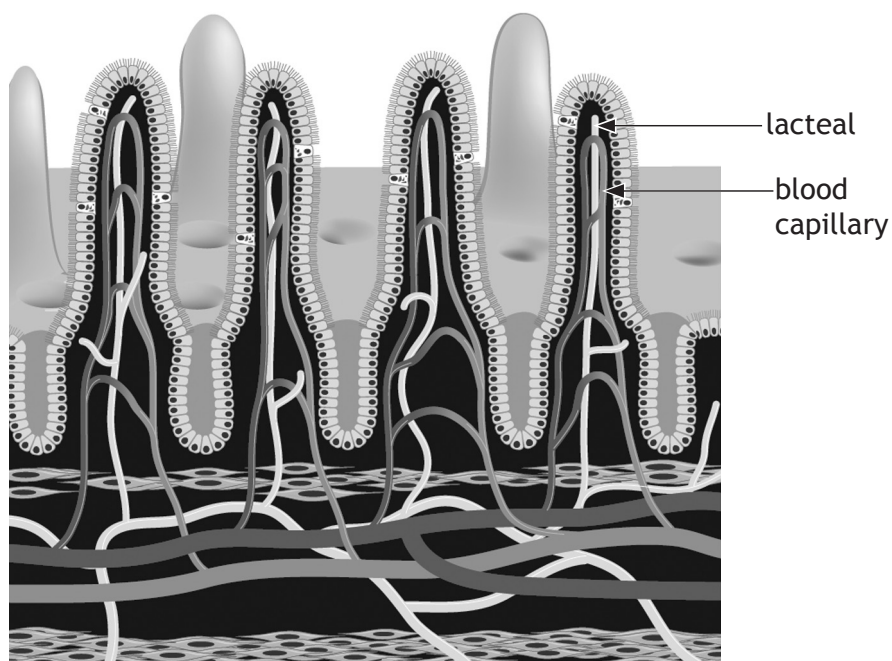
Explain why the **structure and number** of villi make absorption an efficient process in the small intestine.

3

_____

_____

_____

_____

_____

_____

[Turn over

5. Photosynthesis is a two stage process.

Stage 1 — Light reactions

Stage 2 — Carbon fixation

(a) The table below shows some statements about photosynthesis.

Complete the table to show which stage each statement refers to by placing a tick (✓) in the Stage 1 or Stage 2 box.

The first two statements have been completed for you.   **2**

Statement	Stage 1	Stage 2
Carbon dioxide required		✓
Light energy required	✓	
Water required		
Sugar produced		
ATP + Hydrogen required		
Oxygen produced		

(b) Explain why high temperatures (above 50°C) would prevent the photosynthesis reactions from taking place.   **2**

_____

_____

_____

5. **(continued)**

(c) The graph below shows how the rate of photosynthesis is affected by the concentration of carbon dioxide.
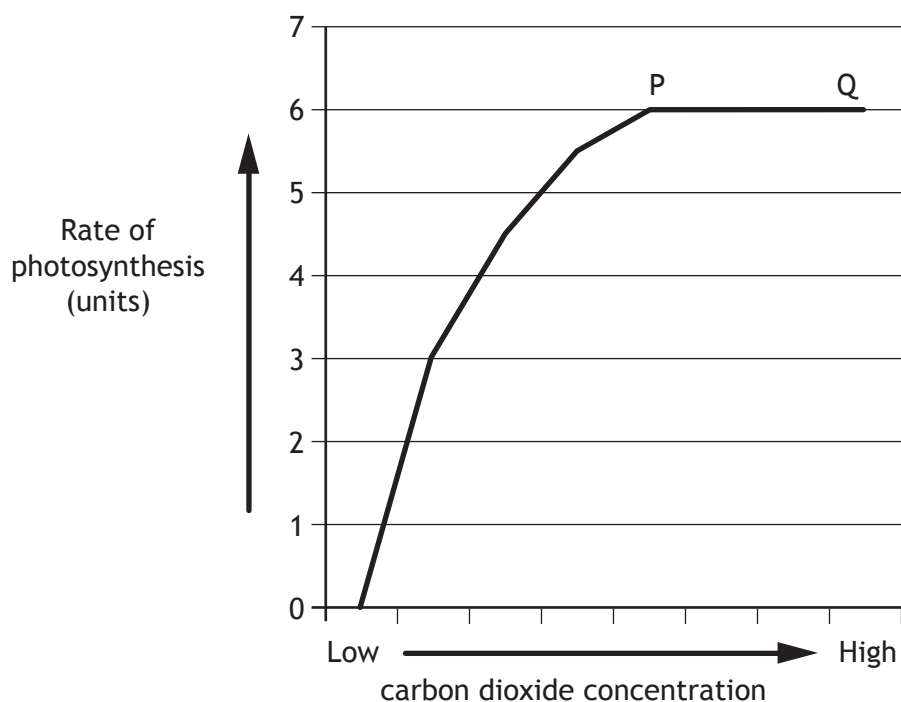
State two environmental factors which could limit the rate of photosynthesis between points P and Q. **1**
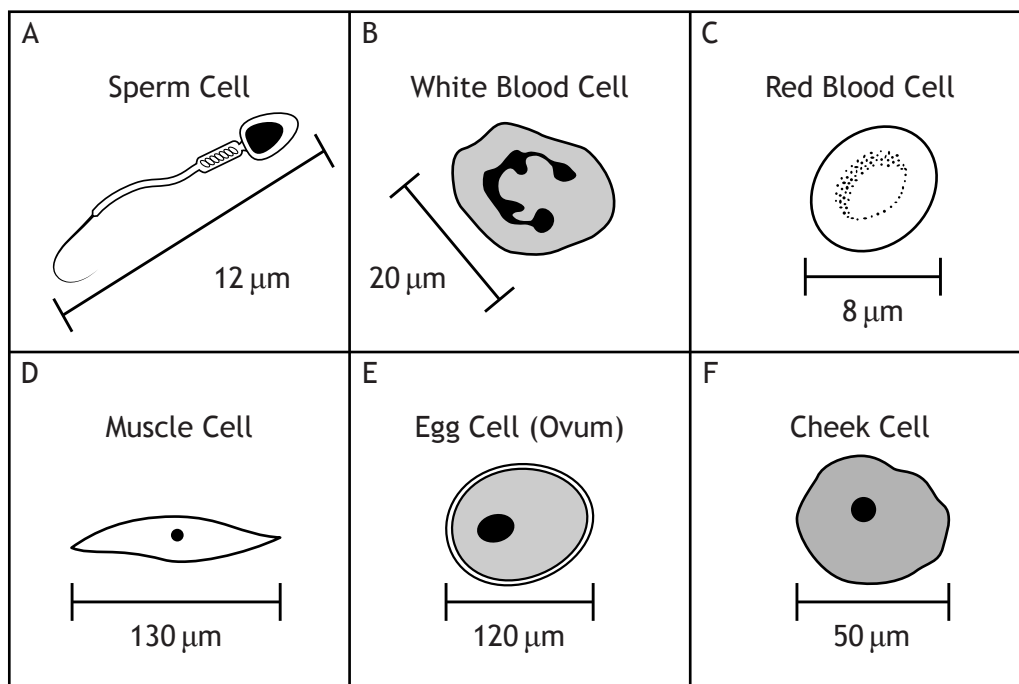
1 _____

2 _____

Total marks **5**

[Turn over

6. The diagrams below show examples of some types of specialised cells from the human body.

A	B	C
Sperm Cell 12 μm	White Blood Cell 20 μm	Red Blood Cell 8 μm

D	E	F
Muscle Cell 130 μm	Egg Cell (Ovum) 120 μm	Cheek Cell 50 μm

The cells are not drawn to the same scale.
(μm = micrometre)

(a) Put letters in the boxes below to arrange the cells in order of size. **1**

increasing size

[ ] [ ] [ ] [ ] [ ] [ ]
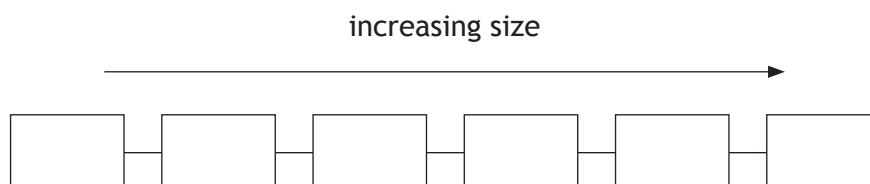
(b) Choose one of the following cell types by (circling) it.

sperm cell   egg cell   red blood cell

Describe the function of the chosen cell and explain how its specialisation allows it to carry out that function. **2**
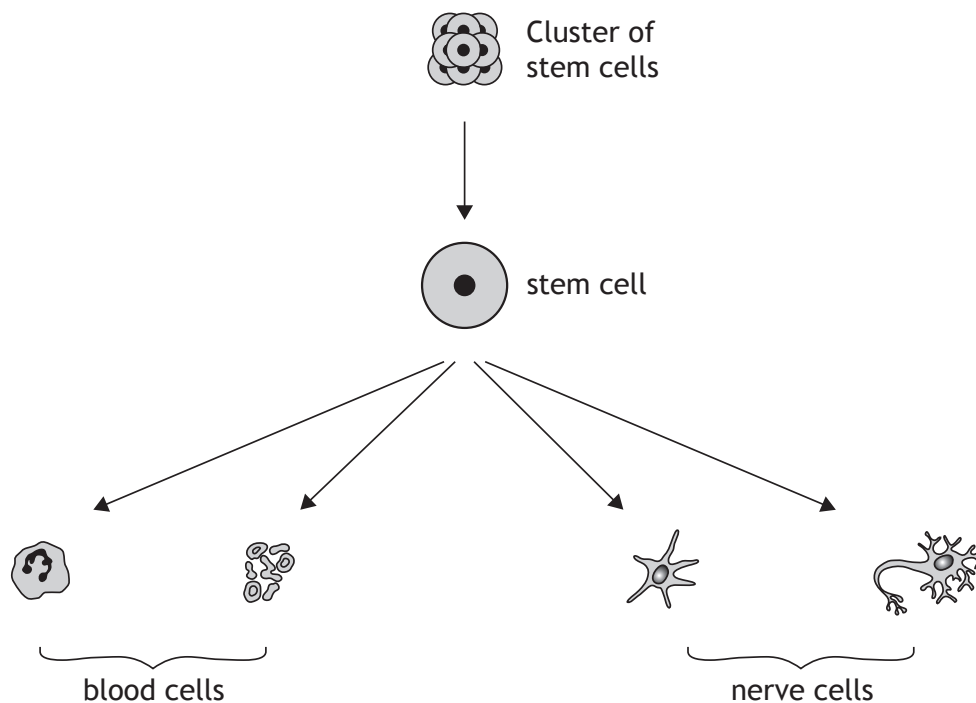
Function _____

Explanation _____

_____

6. **(continued)**

(c) The diagram below shows some stages in the development of blood cells and nerve cells.

Cluster of stem cells

stem cell

blood cells

nerve cells

Describe the feature of stem cells which gives them the potential to develop into many different types of cells, such as blood and nerve cells.   **1**

_____

(d) Which of the following statements refer to processes involving stem cells?

Tick (✓) the correct box(es).   **1**

Growth of new skin ☐

Transmission of nerve impulses ☐

Muscle contraction ☐

Repair of broken bones ☐

Production of insulin ☐

Total marks   5

7. Muscle tissue can be dark or light in colour.

Dark tissue cells use oxygen to release energy.

Light tissue cells do not use oxygen to release energy.

(a) Name the process by which energy is released in the dark tissue cells.

1

_____

(b) (i) Name the substance which muscle cells break down to produce pyruvate.

1

_____

(ii) When pyruvate is being formed, enough energy is released to form two molecules of a high energy compound.

Complete the word equation below to show how this compound is generated.

1

_____ + _____ $\longrightarrow$ _____

(c) The table below shows the average percentage of dark and light tissue cells. These cells were found in the muscles of athletes training for different events at the 2014 Commonwealth games in Scotland.

Type of Athlete	Average percentage of dark tissue cells (%)	Average percentage of light tissue cells (%)
cyclist	60	40
swimmer	75	25
shot putter	40	60
marathon runner	82	18
sprinter	38	62

(i) Using information in the table, identify which type of athlete would be likely to produce the most lactic acid in their muscle cells. Justify your answer.

2

Type of athlete _____

Justification _____

_____

7. (continued)

(ii) A sample of muscle tissue from an athlete was examined and found to contain a total of 360 cells.

90 of these cells were light tissue cells.

Identify which type of athlete the sample was taken from. **1**
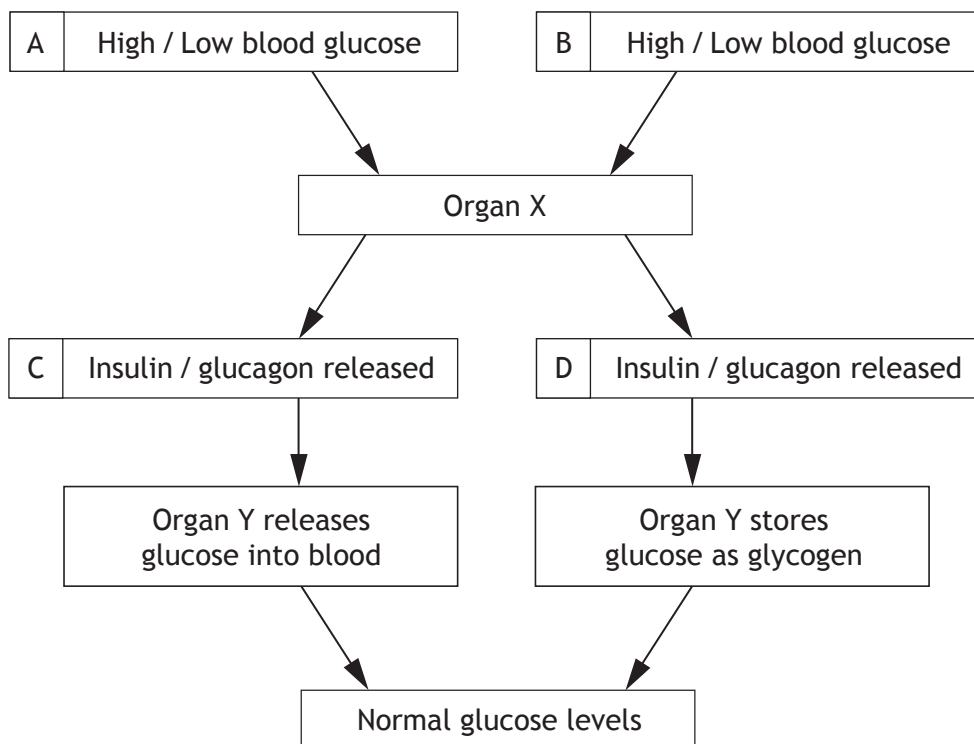
Space for calculation

Type of athlete _____

Total marks 6

[Turn over

8. (a) The regulation of glucose in the blood is represented in the diagram below.

A	High / Low blood glucose

B	High / Low blood glucose

Organ X

C	Insulin / glucagon released

D	Insulin / glucagon released

Organ Y releases glucose into blood

Organ Y stores glucose as glycogen

Normal glucose levels

(i) The diagram above has two options in each of the four boxes A, B, C, D.

(Circle) the correct option in each box. **2**

(ii) Identify organs X and Y. **2**

Organ X _____

Organ Y _____

(b) Insulin and glucagon are hormones.

Describe two features of hormones. **2**

1 _____

2 _____

Total marks   6

9. Coat colour in Labrador dogs is an inherited characteristic. Black coat (**B**) colour is dominant to chocolate coat colour (**b**).

(a) A homozygous black Labrador was crossed with a Labrador with a chocolate coloured coat.

Complete the diagram below to show the genotypes of each of the parents and the F_1 phenotype.

2

Parents: black coat   X   chocolate coat

Genotypes: [   ]   [   ]

F_1 genotype: All Bb

F_1 phenotype: [   ]

(b) (i) Explain what is meant by polygenic inheritance.

1

_____

_____

(ii) State the type of variation shown by polygenic inheritance.
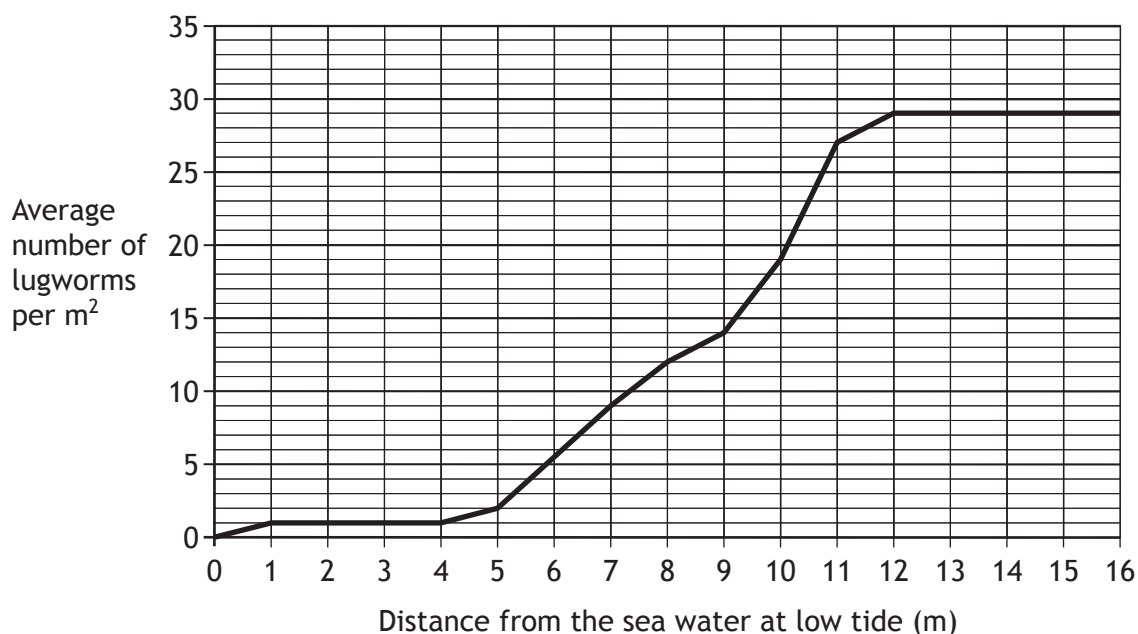
1

_____

Total marks 4

[Turn over

10. (a) Lugworms live on the seashore in dark moist burrows under the sand.

The graph below shows the average number of lugworms at different distances from the seawater at low tide.

Distance from the sea water at low tide (m)

(i) Describe the relationship between the distance from the seawater at low tide and the average number of lugworms per m^2. **2**

_____

_____

_____

_____

(ii) Calculate how many times greater the average number of lugworms at 11 metres is compared to 7 metres from the seawater at low tide. **1**

Space for calculation

_____ times greater

10. (continued)

(b) Dover sole and rex sole are different species of flatfish and are predators of lugworms. Curlews, which are a species of wading bird, also feed on lugworms.

(i) Complete the table below by placing a tick (✓) in the correct box to show the type of competition that would occur between the different predators. **1**

	Type of Competition	
Predator	*Intraspecific*	*Interspecific*
rex sole and curlew		
curlew and curlew		
rex sole and dover sole		

(ii) A curlew gains an average of 165 kilojoules (kJ) of energy daily, by feeding on lugworms.

Select, from the following list, the value of the energy which is used for growth each day by the curlew.

Tick (✓) the correct box. **1**

165 kJ ☐

148·5 kJ ☐

16·5 kJ ☐

0 kJ ☐

Total marks 5

[Turn over

11. During a woodland survey, a group of students measured some abiotic factors. Readings they took included the temperature of the soil and the air.

(a) Name one abiotic factor, other than temperature, which they could have measured in the woodland and describe the method of measuring this factor. **2**

Abiotic factor _____

Method _____

_____

_____

(b) (i) During the survey, the students sampled the leaf litter in the woodland using pitfall traps.

However, when they checked the pitfall traps four days after setting them up, the students discovered that they were all empty.

Describe an error the students might have made which would explain why there were no invertebrates in the traps. **1**

_____

_____

_____

11. (b) (continued)

(ii) The error was corrected and the students set out the pitfall traps once again. The table below shows the types of invertebrates and numbers found.

Invertebrates	Number found
Woodlice	35
Beetles	20
Slugs	0
Spiders	30
Snails	15

Use the information in the table to complete the pie chart below. **2**

(An additional pie chart, if required, can be found on *Page twenty-six*.)
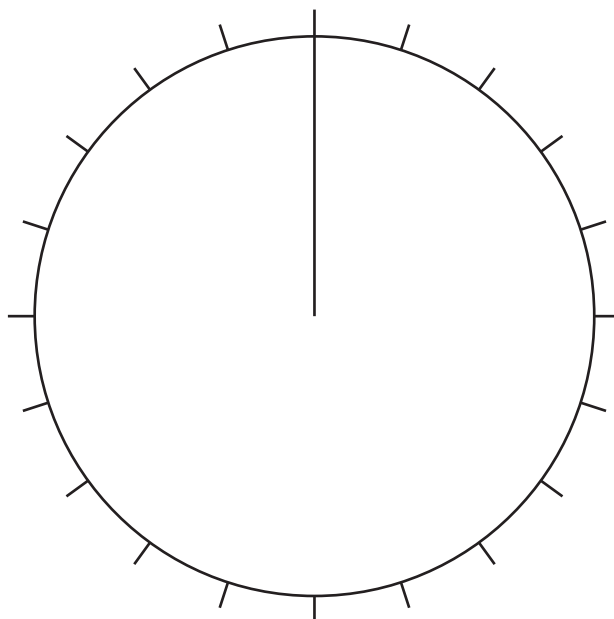
(c) The students saw a large number of butterflies in the woodland.

Give a reason why no butterflies were collected with the invertebrates. **1**

_____

_____

Total marks **6**

12. The following diagram shows the stages in the formation of a new species.

(a) Using the information in the diagram, describe how new species are formed.　**4**

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

12. **(continued)**

(b) Choose either mutation or species and tick (✓) the appropriate box.

Give a definition of the chosen term. **1**

Mutation ☐   Species ☐

Definition _____

_____

_____

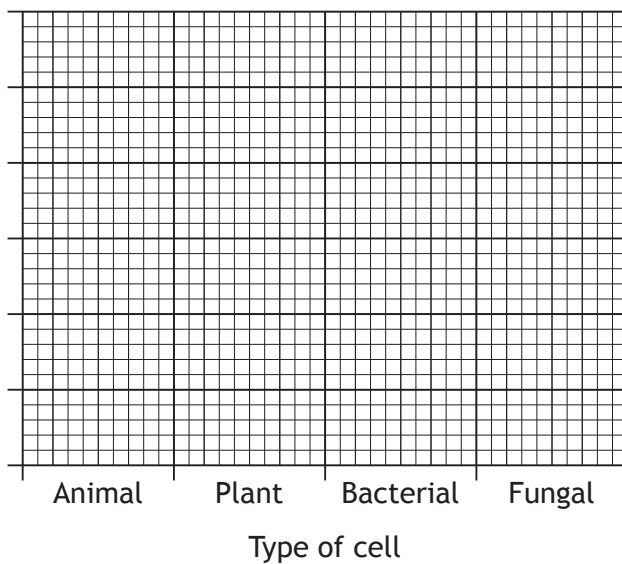(c) In any population, variation exists. Explain why variation is important for the survival of a population. **1**

_____

_____

Total marks   **6**

[END OF QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS

ADDITIONAL GRAPH PAPER FOR QUESTION 1(b)

| Animal | Plant | Bacterial | Fungal |

Type of cell

ADDITIONAL PIE CHART FOR QUESTION 11(b)

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK