N5

National Qualifications 2019

X807/75/01

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

TUESDAY, 30 APRIL

INSTRUCTIONS TO CANDIDATES

Candidates should enter their surname, forename(s), date of birth, Scottish candidate number and the name and Level of the subject at the top of their first answer sheet.

Total marks — 100

SECTION 2 — 75 marks

Attempt ALL questions.

Write your answers clearly on your answer sheet. Clearly identify the question number you are attempting. Any rough work must be written in this booklet.

Marks are shown in square brackets at the end of each question or part question.

Questions marked with an asterisk differ in some respect from those in the printed paper.

An OW in the margin indicates a new question.

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SECTION 1 — 25 marks

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then write the letter at the end of each question.

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

Sample question

The thigh bone is called the

      A   humerus

      B   femur

      C   tibia

      D   fibula.

The correct answer is **B** — femur. You write: Question 7.B

Changing an answer

If you decide to change your answer, cancel your first answer by brailling it out and write the answer you want.

1. (a) The list gives four types of cells.

Bacteria

Fungus

Animal

Plant

  (i) Cell membranes are found in all of these cell types.

Describe the function of the cell membrane. **[1 mark]**

 (ii) Name **one** other structure that is also present in all of these cells. **[1 mark]**

(b) The table gives information on the numbers of mitochondria in different types of mammalian cells.

Cell type	Number of mitochondria per cell			
	Cell 1	Cell 2	Cell 3	Average
Muscle	1352	1203	1450	1335
Skin epithelium	250	330	275	X
Lymphocyte	953	1112	860	975

* (i) Calculate the average number of mitochondria per cell in skin epithelium to complete the table at X. **[1 mark]**

 (ii) Compared to skin epithelium cells, muscle and lymphocyte cells have higher numbers of mitochondria.

Suggest why these cells need more mitochondria. **[1 mark]**

2. Ions move in and out of cells by passive and active processes.

The table shows the concentration of three ions outside and inside a human cell.

Ions	Outside cell (mM)	Inside cell (mM)
Sodium (Na^+)	145	12
Potassium (K^+)	4	139
Chloride (Cl^-)	116	4

(a) Name the process by which sodium ions move into this cell. **[1 mark]**

*(b) Refer to the diagram for Question 2 (b).

(i) Potassium ions (K^+) move by active transport. **[1 mark]**

Using the information in the table, select the correct word or phrase within the brackets to complete the following sentence to describe the direction in which the potassium ions would move on the diagram.

The potassium ions would move (into the cell/move out of the cell).

(ii) Name the type of molecule, found in a cell membrane, which is involved in moving ions by active transport. **[1 mark]**

(c) Calculate how many times greater the concentration of chloride ions is outside the cell compared to inside the cell. **[1 mark]**

* **3.** Enzymes are used to help extract juice from fruit pulp.

A student set up an investigation into the effectiveness of different enzymes on the volume of juice produced.

4 measuring cylinders were collected and a funnel lined with filter paper was placed in each.

For cylinder A, 30 g apple pulp + 1 ml pectinase was placed in the funnel.

For cylinder B, 30 g apple pulp + 1 ml cellulase was placed in the funnel.

For cylinder C, 30 g apple pulp + 1 ml amylase was placed in the funnel.

For cylinder D, 30 g apple pulp + 1 ml water was placed in the funnel.

After 30 minutes, the volume of apple juice collected in the measuring cylinder was recorded and the procedure was then repeated.

The average for each cylinder was calculated and the results are shown in the table.

Cylinder	Liquid added to apple pulp	Average volume of apple juice collected (ml)
A	pectinase	17·6
B	cellulase	3·2
C	amylase	1·8
D	water	1·6

(a) Name the enzyme which was the least effective at extracting juice from the apple pulp. **[1 mark]**

(b) Enzymes can be involved in two types of reaction. The extraction of juice from apple pulp is an example of a degradation reaction.

Name the other type of reaction. **[1 mark]**

(c) Cellulase is an enzyme that speeds up the breakdown of a component of the plant cell wall.

Name this component. **[1 mark]**

(d) All of the enzymes broke down at least some part of the apple pulp to produce apple juice.

What name is given to the substance that an enzyme breaks down? **[1 mark]**

* **4.** Refer to the diagram for Question 4. The diagram represents the process of aerobic respiration in yeast cells.

(a)   (i) Name product S and waste product T. **[2 marks]**

(ii) Name the substance that must be present for yeast to respire aerobically. **[1 mark]**

(iii) Identify which of the two stages releases the larger quantity of ATP. **[1 mark]**

(b) An investigation was carried out into the respiration of yeast. A dough was made containing live yeast and left in optimum conditions. As the yeast respired, the carbon dioxide produced caused the dough to rise. The volume of the dough was measured every 10 minutes for 60 minutes.

The results are shown in the table.

Time (minutes)	Volume of dough (cm^3)
10	8
20	14
30	22
40	26
50	28
60	28

Refer to the diagram for Question 4 (b). The results were also plotted as a line graph.

(i) 1 State the label that should be added to the *y*-axis. **[1 mark]**

2 Identify the time in minutes for the result that has been misplotted. **[1 mark]**

(ii) Predict the volume of dough at 50 minutes if the experiment was carried out at a lower temperature. Give your answer in cm^3. **[1 mark]**

Give a reason for your answer. **[1 mark]**

5. New cells are produced by mitosis throughout life.

(a) Name the cells, found in the early stages of an embryo's development, which have the potential to develop into specialised cells. **[1 mark]**

*(b) Refer to the diagram for Question 5 (b). The flowchart shows the levels of organisation found within a multicellular organism. Sate the missing label at X. **[1 mark]**

(c) State a reason, other than growth, why cells continue to be produced throughout life. **[1 mark]**

(d) Lymphocytes and phagocytes are specialised white blood cells.

Describe the different ways in which these two types of cell destroy pathogens. **[2 marks]**

(e) Name the system in the human body which destroys pathogens. **[1 mark]**

* **6.** Refer to the diagram for Question 6. As part of a study into the health of a group of students, blood glucose readings were taken over a period of time.

The graph shows the readings for one of the students.

(a) Identify the time when this student's blood glucose reached its maximum value. **[1 mark]**

(b) Calculate the percentage decrease in blood glucose between 09:00 and 11:00 hours. **[1 mark]**

(c) By 13:00 hours the blood glucose level had returned to normal from its lowest point.

Describe how blood glucose is returned from low to normal levels in the human body. **[4 marks]**

* **7.** An experiment was carried out to investigate stem height in pea plants.

The parental phenotypes for stem height were tall and dwarf.

(a) The parent plants were both homozygous. When they were crossed the F_1 generation were all tall. These plants were then crossed with each other to produce the F_2 generation.

    (i) Explain what is meant by the term homozygous. **[1 mark]**

   (ii) The dwarf characteristic is recessive.

      Using the information given, explain how this is known. **[1 mark]**

(b)   (i) The expected ratio in the F_2 generation was 3 tall to 1 dwarf.

      Calculate the expected number of tall plants if there were 144 plants produced in this generation. **[1 mark]**

   (ii) The results obtained in the F_2 generation differed from the expected results.

      The actual results were 90 tall and 36 dwarf plants.

      Calculate the simplest whole number ratio of tall to dwarf plants for these results. **[1 mark]**

* **8.** Refer to the diagram for Question 8. Nutrients from food are absorbed into villi found in the small intestine.

The diagram represents a single villus.

(a) Name one type of molecule absorbed by each of the labelled structures, A and B.
     [2 marks]

(b) Explain why having a large number of villi improves the efficiency of absorption in the small intestine. **[1 mark]**

(c) Identify the structural feature of a single villus, that is also found in an alveolus, which increases the efficiency of absorption. **[1 mark]**

* **9.** Refer to the diagram for Question 9. In a study, volunteers were injected with substance V on day 0 and again on day 35. Substance V causes antibodies to be produced.

The graph shows the antibody concentration in the blood of one of the volunteers in response to the two injections. On the graph 1st identifies the time of the 1st injection of substance V and 2nd identifies the time of the 2nd injection of substance V.

(a) Identify the maximum antibody concentration following the first injection, but before the second. **[1 mark]**

Give your answer in mg/100 ml.

(b) Calculate the number of days after the second injection that it took for the antibody concentration to reach its maximum value. **[1 mark]**

(c) The second injection caused a higher concentration of antibody to be produced than the first.

Give **two** other differences in the antibody production in response to the two injections. **[2 marks]**

(d) If the trend continues as shown in the graph, predict the antibody concentration on day 90. **[1 mark]**

Give your answer in mg/100 ml.

10. A study found that exercise can reduce the risk of developing some types of cancer.

Researchers examined the level of exercise of 1·4 million people over an 11 year period and recorded any diagnosis of cancer and when it occurred.

Participants were asked to keep their own record of the frequency and intensity of their exercise.

Those participants who exercised were found to have a reduced risk of developing some types of cancer. These results are shown in the table.

Type of cancer	Average risk reduction (%)
lung	26
kidney	23
stomach	22
myeloma	17
bladder	13

The study did not take into account factors such as diet and smoking, which may have affected the results. The fact that participants were asked to record their own exercise is another limitation of this study.

The doctor in charge of the research suggested that these results support the promotion of exercise as a means of reducing the risk of cancer.

However, it was suggested by a different researcher that further studies would need to be carried out before the results could be considered valid.

(a) Most research starts off with a question. For example, 'Is enzyme activity affected by pH?'

Suggest a question that could have led to the research described above. **[1 mark]**

(b) Name the type of graph that should be used to present the results shown in the table. **[1 mark]**

(c) Suggest one reason why the participants recording their own exercise is described as a limitation. **[1 mark]**

(d) Three factors that could affect the results are age, duration of exercise and type of exercise.

Choose one of these factors.

Describe how the study would be carried out to take the chosen factor into account and improve the validity of the results. **[1 mark]**

*11. (a) Refer to the diagram for Question 11. The food chain represents the transfer of energy from organism to organism.

    (i) Name the process carried out by the gooseberry bush that allows energy to enter the food chain. **[1 mark]**

    (ii) The blue tits are consumers.

    Give another ecological term that describes the role of the blue tits in this food chain. **[1 mark]**

    *(iii) Refer to the diagram for Question 11 (a) (iii). A food chain can be shown as a pyramid of numbers.

    Identify which pyramid would be used to represent the food chain shown in the diagram. **[1 mark]**

   *(b) Refer to the diagram for Question 11 (b). The diagram shows the fates of 20 joules (J) of energy gained by a caterpillar from food.

    (i) Calculate the percentage of the caterpillar's energy intake that is used for growth. **[1 mark]**

    (ii) Write the letter of the fate that allows energy to be passed onto the next level in the food chain shown. **[1 mark]**

    A Heat and movement

    B Growth

    C Faeces

12. Students carried out an investigation into the effect of soil moisture on the percentage ground cover of moss in their school lawn.

A quadrat was used to estimate the percentage ground cover of moss at several sites. Soil moisture was also measured at each of the sites.

The results of the investigation are shown in the table.

Sample site	Average soil moisture (%)	Ground cover of moss (%)
1	18	86
2	14	70
3	15	80
4	11	58
5	13	65
6	12	60
7	22	98
8	30	99
9	35	100

(a) Describe the relationship between average soil moisture and percentage ground cover of moss. **[1 mark]**

(b) Describe how the reliability of these results could be increased. **[1 mark]**

(c) The students also used a soil thermometer to gather data on soil temperature at each of the sample sites.

  (i) Describe what the students should have done each time they used the soil thermometer, to ensure valid results. **[1 mark]**

  (ii) Soil moisture and temperature are examples of abiotic factors.

   Name **one** other abiotic factor that can affect plant growth. **[1 mark]**

(d) (i) The students observed a species of lichen growing on some of the damper parts of the lawn.

   Lichens are indicator species.

   State what is meant by the term 'indicator species'. **[1 mark]**

  (ii) Identify the sample site number that would be least likely to contain this lichen. **[1 mark]**

*13. An investigation was carried out into the conditions needed for photosynthesis.

Before starting the investigation, four plants were de-starched by placing them in the dark for 24 hours.

The plants were then placed in the conditions described below and then left for 48 hours.

Control — plant placed inside a transparent box

Experiment 1 — plant placed inside a transparent box with a chemical to absorb CO_2

Experiment 2 — plant placed inside a black box with a chemical to absorb CO_2

Experiment 3 — plant placed inside a black box

The leaves of each plant were then tested for the presence of starch.

(a) (i) Write the letter(s) to show in which of the following starch would be present after 48 hours. **[1 mark]**

   A Control

   B Experiment 1

   C Experiment 2

   D   Experiment 3

(ii) Explain the purpose of the control. **[1 mark]**

(iii) Explain why experiment 2 is invalid. **[1 mark]**

(iv) State the factor that is being investigated in experiment 3. **[1 mark]**

(b) Name the product of carbon fixation that is converted to starch. **[1 mark]**

14. Antibiotic drugs are only effective in the treatment of bacterial infections. They either kill or prevent the growth of bacteria. Sometimes antibiotics are given but do not have any effect on the particular infection.

(a) The table gives information about the number of cases treated with antibiotics and the success rate for a range of infections.

Type of infection	Number of these cases treated with antibiotics (millions)	Number of these cases successfully treated with antibiotics (millions)	Success rate (%)
ear	23	16·1	70
common cold	18	0	0
chest	16	3·2	20
throat	15	X	48

(i) Calculate the number of cases of throat infections successfully treated with antibiotics to complete the table at X. **[1 mark]**

(ii) Antibiotics have no effect in the treatment of the common cold.

From the information given, suggest a reason why antibiotics have no effect on the pathogen that causes the common cold. **[1 mark]**

(b) The overuse of antibiotics has caused populations of antibiotic-resistant bacteria to evolve. The stages in their evolution are described in the table.

Stage	Description
A	Random mutations in bacteria make some of the bacteria antibiotic-resistant
B	The next generation of bacteria are antibiotic-resistant
C	The surviving bacteria reproduce and pass on the alleles for antibiotic resistance to their offspring
D	Bacterial populations show genetic variation
E	When antibiotics are used, the non-resistant bacteria are killed and the resistant bacteria survive

(i) List the letters from the table in the correct order to show the order of the stages describing how populations of bacteria become resistant to antibiotics. Start the list with the letter D. **[1 mark]**

(ii) Name the process by which the bacteria, best adapted to their environment, survive and reproduce. **[1 mark]**

(iii) Name an environmental factor that can increase the rate of mutation. **[1 mark]**

*15. Refer to the diagram for Question 15. Scientists use bacteria to act as host cells, to produce enzymes commercially by the process of genetic engineering.

(a) Name the structure in the source cell from which the required gene is extracted during the first stage of this process. **[1 mark]**

(b) Describe the stages of the process that would be used to produce genetically engineered bacteria, after the required gene has been extracted from the source cell. **[4 marks]**

[END OF QUESTION PAPER]