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N5

National Qualifications

2025

Biology

Section 2

Tuesday, 27 May

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.

Section 2 — 75 marks

Attempt ALL questions

An ow in the margin indicates a new question.

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

You must clearly identify the question number you are attempting on your answer sheet.

Any rough work must be written on your answer sheet.

Tactile diagrams are produced in a separately bound booklet.

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

[Braille page 2] SECTION 2 — 75 marks

Attempt ALL questions

ow 1. (a) Students carried out an investigation to compare the ultrastructure of typical bacterial and fungal cells.

(i) The table below shows their results for fungal cells.

Using the table, identify if the structures are present in a bacterial cell using the appropriate letter (A-G). Structures present in fungal cell are shown. [1 mark]

[In the table below Structure is followed by: Bacterial cell; Fungal cell.]

Cell wall: A; Yes.

Nucleus: B; Yes.

Mitochondria: C; Yes.

Ribosomes: D; Yes.

Plasmid: E; No.

Cell membrane: F; Yes.

Vacuole: G; Yes.

(ii) The structure of the cell wall in the fungal cells was found to be different to that of a plant cell.

Name the structural carbohydrate that makes up a plant cell wall. (1 **[Braille page 3]** print line) [1 mark]

(b) On average, muscle cells contain 2500 mitochondria, liver cells contain 2000 mitochondria and cheek cells have 200.

Calculate the simple whole number ratio of the number of mitochondria in these cells. [1 mark]

Give your answer as:

_ (muscle cell): _ (liver cell): _ (cheek cell)

(c) Explain why a muscle cell contains a large number of mitochondria. (4 print lines) [2 marks]

[Braille page 4]

ow * 2. Refer to diagram for Question 2. The concentration of some ions within the cell sap of seaweed, the surrounding seawater, and a unicellular organism were measured.

The results are shown in the bar chart.

(a) (i) Name the ion that moves from the seaweed into the seawater by diffusion and give a reason for your choice. [2 marks]

Ion (1 print line)

Reason (4 print lines)

(ii) The unicellular organism must always have a sodium ion concentration below 0.25 mg/L.

Name the process that moves excess sodium ions out of the unicellular organism. (1 print line) [1 mark]

(b) The cell sap of the seaweed was tested to measure the concentration of each ion.

Name the structure in seaweed cells that contains cell sap. (1 print line) [1 mark]

[Braille page 5]

ow 3. Refer to the diagram for Question 3. The enzyme invertase is commonly used to make soft-centred chocolates.

Invertase speeds up the following reaction:

sucrose invertase → glucose + fructose

(a) An investigation into the effect of pH on invertase at different temperatures was carried out.

The results are shown in the graph.

(i) Identify the temperature at which invertase was most active.

Give your answer as: _°C [1 mark]

(ii) State the optimum pH of invertase.

Give your answer as: pH _ [1 mark]

(iii) Predict what would happen to the enzyme activity if the investigation was repeated at 75 °C. (1 print line) [1 mark]

(iv) Describe how this investigation could be changed to find a more exact optimum temperature of invertase. (1 print line) [1 mark]

[Braille page 6]

(b) A different enzyme speeds up the following reaction:

starch → maltose

Explain why invertase would not speed up this reaction. (2 print lines) [1 mark]

[Braille page 7]

ow * 4. Refer to the diagram for Question 4. Interferon is a type of protein made naturally by cells of the immune system. It can be manufactured by genetic engineering and is used to treat viral infections.

(a) Interferon was one of the first human proteins to be manufactured by transferring genes between organisms.

(i) What is a gene? (2 print lines) [1 mark]

(ii) Describe one use of enzymes in the process of genetic engineering. (2 print lines) [1 mark]

(b) (i) Before its manufacture by genetic engineering, interferon was extracted from white blood cells.

45000 litres of blood were needed to produce 400 g of interferon.

Calculate how many litres of blood were required to produce 1 g of interferon.

Give your answer as: _ litres [1 mark]

(ii) During its manufacture by genetic engineering, 85 mg of interferon can be produced per litre of bacterial culture.

[Braille page 8] Calculate the mass in grams of interferon produced in 45000 litres.

(1 g = 1000 mg)

Give your answer as: _ g [1 mark]

(c) Name another type of protein produced by the immune system in response to pathogens. (1 print line) [1 mark]

ow 5. Describe the breakdown of glucose in animal cells when oxygen is present. (8 print lines) [4 marks]

[Braille page 9]

ow * 6. The central nervous system is part of the human nervous system.

(a) The central nervous system (CNS) consists of the brain and one other structure.

Name the other structure. (1 print line) [1 mark]

(b) Refer to the diagram for question 6. The diagram shows a cross section of the human brain with two structures labelled S and T.

(i) Name structure S. (1 print line) [1 mark]

(ii) Give the function of structure T. (1 print line) [1 mark]

(c) State the role of receptors in the nervous system. (1 print line) [1 mark]

[Braille page 10]

ow 7. Refer to the diagram for Question 7. The diagram represents some of the events that occur during reproduction and early growth in humans.

(a) Name the site of sperm production in the body. (1 print line) [1 mark]

(b) Describe how the chromosome complement of a sperm cell differs from cell A. (3 print lines) [1 mark]

(c) Name process B. (1 print line) [1 mark]

(d) Early embryos contain stem cells.

What feature of stem cells makes them important in early embryo development? (1 print line) [1 mark]

[Braille page 11]

ow 8. (a) The ability of a person to roll their tongue is a dominant characteristic represented by the symbol R.

(i) A male with the genotype Rr and a female with genotype rr had a child who was unable to roll their tongue.

State the genotype of their child. (1 print line) [1 mark]

(ii) State whether the child's genotype is homozygous or heterozygous. Give a reason for your choice. (2 print lines) [1 mark]

(iii) The male and female are having another child.

Predict the percentage chance that this child will be able to roll their tongue.

Give your answer as: _% [1 mark]

(b) State which type of variation is shown by tongue-rolling ability. (1 print line) [1 mark]

[Braille page 12]

ow * 9. An investigation was carried out to find out which leaf surface loses most water through transpiration.

Three identical plants growing in pots were selected and a polythene bag was sealed around each pot, enclosing the pot. The plant stem and leaves were not sealed in the polythene bag.

Petroleum jelly was applied to some leaves to prevent water loss.

Plant 1 had no petroleum jelly on leaves.

Plant 2 had petroleum jelly on upper surface of leaves only.

Plant 3 had petroleum jelly on lower surface of leaves only.

The plants were weighed then left for 24 hours at 20 °C before being reweighed.

(a) Name the openings found on leaves that water evaporates through. (1 print line) [1 mark]

(b) Which plant was used as a control in this investigation? [1 mark]

(c) Suggest why it was necessary to cover the plant pots with a polythene bag. (2 print lines) [1 mark]

(d) The results for the investigation are shown in the table.

[Braille page 13] [In the table below, Plant is followed by: Mass of plant at start (g); Mass of plant after 24 hours (g); Percentage decrease in mass of plant (%).]

1: 250; 150.0; 40.

2: 275; 176.0; 36.

3: 220; 211.2; 4.

(i) Explain why the results were calculated as a percentage change. (3 print lines) [1 mark]

(ii) With reference to the aim, give a conclusion for this investigation. (3 print lines) [1 mark]

[Braille page 14]

ow 10. The results of a blood count for two patients are shown.

[In the table below, Component of blood count is followed by: Normal range (units); Patient R (units); Patient S (units).]

White blood cell: 4.0 to 11.0; 6.5; 5.0.

Red blood cell: 4.5 to 5.5; 4.97; 4.01.

Haemoglobin: 130 to 170; 150; 115.

Platelets: 150 to 450; 330; 390.

(a) (i) Which patient has all four components within the normal range? [1 mark]

(ii) Four weeks later, both patients had their blood re-tested.

The haemoglobin content of the blood of Patient S had increased by 20%.

Calculate the number of units of haemoglobin in this second blood count.

Give your answer as: _ units [1 mark]

[Braille page 15] (b) Other than containing haemoglobin, describe one way in which a red blood cell is specialised to carry out its function and explain the advantage of this specialisation. [2 marks]

Give your answer as:

Description (2 print lines)

Explanation (3 print lines)

(c) Two types of blood vessel are arteries and veins.

Compare the structure of these two types of blood vessel. (8 print lines) [3 marks]

[Braille page 16]

ow 11. In a study, scientists interviewed 350 British athletes competing in different sports including: cycling, swimming, rowing, athletics, football, hockey, and rugby.

Approximately half of these athletes have tooth decay compared to a third of adults the same age.

The study showed that these athletes put more effort into looking after their teeth with 95% of them brushing their teeth twice a day compared to 75% of the general public. Only 21% of the general public floss their teeth regularly compared to 44% of the athletes.

The study also found that smoking rates in the athletes were found to be lower and overall diets were better compared to the general public.

However, ‘88% of elite athletes used sports drinks, 56% used energy bars, and 72% used energy gels frequently during training and competitions,’ said one of the researchers, adding that ‘the sugar in these products increases the risk of tooth decay, and their acidity increases the risk of tooth erosion’.

[Braille page 17] (a) The scientists were surprised to find that elite athletes have more tooth decay than the general public.

Use information from the passage to explain why this finding was unexpected. (3 print lines) [1 mark]

(b) Calculate how many of the athletes flossed regularly. [1 mark]

(c) Suggest a reason why this study may not be valid. (2 print lines) [1 mark]

(d) Refer to the diagram for question 11 (d). The diagram is a pie chart showing the nutritional content of a sport energy bar in mass per 100 (g).

Produce a table to show this same information for the four categories shown. [2 marks]

You can write your table in linear braille format as follows.

[In the table below, _ is followed by: _.]

_: _.

_: _.

_: _.

_: _.

[Braille page 18]

ow * 12. Refer to the diagram for Question 12. The diagram shows part of a food web in a pine forest.

(a) (i) Give one example of an organism that is a producer from the food web. [1 mark]

(ii) Give one example of an organism that is a predator from the food web. [1 mark]

(b) Use the words ‘increases’, ‘decreases’, or ‘stays the same’ to suggest what might happen to the size of the squirrel population if all the foxes were removed. [1 mark]

Give your answer as.

Squirrel population: _

Explanation: _

(c) State the term used to describe the role of an organism within its community. [1 mark]

(d) The table shows some features of fungi commonly found in Scotland's pine forests.

[Braille page 19] [In the table below, Fungus is followed by: Maximum cap size (cm); Cap colour; Stem colour.]

Velvet rollrim: 20; mid brown; dark brown.

Sickener: 10; bright scarlet; white.

Earpick fungus: 2; dark brown; dark brown.

Pelargonium bonnet: 1; dark brown; dark brown.

Pinewood gingertail: 2; bright brown; brown.

Use the information in the table to complete the key at (i), (ii) and (iii). [3 marks]

1. Stem colour is not dark brown: Go to 2

Stem colour is dark brown: Go to 3

2. Cap colour is bright scarlet: Sickener

Cap colour is bright brown: (i)

3. Cap colour is dark brown: (ii)

Cap colour is mid brown: Velvet rollrim

4. Maximum cap size is 1 cm: Pelargonium bonnet

[Braille page 20] Maximum cap size is 2 cm: (iii)

[Braille page 21]

ow * 13. An experiment into photosynthesis was carried out. A leaf disc was placed in a test tube filled with water. The leaf disc sank. A lamp was positioned alongside the test tube.

After the lamp was switched on, the time taken for the leaf disc to float to the surface was recorded.

The experiment was repeated five times and the results are shown in the table.

[In the table below, Experiment is followed by: Time taken for disc to float to surface (seconds).]

1: 18.4.

2: 17.8.

3: 16.6.

4: 11.7.

5: 13.8.

(a) Calculate the average time taken for the leaf disc to float to the surface. [1 mark]

Give your answer as: _ seconds

(b) A gas produced during the first stage of photosynthesis diffuses out of the cells, causing the leaf discs to float to the surface.

Name this gas. (1 print line) [1 mark]

[Braille page 22] (c) During photosynthesis the light energy from the lamp is converted into chemical energy.

Name the molecule generated by this chemical energy that is then used in the second stage of photosynthesis. (1 print line) [1 mark]

(d) The second stage of photosynthesis is affected by temperature.

Name this stage and give a reason. [2 marks]

Give your answer as:

Stage: _

Reason: _

[Braille page 23]

ow 14. In an investigation into the distribution of woodlice in a woodland, students collected and counted the woodlice every day for five days using the sampling technique described below.

A hole was dug in the ground and an open container was placed in the hole with the opening level with the soil surface. Leaves were positioned over the top of the container and across the soil surface.

(a) (i) Name this sampling technique. (1 print line) [1 mark]

(ii) Identify two variables that should be kept constant when setting up this sampling technique. [2 marks]

1. (1 print line)

2. (1 print line)

(b) State one way in which the results could be made more reliable. (1 print line) [1 mark]

[Braille page 24]

ow 15. Refer to the diagram for Question 15. The diagram shows the transfer of energy through a food chain in an ecosystem. The numbers represent the energy in the different populations.

(a) Name the type of diagram shown. (1 print line) [1 mark]

(b) 5% of light reaching the plant plankton is converted into new plant material.

Calculate how much energy the plant plankton received. [1 mark]

Give your answer as: _ units

(c) State one way in which energy can be lost from a food chain. (1 print line) [1 mark]

[Braille page 25]

ow 16. A wren is a small bird found in most parts of Britain.

Wrens found on the St. Kilda islands, off the west coast of Scotland, differ from those found on the Scottish mainland in several characteristics including colour, size and wing length.

It is thought that the St. Kilda wren is evolving into a new species.

(a) Suggest how scientists could prove that the St. Kilda's wren is not yet a different species from the Scottish mainland wren. (2 print lines) [1 mark]

(b) The following statements refer to the sequence of events in the possible evolution of a new species.

The statements are not in the correct order.

A - A new species is formed.

B - Natural selection occurs.

C - Part of the mainland population become isolated on an island.

D - Mutation occurs within each sub-population producing variation.

E - Over time each sub-population becomes genetically different.

Rearrange the statements into the correct order by writing the letters to match the correct numbers (i), **[Braille page 26]** (ii), (iii) and (iv) below. The last number (v) has been completed. [1 mark]

(i) → (ii) → (iii) → (iv) → (v) A

Give your answers as:

(i) _

(ii) _

(iii) _

(iv) _

(v) A

(c) Explain how natural selection results in the evolution of a species. (3 print lines) [2 marks]

[END OF QUESTION PAPER]