N5
National Qualifications

2022

Biology

Section 2

Thursday, 19 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

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.

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

An ow in the margin indicates a new question.

[Braille page 2] Section 2 - 75 marks

Attempt **ALL** questions

ow 1. Palisade mesophyll cells are found in leaves and carry out photosynthesis. Refer to the diagram for question **1.**(a)(i). The diagram shows a palisade mesophyll cell with a structure **labelled P.**

ow *1. (a) (i) Name structure P. [1 mark]

Refer to the diagram for question 1.(a)(ii). The diagram shows the outlines of a layer of palisade mesophyll cells viewed under a microscope.

ow *1. (a) (ii) Calculate the average width of a single palisade mesophyll cell in micrometres (µm). Give your answer in µm. [1 mark]

ow 1. (b) Describe the difference that would be found in the ultrastructure of plant cells that do not carry out photosynthesis. [1 mark]

ow *2. The DNA molecule has a characteristic twisted structure.

ow 2. (a) Give the term used to describe the structure of a DNA molecule. _ [1 mark]

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ow 2. (b) The following results show an analysis of the DNA bases contained in a cell.

DNA Base :	Composition(%)
X:	28
Guanine:	22
Y:	22
Z:	28

Which letter in the table represents the base cytosine? [1 mark]

ow 2. (c) (i) Name the type of molecule coded for by a section of DNA. _ [1 mark]

ow 2. (c) (ii) A mutation occurred in a section of DNA as shown.

This is shown below, original code is the top line, the mutated code is the line below.

,c ,a ,t ,g ,t ,a ,a ,a ,t

,c ,a ,t ,c ,t ,a ,a ,a ,t

Describe the effect of this mutation on the molecule produced. [2 print lines] [1 mark]

ow 2.(c) (iii) State one environmental factor that can increase the rate of mutation. [1 print line] [1 mark]

ow *3. An investigation was carried out into the breakdown of cooked egg white by enzymes.
2 g of cooked egg white was placed in each of four test tubes containing different enzyme solutions at different pH levels as described in the table below.

In the table below, Test tube is followed by: Enzyme; pH

A: pepsin; 2
B: pepsin; 7
C: catalase; 2
D: catalase; 7

The test tubes were placed in a water bath at 37° C for 2 hours.

The cooked egg white was then removed and weighed.
The results are shown in the table below.

In the table below, Test Tube is followed by: Mass after 2 hours (g); Change in mass (g); % change in mass.

A: 0.3; __ ; 85.0
B: 1.9; 0.1; 5.1
C: 2.0; 0; 0
D: 2.0; 0; 0

ow *3.(a) Calculate the change in mass for test tube A. This value is missing in the table. Give your answer in g. [1 mark]

ow 3. (b)(i) Explain why the change in mass in test tube B was less than in test tube A. [2 print lines] [1 mark]

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ow 3. (b) (ii) Explain why there was no change in mass in test tubes C and D. (2 print lines] (1 mark]

ow 3. (c) If the investigation was repeated at 70°C, describe the change in the:

3. (c) (i) structure of the active site of the enzymes. [1 print line] (1 mark]

3. (c) (ii) rate of the reaction in test tubes A and B. [1 print line] (1 mark]

ow 4. Describe similarities and differences in the process of fermentation in yeast cells and muscle cells. (10 print lines] (4 marks]

ow *5. Penicillin was the first antibiotic used to treat bacterial infections. Bacteria have been genetically engineered to produce large quantities of penicillin. Refer to the diagram for question 5. The diagram represents some stages of this process.

ow 5.(a) Using information from the diagram:

ow *5. (a) (i) State the letter that represents the bacterial cell [1 mark]

ow *5. (a) (ii) State the letter that represents the gene for penicillin [1 mark]

ow *5. (a) (iii) Name the structure represented by the letter D [1 mark]

ow 5. (b) Describe the next stage in the production of penicillin. [2 print lines] (1 mark]

ow *6. Two test tubes were used to set up respirometers to investigate aerobic respiration in peas. Dead peas were added to tube Hand live peas were added to tube J. A chemical to absorb carbon dioxide was placed at the bottom of each test tube. The peas were placed on a platform above this chemical in the middle of the test tube. Each test tube was stoppered. One arm of a narrow inverted LI-shaped tube was inserted through the stopper into the test tube. The other end of this tube was placed in a beaker filled with coloured liquid. The coloured liquid filled the end of this tube. A scale was placed alongside this arm of the tube to measure change in the coloured liquid level.

When peas respire this alters the composition of the gases in the test tubes, causing a change in the coloured liquid level in this arm of the tube.

Liquid levels were recorded as shown in the table below.

In the table below, Respirometer is followed by: Liquid level at start (mm); Liquid level at 30 minutes (mm); Liquid level at 60 minutes (mm)

H: 0; 0; 0
J: 0; 25.5; 40.8

ow 6. (a) Explain why the same number of peas were placed in both test tubes. [2 print lines] [1 mark]
ow 6. (b) Calculate the percentage increase between the 30 minute and 60 minute readings in tube J. [1 mark] ow 6. (c) Give a suitable conclusion for this investigation. [2 print lines] [1 mark]
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ow 6. (d) Suggest an improvement to this investigation that would make the results more reliable. [2 print lines] [1 mark]
ow* 7. Refer to the diagrams for question 7 (a). The diagrams represent two stages of mitosis.
ow 7. (a) (i) Name the structures that pull the pairs of chromatids apart. _ [1 mark]
ow 7. (a) (ii) Describe what happens immediately after stage C. [2 print lines] [1 mark]
ow 7. (b) Stem cells can divide in order to self-renew. State the feature of stem cells that gives them the potential to develop into different types of cell. _ [1 mark]

ow *8. Cholesterol is a fatty substance found in blood. High cholesterol levels can be caused by a condition known as familial hypercholesterolemia (FH).
Refer to the diagram for question 8. The diagram shows part of a family tree showing the inheritance of FH.

'A' represents the FH allele.
'a' represents the non-FH allele

ow 8. (a) Use the information given about the male in the parental generation to explain how it is known that the FH allele is dominant. [3 print lines] [1 mark]

ow 8. (b) The unaffected female in the F2 generation has a child with a male who is homozygous dominant for FH. State the percentage chance of their child having FH. [1 mark]

ow 8. (c) Identify the type of variation shown by FH. _ [1 mark]

ow *9. Refer to the diagram for question 9. The diagram shows the process of fertilisation in animals.
ow 9. (a) Name the organ that produces egg cells. _ [1 mark]
ow 9. (b) Choose the correct word from the options in the brackets to complete the following sentence. [1 mark]

Cell Y contains a (haploid/ diploid) number of chromosomes.

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ow 9. (c) In vitro fertilisation (IVF) is a technique that can be used to help people with fertility problems to have a baby. The table shows the results of IVF treatments for women of different ages.

Age of woman (years);	IVF treatments resulting in births (%)
Under 35;	32.2
35-37;	27.7
38-39;	22.0
40-42;	14.0
43-44;	4.4
45+;	1.9

ow 9. (c) (i) Calculate how many times greater the chance of a 38 year old woman giving birth to a baby is compared to that of a 44 year old woman. (1 mark]
ow 9. (c) (ii) Calculate the number of births likely to occur if an IVF clinic treated 250 women aged 41. (1 mark]
ow 9. (d) One of the causes of fertility problems is that some sperm are unable to swim to the egg due to a lack of energy. Name the organelle that is low in number in these affected sperm. _ (1 mark]

ow 10. Multicellular organisms require efficient communication amongst their cells, tissues and organs.
ow 10. (a) (i) Name the chemical messengers carried from one part of the human body to another in the blood. _ (1 mark]
ow 10. (a) (ii) Explain why only the target tissues are affected by these chemical messengers. [3 print lines] (2 marks]
ow 10. (b) Chemical messengers are also found in plants. Name a transport structure through which these chemicals could flow to move around the plant. _ [1 mark]

ow *11. A piece of mammal tissue is magnified to show a blood capillary surrounded by body cells. At this magnification, the blood capillary is shown to be just wider than the red blood cells passing along it.
ow 11. (a) (i) Name a gas that is transported from the body cells into the capillary. _ [1 mark]
ow 11. (a) (ii) Name the method of transport for this gas. _ [1 mark]
ow 11. (b) Give a feature of a capillary network that increases the efficiency of absorption of materials. _ (1 mark]

ow 12. Measles in the UK

Measles is a disease that can be prevented through two doses of the MMR vaccine. The target set by health experts to achieve measles-free status is to have at least 95% of the population vaccinated. The World Health Organization declared the UK measles-free in 2016.

However, since 2016, cases of measles in the UK have been increasing, with too few people being vaccinated. It was suggested by experts that when measles cases became less common, some people believed that the threat of the disease was less.

[Braille page 7] Another factor was the publication in the late 1990s of a controversial, and since discredited, piece of research wrongly linking the MMR vaccine with autism.

In 2018, there was a marked increase in reported cases, with 994 cases in England and Wales, compared with 284 cases in 2017. There were 307 cases across the UK during the first three months of 2019. In 2019, only 87% of the population in England received their second dose of MMR. In both Wales and Scotland it was 92%, and in Northern Ireland it was 91%.

ow 12. (a) Measles is caused by a pathogen. State the meaning of the term 'pathogen'. [1 print line] [1 mark]

ow 12. (b) (i) Describe the relationship between the uptake of the vaccine and the number of cases of measles. [3 print lines] [1 mark]

ow 12. (b) (ii) Suggest a reason why the uptake of the vaccine in the UK has been lower since 2016. [2 print lines] [1 mark]

ow *12.(c) Calculate the simplest, whole number ratio, of measles cases in England and Wales in 2017 to 2018. Give your answer in the following format:

__ (2017): __ (2018) cases [1 mark]

ow 12. (d) Using data from the passage, explain why Scotland lost its measles-free status in 2019. [2 print lines] [1 mark]

ow *13. Refer to the diagram for question 13. The diagram shows apparatus that can be used to investigate the effect of the total leaf surface area on the rate of water uptake. The rate of water uptake can be calculated by measuring the distance the air bubble moves along the capillary tube in a set time.

ow 13. (a) Name this apparatus. _ [1 mark]

ow 13. (b) The apparatus was set up and the distance moved by the bubble in 10 minutes was recorded. One of the leaves was then removed from the plant and the distance moved by the bubble was measured over another 10 minute period. This was repeated until only one leaf remained. The results are shown in the table below.

Number of leaves:	Distance moved by bubble in 10 minutes (mm)
5:	85
4:	69
3:	52
2:	12
1:	8

With reference to the aim, give a conclusion for this investigation. [2 print lines] [1 mark]

ow 13. (c) (i) Name the process responsible for the movement of water and its evaporation from the leafy shoot. _ [1 mark]

ow 13. (c) (ii) Water evaporates from leaves through stomata. Name the cells surrounding the stomata that control their opening and closing. _ (1 mark]

ow * 14. A student set up four round Petri dishes of equal size to investigate competition in cress seeds of the same species.

[Braille page 8] The seeds were evenly scattered on moist filter paper and left to germinate (grow) in the dark.

- Dish A contained 50 seeds
- Dish B contained 100 seeds
- Dish C contained 150 seeds
- Dish D contained 200 seeds

ow 14. (a) (i) Identify a variable, not already mentioned, that should have been kept the same for each dish. [1 mark]

ow 14. (a) (ii) The number of seeds germinating in each dish was counted. The table below shows the results.
In the table below, Dish is followed by: Seeds per dish; Number of germinating seeds; Germinating seeds(%)

A: 50; 45; 90
B: 100; 80; 80
C: 150; __; 60
D: 200; 60; 30

[Braille Page 9] Calculate the number of germinating seeds in dish c. This value is missing in the table. [1 mark]

ow 14. (a) (iii) Competition was greatest in dish D. Explain why this conclusion was drawn. [2 print lines] [1 mark]

ow 14. (b) Name the type of competition that occurs among these germinating seeds. _ [1 mark]

ow 14. (c) Explain why competition in ecosystems occurs. [2 print lines] [1 mark]

ow 15. Light intensity readings were taken at 5 sites evenly spaced along a transect line running from an open grass field to a woodland.

- Sites 1 and 2 were in the open grass field
- Site 3 was at the edge of the woodland
- Sites 4 and 5 were in the woodland

ow 15. (a) Name the apparatus used to measure light intensity and give one precaution that should be taken when using it to minimise error. [2 marks]

ow 15. (a) (i) Apparatus__

ow 15. (a) (ii) Precaution [2 print lines]

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ow 15. (b) Three readings were taken at each site at the same time on different days. The results are shown in the table.

In the table below, Site is followed by: Light intensity reading (lux) - Day 1, Day 2, Day 3.

1: 18,160; 17,845; 18,180
2: 11,500; 11,306; 11,494
3: 14,600; 15,550; 14,590
4: 5,300; 4,800; 5,275
5: 3,600; 3,200; 3,610

ow 15. (b) (i) Suggest a reason why the readings taken on day 2 were lower than the readings on days 1 and 3. [2 print lines] [1 mark]

ow 15. (b) (ii) Explain why three readings were taken at each site. [2 print lines] [1 mark]

ow 15. (c) Light intensity is an example of an abiotic factor. Name one other abiotic factor. _ [1 mark]

ow 16. When light is absorbed by a plant, photosynthesis takes place and as a result substance K is released from the leaves.

ow 16. (a) Name substance K. _ [1 mark]

ow 16. (b) Describe the energy change that takes place during the first stage of photosynthesis. [2 print lines] [1 mark]

ow * 16. (c) Refer to the graph for question 16 (c). The graph shows the effect of increasing light intensity on the rate of photosynthesis at two different temperatures. All other factors were kept constant. Identify the limiting factor at each of the points M and N. [2 marks]

ow 16. (c) (i) M __ [1 print line]

ow 16. (c) (ii) N __ [1 print line]

ow * 17. A study was carried out to investigate the effect of using the chemicals ethanol and methanol on bacterial growth. Controls without either chemical were also set up.
Refer to the bar chart for question 17. The bar chart shows the growth of three species of bacteria as a percentage of the overall bacterial growth in the control experiment.

ow 17. (a) (i) Use the bar chart to complete the table of results below for V. cholerae and S. paratyphi. [1 mark]
In the table below, Species of bacteria is followed by: Bacteria growth (percentage of control) with ethanol treatment; Bacteria growth (percentage of control) with methanol treatment

S. flexneri: 35; 55
V. cholerae: __; __
S. paratyphi: __; __

ow 17. (a) (ii) The label on the vertical axis of the bar chart is missing. State the label that should be added to this axis. [1 mark]

ow 17. (b) It was concluded that ethanol was more effective than methanol at preventing bacterial growth. State whether this conclusion is valid or invalid and give a reason for your answer. [2 print lines] [1 mark]

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ow 17. (c) The researchers used a 6% ethanol solution in their study. Predict the effect of using a 3% ethanol solution instead, on the growth of the bacteria. [2 print lines] [1 mark]

ow *18. (a) Plant growth can be improved if the soil has a suitable nitrate content.

ow 18. (a) (i) Describe the use of nitrates in a plant. [1 print line] [1 mark]

ow 18. (a) (ii) Nitrates can be found in compost.
The table below gives some information about the nutrient content of three different composts.
In the table below, Type of compost is followed by: Carbon content (g/100g); Nitrogen content (g/100g); Carbon: Nitrogen ratio

R: 9.45; 1.35; 7:1
S: 14.40; __; 24:1
T: 9.80; 0.20; 49:1

Calculate the nitrogen content in 100g of composts. This value is missing in the table. Give your answer in (g/100g). [1mark]

ow 18. (b) Nitrates can leach from the soil into nearby rivers.

ow 18. (b) (i) Give the term that describes the increased growth of algae caused by leached nitrates. __ [1 mark]

ow 18. (b) (ii) Explain how this increase in algae can cause aquatic plants in a river to die. (3 print lines] [2 marks]

[END OF QUESTION PAPER)