| Centre Number | Candidate Number | Candidate Name |
|---|---|---|
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**NAMIBIA SENIOR SECONDARY CERTIFICATE**

# BIOLOGY HIGHER LEVEL

# 8321/2

PAPER 2

2 hours 15 minutes

Marks 100

**2020**

Additional Materials: Ruler

## INSTRUCTIONS AND INFORMATION TO CANDIDATES

- Candidates answer on the Question Paper in the spaces provided.
- Write your Centre Number, Candidate Number and Name in the spaces at the top of this page.
- Write in dark blue or black pen.
- You may use a soft pencil for any rough work, diagrams or graphs.
- You may use a non-programmable calculator.
- Do not use correction fluid.
- Do not write in the margin *For Examiner's Use*.

### Section A

- Answer **all** questions.
- You are advised to spend no longer than 1 hour on Section A.

### Section B

- Answer **two** questions.
- Write your answers on the answer sheets provided at the back of the booklet.
- The number of marks is given in brackets [ ] at the end of each question or part question.

| For Examiner's Use | |
|---|---|
| **Section A** | |
| **Section B** | |
| **Question .....** | |
| **Question .....** | |
| **Total** | |

| | |
|---|---|
| *Marker* | |
| *Checker* | |



This document consists of **20** printed pages.

**Republic of Namibia**

**MINISTRY OF EDUCATION, ARTS AND CULTURE**

## SECTION A

**1** In an experiment, the percentage of human haemoglobin that is saturated with oxygen was compared with the percentage of mouse haemoglobin that is saturated with oxygen. Oxygen saturation was measured at different partial pressures of oxygen.

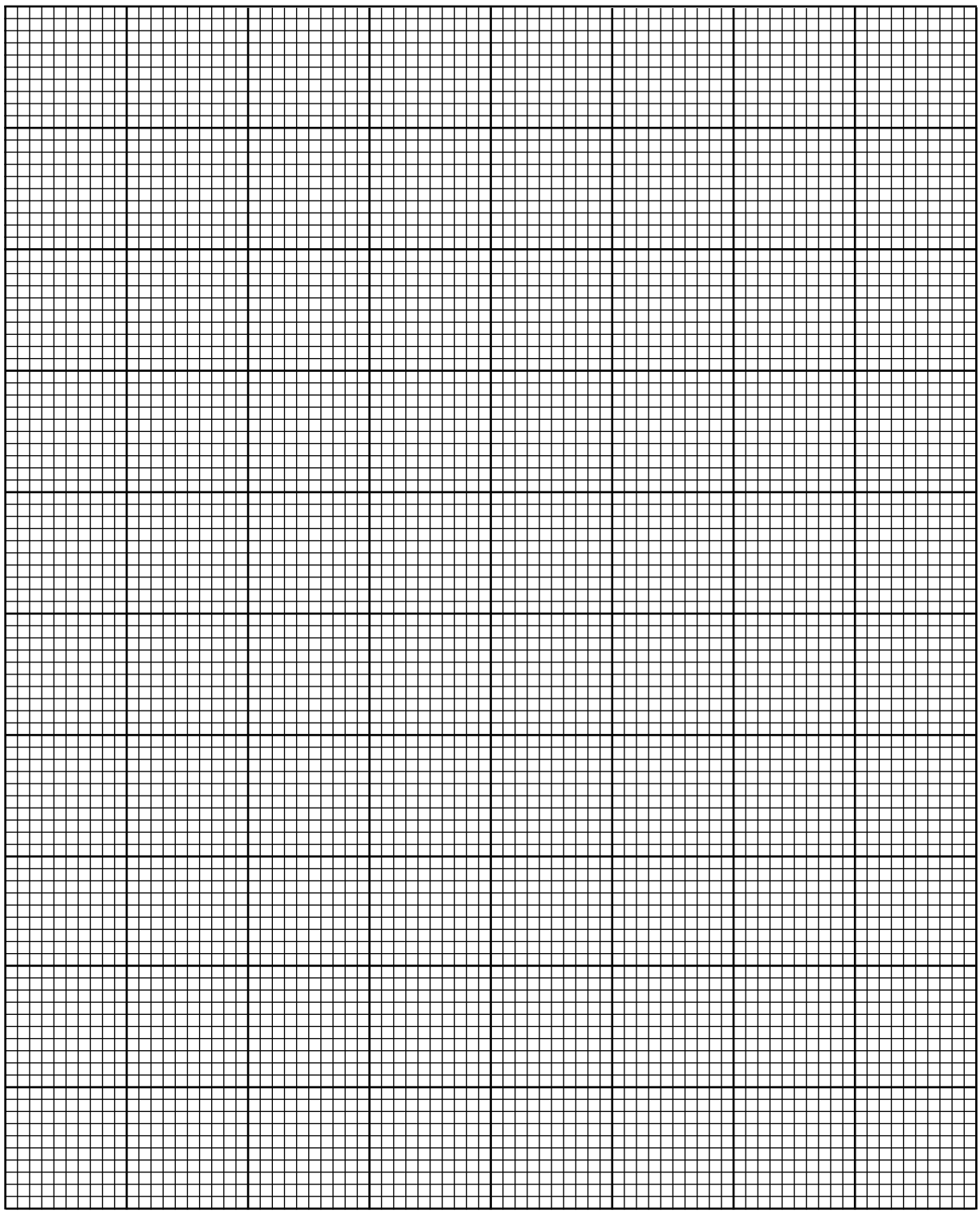
The results were recorded in Table 1.1.

**Table 1.1**

| partial pressure of oxygen/kPa | percentage saturation of haemoglobin with oxygen | |
|---|---|---|
| | human haemoglobin | mouse haemoglobin |
| 1 | 8 | 3 |
| 3 | 40 | 10 |
| 5 | 71 | 25 |
| 7 | 85 | 50 |
| 9 | 92 | 75 |
| 11 | 96 | 90 |
| 13 | 98 | 97 |
| 15 | 98 | 98 |

*For Examiner's Use*

**(a) (i)** Use the data in Table 1.1 to plot the oxygen dissociation curves for **both** the human haemoglobin and the mouse haemoglobin.



[5]

**(ii)** In humans the partial pressure of oxygen in the lungs is approximately 13.4 kPa and in the blood of the pulmonary artery it is 3.6 kPa.

Use your graph in **(a) (i)** to calculate the increase in the percentage saturation of haemoglobin as it passes through the lungs from the pulmonary artery. Show your working.

[2]

**(b)** Describe the differences in the dissociation curves for the human and the mouse.

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..... [3]

**(c)** Haemoglobin is found in red blood cells. Describe **three** other adaptations of the red blood cells to their function of transporting oxygen.

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..... [3]

**[13]**

*For Examiner's Use*

**2** Blood is made of the same cell types, but not all blood is the same. There are four major blood groups determined by the presence or absence of two antigens on the surface of red blood cells.

**(a)** State the type of variation shown by the ABO blood group types. Justify your answer.

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..... [3]

**(b)** A family consists of two parents and their three children. One child is adopted. The blood types of all the family members are summarized in Table 2.1.

**Table 2.1**

| **person** | **blood type** |
|---|---|
| father | AB |
| mother | homozygous A |
| child 1 | AB |
| child 2 | A |
| child 3 | B |

Determine, using a genetic cross, which child has been adopted. Include a genetic diagram, and the genotypes and phenotypes of **both p**arents and **two** of their children in your answer.

[6]

**(c)** Table. 2.2 shows how blood types can be matched for safe transfusions.

**Table 2.2**

| blood group | antigens present | antibodies produced | can donate red blood cells to: |
|---|---|---|---|
| **O** | none | A and B | anybody (universal donor) |
| **A** | antigen A | A | A and AB |
| **B** | antigen B | B | B and AB |
| **AB** | antigen A and B | none | AB only |

Explain why persons with blood group O can donate blood to anybody but only receive blood from another person with blood group O.

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..... [4]

**[13]**

**3** Acacia is a large genus of trees and shrubs of the subfamily Mimosiodeae of the pea family Fabaceae. A Namibian example of these trees is the *Acacia erioloba*.

**(a)** Use the information in the introduction to classify this tree into its correct kingdom, family, genus and species.

kingdom .....

family.....

genus .....

species..... [2]

**(b)** The branch of the camel thorn tree shown in Fig. 3.1 develops round, yellow, sweet-scented flowers in spring. The fruit is a light grey seedpod with fine hairs on the surface. Rhino, eland, kudu and elephants collect the pods from the ground and eat them. The seed of camel thorn is covered with a tough, protective membrane.


**Fig. 3.1**

**(i)** Suggest a possible pollinator for these flowers and give a reason for your answer.

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**(ii)** Suggest how these seeds are distributed.

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**(iii)** Lions are predators of eland, kudu and baby elephants.
Use all the information provided in **(b)** to draw a food chain for the camel thorn tree.

[3]

**(c)** The camel thorn tree has a strong root system that can absorb water from a depth of 60 m. The green leaves remain on the tree during most of the year. A pair of sharp thorns at the base of the leaves provides protection against hungry herbivores.

It has been established that nutrient levels in the soil under large trees is distinctly higher than at a distance from such trees.

Using the information provided and Fig. 3.1, explain how the camel thorn tree is adapted to survive in the arid conditions in Namibia.

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**(d)** Suggest an explanation for the high nutrient level in the soil under large camel thorn trees.

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**[17]**

**4 (a)** Fig. 4.1 shows a synapse.

Label the structures **A** – **F**.

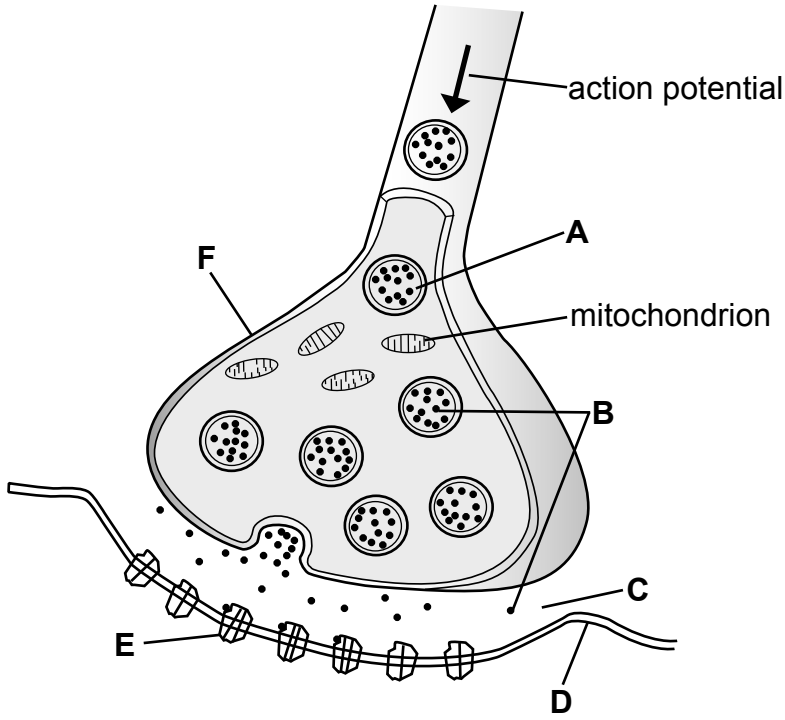


**Fig. 4.1**

**A** .....

**B** .....

**C** .....

**D** .....

**E** .....

**F** ..... [6]

**(b)** Explain the presence of the large numbers of mitochondria in a presynaptic neurone.

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**(c)** Opioids are used as painkillers. The major function of opioids is to inhibit neurotransmitter release. Explain how this effect of the opioids makes them efficient painkillers.

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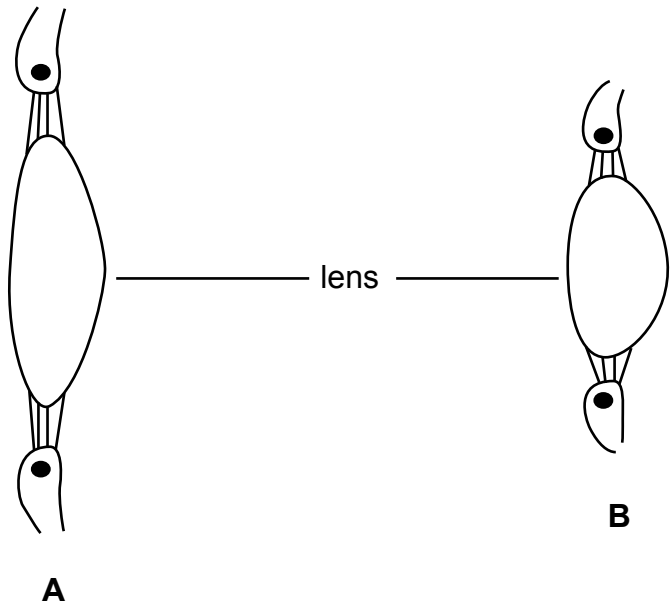


**Fig. 4.2**

**(d) (i)** Fig. 4.2 shows the lens and ciliary muscles of the eye when focusing on a near and distant object.

State which diagram **A** or **B** shows the lens when looking at an object nearby. Give a reason for your answer.

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..... [2]

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**(ii)** Describe the changes that take place when the eye needs to change focus from an object nearby to an object far away.

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..... [3]

**[17]**

## SECTION B

Answer any **two** questions from this section.

Write your answers on the answer sheets provided at the back of the booklet.

**5** A number of environmental factors play a role in seed germination.

**(a)** Name **three** of the environmental factors and describe the role of each in the germination process. [6]

**(b)** Plant growth regulators prevent the germination of the seed during a drought. Plant growth regulators also set off a chain of reactions inside the seed which lead to the germination of the seed. Name **two** plant growth regulators and describe their roles in germination. [8]

**(c)** Seedlings show tropic responses to light and gravity. State the plant growth regulator responsible for these responses and explain their importance to the growth of the seedling. [6]

**[20]**

**6** Hormones control the reproductive process in humans.

**(a)** Name and describe the role of the hormone responsible for the development of secondary sexual characteristics in a human male. [4]

**(b)** **(i)** From puberty to menopause a woman experiences monthly menstrual cycles. A number of hormones are involved in these cycles. Name and describe the role of **four** of these hormones from the start of one cycle to the start of the second cycle. Refer to the place of production in your answer. [12]

**(ii)** One of these female hormones is also used in fertility treatment. Explain the role of this hormone and how it could help a woman to fall pregnant. [4]

**[20]**

**7** The Health Ministry announced that 11 902 people had contracted malaria in Namibia, between January and March 2019, 18 people had died.

This number 11 902 shows an increase in the number of cases of malaria patients in Namibia.

**(a)** Three different living organisms are involved in the spread of malaria. Name the **three** living organisms and classify them into the respective kingdoms they belong to, giving reasons for each placement. [8]

**(b)** Suggest **six** different methods that can be used to control malaria. For each method of control, discuss a disadvantage of using the method. [12]

**[20]**

**8** **(a)** The nitrogen cycle is a cycle of natural processes by which nitrogen passes from air to soil to organisms and back into the air involving the following four processes: nitrogen fixation, nitrification, ammonification and denitrification. Describe, using examples, each of these processes. [8]

**(b)** Describe the impact an increased nitrogen oxide emissions has on

**(i)** human health. [2]

**(ii)** the environment. [10]

**[20]**

*For Examiner's Use*

## ANSWER SHEET FOR SECTION B

**[Turn over**