Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

BIOLOGY ORDINARY LEVEL

4322/3

PAPER 3 Applied Practical Skills

2 hours

Marks 60

2021

Additional Material: 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 diagrams, graphs or rough working.
- Do not use correction fluid.
- You may use a non-programmable calculator.
- Do not write in the margin *For Examiner's Use*.
- Answer **all** questions.
- The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
4	
5	
Total	

Marker	
Checker	

This document consists of **15** printed pages and **1** blank page.

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

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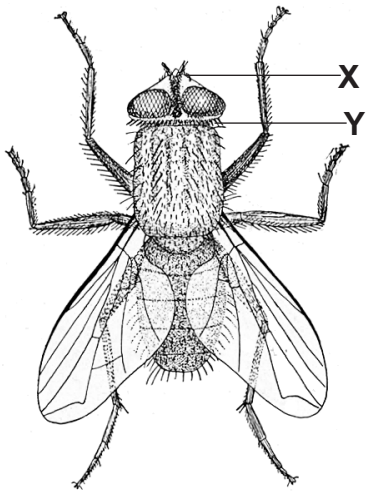
1 (a) Fig. 1.1 is a diagram of insect **A**.



X5

Fig. 1.1

Make a large drawing of the head of insect **A**.

[6]

(b) Fig. 1.2 is a diagram of insect **B**.

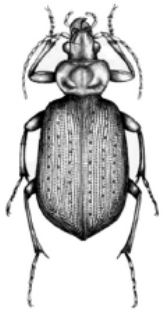


Fig. 1.2

(i) List **two** similarities which are visible in the diagrams of the two insects.

1 .....

2 ..... [2]

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(ii) Construct a table, with ruled lines, and record **two** visible differences, between insect **A** and insect **B**.

[2]

(c) The photograph in Fig. 1.1 shows insect **A** magnified X5.

Measure the distance between points X and Y on Fig. 1.1 and use this measurement to calculate the magnification of your drawing, allowing for the X5 magnification of the photograph.

Distance between points **X** and **Y**: .....

Magnification of your drawing: ..... [2]

[12]

2 Fig. 2.1 shows the apparatus used to determine the rate of photosynthesis of water weed at different light intensities.

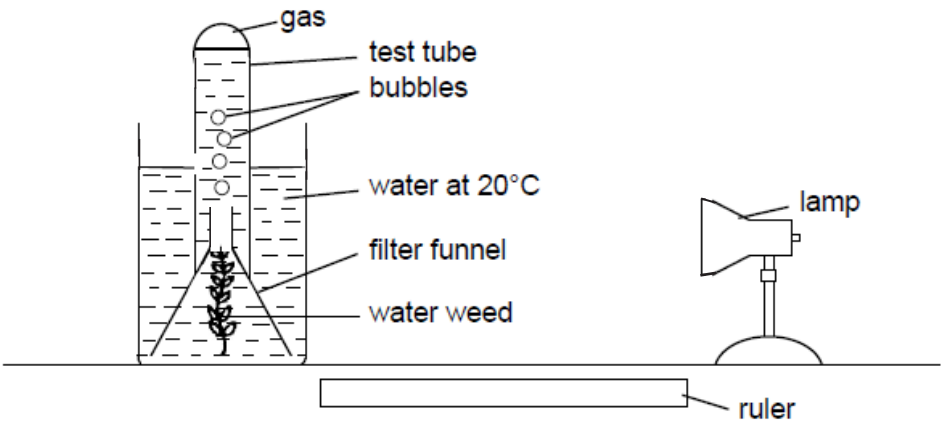

Fig. 2.1

The rate of photosynthesis was measured by counting the number of bubbles produced per minute. The only source of light in the room was the lamp.

The light intensity was decreased by moving the lamp away from the plant.

Fig. 2.2 shows the results of this experiment.

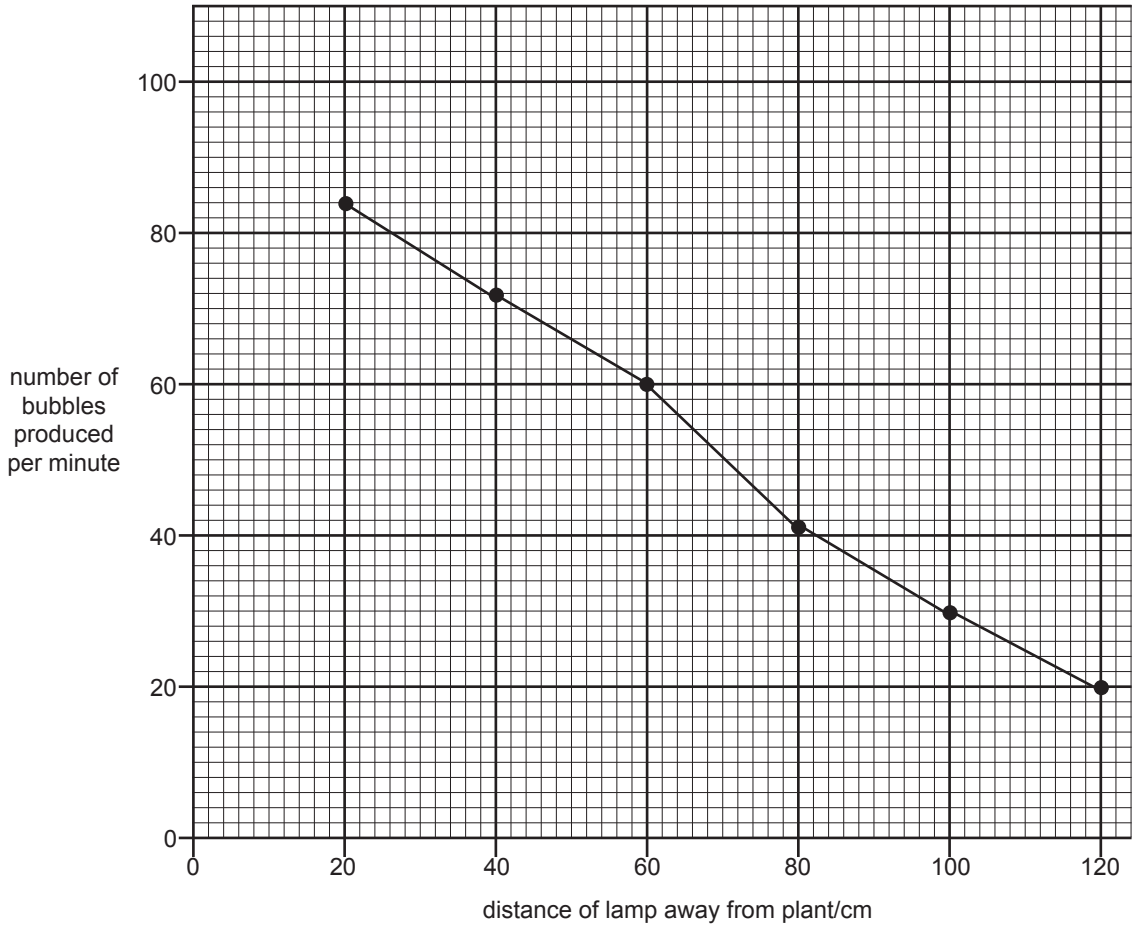

Fig. 2.2

(a) (i) Describe the relationship shown by the graph.

.....

..... [1]

(ii) Using the graph, state how many bubbles/min you would expect to be produced with the lamp at a distance of 50 cm from the plant.

..... [1]

(iii) Sodium hydrogencarbonate was added to the water before the experiment began. Explain why this was added.

.....

..... [1]

(iv) Name the gas produced by the plant.

..... [1]

(v) Describe the test for the gas named in **(iv)**.

..... [1]

(vi) Describe and explain the results you would expect if the experiment was repeated with the temperature of the water 10°C higher.

.....

.....

.....

..... [2]

(b) When testing a leaf for starch, certain instructions need to be followed. The instructions below are in the wrong order.

A Soften the leaf by dipping it into hot water for about 30 seconds.

B Place the leaf in alcohol and boil the tube in a beaker of hot water for about 5 minutes.

C Remove the leaf from the plant and dip it into boiling water for about one minute.

D Cover the leaf with iodine solution.

E Remove the leaf when it has lost its green colour.

F Observe and record the colour of the leaf.

(i) Write the letters of the instructions in the correct order.

..... [2]

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(ii) Explain why procedure **B** is necessary.

.....

.....

.....

..... [1]

(iii) Explain why procedure **B** uses a beaker of hot water for boiling.

.....

..... [1]

(iv) Explain why procedure **C** is necessary.

.....

..... [1]

[12]

3 Paper chromatography can be used to separate the different pigments in leaves.

(a) Students used paper chromatography to separate the pigments found in leaves. Fig. 3.1 illustrates the results of the chromatogram.

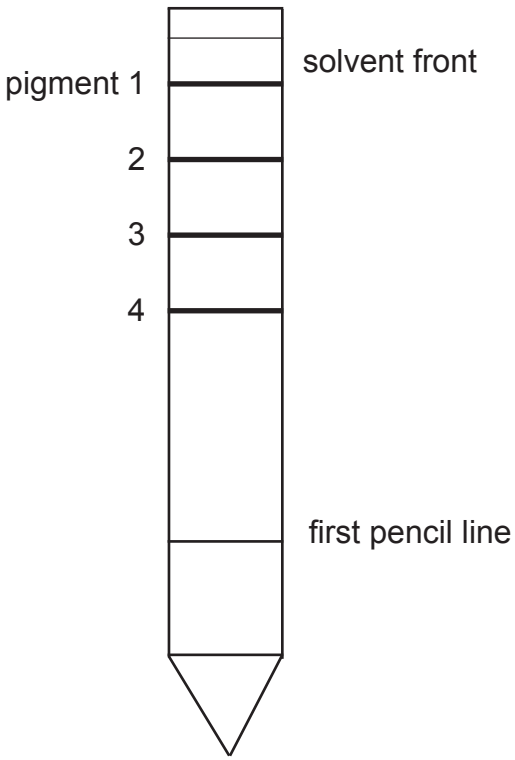

Fig. 3.1

(i) Measure the distance from the first pencil line to the height for each pigment. Record these values in Table 3.1 (column **D**). [1]

(ii) The colour of the pigments can be a general guide to identify the pigments or the Rf value can be used. The distance that the solvent front moves is 7 cm. Calculate the Rf value for each pigment and record the values in Table 3.1 (column **E**) using the formula shown.

$$\text{Rf} = \frac{\text{distance pigment travels}}{\text{distance the solvent travels}}$$

[1]

(iii) Determine the name of each pigment using the information below. Complete column **F** in Table 3.1.

pigment	Rf values
chlorophyll b	0.42
xanthophyll	0.77
chlorophyll a	0.60
carotene	0.98

[1]

(iv) Which pigment moved the greatest distance? What would cause this to happen?

.....

..... [2]

Table 3.1

A	B	C	D	E	F
pigment	colour of pigment	distance solvent front travels (cm)	distance pigment travels (cm)	Rf value	name of pigment
1	orange	7			
2	yellow	7			
3	blue - green	7			
4	yellow - green	7			

(b) A student placed the plants in a room with green light only. Would these plants be able to grow?

Explain your answer.

.....

..... [1]

(c) Digestion of starch occurs in the small intestine.

A student investigated the effect of temperature on the digestion of starch by amylase.

The student set up three tubes at different temperatures, each containing starch, amylase and iodine solution. The student calculated the rate of reaction and recorded it in Table 3.2.

Table 3.2

		rate of reaction / arbitrary units			
tube	**temperature /°C**	**trial 1**	**trial 2**	**trial 3**	**average**
A	10	2	6	1	
B	20	8	9	10	
C	30	12	10	11	

(i) Calculate the average rate of reaction for each tube. Write your answers in Table 3.2.

Space for working.

[1]

(ii) Identify the optimum temperature for the digestion of starch in this experiment **and** give a reason for your choice.

optimum temperature .....

reason .....

.....

..... [2]

(iii) The student decided that the result collected for tube **A** during trial 2 was anomalous.

Suggest a reason for their decision.

.....

..... [1]

(iv) The independent variable is the variable that is changed in an investigation. The dependent variable is the variable that is measured in an investigation.

Identify the independent and dependent variables in this investigation.

independent variable .....

.....

dependent variable .....

..... [2]

[12]

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4 You are going to consider two investigations into how the eye works.

Read through the instructions for each investigation before carrying it out.

(a)
- With your left hand cover your left eye to start the first investigation.
- With your uncovered right eye, look steadily at the cross shown in Fig. 4.1 below.
- do not let your gaze wonder.
- Slowly move your head towards the question paper while looking steadily at the cross in Fig. 4.1.
- Notice what happens to the dot **without looking directly at it**.

At a certain distance from your eye the dot will disappear from view.

Fig. 4.1

Use your ruler to measure the distance of the question paper from your eye when the dot disappears.

Record this distance.

distance ..... [1]

(b) (i) A student in a brightly lit room covered both of her eyes with her left hand while holding a mirror in the other hand. The student closed her eyes. She counted slowly to 60. Then she quickly removed her hand from her eyes, opened them and looked in the mirror. Make drawings of what her iris and pupil would look like, as they appeared when the eye was first uncovered and about one minute later.

Appearance of iris and pupil when first uncovered.	Appearance of iris and pupil about one minute after uncovering.

[2]

For Examiner's Use

(ii) Explain how the changes shown between your drawings in **(b)(i)** occurred and how these changes help the functioning of the eye.

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.....

.....

.....

.....

..... [4]

(c) In an investigation into the effects of alcohol on the nervous system, people were asked to carry out a test on their reaction time.

The person being tested looked at a coloured block on a computer screen.
As soon as the colour changed they pressed a button.
The time taken to press the button was recorded by the computer.
This was their reaction time.

Twenty people were tested before and after consuming a drink containing the same concentration of alcohol.

Table 4.1 shows the results of this investigation.

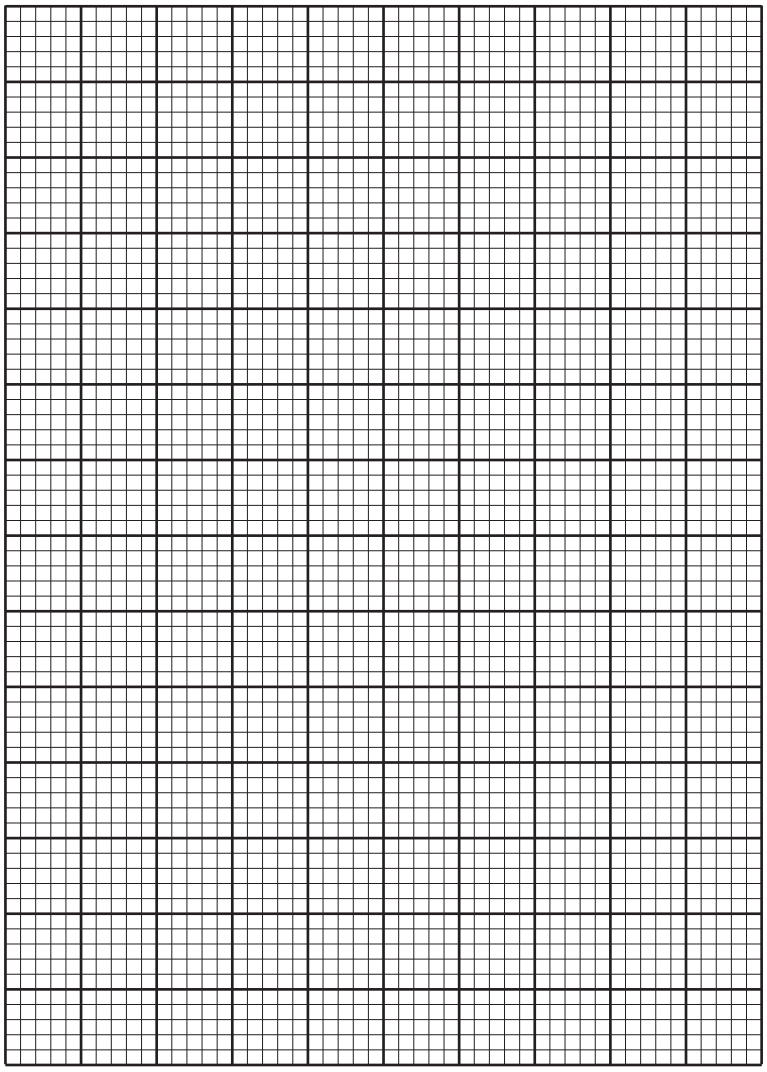
Table 4.1

test person	reaction time before consuming alcohol / milliseconds	reaction time after consuming alcohol / milliseconds
1	272	322
2	310	350
3	225	270
4	243	290
5	240	308
6	264	315
7	201	238
8	262	300
9	225	252
10	235	278
11	225	253
12	247	271
13	226	266
14	194	220
15	206	239
16	309	340
17	223	261
18	243	286
19	270	316
20	180	225
mean	240	

(i) Calculate the mean for the reaction time after consuming alcohol.

Write your answer in Table 4.1. [1]

(ii) Plot a bar chart to show the **mean** reaction time of the people tested before and after consuming alcohol.



[3]

(iii) The range of reaction times recorded before consuming alcohol is 180–310 milliseconds.

Use Table 4.1 to identify the range of reaction times recorded after consuming alcohol.

.....milliseconds [1]

[12]

For Examiner's Use

5 A mahangu seed company has packets of seeds for sale. Fig. 5.1 shows the label on the seed packet.

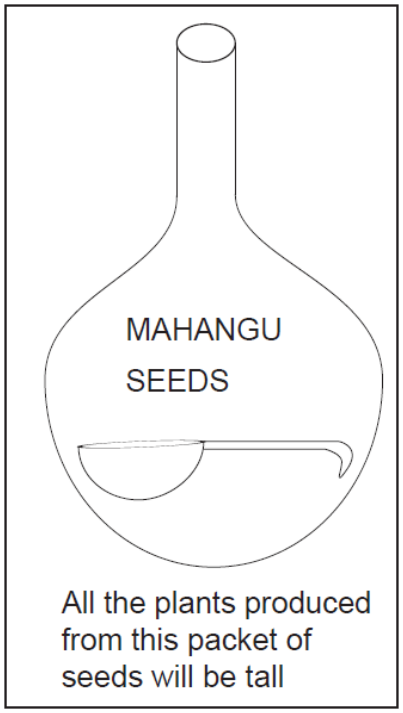


Fig. 5.1

A farmer planted seeds from one of these packets and found that all of the plants produced were tall. These were then cross pollinated. The farmer collected all the seeds produced. The following year when he planted those seeds, some of the new plants were tall while some short.

Height in these plants is controlled by a gene with two alleles, **T** (tall) and **t** (short).

(a) (i) Define the term *allele*.

.....

..... [1]

(ii) State the term used to describe a pair of identical alleles.

..... [1]

For Examiner's Use

(b) (i) Draw a genetic diagram to show how the farmer obtained some short plants after the cross-pollination of the tall plants.

[4]

(ii) Calculate the expected percentage of short plants in the offspring of the cross in **(b) (i)**. Show your working.

[1]

(c) (i) Identify the process that caused bacteria to develop resistance to antibiotics.

..... [1]

(ii) Describe how these resistant strains of bacteria developed.

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..... [4]

[12]

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