Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

BIOLOGY ORDINARY LEVEL

4322/3

PAPER 3 Applied Practical Skills

2 hours

Marks 60

2017

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 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 **12** printed pages and **4** blank pages.

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

1 An investigation was carried out by some students to determine the effect of temperature on cell membranes in beetroot. Beetroot cells contain a red pigment in the vacuoles.

Cylinders were cut from the beetroot and washed in distilled water until no more colour appeared in the water. They were then blotted dry using a paper towel.

Test-tubes containing 5 cm^3 of distilled water were placed into water baths set at 20˚C, 30˚C, 40˚C, 60˚C and 80˚C and left for 5 minutes.

The beetroot cylinders were then placed into the different test-tubes in the different water baths for 30 minutes. Fig. 1.1 shows one of the water baths.

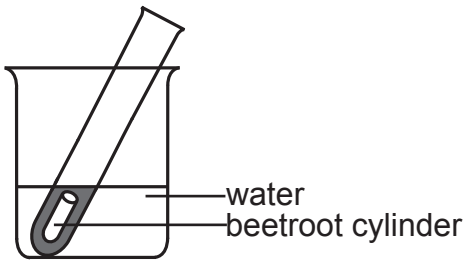

Fig. 1.1

After 30 minutes the test-tubes were shaken gently and the beetroot cylinders were removed. The students then described the colour of the water in the test-tubes.

Table 1.1 shows the results.

Table 1.1

temperature /˚C	**description of colour**
20	clear
30	very pale pink
40	pink
60	dark pink
80	red

(a) Make a large drawing of a plant cell and label the following parts: cell wall, cell membrane, vacuole, cytoplasm and nucleus.

[3]

(b) Explain the reasons for the following procedures.

- Test-tubes were left for 5 minutes in the water baths before the cylinders were added.

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..... [1]

- Tests-tubes were shaken gently before the cylinders were removed.

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..... [1]

(c) When the beetroot cylinders were initially cut, the red pigment leaked from the cut ends. Explain why.

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..... [1]

(d) Explain why it did not continue to leak.

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..... [1]

(e) Explain why some of the pigment leaked out when the cylinders were placed in the test-tubes at different temperatures.

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..... [1]

(f) What is the relationship between the amount of pigment released and the temperature?

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..... [1]

(g) Another group of students carried out the same investigation, but found some differences in the results obtained.

Below is a list of contributing factors which they thought may have caused these differences.

Explain why each of the facts stated may have caused variation in the results.

Fact 1

The student had trouble removing the beetroot from the test-tube.

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..... [2]

Fact 2

Not all the beetroot cylinders were the same size.

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..... [2]

Fact 3

The test-tubes contained different volumes of distilled water.

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..... [1]

[14]

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

(a) Outline the process of paper chromatography.

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..... [4]

(b) Students used paper chromatography to separate the pigments found in leaves. Fig. 2.1 illustrates the results of the chromatogram.

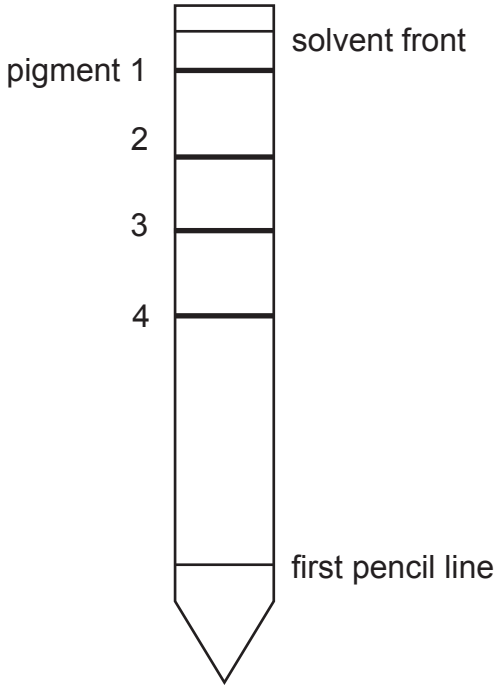

Fig. 2.1

(i) Measure the distance from the first pencil line to the height for each pigment. Record these values in Table 2.1 (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 2.1 (column **E**) using the formula shown.

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

[2]

(iii) Determine the name of each pigment using the information below. Complete column **F** in Table 2.1.

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?

Pigment .....

Explanation .....

..... [2]

Table 2.1

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			

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

Explain your answer.

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..... [2]

[12]

For Examiner's Use

3 An experiment was carried out to investigate the uptake and evaporation of water in a plant.

Four test-tubes were filled up to a line 1 cm from the rim. Four leaves of the same size and from the same plant were removed and treated as follows:

Leaf 1: A thin layer of vaseline was smeared all over the upper surface of the leaf.

Leaf 2: A thin layer of vaseline was smeared all over the lower surface of the leaf.

Leaf 3: A thin layer of vaseline was smeared all over both surfaces of the leaf.

Leaf 4: No vaseline was smeared on either surface.

Each leaf was placed in a test-tube with water as shown in Fig. 3.1 and all four were placed at the same spot where they will not receive direct sunlight.

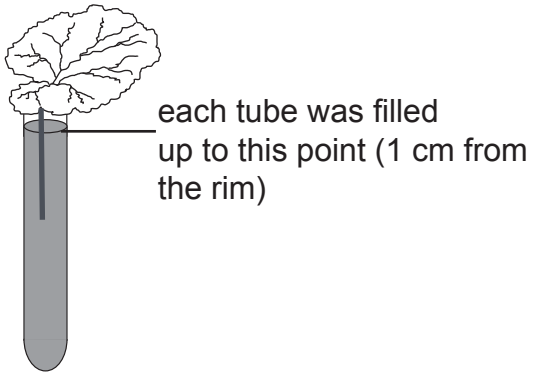

Fig. 3.1

After one week, a syringe was used to add water to each of the test-tubes until the water level reached the original 1 cm^3 mark from the top of each test-tube. The volume of water that needed to be added is shown in Table 3.1.

Table 3.1

leaf number	volume of water added cm^3
1	2.0
2	1.0
3	0.5
4	3.0

(a) Explain how the layer of vaseline affects evaporation from a leaf surface.

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..... [2]

(b) Explain why it is necessary to use leaves of similar size.

.....

..... [1]

(c) (i) State which of the four leaves took up the least water.

..... [1]

(ii) Not all of the water taken up by the leaf will be lost by evaporation from the leaves.

State **one** use of the water taken up in the leaf itself.

.....

..... [1]

(d) (i) Describe the difference in water loss between leaves 1 and 2.

.....

..... [1]

(ii) Suggest an explanation for this difference.

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..... [2]

(e) Water will evaporate directly from the exposed water surface in each test-tube.

(i) Explain how this will affect the result.

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..... [1]

(ii) Will this effect be the same for all of the leaves?

Explain why.

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..... [1]

(iii) Describe how this apparatus can be modified to prevent evaporation from the water surface.

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..... [1]

(f) Name **three** environmental conditions which will increase the uptake of water by a plant.

1 .....

2 .....

3 ..... [3]

[14]

For Examiner's Use

4 Amylase is an enzyme that catalyses the breakdown of starch into sugars.

Describe an experiment you would carry out to find the rate of reaction between amylase and starch in a range of different temperatures (0˚C, 20˚C, 40˚C, 60˚C, 80˚C). You may use the following materials and apparatus in your experiment.

amylase solution

iodine solution

measuring cylinders

pH test strips

starch solution

stopwatches

test-tubes

thermometers

water baths

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..... [9]

[9]

5 **(a)** Describe how you will determine the heart rate of a human being.

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..... [2]

(b) Exercise has an effect on the heart rate. Table 5.1 shows the effect of different activities on the heart rate of a student.

Table 5.1

type of activity	heart rate (beats/min)			average heart rate (beats/min)
	trial 1	trial 2	trial 3	
resting	84	85	83	84
roller blading	156	150	162	
weight lifting	120	105	114	113
watching the world series	96	90	90	92

(i) Use the information from the table to calculate the average heart rate for roller blading.

..... [1]

(ii) Which activity produced the least amount of variation in heart rate for each trial?

..... [1]

(iii) A student roller blades for 10 minutes and then watches the world series for 20 minutes.

Use this information to calculate the average heart rate per minute over the 30 minute period.

Show your working.

Answer …….. [2]

(iv) Suggest why different people of the same age and gender have different resting pulse rates.

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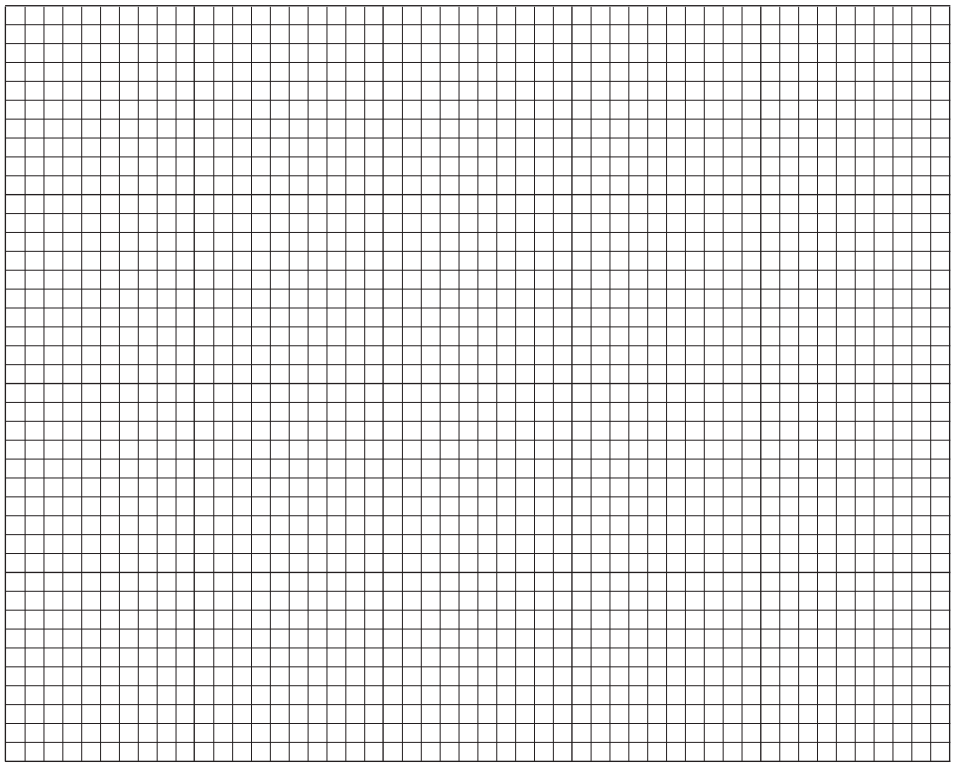
..... [1]

(c) Plot the data in Table 5.1 in a bar chart to show the average heart rate for the four different activities.



[4]

[11]

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