

BOTSWANA EXAMINATIONS COUNCIL

## Botswana General Certificate of Secondary Education October/November 2025

## Confidential Mark Scheme SPECIMEN

## 1428/05 BIOLOGY

Maximum Mark: 40

A1 answer marks that generally follow **compensation mark** or a **method mark**. The answer mark is awarded only when the answer is obtained from the correct working or method.

B1 an independent mark that is awarded whenever the answer given is correct.

**C1** compensation mark for writing the correct preceding formula or condition. The mark may not be given when the formula required has not been given.

M1 method mark that must be seen before awarding the answer mark

() the word, phrase or unit in brackets is not required but is in the mark scheme for clarification

accept the response is not necessarily the perfect answer but may be credited

**reject** do not accept some answers that candidates may write and they appear to be correct

and both responses are necessary for the mark to be given

c.a.o correct answer only

**e.c.f.** error carried forward; marks are awarded if a candidate has carried an incorrect value forward from earlier working, provided the subsequent working is correct.

ignore this response is to be disregarded and does not negate an otherwise correct response

/ or alternative responses for the same marking point

**AW** alternative wording. This is applicable where there are several ways of writing the correct response <u>underline</u> mark is not allowed unless the underlined word or idea is used by candidate

**unit penalty** the unit that follows the answer is required. There must a maximum of **one** unit penalty per question unless otherwise indicated and not more than **four** in the whole question paper.

in any form indicates that the formula can be presented in any other form that may include changing the subject of the formula or using numbers to represent the formula

**BOD** benefit of the doubt given when an examiner is not very certain about a response **spelling** be generous about spelling but ensure the science is not distorted. Single answer words should not have any other meaning while those used in phrases and sentences should be interpreted from the sentence.

decimal places unless specified ignore the number of decimal places for an answer.

Number	Answer	Mark	Additional Guidance
1 (a)	- Title: The Effect of light Intensity on the rate of photosynthesis;	1	title must be clear and relevant to the field of study
1 (b)	- Hypothesis: As light intensity increases, the rate of photosynthesis increases, up to a certain point, after which the rate remains constant (due to other limiting factors such as carbon dioxide or temperature);	1	hypothesis must be predictive and relevant
1 (c)(i)	- Basic list of materials provided;	3	Max 3
	- Materials appropriate;		
	- Detailed list and justification for selection;		
	e.g.		
	- aquatic plant (e.g., <i>Elodea</i> or <i>Cabomba</i> )		
	- container (to submerge the plant)		
	- light source (adjustable lamp or LED light)		
	- light meter (to measure light intensity)		
	- stopwatch		
	- thermometer (to ensure a consistent temperature)		
	- ruler (to measure the distance from the light source to the plant)		
	- sodium bicarbonate solution (to ensure a constant concentration of carbon dioxide)		
	- oxygen sensor or gas syringe (to measure oxygen production)		
	- thermostat (to maintain a stable temperature in the room)		
	- heat shield (between light and plant)		

1 (c)(ii)	- Method is logical and relevant;	4	Max 4
	- Method to vary independent variable;		
	- Method to measure dependent variable;		
	- Method to control variables (at least one);		
	e.g.		
	- add water to the container and add sodium bicarbonate (to ensure a constant supply of carbon dioxide for the plant)		
	- submerge the aquatic plant in the water		
	- position a light source a known distance the plant		
	- measure the distance from the plant to the light source		
	- ensure that the temperature is maintained at a constant value using the thermostat (e.g., 25°C)		
	- start the stopwatch and allow the plant to acclimatize for a set time		
	- measure oxygen production for a set time using the oxygen sensor or by counting the number of oxygen bubbles or collecting the gas		
	- move the light source to various distances from the plant (to change light intensity. e.g. 5 cm, 10 cm, 15 cm, and 20 cm from the plant)		
	- at each distance, measure the oxygen production after a set time		
	- repeat the experiment two/three times		
1 (c)(iii)	- dependent:: volume of oxygen / number of bubbles;	3	
	- independent: light intensity;		
	- control variables: concentration of carbon dioxide;		Max 1 for control
	temperature;		variables
	same amount of plant;		
	same type/species of plant;		
	pH of water;		

1(c)(iv)	<ul> <li>care taken with electricity and water;</li> <li>care not to look directly at light source;</li> <li>wash hands or wear gloves when handling plant/water;</li> <li>be cautious with glassware to prevent cuts;</li> <li>wear eye protection;</li> <li>handle chemicals with care;</li> </ul>	2	Max 2
(b)	<ul> <li>photosynthesis converts light energy to chemical energy;</li> <li>light is the energy for the reactions that produce glucose / the light-dependent reaction;</li> <li>rate of photosynthesis is proportional to the light intensity / the more light available the greater the rate of photosynthesis;</li> <li>the products of the light-dependent stage are used in the light-independent stage of photosynthesis (to make glucose);</li> <li>beyond a certain light intensity, other factors (carbon dioxide, temperature, chlorophyll) become limiting;</li> <li>not enough carbon dioxide available for the plant, the photosynthesis rate can't increase, even if light intensity is higher;</li> <li>temperature is too high or low, the enzymes involved in photosynthesis can become less active, reducing the rate of the process;</li> <li>not enough chlorophyll the plant can't absorb enough light at higher intensities;</li> <li>after a certain light intensity, the rate of photosynthesis reaches a maximum because one or more of the factors (CO<sub>2</sub>, temperature, or chlorophyll) limit the process</li> </ul>	6	AW Max 6

Number	Answer	Mark	Additional Guidance
2(a)(i)	- orange;	1	
(ii)	- 230 x 5; - 1130; - mg;	3	
(iii)	- 45÷60 x 100; - 75;	2	

(b)(i)	<ul> <li>bar chart with axes labels e.g. fruit + concentration of vitamin C including unit;</li> <li>linear scale on <i>y</i>-axis;</li> <li>correct plots ± half a small square tolerance;</li> <li>bars of same width + bars not touching;</li> </ul>	4	
(ii)	more in guava / less in bell peppers; double the concentration in guava / half the concentration in bell peppers;	2	
(iv)	only one fruit of each type is tested / each fruit has a different concentration; fruit may not be ripe / vitamin C concentration changes;	2	
(v)	test more fruits; repeat for each fruit and calculate mean; identify and remove anomalous results;	2	Max 2
(c)	<ul> <li>conclusion based on data in Table 2.1;</li> <li>conclusion related to a real-life situation;</li> <li>e.g.</li> <li>fruits have different concentrations of vitamin C</li> <li>fruits help prevent scurvy</li> </ul>	2	
(d)	- named green vegetable or named source;	1	
(e)	- DCPIP	1	