2019 O' Levels 6093/3 – Recommended Answers

1a. Correct headings [1] / Correct units [1] / Correct calculation of rate [1] / Correct trend [1] Rate is rounded off to nearest whole number [1]

Test-tube	Chloroplast suspension concentration / %	Time / s	Rate of photosynthesis / s ⁻¹
A	50	10	100
В	40	30	33
С	30	50	20
D	20	120	8
E	15	225	4
F	10	Ø	0

- 1b. [1] each. Total: [4]
 - Vertical axis labelled "Rate of photosynthesis" & horizontal axis labelled "Chloroplast suspension concentration"
 - Units included on both axis
 - Scale: Appropriate, easy to read and graph occupies at least ½ of grid
 - All values plotted in accurately
 - Smooth and best-fit line drawn (based on trend of points)



- 1c. i. independent variable: chloroplast suspension concentration [1] dependent variable: rate of photosynthesis [1]
- 1c. ii. [1] each. Total: [3]
 - As chloroplast suspension concentration increases, rate of photosynthesis increases.
 - As chloroplast suspension concentration increases from 10% to 20%, rate of photosynthesis increases slightly [1].
 - As chloroplast suspension concentration increases beyond 20%, rate of photosynthesis increases exponentially [1]. [A: values from student's graph.]
 [P for MP2 & MP3: Straight line trend]
 - iii. Chloroplast contains chlorophyll which is needed to absorb light energy for photosynthesis to occur [1]. The higher the chloroplast suspension concentration, the more the light energy absorbed [1].
- 1d. [1] each. Any 2. Max: [2] [R: No discussing purpose of effort]
 - 1. Lightly tap the syringe to remove air bubbles when taking up liquids.
 - 2. Use syringe that provides greater precision, e.g 0.1 cm³, for more accurate volume measurement.
 - 3. Read off the measurements on the syringe at eye level to prevent parallax error.
 - [R: Using of different syringes for different liquids as focus is on accurate measurement]
- 1e. i. [1] each. Any 2. Max: [2] [Note: Must state impact of error] [R: Human reaction time]

Source of Error	Explain (impact of error on results)	
1. It is difficult to determine the exact moment	The time recorded may be higher or	
when the indicator became colourless.	lower than expected.	
2. There is a delay between addition of sulfuric	The time recorded will be shorter than	

acid and indicator to the chloroplast-sucrose	expected.
mixture and starting the stop watch	
3. Lighting in the surrounding allows	The time recorded will be shorter than
photosynthesis to occur even before placing the	expected.
specimen tube in front of the lamp.	

1e. ii. [1] each for the correct corresponding SOE. Any 1. Max: [1]

SOE	Explain (impact of error)
1	Place a specimen tube with a mixture that has turned colourless beside the tube
	under investigation to determine when the indicator turned colourless.
2	To quickly start the stop watch after mixing sulfuric acid, indicator and chloroplast-
	sucrose mixture.
3	To quickly start the stop watch after mixing sulfuric acid, indicator and chloroplast-
	sucrose mixture./ To conduct the experiment in a dimmer room with control of lighting
	so that ambient light is at a constant.

1f. [1m: independent variable – distance of chloroplast suspension from lamp 1m: dependent variable – time taken for indicator to become colourless 1m: at least two constant variables 1m: logical set-up and approach – use of indicator

1m: interpretation and prediction of results]

- Prepare 6 solutions of chloroplast suspensions of the same concentration and volume [1] in specimen tubes.
- Place one specimen tube 10 cm away from the lamp.
- Add the indicator solution to the suspensions and mix well [1].
- Observe the colour. Turn on the lamp and immediately start a stop watch and record the time taken for the indicator to become colourless [1].
- Repeat the experiment, varying the distance of the specimen tube from the lamp [1].
- The shorter the distance from the lamp, the higher the light intensity, the higher the rate of photosynthesis, the faster the indicator becomes colourless [1].
- 2a. To allow for better/ clearer viewing of the cell structures/ parts [1]. [R: organelles]
- 2b. i. [1m: proportion thickness of cell wall, size of nucleus
 1m: quality of lines & realistic clean lines
 1m: size take up at least half the space given
 1m: labels cell wall, cell surface membrane, nucleus, cytoplasm]



- ii. [1m for working. 1m for answer] Magnification = length of drawing / length of actual = 147 / 0.20 = 735 X
- 2c. Cell sap of the cells have a higher <u>water potential</u> than the salt solution [1]. Water molecules move from the cell sap into the salt solution [1] through the partially permeable cell surface membrane and tonoplast via osmosis [1].
- 2d. i. 73.53, 70.67 (both to 2dp)

ii. Since the cells are of different lengths, comparing the absolute length of the cell contents will not be accurate [1].