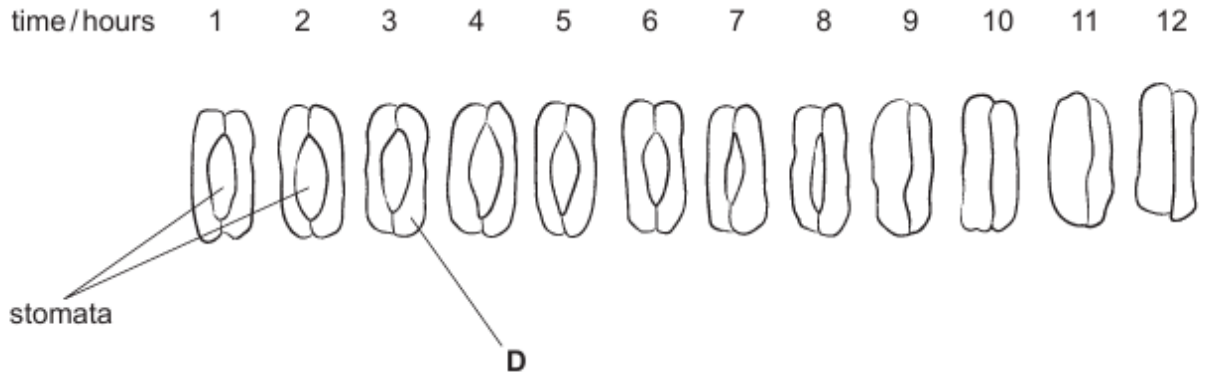
A student placed a plant in a very hot room for 12hours. There was very bright light in the room and the plant was not given any water in the 12-hour period. The figure below shows the sketches that the student made of the stomata during the 12-hour period.



(a) Identify the cell labelled D
Guard cell

(b) Explain the

(i) changes in the stomata during the last 5 hours of the experiment.
The stomata are closed/partially closed; the plant suffers from water stress; excess water loss from the guard cells results into their flaccidity or plasmolysis; the thick inner walls of the guards move close together; closing the stomata

(ii) Effect of the state of the stomata in the last 5 hours of the experiment on primary productivity of the plant.
Primary productivity decreases/reduces; the closure of the stomata prevents/decreases the entry of carbon dioxide in the leaf air space; the Calvin cycle is starved; decreasing the amount of photosynthetic product formed.

(iii) Ecological significance of the state of the stomata in the last 5 hours to the survival of the plant.
Minimizes water loss; conserving water;

(c) The student increased the humidity in the room and repeated the investigation. Predict and explain the effect of humidity on the stomata.
The stomata open; high humidity decreases the rate of loss of water from the plant/guard cells; more water in the guard cells makes become guard cells become turgid, the thinner cell wall stretch while the thicker wall resist expansion and draw away from each other creating a pore.

2. Chemengu a day scholar climbed a Mango tree on his way back home after classes. Unfortunately, he couldn't find any ripe mango. He picked 10 raw, green mangoes and took them home. When he reached home, he tried to eat one unripe mango. He couldn't finish eating as the mango was very sour, hard. His mother told him to keep the remaining mangoes in an air tight paper bag for 2 days.

After the two days the mangoes ripened. The ripe mangoes were sweet, soft and yellow in colour. Chemengu didn't know how all this came about.

Task

(a) Explain why the mangoes ripened faster when kept in an air tight paper bag.
Ethylene is a gas produced from fruits during ripening to trigger the process of ripening; ripening triggers more ethylene production (positive feedback); the paper bag prevents the gas from escaping; accumulation of ethylene triggers fast ripening.

(b) Describe the changes that occurred to cause green, hard and sour Mangoes to became soft, sweet and yellow and state the ecological significance of the changes.
Ethylene production activates enzymes such as amylases, proteases that convert starch and the acids to sugars, decreasing the concentration of acids (sour taste); thus, a sweat taste and chlorophyll in the epicarp is also degraded to carotenoids thus a green colour changes to a yellow colouration. The yellow colour , new scents and sweet taste attracts animals which disperse the fruit

(c) How can ripening be effected commercially.
On a commercial scale, many kinds of fruits are ripened in huge storage containers in which ethylene levels are enhanced.

3. Cassava, *Manhot esculenta* is a crop grown in most parts of Uganda. The plants store starch in their roots, which form the largest part of diet for many people. Cassava does not provide many vitamins and minerals. Genetic engineers have modified cassava to increase its iron and vitamin content.

Task

(a) Make a well labelled drawing measuring 5cm long of the structure of an organelle in cassava leaf responsible for formation of starch.

Hint: deny some marks if the structure of the chloroplast drawn is not 5cm long.

(b) Assuming the actual drawing of that organelle measures 5µm. calculate the magnification of your drawing.

Magnification $= \frac{image\ size}{object\ size}$

Object size = 5µm

Image I mage size =

5cm.

Convert 5cm into µm

1cm=10mm=10000µm, since 1mm =1000µm.

Therefore 5cm=50000µm.

Magnification $= \frac{50000}{5}$

Magnification = X10000

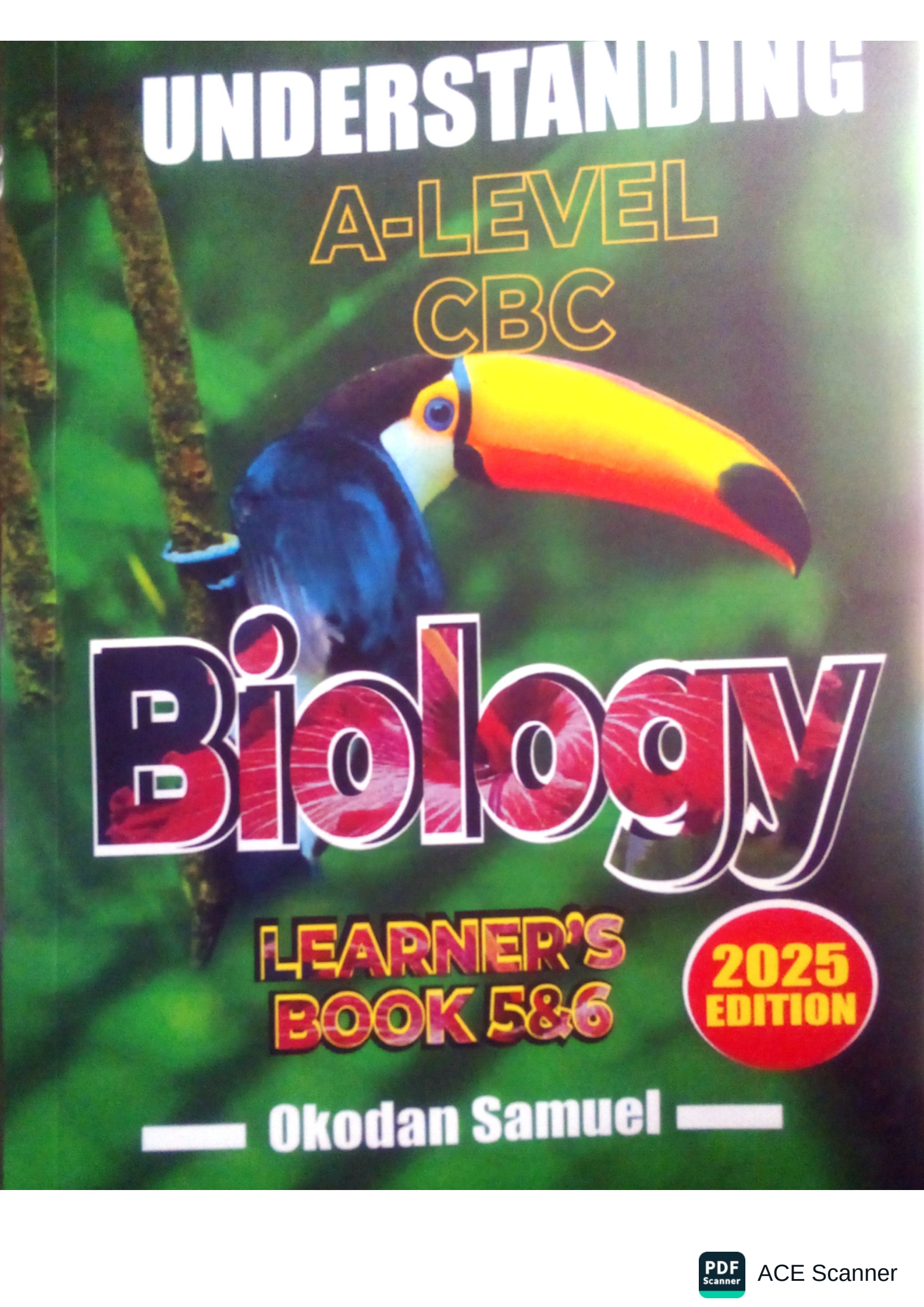
(c) Describe the processes involved in the formation of starch in the organelle above. *Carbon dioxide is captured from the atmosphere; ribulose-1,5-bisphosphate carboxylase (RuBisCO) enzyme in the stroma attaches carbon dioxide to RuBP (Ribulose bisphosphate); Forms 3-PGA (3-phosphoglycerate); ATP and NADPH from the light reactions; reduce 3-PGA into Glyceraldehyde 3 phosphate (G3P). Some G3P molecules exit the cycle to form glucose; two molecules of G3P combine to form glucose through reversal of stages of glycolysis. Several glucose units polymerize to form starch; Remaining G3P molecules are recycled to regenerate RUBP, allowing the cycle to continue;ATP is used in this process*

(d) What are likely effects of planting genetically modified cassava.

- *The cost of GM propagules is high.*
- *Engineered genes may spread to other species throughhybridisation.*
- *GM cassava crops may become difficult to sell due to consumer concerns*
- *GM cassava varieties may be genetically unstable.*
- *Biodiversity may be reduced.*
- *There are no long-term studies on the effects to human health.*

UNDERSTANDING

A-LEVEL CBC



Biology

LEARNER'S BOOK 5&6

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