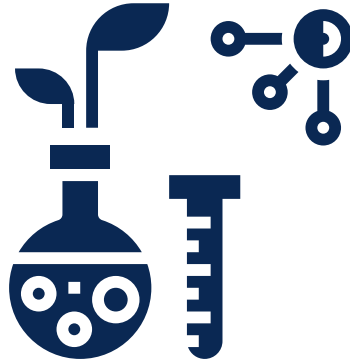




THE DUBLIN  
ACADEMY OF  
EDUCATION

# BIOLOGY

## 6TH YEAR HIGHER LEVEL



# Photosynthesis

## DAVID LEWIS

## Table of Contents

<b>THE BIOLOGY COURSE</b> .....	<b>4</b>
<b>EXPERIMENTS</b> .....	<b>5</b>
<b>EXAM FOCUS</b> .....	<b>6</b>
THE STUDY PLAN .....	6
<b>UNIT 2</b> .....	<b>7</b>
<b>PHOTOSYNTHESIS</b> .....	<b>8</b>
PHOTOSYNTHESIS .....	10
DETAILED STUDY .....	12
SUMMARY .....	14
MANDATORY EXPERIMENT: .....	15
NOTES .....	16
<b>PAST PAPER QUESTIONS</b> .....	<b>17</b>
<b>EXPERIMENT QUESTIONS</b> .....	<b>28</b>
<b>SOLUTIONS</b> .....	<b>31</b>

# STILLOGAN WEEKLY GRINDS TIMETABLE

South Dublin weekly grinds take place in Stillorgan Plaza, Lower Kilmacud Road, Stillorgan, Dublin.

## 6th Year

SUBJECT	LEVEL	DATES	TIME
Accounting	H	Wednesdays	5:00pm - 6:15pm
Accounting	H	Saturdays	10:30am - 11:45am
Applied Maths	H	Mondays	5:00pm - 6:15pm
Applied Maths	H	Fridays	4:45pm - 6:00pm
Biology	H	Mondays	8:00pm - 9:15pm
Biology	H	Tuesdays	5:30pm - 6:45pm
Biology	H	Saturdays	9:00am - 10:15am
Business	H	Wednesdays	5:00pm - 6:15pm
Business	H	Saturdays	12:30pm - 1:45pm
Chemistry	H	Mondays	6:15pm - 7:30pm
Chemistry	H	Wednesdays	6:30pm - 7:45pm
Chemistry	H	Saturdays	9:00am - 10:15am
Economics	H	Mondays	6:30pm - 7:45pm
Economics	H	Saturdays	9:00am - 10:15am
English	H	Tuesdays	7:00pm - 8:15pm
English	H	Wednesdays	5:00pm - 6:15pm
English	H	Wednesdays	6:30pm - 7:45pm
English	H	Saturdays	10:30am - 11:45am
English	H	Saturdays	12:15pm - 1:30pm
French	H	Mondays	6:15pm - 7:30pm
French	H	Wednesdays	6:45pm - 8:00pm
French	H	Saturdays	9:00am - 10:15am
Geography	H	Tuesdays	5:30pm - 6:45pm
Geography	H	Thursdays	5:45pm - 6:45pm
German	H	Mondays	8:00pm - 9:15pm
History	H	Thursdays	5:45pm - 7:00pm
Home Economics	H	Tuesdays	5:30pm - 6:45pm
Irish	H	Mondays	8:15pm - 9:30pm
Irish	H	Wednesdays	6:45pm - 8:00pm
Irish	H	Saturdays	10:45am - 12:00pm
Maths	H	Mondays	8:00pm - 9:15pm
Maths	H	Tuesdays	7:00pm - 8:15pm
Maths	H	Wednesdays	5:00pm - 6:15pm
Maths	H	Wednesdays	8:15pm - 9:30pm
Maths	H	Saturdays	10:30am - 11:45am
Maths	H	Saturdays	12:15pm - 1:30pm
Maths (Fast Paced)	H	Fridays	6:15pm - 7:30pm
Maths	O	Tuesdays	7:00pm - 8:15pm
Maths	O	Saturdays	12:15pm - 1:30pm
Physics	H	Mondays	6:30pm - 7:45pm
Physics	H	Thursdays	7:15pm - 8:30pm
Spanish	H	Tuesdays	7:00pm - 8:15pm
Spanish	H	Saturdays	10:30am - 11:45am

**LIMITED TIME SPECIAL OFFER**  
BOOK 1 SUBJECT, GET ADDITIONAL SUBJECTS HALF PRICE

TO BOOK CALL US ON  
**01 442 4442**  
OR BOOK  
ONLINE AT  
**WWW.DUBLINACADEMY.IE**

## 5th Year

SUBJECT	LEVEL	DATES	TIME
Accounting	H	Saturdays	9:00am - 10:15am
Applied Maths	H	Thursdays	5:45am - 7:00pm
Biology	H	Thursdays	5:30pm - 6:45pm
Business	H	Mondays	5:00pm - 6:15pm
Chemistry	H	Wednesdays	5:00pm - 6:15pm
Chemistry	H	Saturdays	10:45am - 12:00pm
Economics	H	Thursdays	7:15pm - 8:30pm
English	H	Wednesdays	8:15pm - 9:30pm
English	H	Saturdays	9:00am - 10:15am
French	H	Wednesdays	5:00pm - 6:15pm
Geography	H	Tuesdays	5:30pm - 6:45pm
Geography	H	Thursdays	5:45pm - 7:00pm
German	H	Mondays	8:00pm - 9:15pm
Irish	H	Mondays	8:00pm - 9:15pm
Maths	H	Tuesdays	7:00pm - 8:15pm
Maths	H	Wednesdays	6:30pm - 7:45pm
Maths	H	Saturdays	10:30am - 11:45am
Maths	(O)	Tuesdays	7:00pm - 8:15pm
Maths	(O)	Saturdays	12:15pm - 1:30pm
Physics	H	Tuesdays	7:00pm - 8:15pm
Spanish	H	Tuesdays	5:30pm - 6:45pm

## 4th Year

SUBJECT	LEVEL	DATES	TIME
Biology	H	Thursdays	5:30pm - 6:45pm
English	H	Tuesdays	5:45pm - 6:45pm
Irish	H	Mondays	5:15pm - 6:15pm
Maths	H	Mondays	6:30pm - 7:30pm
Maths	H	Tuesdays	7:00pm - 8:00pm
Physics	H	Thursdays	5:30pm - 6:45pm

## 3rd Year

SUBJECT	LEVEL	DATES	TIME
English	H	Wednesdays	6:30pm - 7:30pm
English	H	Saturdays	10:30am - 11:30am
Irish	H	Mondays	6:30pm - 7:30pm
Maths	H	Tuesdays	5:45pm - 6:45pm
Maths	H	Thursdays	5:30pm - 6:30pm
Maths	H	Saturdays	9:15am - 10:15am
Science	H	Saturdays	12:15pm - 1:15pm

## 1st & 2nd Year

SUBJECT	LEVEL	DATES	TIME
English	H	Wednesdays	5:15pm - 6:15pm
Irish	H	Thursdays	5:30pm - 6:30pm
Maths	H	Mondays	5:15pm - 6:15pm
Maths	H	Thursdays	6:45pm - 7:45pm

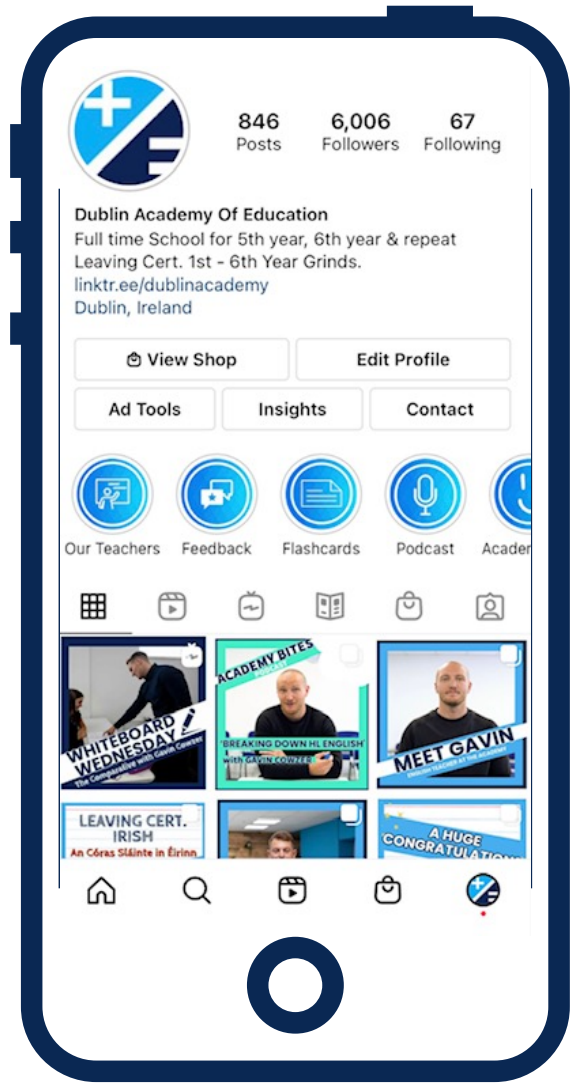
FOR OUR KILLESTER, LIVE-STREAMED  
AND ON-DEMAND GRINDS OPTIONS,  
PLEASE SEE OUR WEBSITE



THE DUBLIN  
ACADEMY OF  
EDUCATION

Follow us on  
Instagram for:

- ★ Tutorials
- ★ Podcasts
- ★ Free Notes
- ★ Top Tips



scan me



@dublinacademy

## The Teacher



As the Dublin Academy's study skills strategist, David does more than just present course material in maths and biology. With more than 7 years' experience teaching at the highest level, he is fascinated with innovating new ways of creating effective, personalised exam strategies that are extraordinarily useful and proven to achieve results.

No matter which teaching hat he is wearing, David's motivation is simple - to give students tools and methods that drive confidence and empower them to produce a successful leaving cert. This motivation has transferred into his private life as he has helped to build schools for underprivileged children in India with EDUCO. He also hosts the Academy podcast, co teaches the schools personal development club and in 2020 David authored his first book.

Throughout his career, David has modeled himself on the saying:

'work hard, work smart, have fun'

No part of this publication may be copied, reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from The Dublin Academy of Education.

Ref: 6/bio/h/dl/freecourse2020

# The Biology Course

Unit 1	Unit 2	Unit 3
Scientific Method	Cell Structure	Monera
Food	Cell Diversity	Fungi
Ecology	Enzymes	Viruses
	Photosynthesis	Protista
	Respiration	Plant Structure
	Enzymes	Plant Transport
	Osmosis + Diffusion	Plant Responses
	DNA + RNA	Plant Reproduction
	Cell Division	Vegetative Propagation
	Genetic Crosses	Breathing System
	Variation + Evolution	Circulatory System
	Genetic Engineering	Digestive System
		Endocrine System
		Lymphatic System
		Nervous System
		Excretion + Homeostasis
		Human Reproduction
		Human Defence
		Senses
		Skeletal System

# Experiments

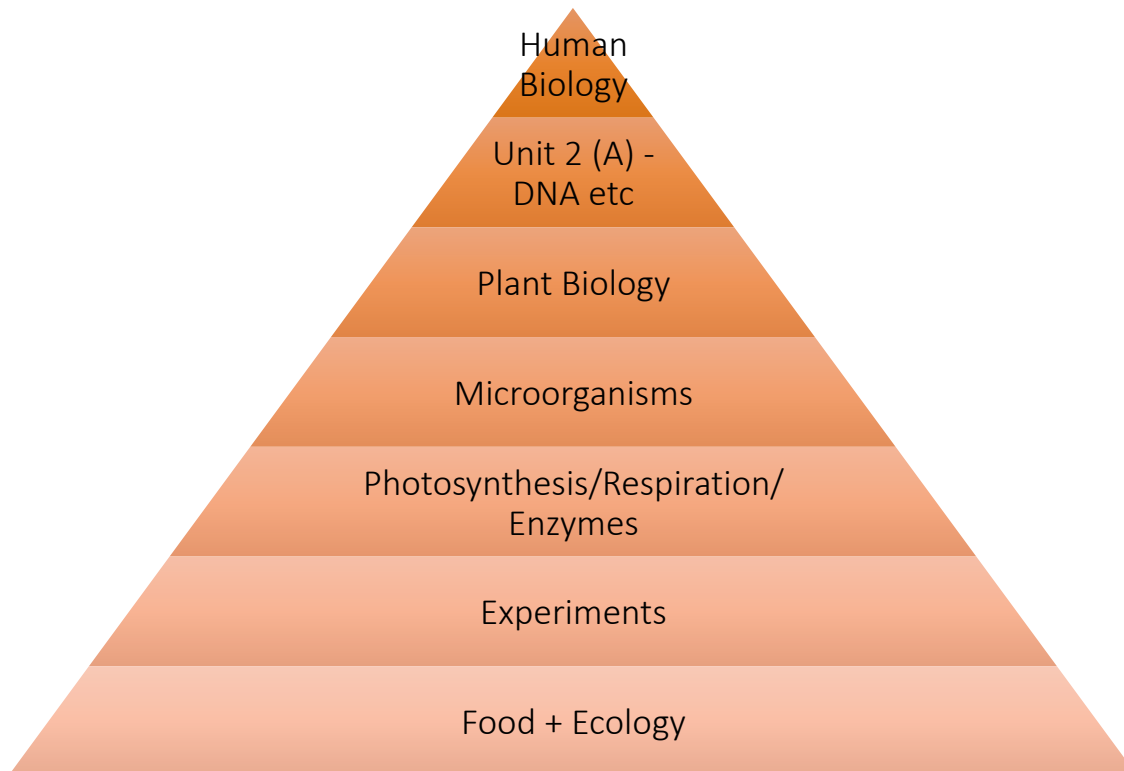
Unit 1	Unit 2	Unit 3
<ol style="list-style-type: none"> <li>1. Use a light Microscope</li> <li>2. Food Tests:               <ul style="list-style-type: none"> <li>– Test for Starch</li> <li>– Test for Fats</li> <li>– Test for Reducing Sugar</li> <li>– Test for Protein</li> </ul> </li> <li>3. Identify 5 Animals</li> <li>4. Identify 5 Plants</li> <li>5. Use equipment to collect Animals and Plants</li> <li>6. Quantitative survey of plants</li> <li>7. Quantitative survey of Animals (capture-recapture)</li> <li>8. Investigate 3 Abiotic factors</li> </ol>	<ol style="list-style-type: none"> <li>9. Prepare a Plant Cell</li> <li>10. Prepare an Animal Cell</li> <li>11. Effect of pH on Enzymes</li> <li>12. Effect of Temp on Enzymes</li> <li>13. Effect of Heat denaturation on Enzymes</li> <li>14. Prepare and Examine an immobilised Enzyme</li> <li>15. Light intensity effect on Photosynthesis</li> <li>16. Production of alcohol using yeast</li> <li>17. Demonstrate osmosis</li> </ol>	<ol style="list-style-type: none"> <li>18. Isolate DNA from a Plant</li> <li>19. Investigate growth of leaf yeast.</li> <li>20. Prepare TS of a Dicot Stem</li> <li>21. Effect of IAA on plant tissue</li> <li>22. Digestive activity during Germination</li> <li>23. Effect of H<sub>2</sub>O, O<sub>2</sub> and Temperature on Germination</li> <li>24. Heart Dissection</li> <li>25. Effect of exercise on pulse rate</li> </ol>

## EXAM FOCUS

The Leaving Cert Biology Exam is broken into 3 sections for a total of 400m

<u>Section A 25%</u>	<u>Section B 15%</u>	<u>Section C 60%</u>
Answer 5/6 Qs (20 m)	Answer 2/3 Qs (30 m)	Answer 4/6 Qs* (60 m)
Unit 1 : 2 Qs	<u>23 Experiments</u>	Unit 1 : 1 Q
Unit 2 : 2 Qs		Unit 2 : 2 Qs
Unit 3 : 2 Qs		Unit 3 : 3 Qs
<b>100m</b>	<b>60m</b>	<b>240m</b>

### The Study Plan





# UNIT 2

How does it appear?

Section A	Section B	Section C
2 Qs (2 x 20 marks)	Experiments 6-14 (30 marks)	2 Question* (2 x 60 marks)
		*may contain experiment

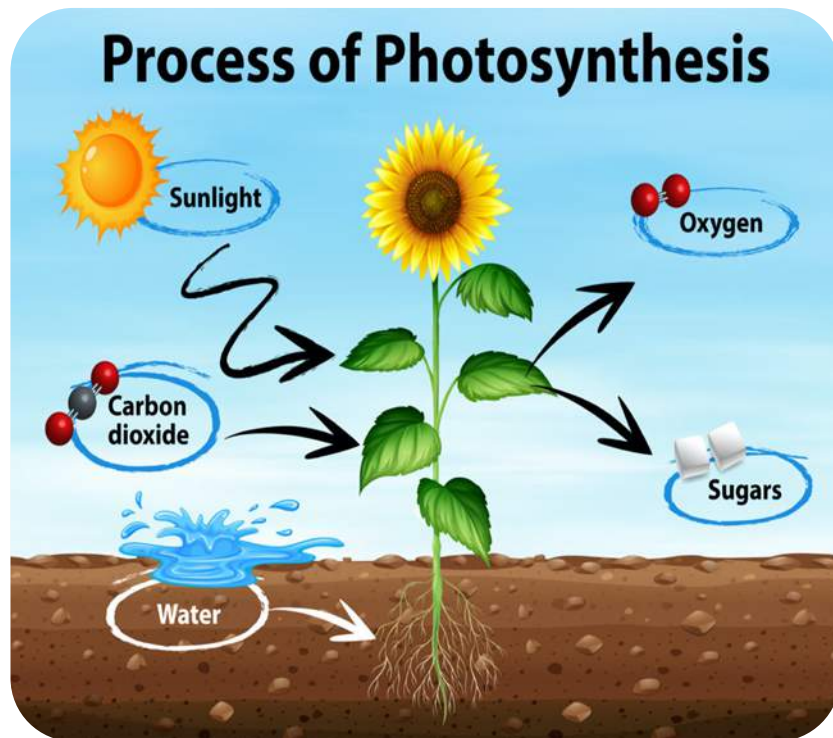
HISTORY OF TOPIC	19	18	17	16	15	14	13	12	11	10	09	08	07	06	05
<b>The Cell</b>	X	6m	20m	6m	X	30m	6m	9m	12m	3m	X	X	X	30m	X
<b>Cell Diversity</b>	20m	X	X	30m	X	X	X	20m	X	20m	X	X	X	X	X
<b>Osmosis + Diffusion</b>	6m	X	36m	30m	20m	X	26m	3m	30m	30m	X	18m	X	X	80m
<b>Enzymes</b>	36m	24m	30m	6m	9m	60m	30m	30m	30m	30m	30m	30m	54m	20m	30m
<b>Respiration</b>	X	42m	20m	36m	24m	44m	60m	24m	20m	X	36m	20m	36m	20m	60m
<b>Photosynthesis</b>	24m	30m	36m	27m	36m	X	36m	27m	30m	36m	24m	30m	30m	60m	20m

# Photosynthesis

Questions		Headings:	
How often does it appear?	14/15 Years	- Role	- Experiment
How much is it worth?	24m – 60m	- General Overview	
When did it last appear?	2019 (24m)	- Detailed Study	

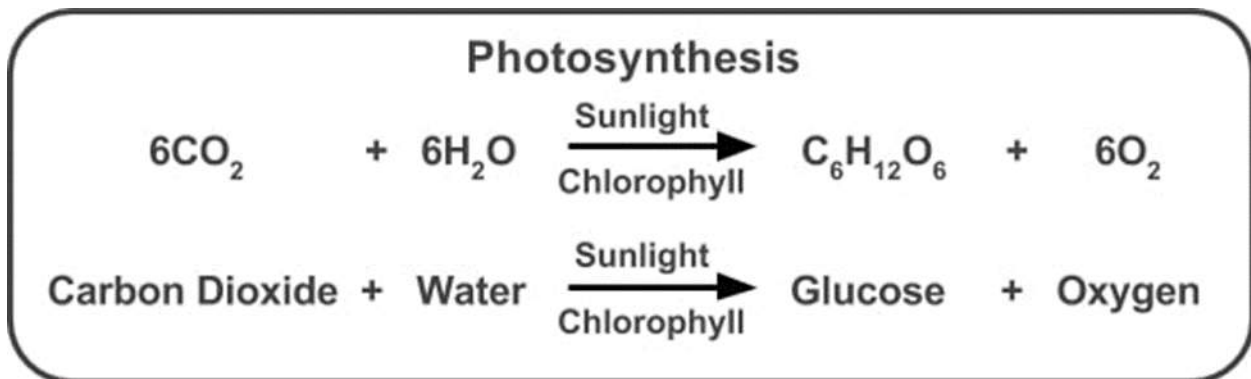


*Photosynthesis*: production of food from inorganic materials using light energy trapped by chlorophyll. (Eg. Plants, Algae, some Bacteria)



### Role of Photosynthesis:

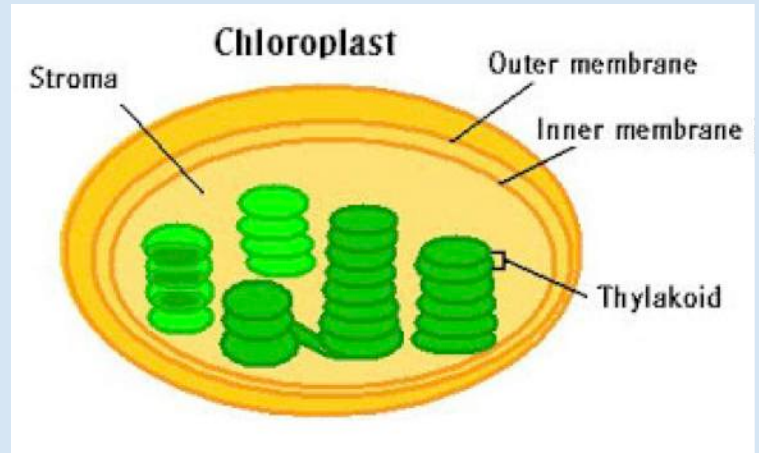
1. Provide plants with food.
2. Provide oxygen for aerobic respiration.
3. Provide animals with food



## Photosynthesis

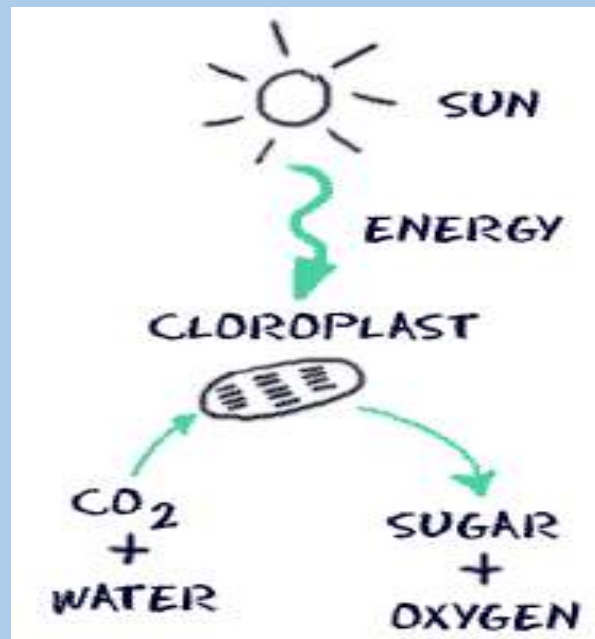
Where :

**Photosynthesis takes place in the chloroplasts of cells**



### 1) General Overview

- Chlorophyll absorbs light.
- Photolysis (splitting of water) produces 4 protons, 4 electrons and an oxygen molecule.
- Sunlight energises the electrons.
- Plant absorbs carbon dioxide.
- The energy combines protons, electrons and carbon dioxide to form glucose.



**Notes:**

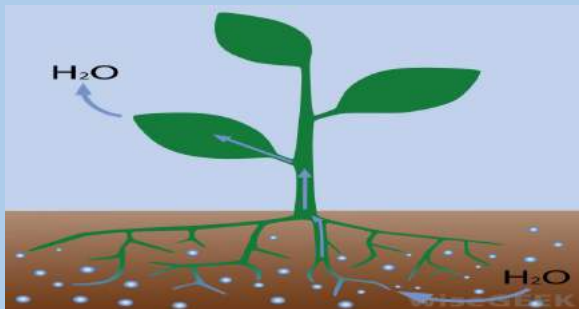
**Oxygen**

1. Released into atmosphere.
2. Stored for aerobic respiration in plant.



**Water**

- **absorbed from soil**

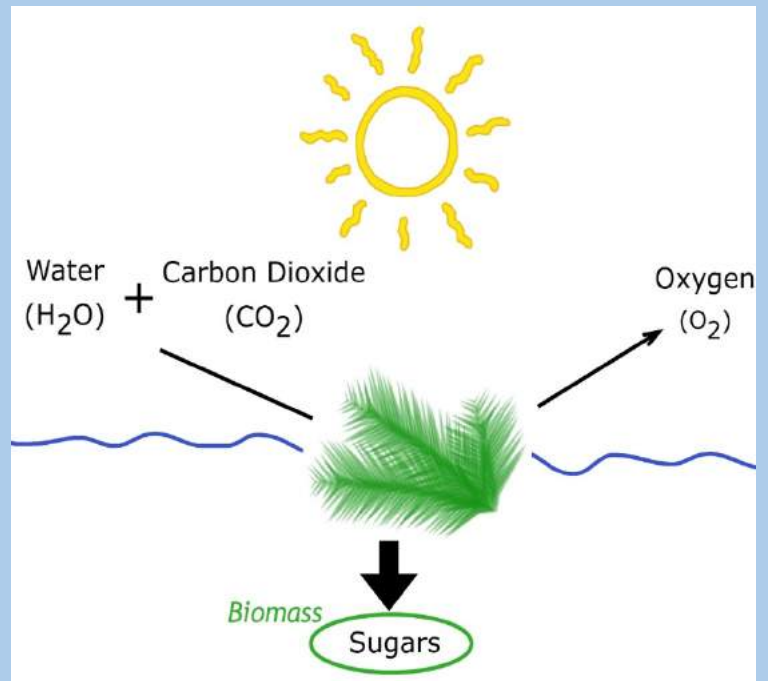


**Carbon Dioxide**

1. Internal: from respiration
2. External: atmosphere, burning of fossil fuels



**Summary:**





## Detailed Study

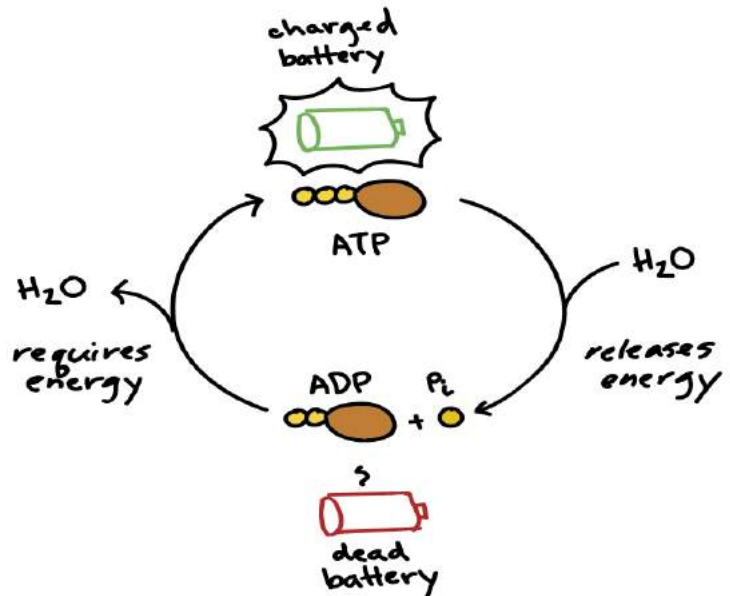
### Energy Carriers:

#### 1) ADP/ATP

Adenosine DiPhosphate

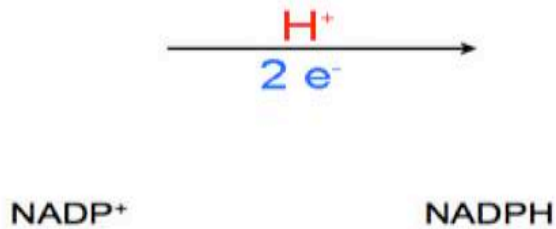
Adenosine TriPhosphate

(Phosphorylation: adding a phosphate)



#### 2) NADP+ / NADPH

Nicotinamide Adenine Dinucleotide Phosphate



**Light Stage (light dependent)**

**1) Light is absorbed**

- chlorophyll - photolysis

**2) Pathways**

**Pathway 1 (Cyclic)**

- electrons absorb the light energy
- high energy electrons transferred along electron acceptors and back to chlorophyll
- as it moves excess energy is released which is used to make ATP from ADP

**Pathway 2 (Non Cyclic)**

- Electrons (2) absorb the light energy
- high energy electrons do not return to chlorophyll
- as it moves excess energy is released which is used to make ATP from ADP
- the electrons combine with NADP+ and a proton to form NADPH

**3) Products**

ATP: gives energy to dark stage reactions

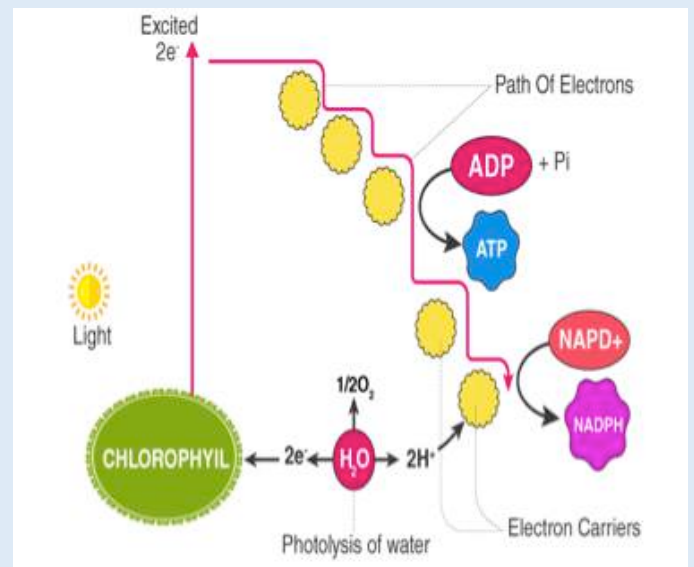
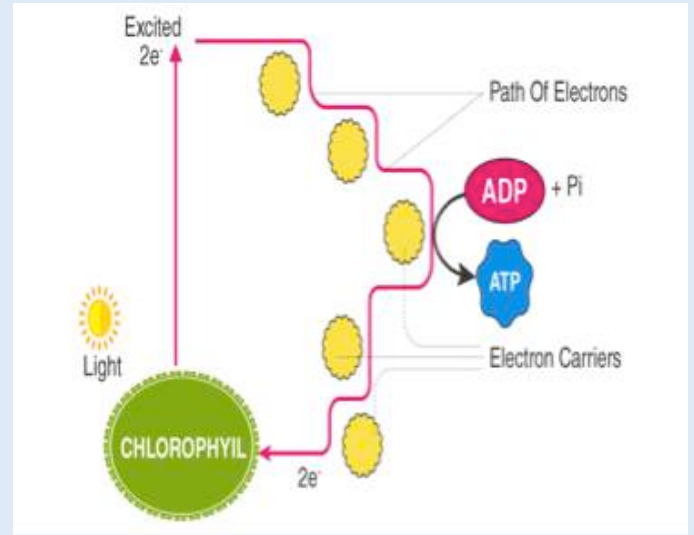
NADPH: supplies protons and energised electrons for dark stage reactions

O<sub>2</sub> : respiration/released to atmosphere

\*grana of chloroplasts

**Ingredients**

1. Water
2. Light
3. Chlorophyll

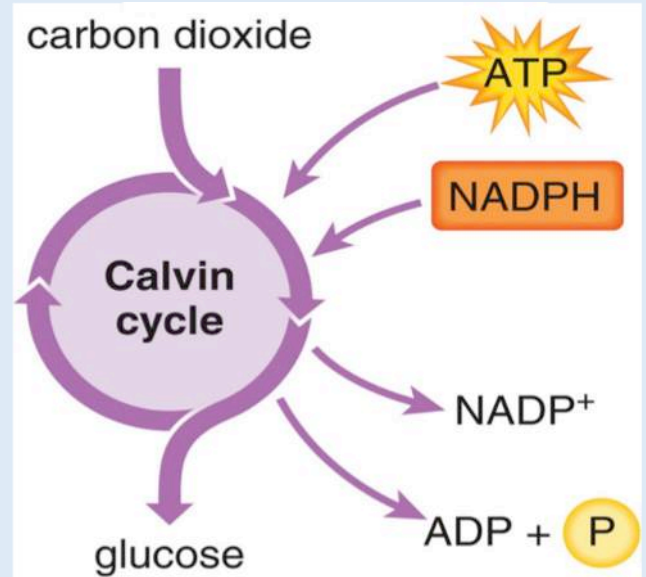


**Dark Stage (light independent)**

**\*stroma of chloroplasts**

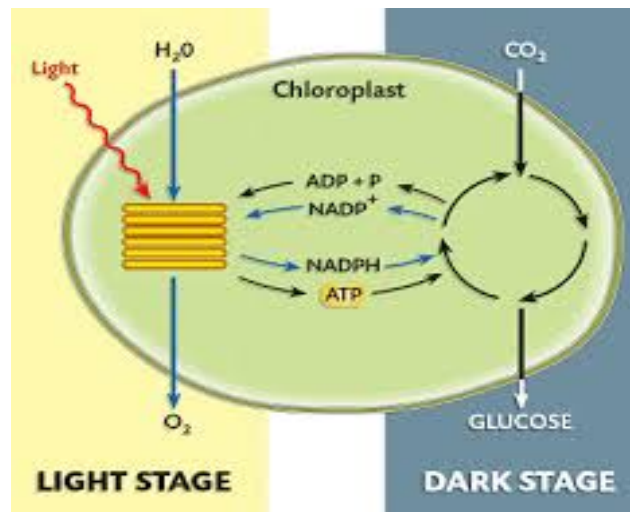
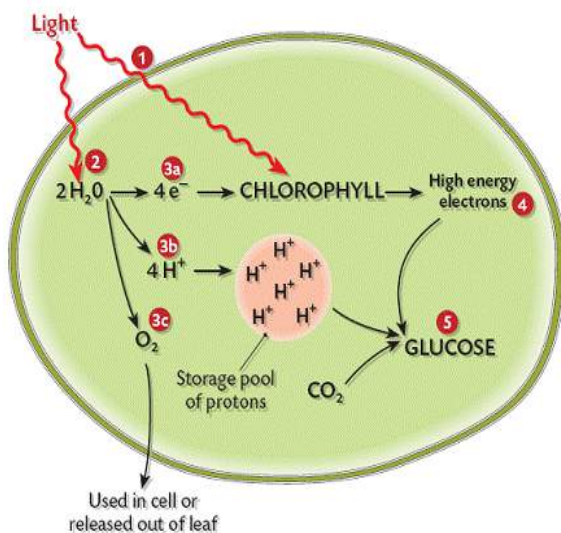
\*Controlled by enzymes

- 1) Carbon dioxide diffuses into the stroma
- 2) CO<sub>2</sub> is reduced to C<sub>6</sub> H<sub>12</sub> O<sub>6</sub> (glucose) using products of NADPH and energy supplied by ATP
- 
- 3) NADPH returns to NADP+, ATP returns to ADP + P
- 4) Products are recycled back to the light stage



(Note: Also known as Calvin Cycle)

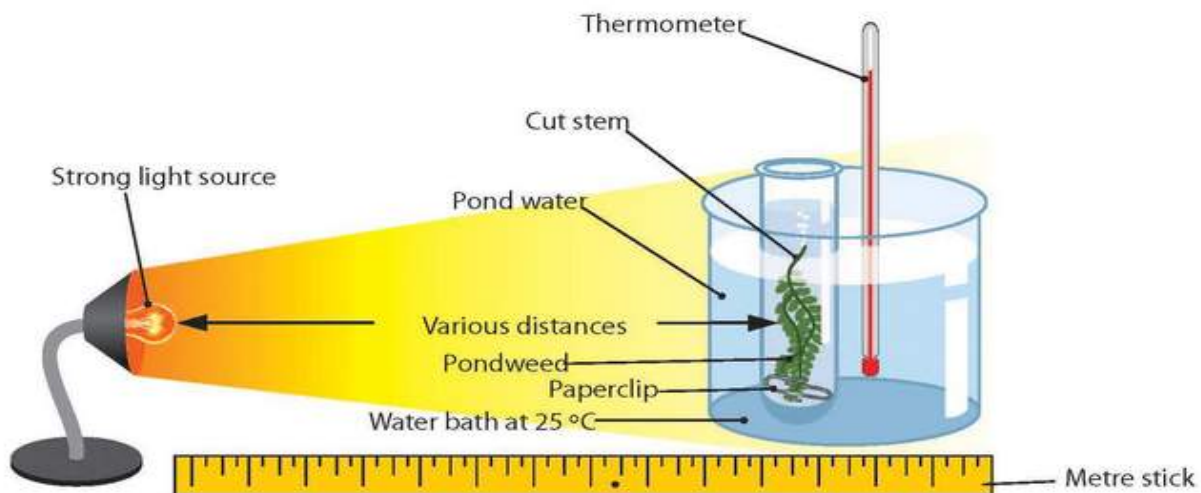
**Summary**





## Mandatory Experiment:

To investigate the effect of light intensity on the rate of photosynthesis



### Method:

- Obtain fresh pondweed.
- Cut a small section using the backed blade and crush the cut end slightly between your fingers.
- Place pondweed in a test tube with pond water.
- Ensure the cut end is facing upwards and weigh the pondweed down by attaching a paperclip.
- Shine the strong fluorescent light source on the pondweed for 5 minutes to allow the pondweed to adjust.
- Move the light source various distances from the pondweed.
- Allow the pondweed to adjust to each new light intensity for 5 minutes before counting the number of bubbles per minute.
- Count the number of bubbles per minute at each distance.

**Result:** As the light source is moved further away from the pondweed, the rate of bubbles per minute decreases.

**Conclusion:** The rate of photosynthesis increases with light intensity

