glucose

glucose

Making Food

glucose

glucose

Photosynthesis

glucose

glucose

Photosynthesis

1. Photosynthesis Revision;
2. Fate of Sugar;
3. Chemistry of Photosynthesis;
4. Limiting Factors.

Photosynthesis

- Where do plants get their energy from?

Light

Light

Light

Light

Light

Light

Photosynthesis - copy

- **Green** plants are capable of making glucose(chemical energy) using light energy from the sun.

- This process is called **photosynthesis**.

Photosynthesis

Using Light — To make...

GLUCOSE

Photosynthesis

- What plants need for photosynthesis to occur?

Light Energy

Carbon Dioxide

Water

} RAW MATERIALS

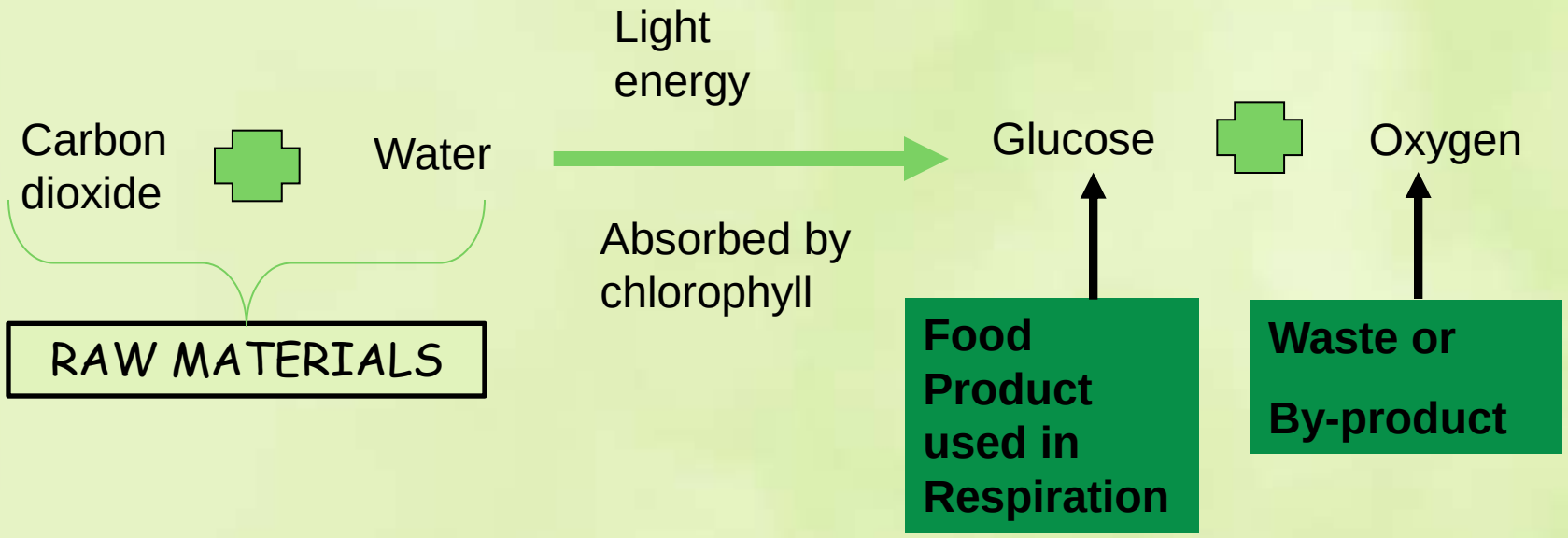
- What is produced?

Glucose

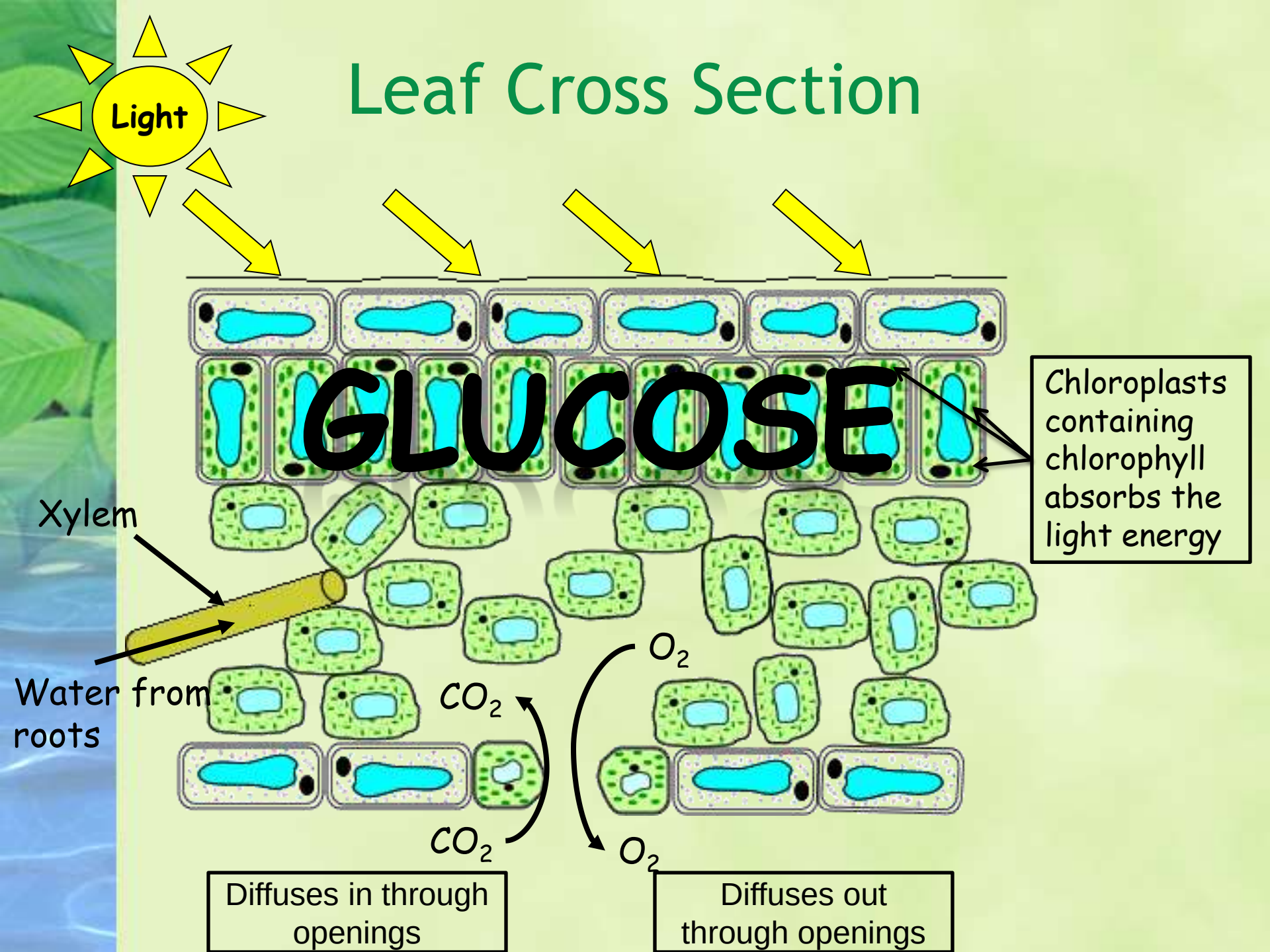
Oxygen

Photosynthesis - copy

- Word equation for photosynthesis is as follows:



Leaf Cross Section

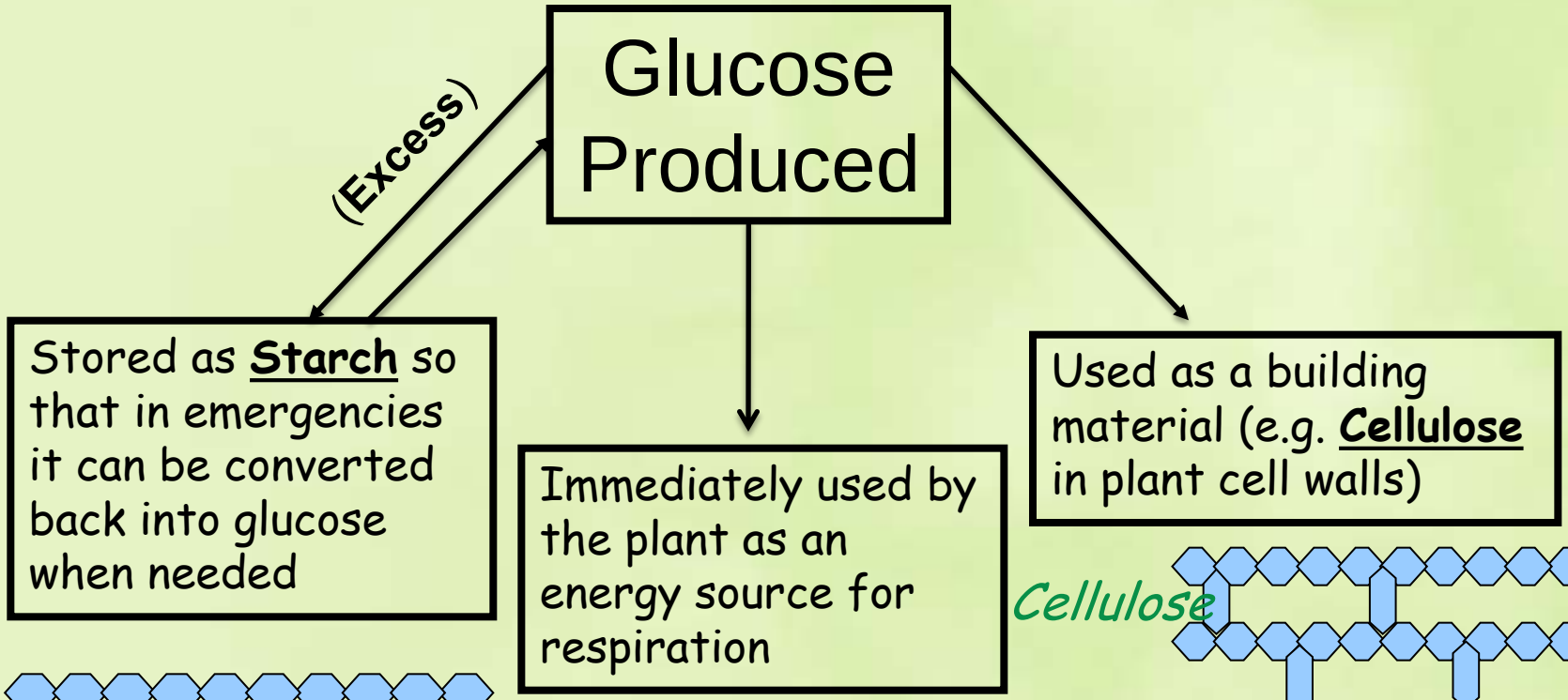


Copy and complete

- Photosynthesis is a series of e_____ controlled reactions which allows plants to p_____ their own f_____. The process involves L_____ e_____ from the _____. It also requires the 2 r_____ materials C_____ D_____ and w_____.
- Light energy gets t_____ by the g_____ pigment Ch_____ found in chloroplasts.
- Light energy is c_____ into ch_____ energy in the form of ATP.
- This immediate source of energy is then u_____ to produce g_____ during the Calvin Cycle. O_____ gas is also produced and released as a w_____ product.

Fate of the glucose produced

- The whole point of photosynthesis is to produce glucose for respiration.



So far I can…

- State that…

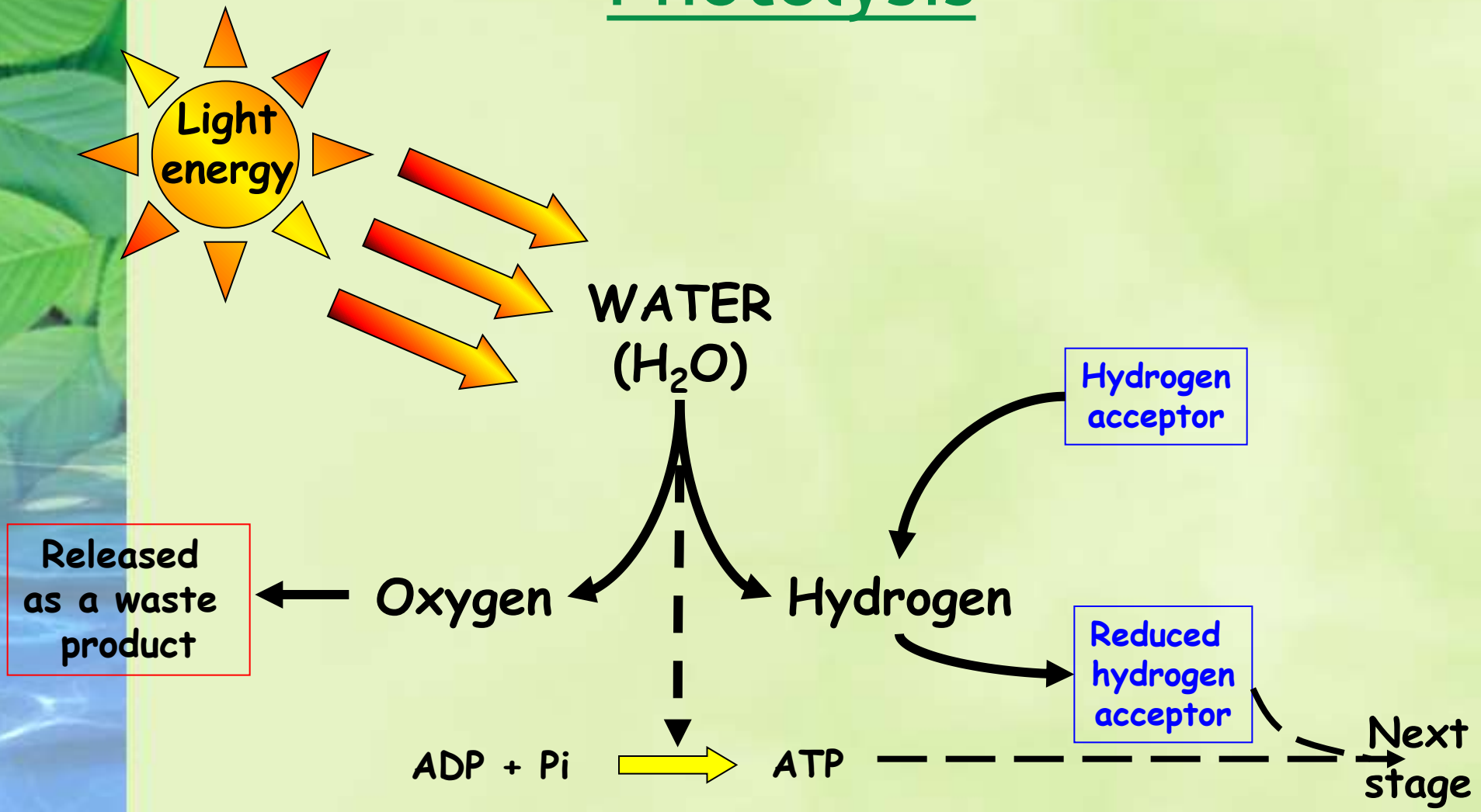
1. photosynthesis is a series of enzyme-controlled reactions which allow green plants to make their own food.
2. Light energy is absorbed by chlorophyll in chloroplasts and is converted into chemical energy.
3. C.Dioxide and water are the raw materials
4. Glucose is the food product and oxygen is the by-product.
5. Carbon Dioxide and oxygen move in/out of the cell by diffusion.
6. Starch is the storage carbohydrate found in green leaves and the test for starch is if iodine turns blue-black
7. Cellulose is the structural carbohydrate found in cell walls

Chemistry of Photosynthesis

- Photosynthesis is an enzyme-controlled process.
- 2 separate stages(both take place in the chloroplasts):

1. **Photolysis**
2. **Carbon fixation**

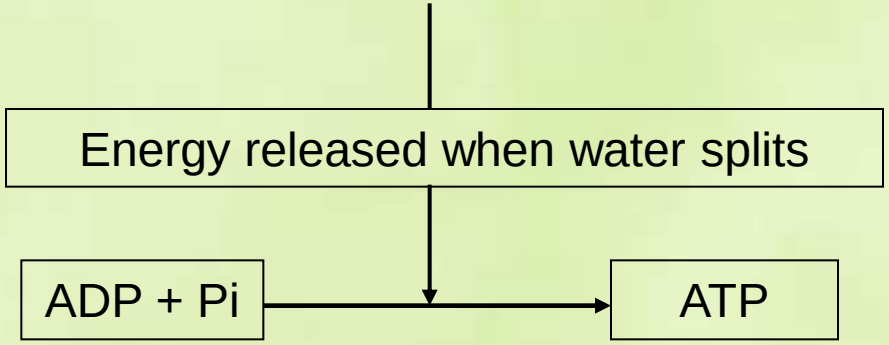
Photolysis


Light energy
WATER (H_2O)
Hydrogen acceptor
Released as a waste product
Oxygen
Hydrogen
Reduced hydrogen acceptor
ADP + Pi
ATP
Next stage

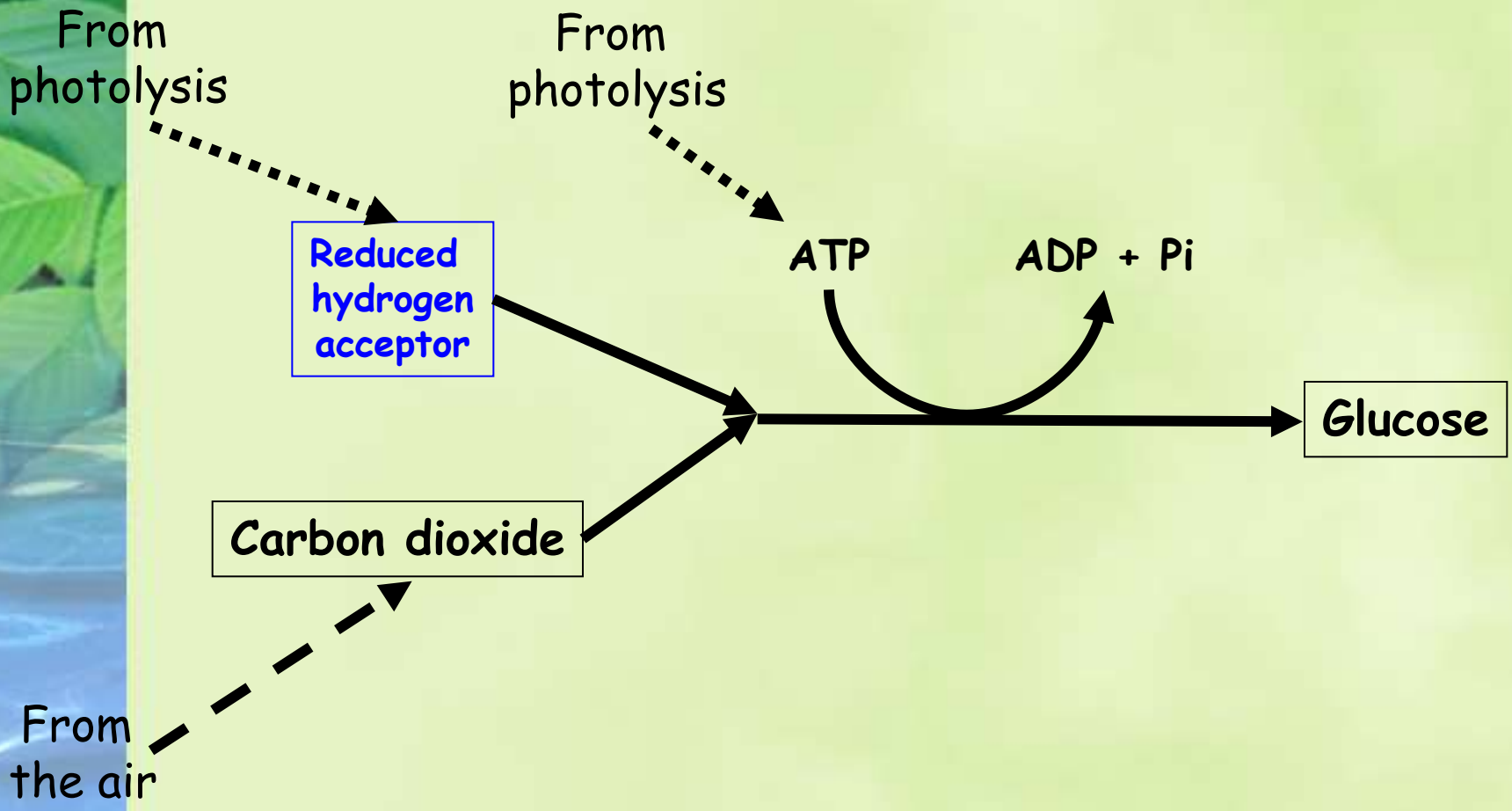
Photolysis

1. The light energy is used to split the water into oxygen and h_____.
2. O_____ is the by-product.
3. The hydrogen combines with a hydrogen a_____. The hydrogen acceptor is now said to be **r**_____.

4. Energy is made available for the s_____of ATP from A__ + __. This is called photo-phosphorylation.



Carbon Fixation



Carbon Fixation

- Carbon f_____ is the 2nd stage of photosynthesis and also occurs in the ch_____.
- It is a series of e_____ controlled reactions using the h_____ and ATP from p_____, and carbon dioxide from the a__.
- The carbon dioxide and the hydrogen are combined to produce g_____.

What factors affects the rate of photosynthesis?

- What does a plant need to photosynthesise?
- What biological molecules control photosynthesis – what affects these molecules?

Factors affect photosynthesis:

1. ***Light*** *– If there is no light, photolysis can't take place and there would be no hydrogen & ATP for stage 2.*

2. ***CO_2*** *– If there is no carbon dioxide, stage 2 (carbon fixation) cannot take place.*

3. ***Temperature*** *– Photosynthesis is an enzyme-controlled reaction. Enzymes are denatured at high temperatures*

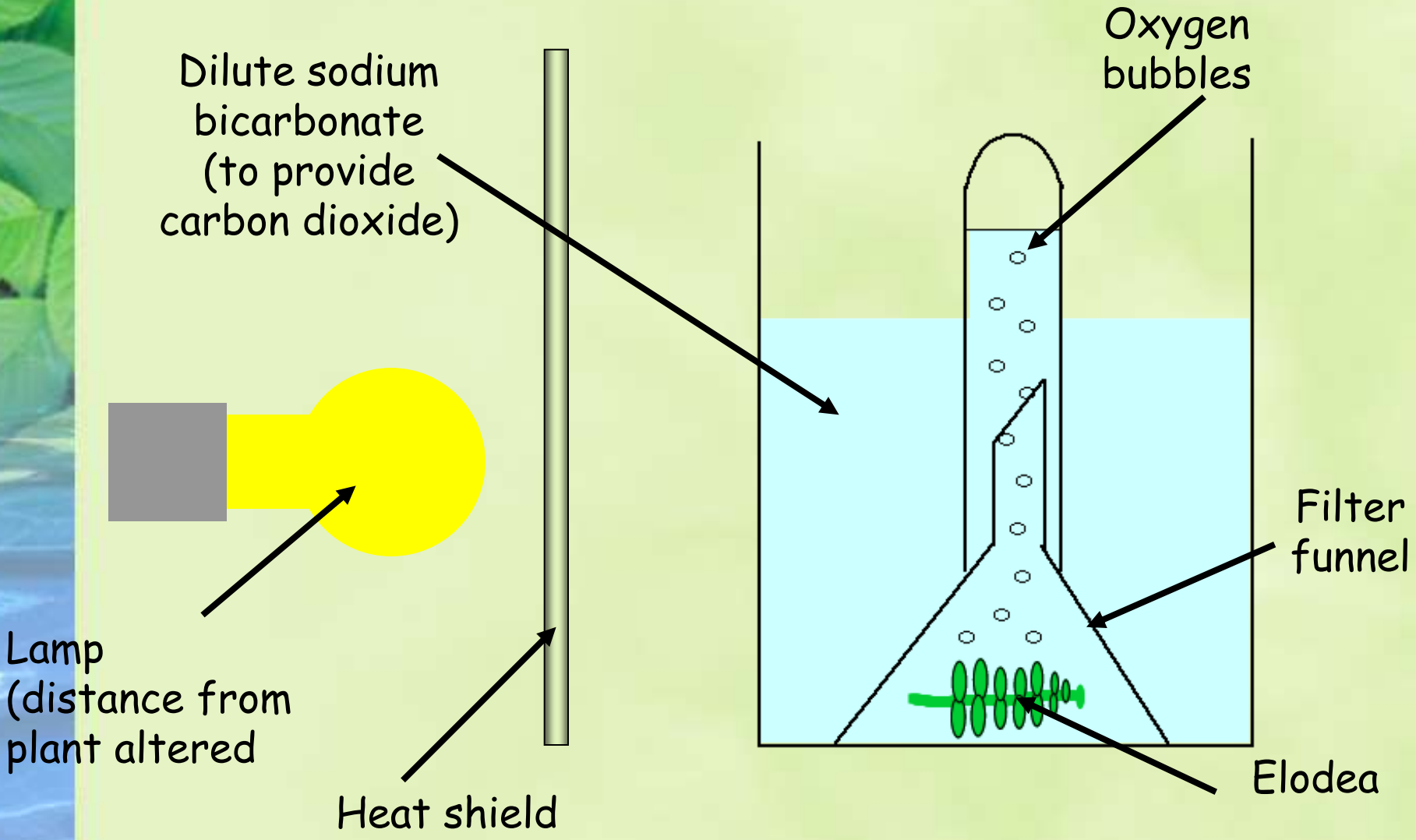
Limiting Factor

A Limiting factor is a substance that affects the rate of a reaction

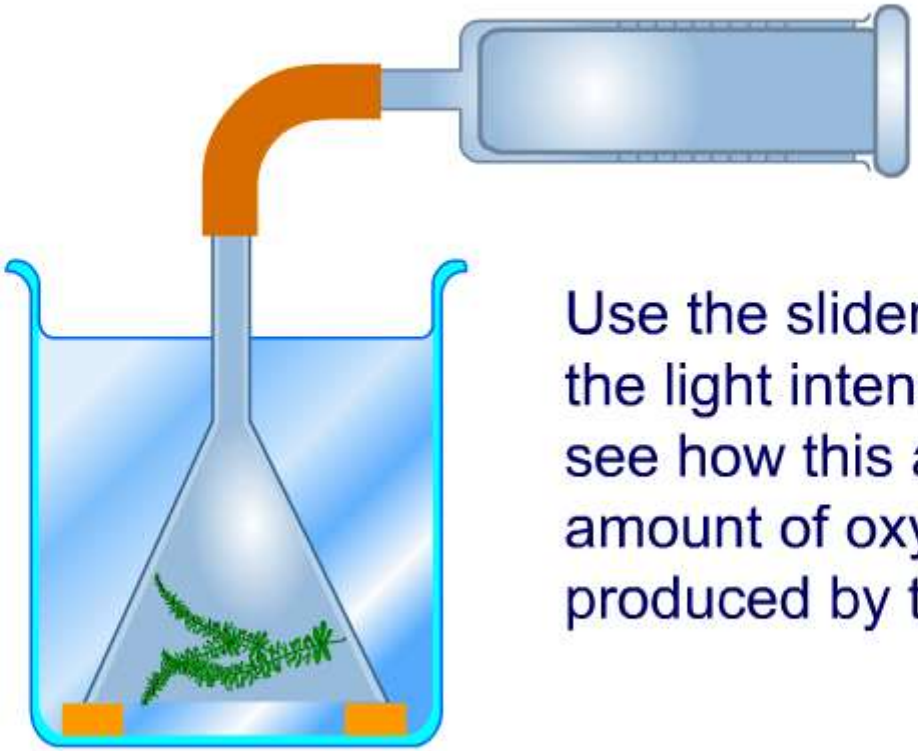
Limiting factors that affect the rate of Photosynthesis are:

1. light intensity
2. Carbon dioxide concentration
3. temperature

Light Intensity - Copy



How does light intensity affect the rate of photosynthesis?



max

off

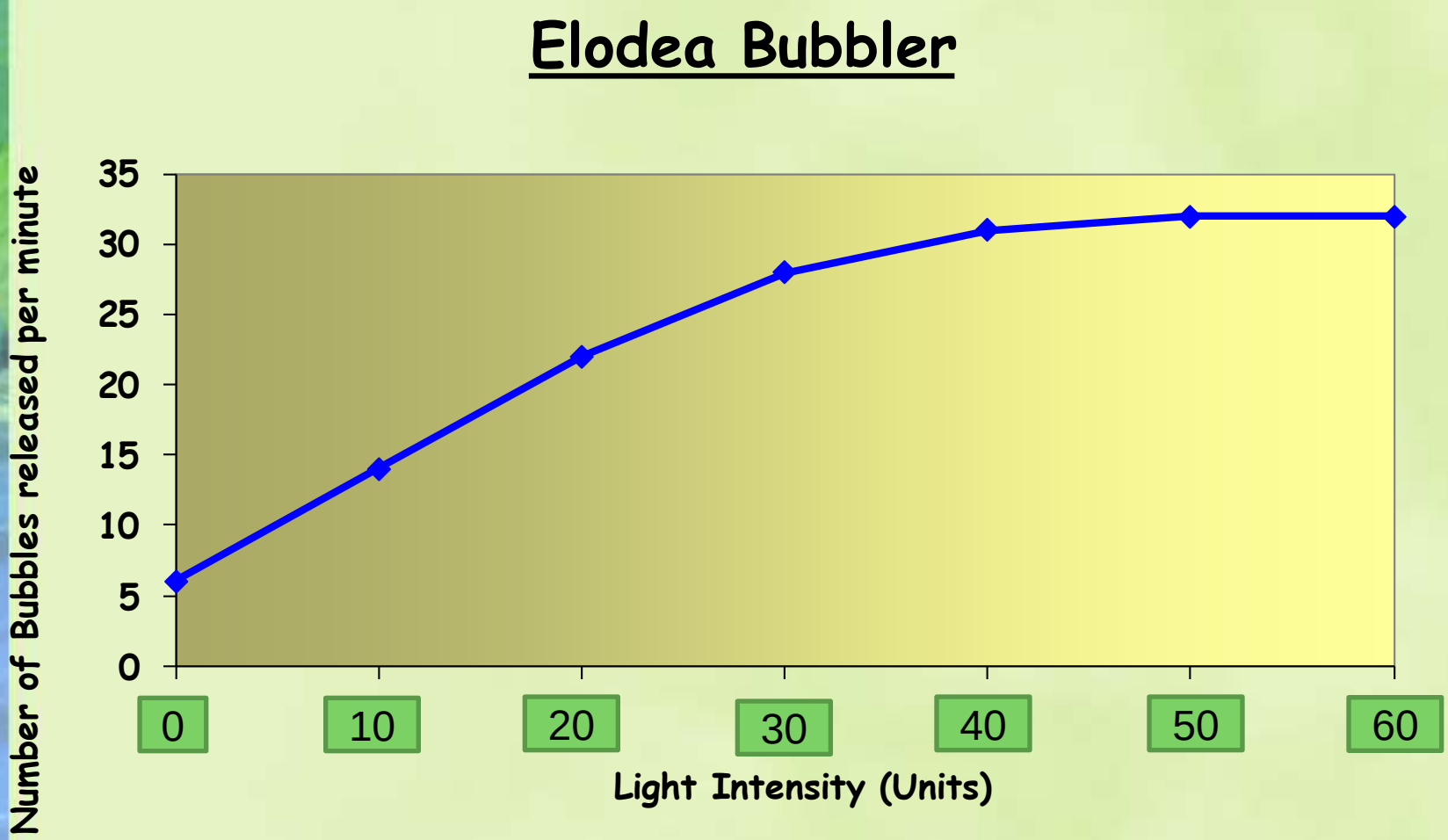
Use the slider to change the light intensity and see how this affects the amount of oxygen produced by the plant.

Light Intensity

Light Intensity (Units)	Number of Bubbles per minute
0	6
10	14
20	22
30	28
40	31
50	32
60	32

Activity: From these results plot a line graph.

Light Intensity

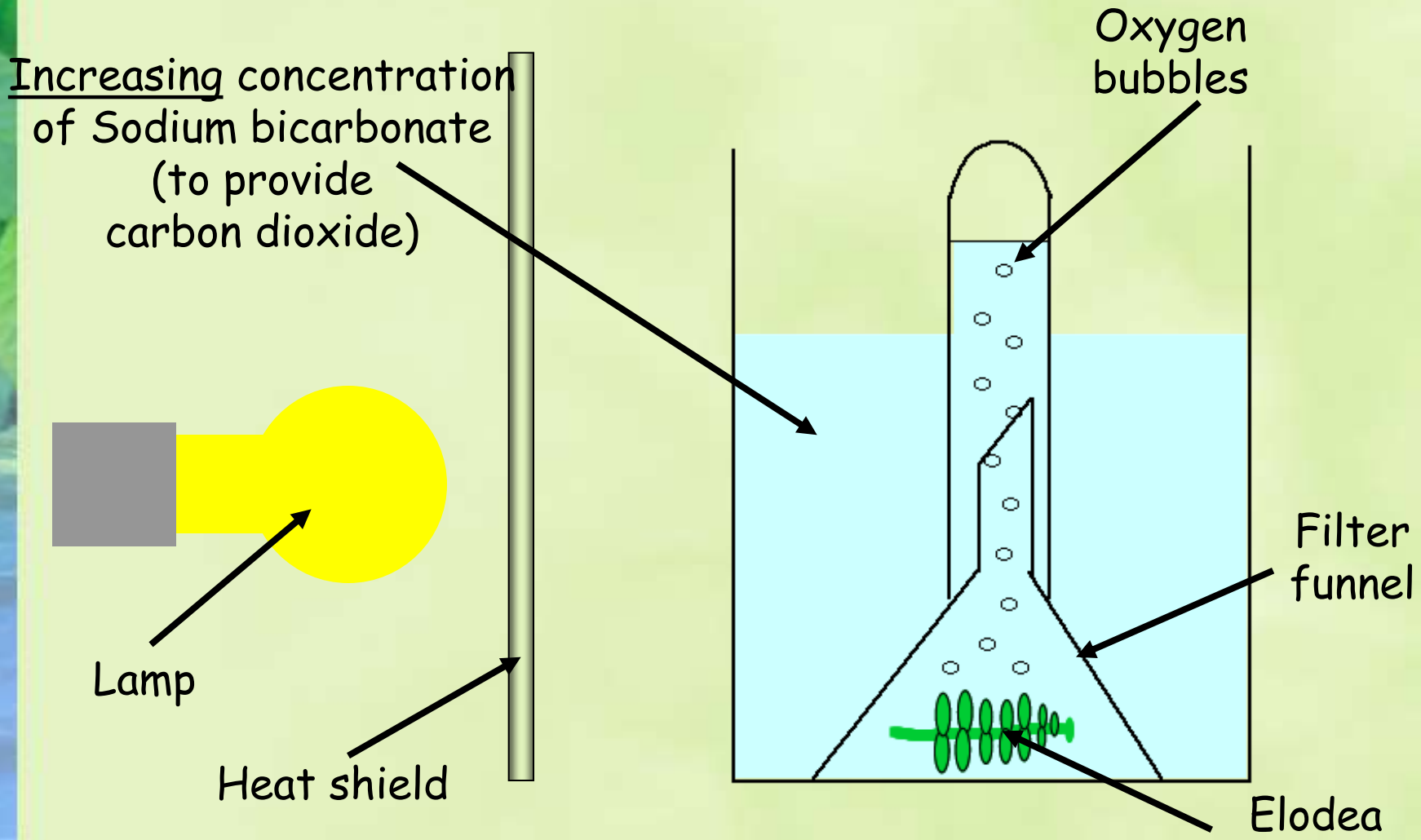


Answer the following question

- Describe the relationship between the light intensity and the number of bubbles. (2)

- As the light intensity increases from 0 – 50, the number of oxygen bubbles produced increases (1)
- From 50 – 60, the number of oxygen bubbles produced levels off (1)

CO_2 Concentration - Copy



Carbon Dioxide Concentration

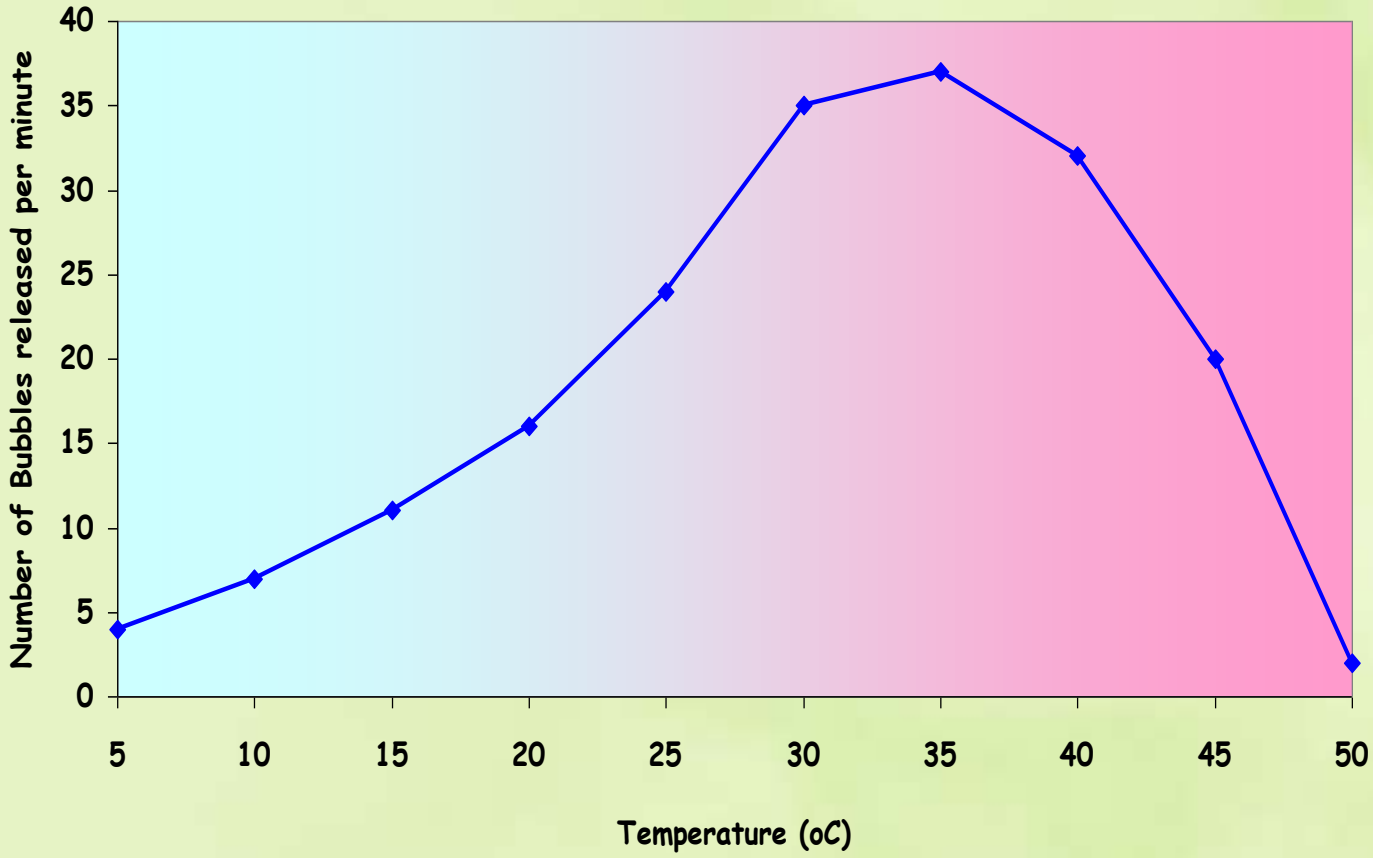
- This investigation also uses the Elodea bubbler apparatus.
- This time the lamp is kept in the s____ position but the mass of s_____ b_____ in the w_____ is gradually i_____.
- The results would produce a similar line graph, i.e. it would increase then level off.

Temperature

- Temperature is also a limiting factor for photosynthesis.
- However, the line graph is not the same as the graphs for Light Intensity and CO_2 concentration.
- Can you see the difference?

Temperature

Elodea Bubbler



Temperature

15	10
20	15
25	24
30	35
35	37
40	20
45	20
50	2

Activity: From these results plot a line graph.

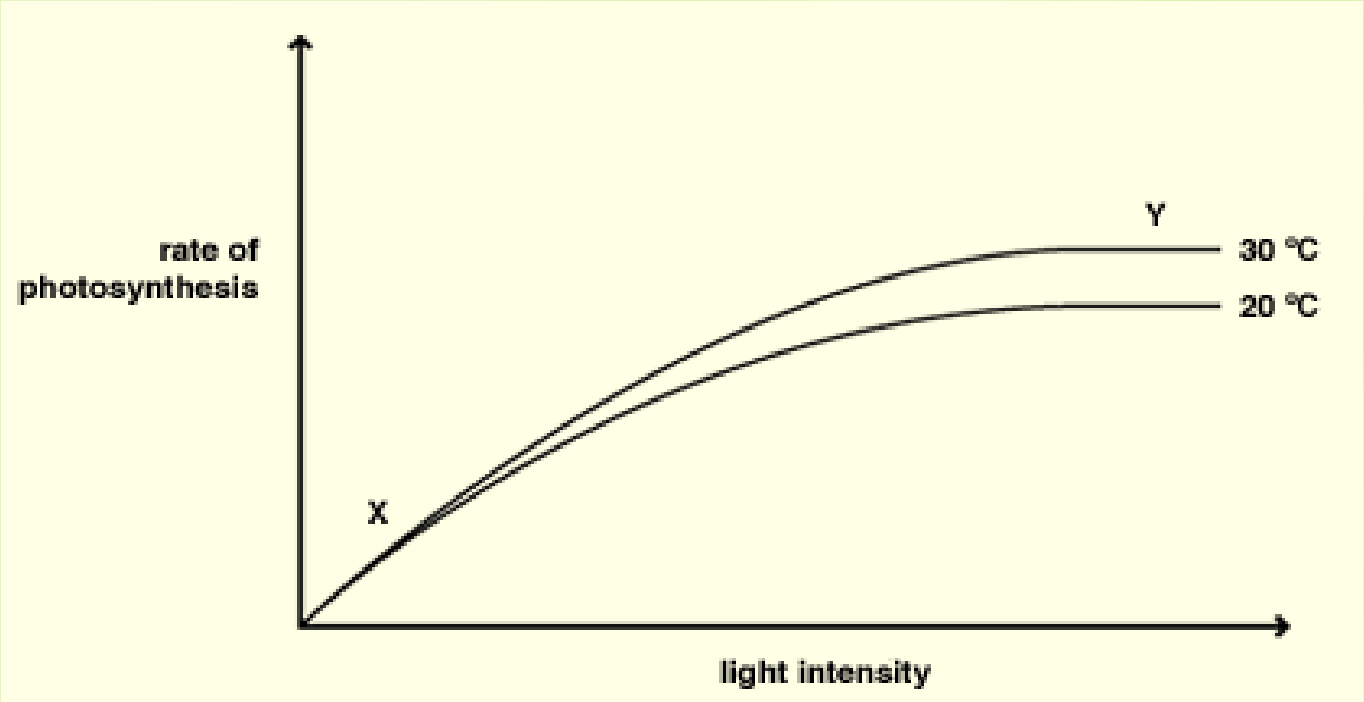
Graph Analysis

- We can see from the graph that as the temperature increases, so does the rate of photosynthesis.
- This happens until it reaches the **o_____** temperature. This is the temperature at which the rate of photosynthesis is g_____
- After this, the rate of photosynthesis slows down rapidly as the enzymes which control it are d_____ at high temperatures.

Sample Questions

The limiting factors of photosynthesis

Increasing light intensity



1. What is the factor which is limiting the rate of photosynthesis at point X on the graph?

2. Account for the increase in the rate of photosynthesis in graph 1 when the temperature is raised from 20 degrees C to 30 degrees C.

3. Name an environmental factor other than temperature which may be limiting the rate at point Y.

1. ***Light intensity***

In any question on limiting factors, the factor on the X axis remains a limiting factor for as long as the graph continues to rise; in this case the point at which it levels off. At this point photosynthesis may still be limited by other factors such as temperature or carbon dioxide concentration.

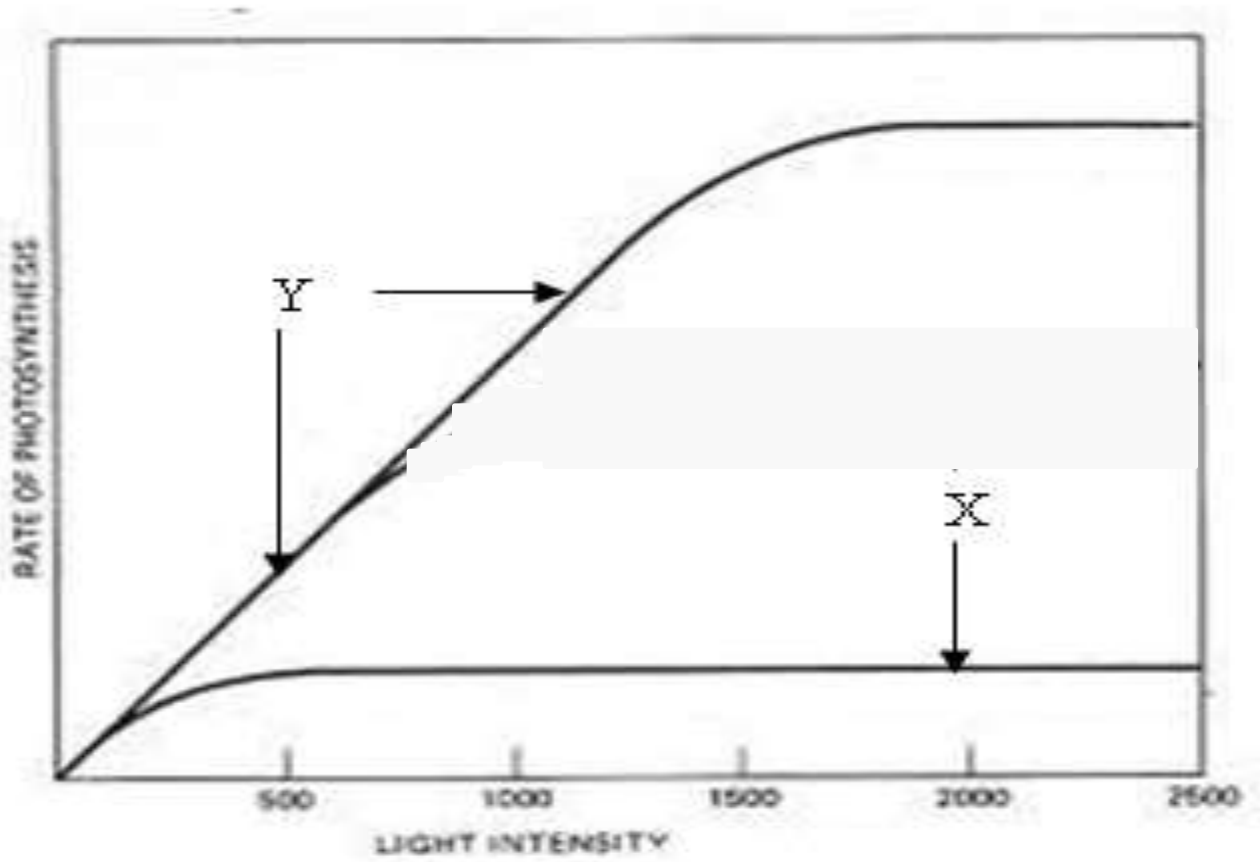
2. ***The enzymes controlling photosynthesis are nearer or at their optimum temperature.***

Giving an account means to explain and not simply describe the rate increase.

3. ***Carbon dioxide concentration***

Here giving one of the other limiting factors would be sufficient in your answer.

What is limiting at points X and Y?



B - 0.50% CO_2

A - 0.01% CO_2

ICT task…

- We depend on plants for a huge variety of things. Your task is to:

a) Find out what plants are useful in the 9 different areas shown on the next slide.

b) Write down 3 examples of plants that are useful in those areas including one that you have never heard of.

c) Draw a picture of one plant in each of the 9 sections.

1. Food
2. Drinks
3. Clothing
4. In the home
5. Entertainment
6. Travel
7. Sport
8. Medicines
9. Toiletries