

## Study sheet | Lower Secondary Stage of (6-8)

1<sup>st</sup> Semester | 2023-2024

**Subject:** Biology

**Chapter:** Limiting Factors of photosynthesis

Name :

Date :

**Objectives:** Explain the factors that affects the rate of photosynthesis

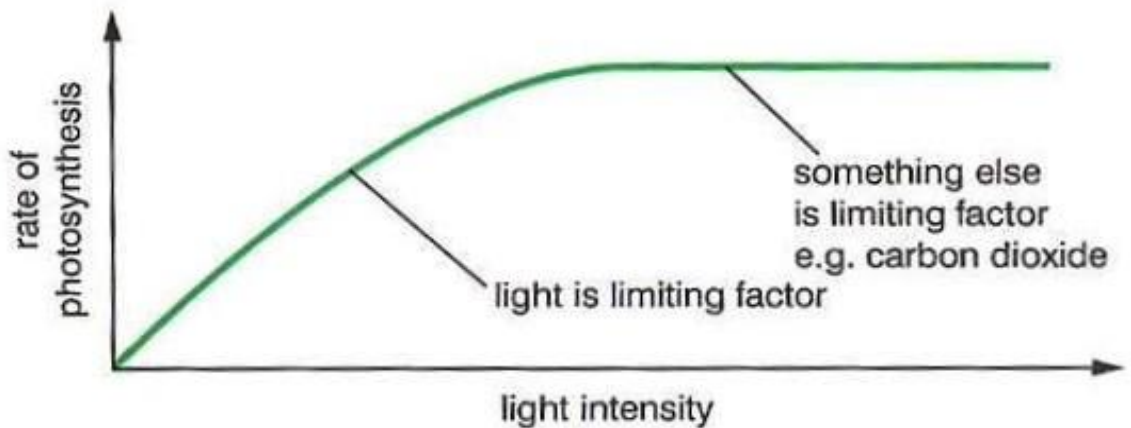
### Factors that affect the rate of photosynthesis

#### 1. The effect of light on the rate of photosynthesis :

As the light intensity increases, the rate of photosynthesis increases, up to a point after which the rate remains constant, due to either :

- No more light can be absorbed by the available chloroplasts** which are filled already.
- Carbon dioxide concentration:** Since there is only 0.04 per cent carbon dioxide in the atmosphere, it seems logical that carbon dioxide can **limit the increase in the rate of photosynthesis.**
- The temperature is not good enough for the activity of enzymes.** Overall, the process of photosynthesis is sensitive to higher temperatures. This is

because the enzymes involved in photosynthesis become denatured at higher temperatures. Low temperatures also inactivate the enzymes.



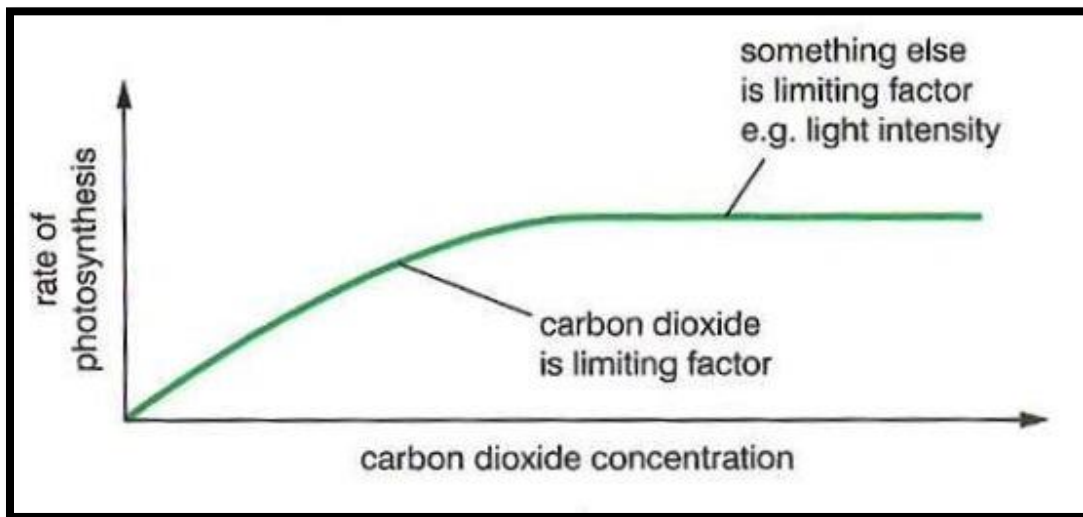
**The Factors that limit the increase in the rate of photosynthesis are called limiting factors**

*In this case the limiting factors are Temperature and Carbon dioxide concentration.*

***So at any point in time if one of the three factors is in short supply, this factor will be the limiting factor. Only a change to the limiting factor will increase or decrease the rate of photosynthesis. Changing the other two will have no effect.***

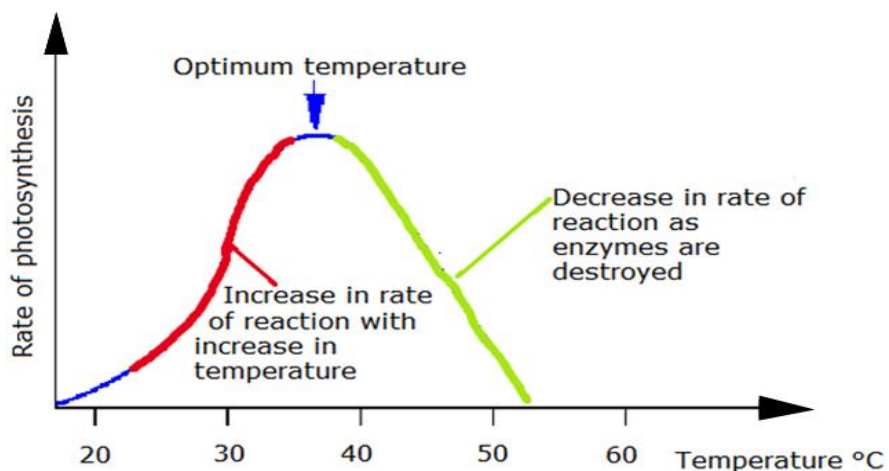
## **2. The effect of carbon dioxide concentration on the rate of photosynthesis :**

The concentration of carbon dioxide in the Earth's atmosphere varies between 0.03% and 0.04% that's why it has a major influence on the rate of photosynthesis since **it is the substrate that is in shortest supply.** **An increase in the concentration of carbon dioxide allows an increase in the rate of photosynthesis** because CO<sub>2</sub> is a raw material for photosynthesis.



### 3. The effect of temperature on the rate of photosynthesis :

The higher the temperature, then typically the greater the rate of photosynthesis, photosynthesis is a chemical reaction and the rate of most enzyme catalyzed reactions increases with temperature. However, for photosynthesis at temperatures above 40°C the rate slows down. This is because the enzymes involved in the chemical reactions of photosynthesis are temperature sensitive and are denatured at higher temperatures.

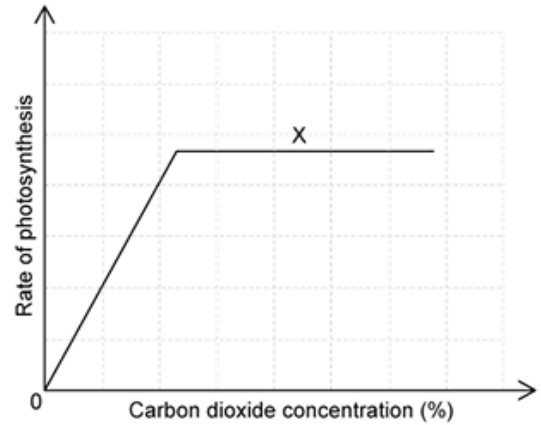


**Check your understanding :**

**Question :**

Fig. 1 shows the relationship between carbon dioxide concentration and the rate of photosynthesis.

- a. Describe the relationship between carbon dioxide concentration and rate of photosynthesis shown in the figure



**Fig. 1**

.....  
.....

- b. Identify a possible limiting factor at the point labelled X in Fig. 1.

.....

- c. Sketch a graph of the rate of photosynthesis against temperature.

- d. Explain the shape of the graph that you have drawn in part C .

.....  
.....