المدرسة الوطنية الأرثوذكسية الشميساني

The National Orthodox School Shmaisani

Worksheet | The Secondary Stage of (6-8)

1st Semester | 2023-2024

Subject: Biology **Chapter:** Limiting Factors of photosynthesis

Name :

Date :

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

Objective : Understand the factors that affects the rate of photosynthesis .

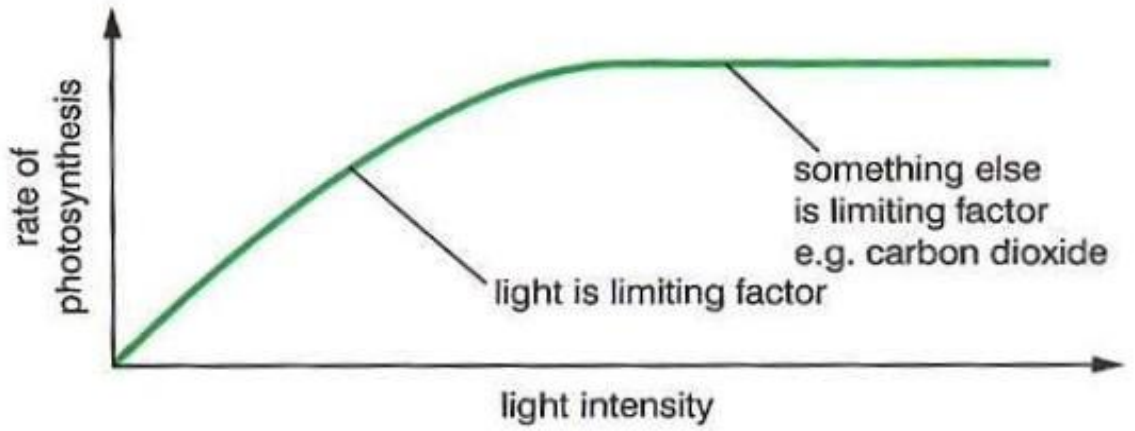
Factors that affect the rate of photosynthesis

1. **<u>The effect of light on the rate of photosynthesis :</u>**

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

a. **No more light can be absorbed by the available chloroplasts** which are filled already.
b. **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.**
c. **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.



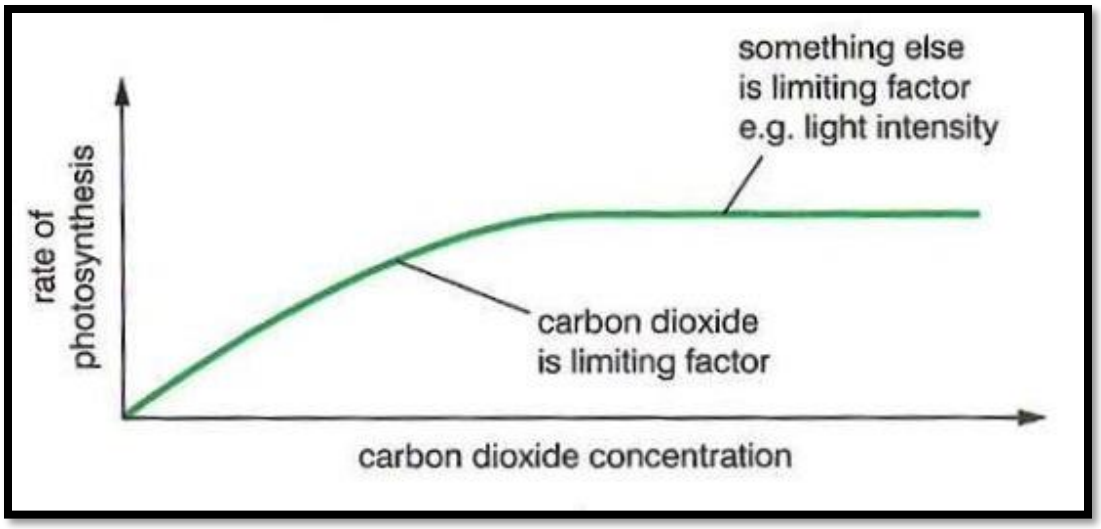
The Factors that limit the increase in the rate of photosynthesis are called limiting factors

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.

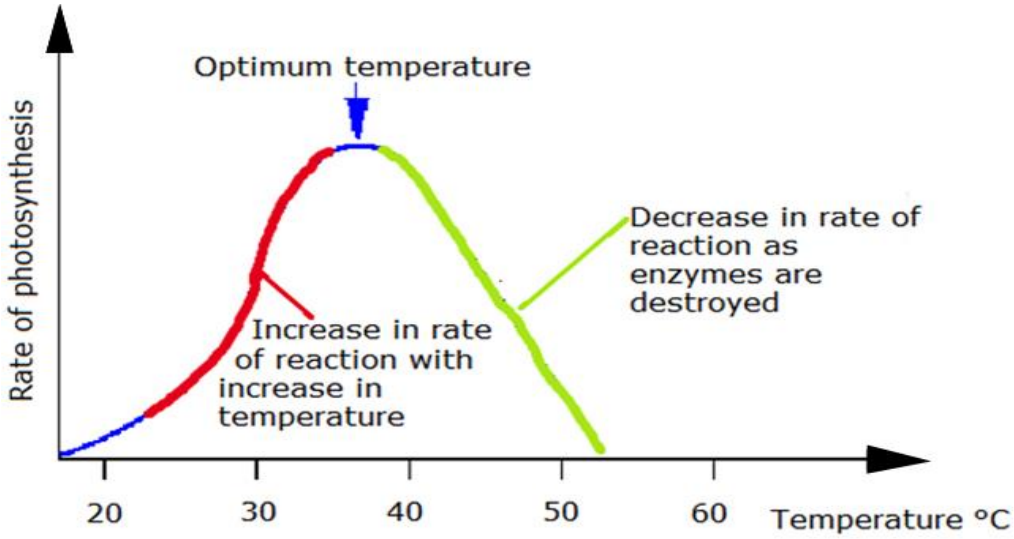
2. The effect of carbon dioxide concentration on the rate of photosynthesis :

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_2 is a raw material for photosynthesis.



3. **<u>The effect of temperature on the rate of photosynthesis</u> :**

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 1 :

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

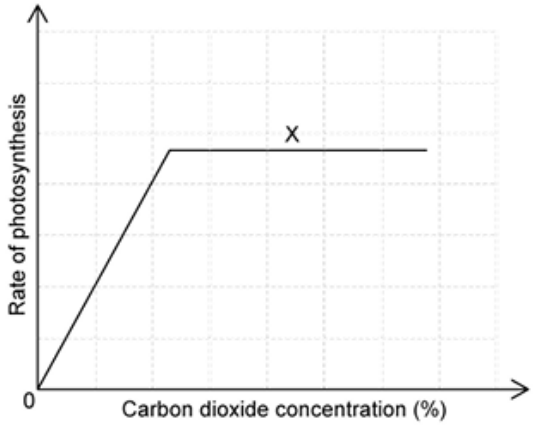


Fig. 1

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

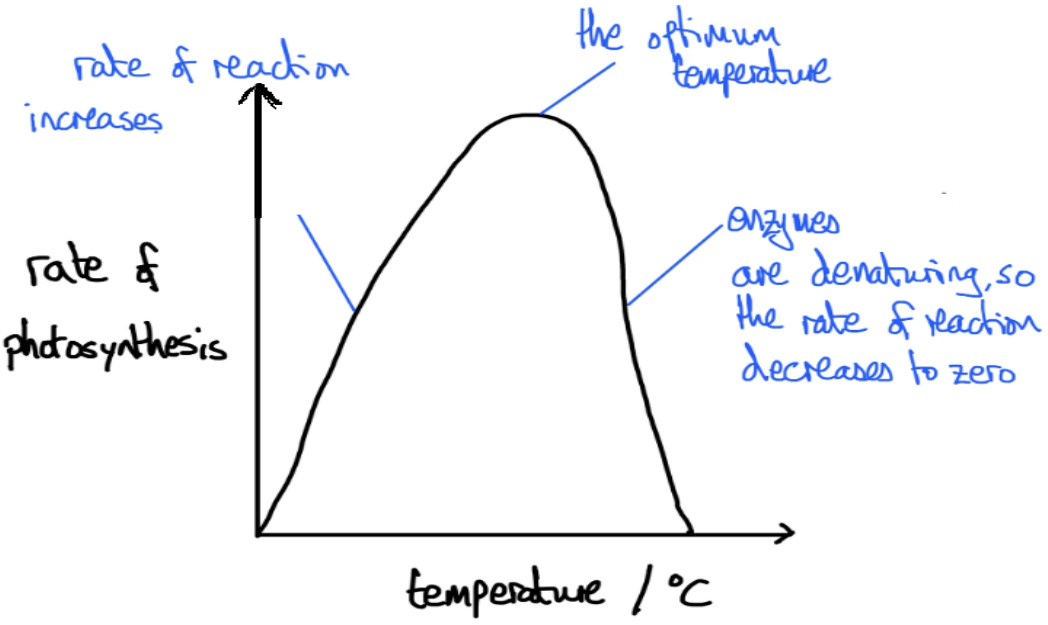
As carbon dioxide concentration increases the rate of photosynthesis also increases (up to a point)

(After a certain concentration is reached) the rate of photosynthesis levels stays constant

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

Temperature or Light intensity

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



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

As temperature increases the reaction rate increases , above a certain temperature enzymes are denatured causing reactions to slow down and stop.