

Bio Factsheet



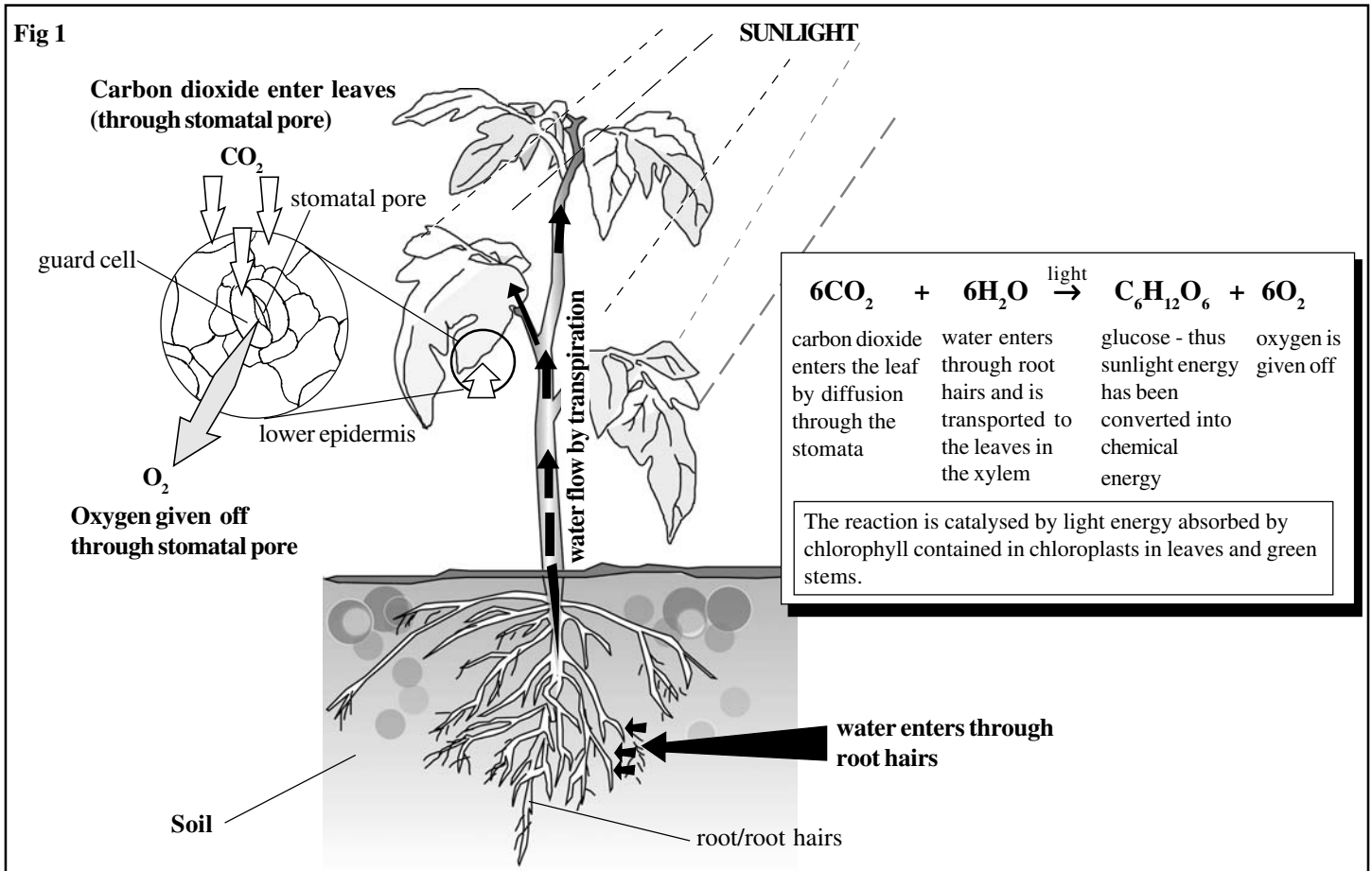
www.curriculum-press.co.uk

Number 153

The Light Dependent Stage of Photosynthesis

This Factsheet focusses on the first stage of photosynthesis: the light dependent stage. It updates Factsheet 2 (The essential guide to photosynthesis) 1994 and reviews the exam questions which have appeared since September 2000 (all specification)

Fig 1 summarises what you learned at GCSE.



Photosynthesis occurs in the chloroplast and you've got to know your basic chloroplast structure (Fig 2).

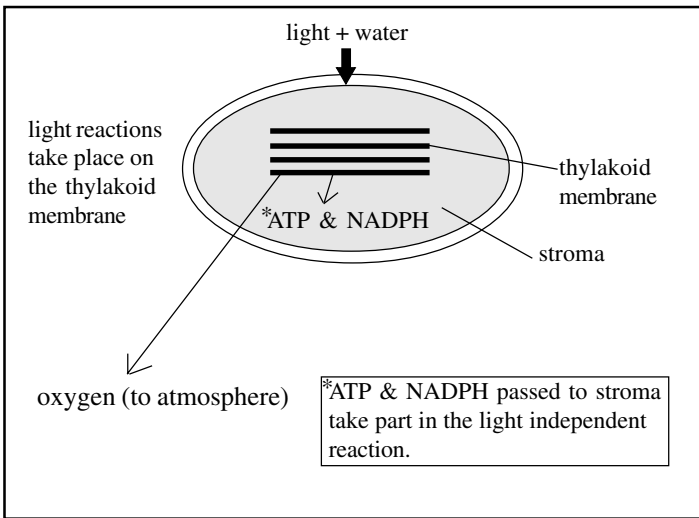
Fig 2

Structures	Functions
Ribosomes in stroma	Synthesising enzymes – Ribulose biphosphate carboxylase, for example.
Starch grain	The soluble sugars made in photosynthesis cannot be stored. They can only be stored if they are converted into an insoluble form.
Grana	Creates large surface area for chlorophyll so lots of light can be absorbed.
Thylakoid membranes	Compartmentalization - allowing different enzyme – driven reactions to occur within the chloroplasts at the same time.
DNA	Codes for some of the chloroplast proteins.

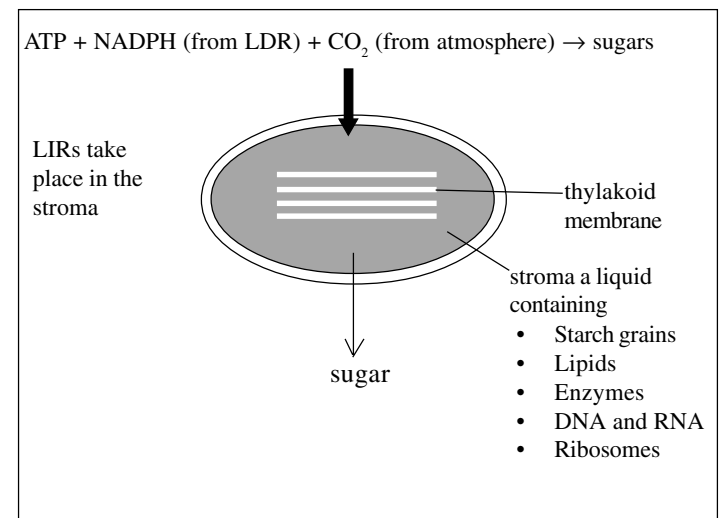
Exam Hint: In the exam you won't be asked to draw the chloroplast but could be asked to label or describe the functions of the parts.

Photosynthesis can be broken down into two stages:

1. The Light-Dependent Reaction (LDR) which only occurs in the light.

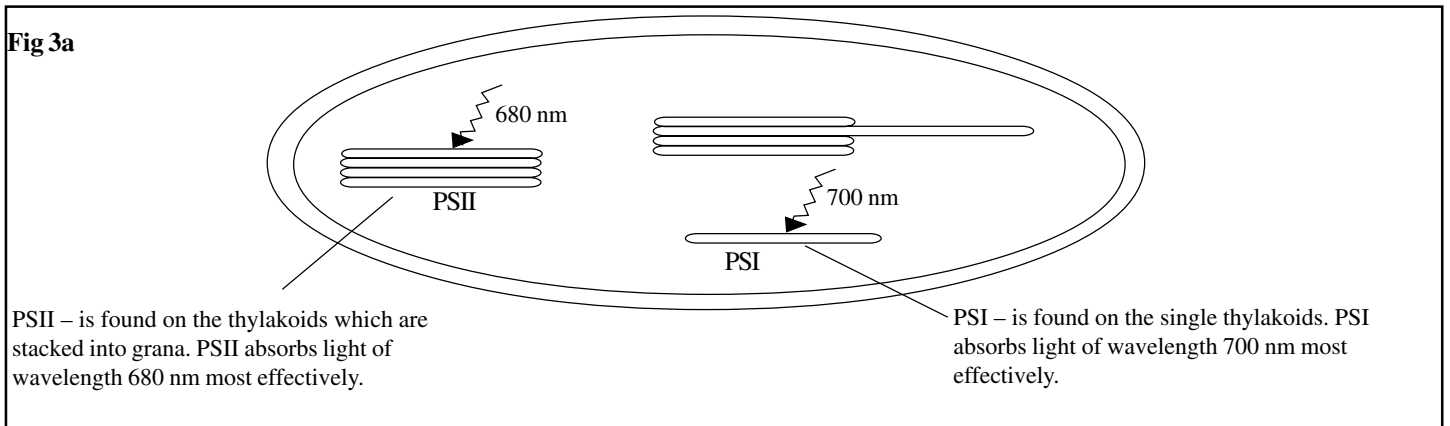


2. The Light-Independent reaction (LIR), which as the name implies, doesn't need light. So it can, in theory, occur day and night.



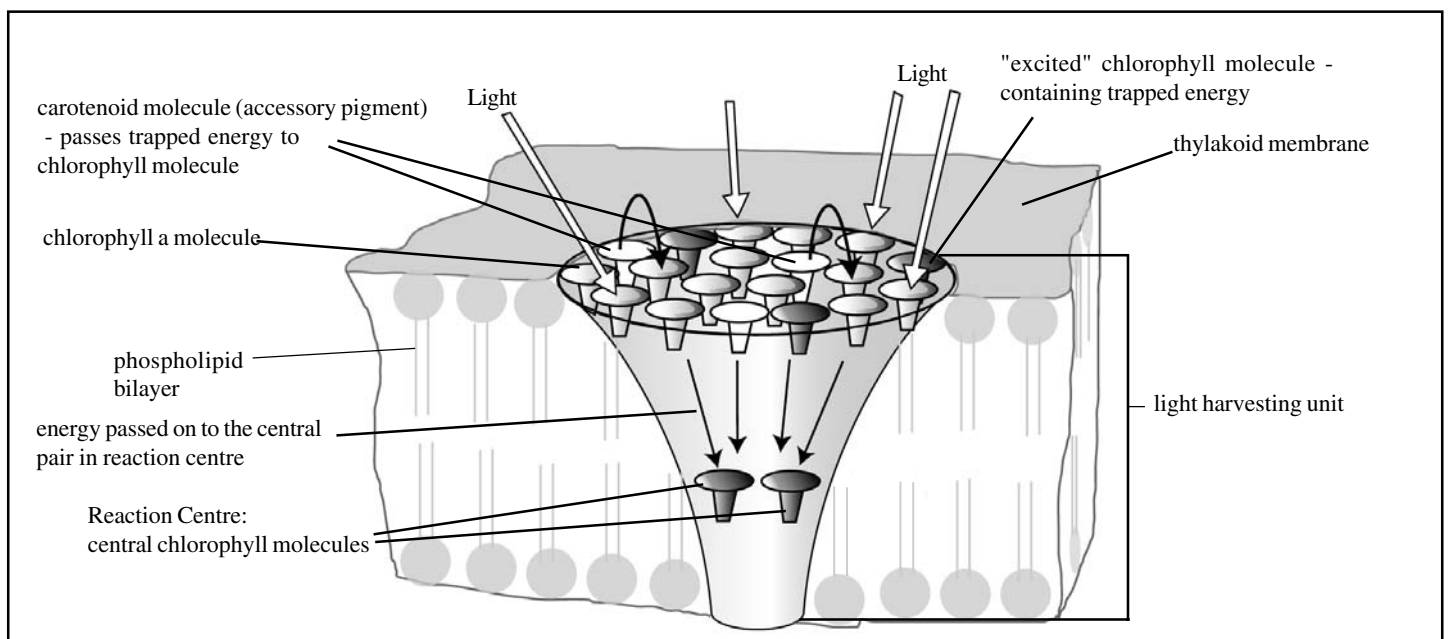
Photosystems

On the thylakoid membranes chlorophyll molecules are arranged into clusters called photosystems I and II (PSI and PSII) (Fig3a)



Both PSI and PSII consist of **primary pigments** (forms of chlorophyll a molecules) and **accessory pigments** (other forms of chlorophyll a, along with chlorophyll b and carotenoids) (Fig 3 b). The role of the accessory pigments is to capture light energy and pass it to a chlorophyll a - the primary pigment.

Fig 3 b. Photosystem unit



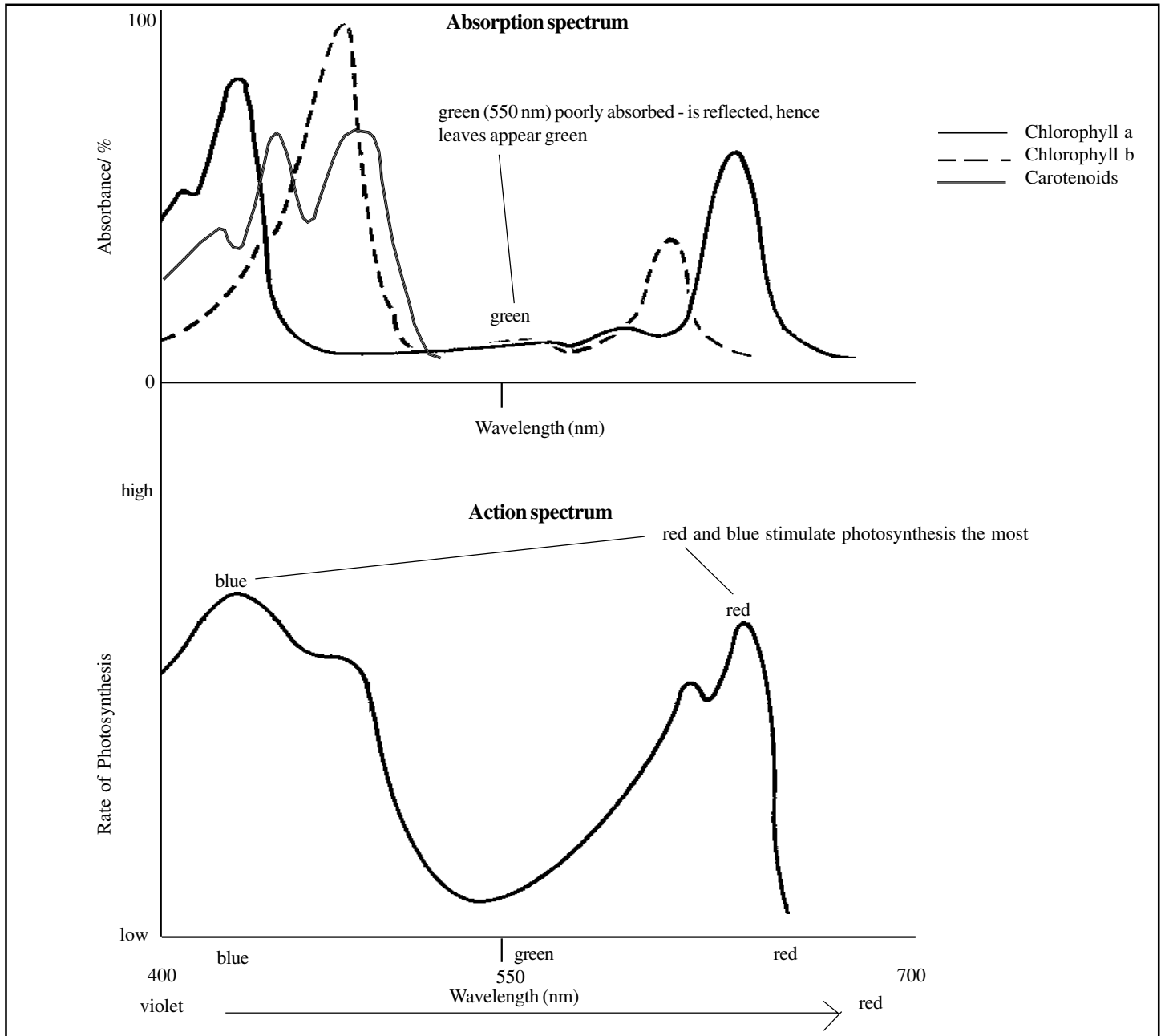
Chlorophyll a and b and the carotenoids absorb different parts of the visible spectrum

You need to know about two important graphs :

1. The absorption spectrum is a graph that shows which wavelengths of light are absorbed by a pigment. The absorption spectrum below shows the wavelengths absorbed by chlorophyll a, chlorophyll b and the carotenoids. Red (650nm) and blue(460nm) are absorbed strongly. Green (550nm) is poorly absorbed most of it is in fact reflected – which is why leaves appear green.

2. The action spectrum is a graph which shows the wavelengths of light that are actually **used** in photosynthesis.

Fig 4. Absorption/action spectrum



As you might expect, the absorption and action spectra look similar i.e. the wavelengths that are **absorbed** most strongly are the ones that **stimulate photosynthesis** the most.

Typical Exam Questions

1. What is the advantage of having more than one type of pigment?

Answer : because each type absorbs a different part of the visible spectrum. So, having several pigments means that more light can be absorbed. The job of the accessory pigments is to absorb light energy and pass it to the primary pigment molecules.

2. Define absorption spectrum/action spectrum

Fig 5. Overleaf describes what happens in the light dependent stage. Start at 1 and follow the numbers round.

