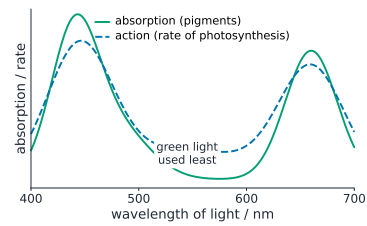


Photosynthesis A-Level Biology ■ Topic 13 A-Level Biology 	Photosynthesis What we will cover 1 The chloroplast 2 The two stages 3 Pigments & spectra 4 The light-dependent stage 5 The Calvin cycle 6 Limiting factors  leaves are green with chlorophyll
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2 Pigments

Photosynthesis Pigments

Pigments and spectra

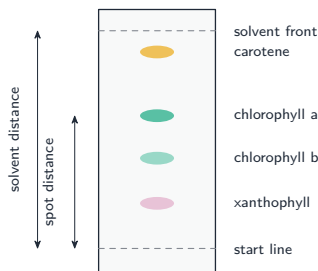


Chlorophyll 叶绿素 absorbs mainly red & blue light.

The **absorption spectrum** 吸收光谱 matches the **action spectrum** 作用光谱 – showing the pigments drive photosynthesis.

Photosynthesis Pigments

Chromatography



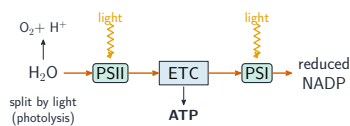
Chromatography 色谱法 separates the pigments – each travels its own distance up the paper.

$$R_f = \frac{\text{spot distance}}{\text{solvent distance}}$$

3 The reactions

Photosynthesis The reactions

The light-dependent stage

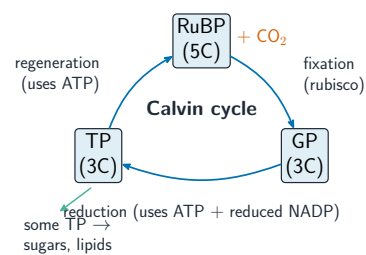


Photophosphorylation 光合磷酸化 makes ATP. In the **non-cyclic** form:

- **photolysis** 光解 of water releases **oxygen** 氧气
- electrons flow PSII → PSI
- ATP and reduced NADP are made

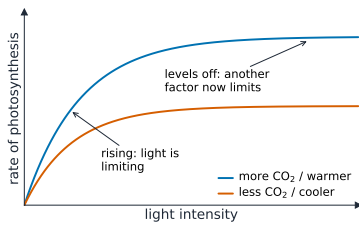
Photosynthesis The reactions

The Calvin cycle



- **fixation** 固定 – **rubisco** 核酮糖二磷酸羧化酶 joins CO₂ to RuBP → GP
 - **reduction** 还原 – GP → TP using ATP & reduced NADP
 - **regeneration** 再生 – TP remakes RuBP
- Some TP leaves to make sugars.

Limiting factors



A **limiting factor** 限制因素 is the one in shortest supply.

While the rate rises, **light** 光照强度 limits it; where it levels off, CO_2 or temperature limits it. (Too hot $\rightarrow$ enzymes denature.)

4

Recap

Worked example – the Calvin cycle disturbed

A plant photosynthesising steadily is suddenly given no CO_2 . What happens to GP and RuBP?

- CO_2 joins RuBP (via rubisco) to make GP; no $\text{CO}_2 \Rightarrow$ that step stops.
- GP is still being **used up**, reduced to triose phosphate $\Rightarrow$ **GP falls**.
- RuBP is still being **regenerated** from triose phosphate but no longer consumed $\Rightarrow$ **RuBP rises**.
- Remove the **light** instead: the opposite – GP rises, RuBP falls.

Track **what is made** and **what is used** for each molecule. Cutting CO_2 and cutting light give **opposite** answers – read which one the question removed.

Topic 13 – key takeaways

1 Chloroplast

grana for stage 1; stroma for stage 2

2 Light stage

photolysis releases O_2 ; makes ATP & NADPH

3 Calvin cycle

fixation, reduction, regeneration

4 Limiting factors

light, CO_2 , temperature

Check yourself

- Where does the Calvin cycle happen?
- What gas is released by photolysis of water?
- Which enzyme fixes carbon dioxide?
- Name a limiting factor of photosynthesis.



Answers 1. the stroma 2. oxygen 3. rubisco 4. light / CO_2 / temperature