

The Three-Step Sugar-Making Cycle

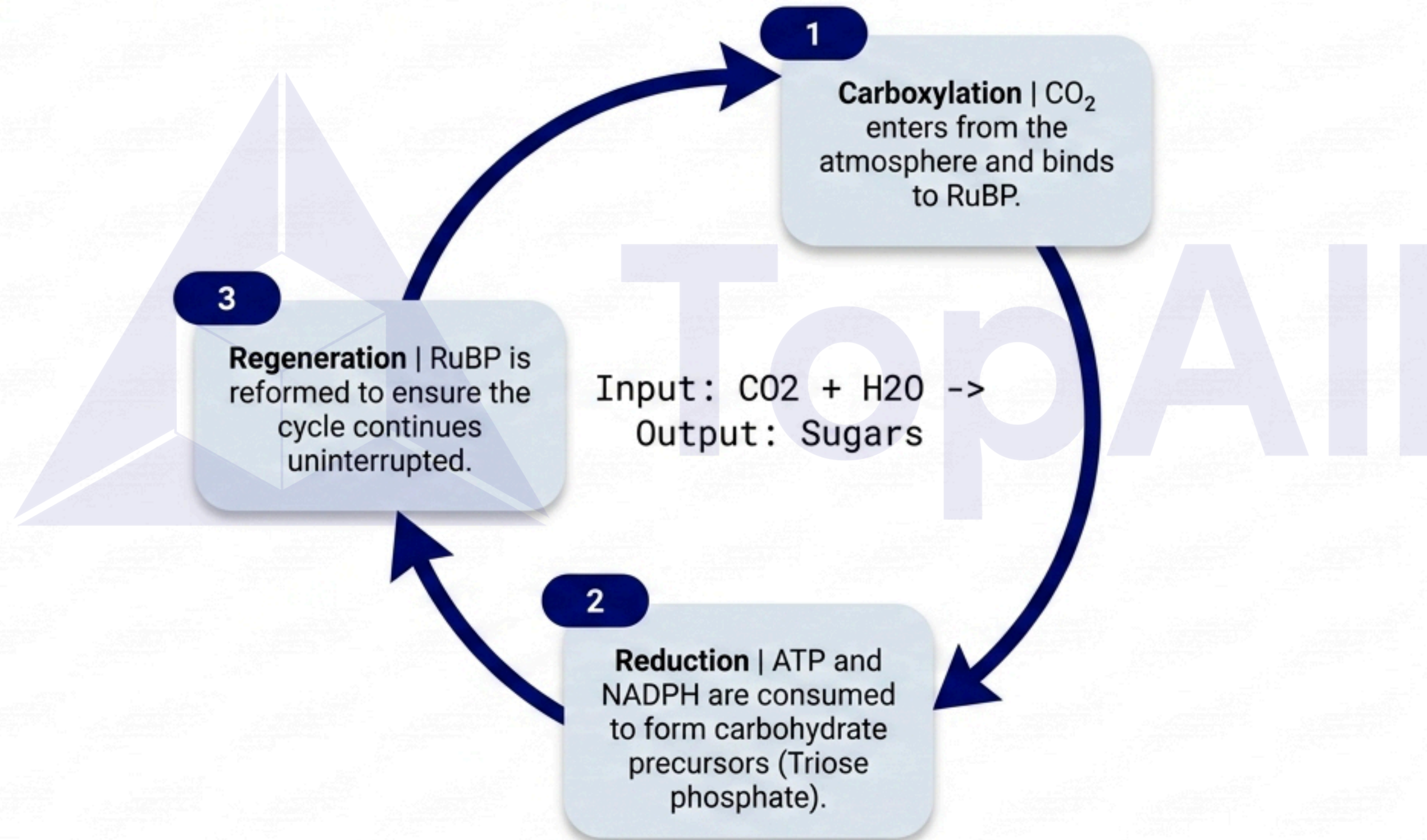
A structural breakdown of the Calvin Cycle
and the mechanics of carbon fixation.

The Universal Biosynthetic Pathway

The Calvin Cycle occurs in **all photosynthetic plants**. Whether a plant utilizes a C_3 or C_4 pathway for initial carbon capture, the ultimate synthesis of organic sugars is always executed through this exact cycle.

Location & Discovery: This cycle takes place in the matrix stroma of the chloroplast. It was mapped by Melvin Calvin using radioactive ^{14}C in algal photosynthesis, revealing that the first stable product of CO_2 fixation is a 3-carbon organic acid.

The Cycle Overview





**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

Practice Now



At prep.topall.app

Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



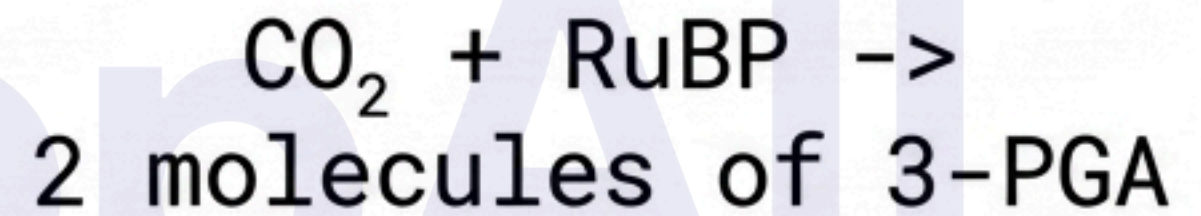
Step 1 of 3



Carboxylation: Fixing Carbon

This is the most crucial step of the cycle. Inorganic carbon dioxide is captured and combined with a 5-carbon ketose sugar (Ribulose biphosphate, or RuBP) to form a highly stable organic intermediate.

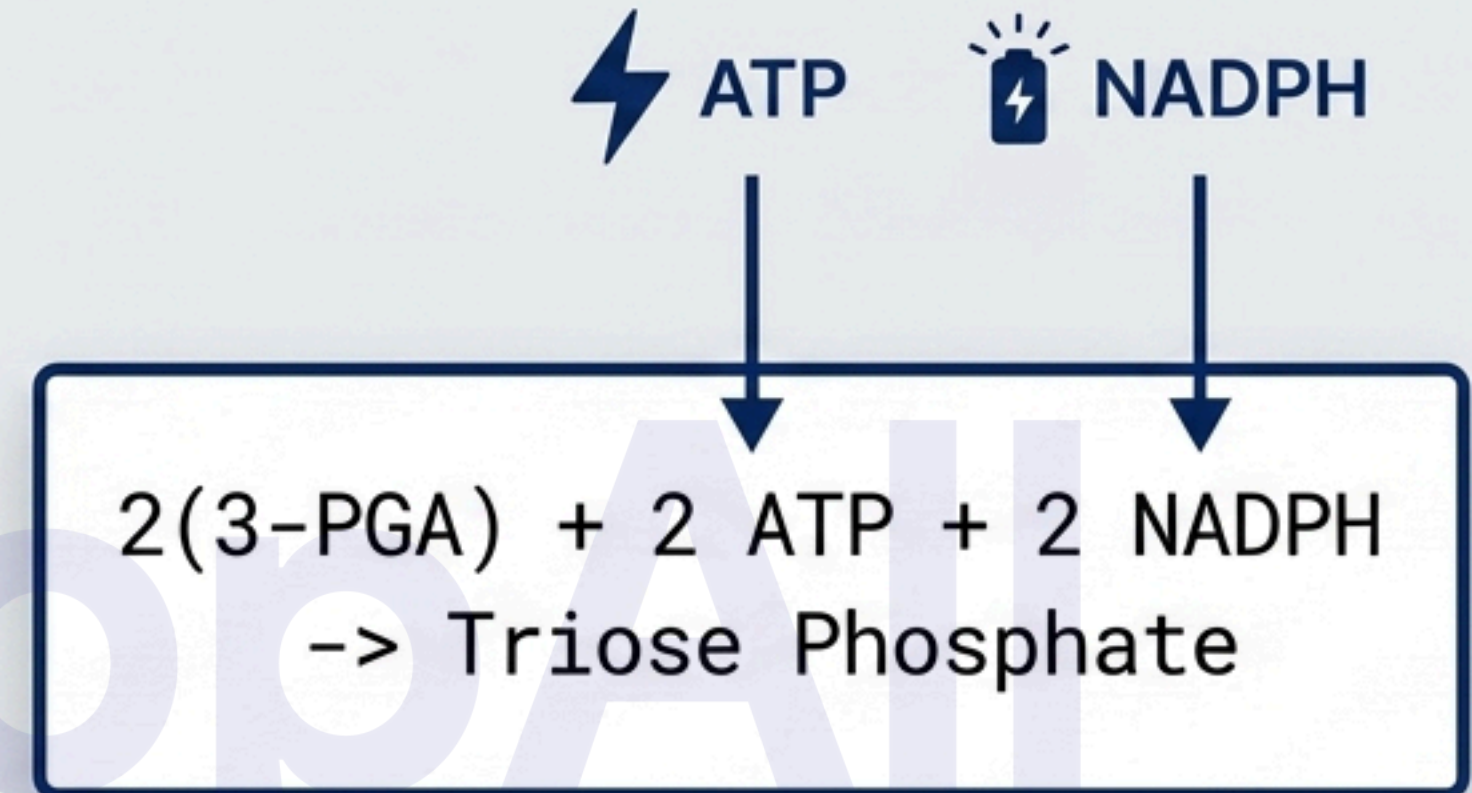
The Catalyst: This reaction is driven by **RuBisCO** (RuBP carboxylase-oxygenase), recognized as the most abundant enzyme in the world.



Reduction: Building the Sugar

A series of reactions that ultimately lead to the formation of glucose. The photochemically synthesized energy harvested from the light reactions is heavily consumed here to reduce 3-phosphoglyceric acid (3-PGA) into triose phosphate.

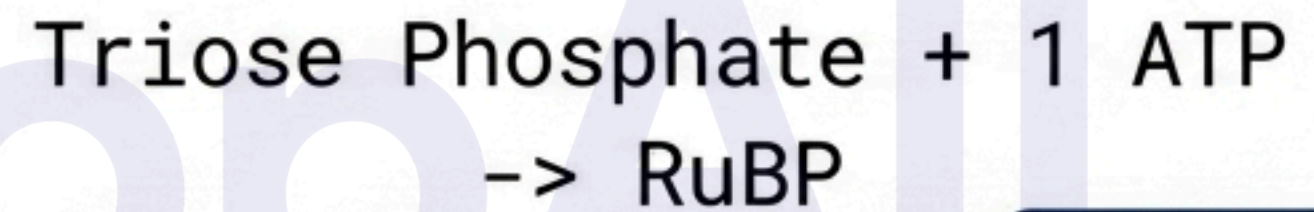
- Requires 2 ATP for phosphorylation (per CO₂ fixed)
- Requires 2 NADPH for reduction (per CO₂ fixed)



Regeneration of RuBP

For the cycle to continue uninterrupted, the primary CO₂ acceptor molecule—RuBP—must be successfully reformed.

This crucial resetting step demands one final energy expenditure, costing the cycle one additional ATP molecule for phosphorylation.



 + 1 ATP

The Energy Budget (6 Turns)

The synthesis of exactly one molecule of glucose requires the Calvin Cycle to turn six times. Here is the final biological ledger for those six turns:

IN	OUT
6 CO_2	1 Glucose
18 ATP	18 ADP
12 NADPH	12 NADP^+

Note: The cyclic phosphorylation in the light reactions accounts for the higher total demand for ATP (18) compared to NADPH (12).

The Foundation of Life on Earth

Key Takeaway: The Calvin Cycle is the ultimate bridge between solar energy and biological life. By continuously looping through **Carboxylation**, **Reduction**, and **Regeneration**, it invests ATP and NADPH to transform inorganic CO_2 into the organic sugars that fuel the entire biosphere.



You've Learned the Theory.

Now Let's Test It.

Reading notes gets you knowledge.

Practicing MCQs gets you marks.

That's exactly what TopAll Pro is built for.

Try TopAll Pro Now

What TopAll Pro Does Differently

-  **Stuck? Snap it. Solve it. — Doubts AI**
Photo → step-by-step solution in seconds, 24/7
-  **Your AI Coach finds your blind spots**
Concept-level weakness detection — not just chapter-level
-  **4.5 Lakh+ questions. Never run out.**
13× more content than any other prep app in India
-  **Build your own test in 60 seconds**
Pick a chapter, set difficulty — AI does the rest instantly.
-  **AI Recommendation that helps you improve**
AI Recommendation Analysis your Tests and tell you where you need to improve.



Practice the moment you finish studying
Jump in while the concept is still fresh in your head

4.5L+
MCQs

1.5L+
Students

AI Powered
In-Depth Analysis