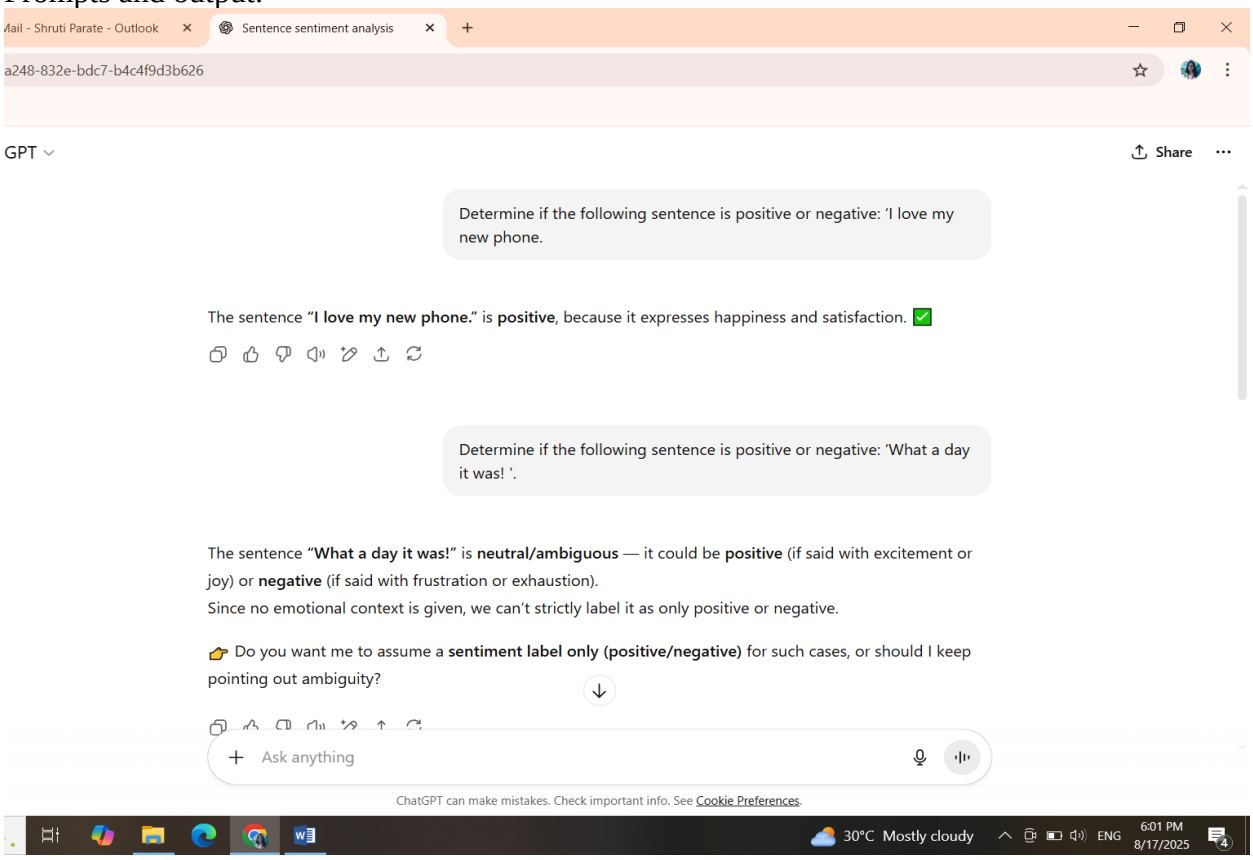
Assignment week - 2

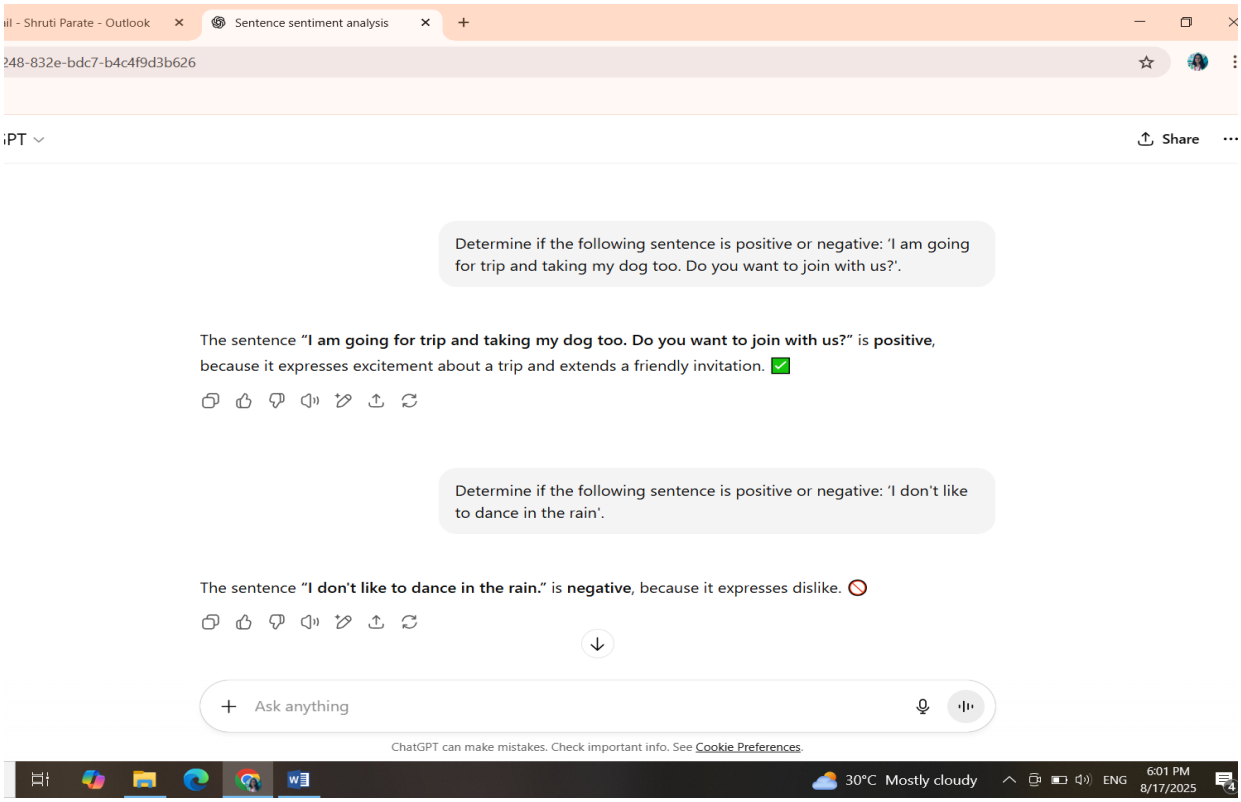
Topic 1: Prompt Engineering

Assignment 1: Zero-shot vs Few-shot Prompting

- **Objective:** Understand the difference between zero-shot and few-shot prompting.
- **Instructions:**
    1. Pick a simple task (e.g., sentiment analysis of a sentence).
    2. Write a **zero-shot prompt** and test it using any LLM (OpenAI GPT or Hugging Face hosted models). Example:
        - "Determine if the following sentence is positive or negative: 'I love my new phone.'"

Prompts and output:





3. Write a **few-shot prompt** by giving 2–3 examples before the query. Example:

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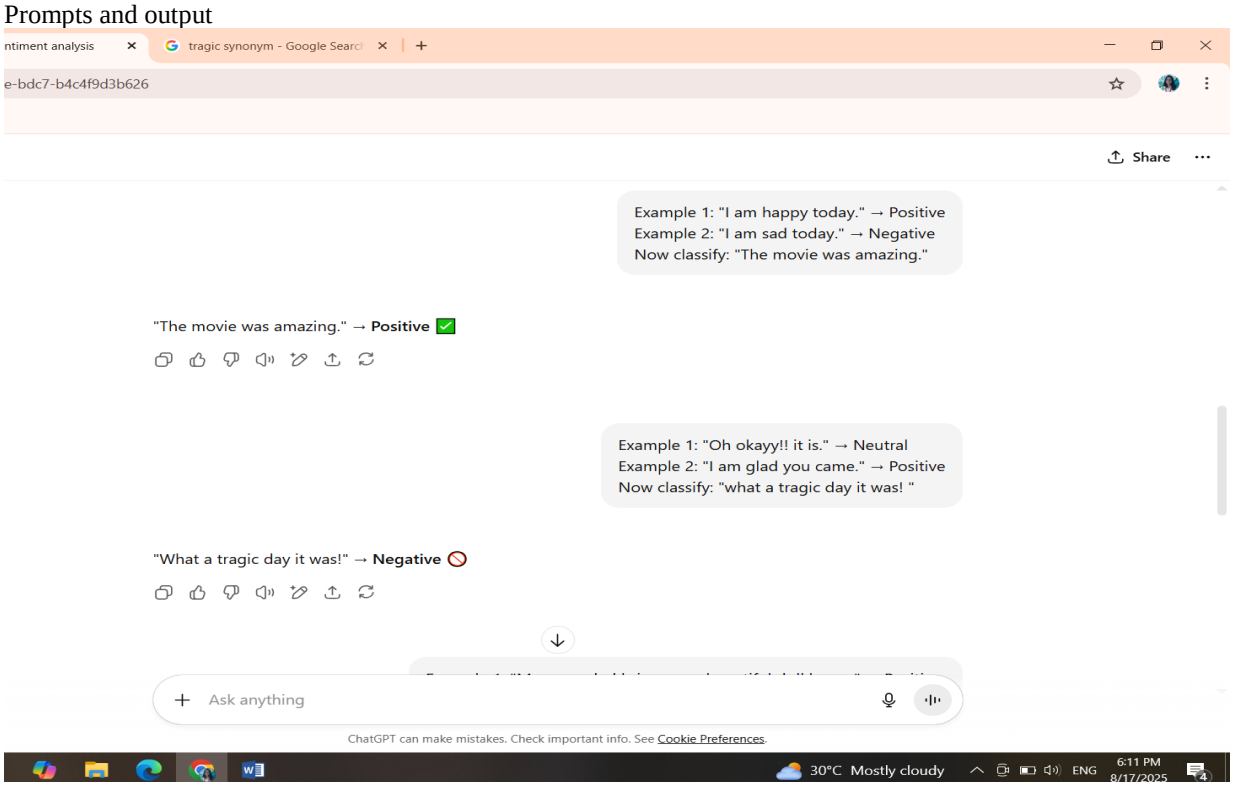
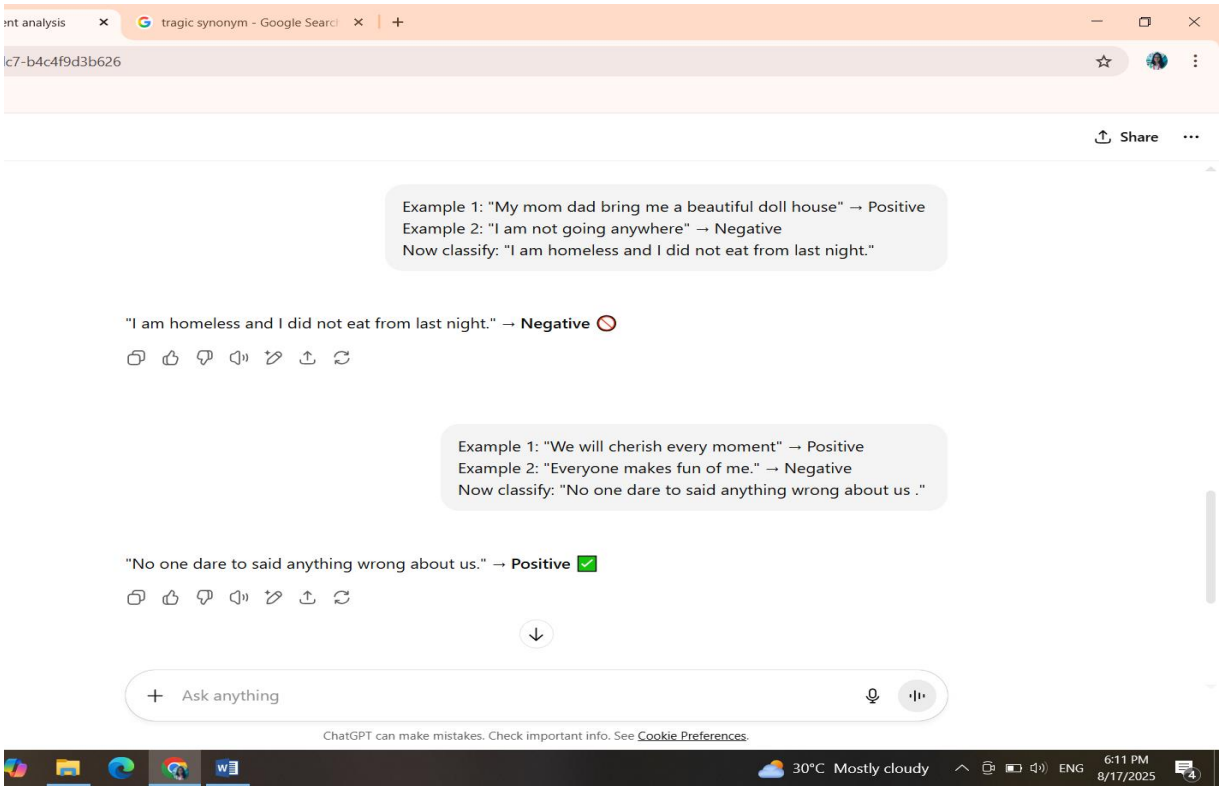
mathematica
CopyEdit
Example 1: "I am happy today." → Positive
Example 2: "I am sad today." → Negative
Now classify: "The movie was amazing."
```

Prompts and output





4. Compare the outputs and note differences in accuracy.

Zero-shot prompting means asking ChatGPT for information on a specific topic without giving any prior examples. In this case, the model generates answers purely based on its existing knowledge. On the other hand, **few-shot** prompting tends to produce more accurate results because we provide 2–3 examples within the query itself. These examples guide the model, helping it analyse and respond more effectively. While zero-shot prompting can sometimes lead to ambiguous results, this issue is largely minimized when using few-shot prompting.

Zero Short Prompting: Observation

- Works well for clear positive/negative sentences.
- Struggles with ambiguous sentences
- Sometimes outputs extra explanation, not just the label.

Few Shot Prompting: Observation

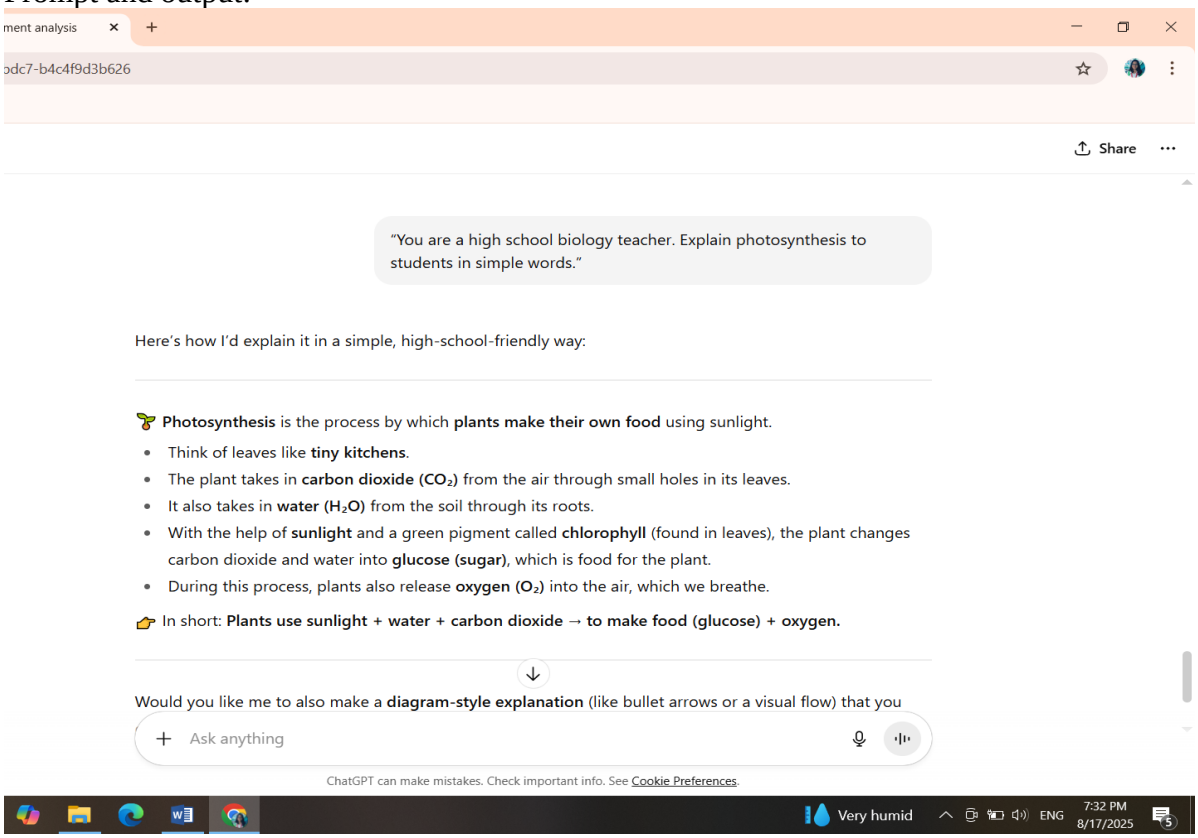
- More consistent labeling compared to zero-shot.
- Correctly identifies negative emotions (*tragic*, *homeless*, *hungry*).
- Learns from examples → gives direct label output without extra explanation.
- Handles context-sensitive words better (e.g., *tragic* clearly negative).

Assignment 2: Role-based & Chain-of-Thought Prompting

- **Objective:** Learn role-based and step-by-step reasoning prompts.
- **Instructions:**
    1. Choose a task like “Explain how photosynthesis works.”
    2. Create a **role-based prompt**:
        - “You are a high school biology teacher. Explain photosynthesis to students in simple words.”
    3. Create a **chain-of-thought prompt**:
        - “Explain photosynthesis step by step, reasoning each step clearly.”
    4. Test both prompts and observe the difference in response detail and clarity.
- **Deliverables:** A table with prompts, model outputs, and short reflections.

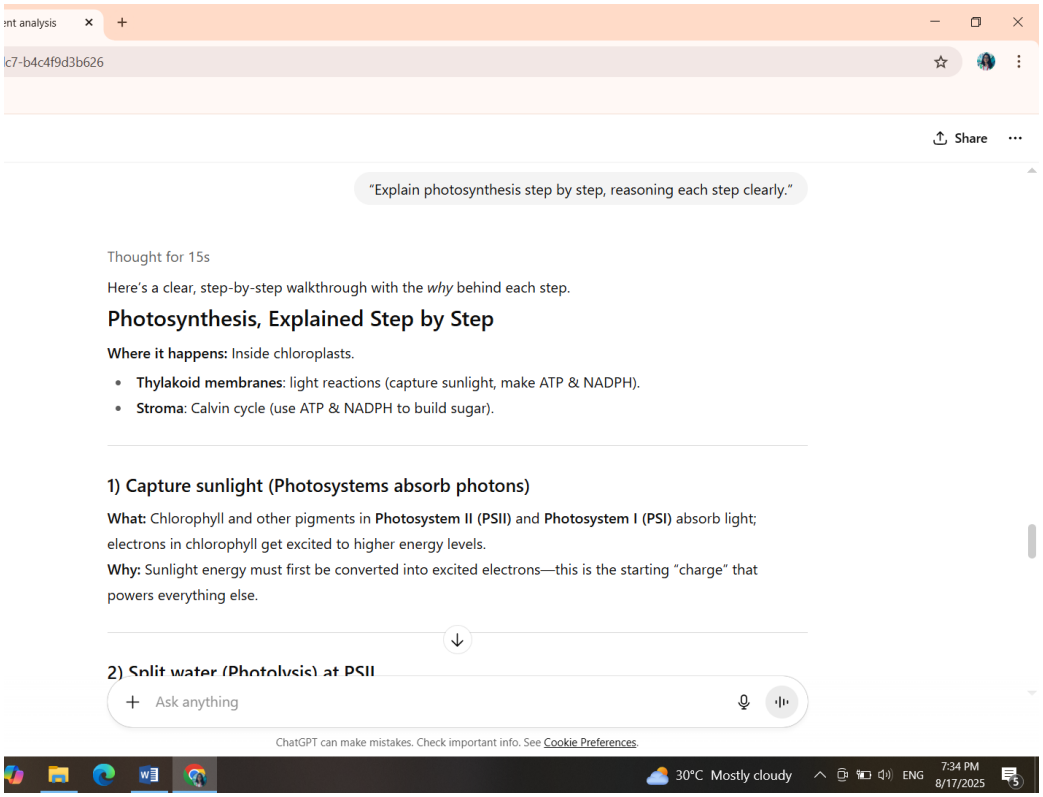
ROLE BASED PROMPT:

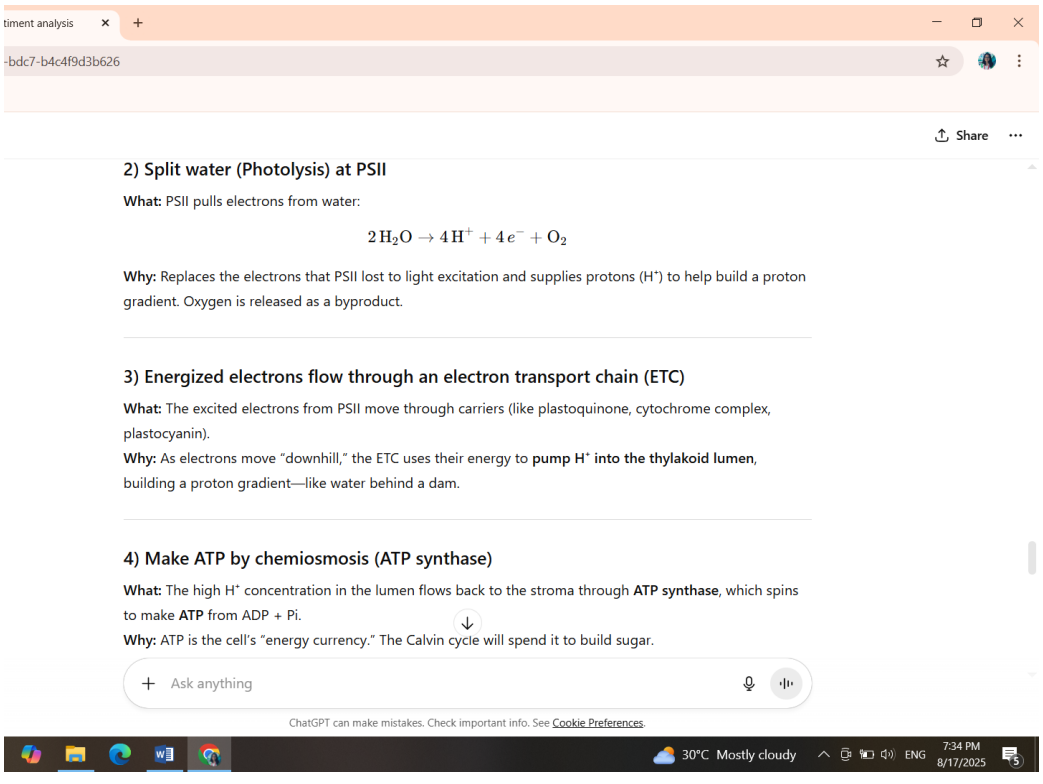
Prompt and output:



CHAIN OF THOUGHT BASED PROMPT

Promt and output:





5) Re-excite electrons in PSI and make NADPH

What: Electrons reaching **PSI** get re-energized by light and are passed to **$NADP^+$ reductase**, forming **NADPH** from $NADP^+ + H^+$.
Why: **NADPH** is a high-energy electron carrier—essential reducing power to convert CO_2 into carbohydrates.

> **End of Light Reactions:** Inputs—light, water, ADP, $NADP^+$.
> Outputs—**O_2**, **ATP**, **NADPH**.

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6) Fix carbon dioxide (Calvin cycle—Phase 1: Fixation)

What: In the **stroma**, the enzyme **Rubisco** attaches CO_2 to **RuBP** (a 5-carbon sugar), making two molecules of **3-PGA** (3-phosphoglycerate).
Why: This step **incorporates inorganic CO_2 into organic molecules**—the first step in turning "air" into sugar.

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7) Reduce 3-PGA to G3P (Phase 2: Reduction)

What: **ATP** and **NADPH** from the light reactions convert 3-PGA into **G3P** (glyceraldehyde-3-phosphate), a higher-energy 3-carbon sugar.
Why: Adding energy (ATP) and electrons (NADPH) ra… **the energy content** of the carbon skeleton so it can become glucose and other carbs.

8) Regenerate RuBP (Phase 3: Regeneration)

What: Most G3P molecules are recycled, using **ATP**, to remake **RuBP** so the cycle can continue capturing CO_2. A small portion of G3P exits the cycle.
Why: **RuBP must be replenished**; otherwise CO_2 can't be fixed in the next round. The **G3P that exits** is the building block for **glucose**, **starch**, **cellulose**, etc.

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9) Put it all together (Stoichiometry)

To net one molecule of **glucose ($C_6H_{12}O_6$)**, the Calvin cycle typically uses:

- **6 CO_2**, **18 ATP**, **12 NADPH** (numbers vary slightly by accounting, but this is the classic estimate).
  Overall summary equation:

$$6\,CO_2 + 6\,H_2O + \text{light} \rightarrow C_6H_{12}O_6 + 6\,O_2$$

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10) Why conditions matter (brief)

- **Light intensity & quality:** Drives the light reactions.
- **CO_2 availability:** Limits how fast the Calvin cycle can run.
- **Water:** Needed for electrons/H^+; drought closes …nata, reducing CO_2 intake.
- **Temperature:** Affects enzymes like Rubisco; high heat can increase **photorespiration** (a wasteful side

Observation Table:

Type	Prompt	Model output	Reflection
Role-based	You are a high school biology teacher. Explain photosynthesis to students in simple words.	Explained photosynthesis in everyday terms: leaves are like "tiny kitchens," plants use sunlight, water, and CO_2 to make sugar (glucose) and release oxygen. Ended with a short equation.	Clear, simple, and student-friendly. Good for beginners since it avoids heavy jargon. However, it's a surface-level explanation and doesn't cover the steps in depth.
Chain-of-thought style prompt	Explain photosynthesis step by step, reasoning each step clearly	Provided a structured, detailed breakdown: light capture, water splitting, electron transport, ATP & NADPH production, Calvin cycle (fixation, reduction, regeneration). Included equations, why each step is needed, and conditions affecting photosynthesis.	Much more detailed and logical. Suitable for advanced high school or college-level students. Explains not just *what* happens but also *why* each step matters. Might be overwhelming for beginners but excellent for deeper learning.