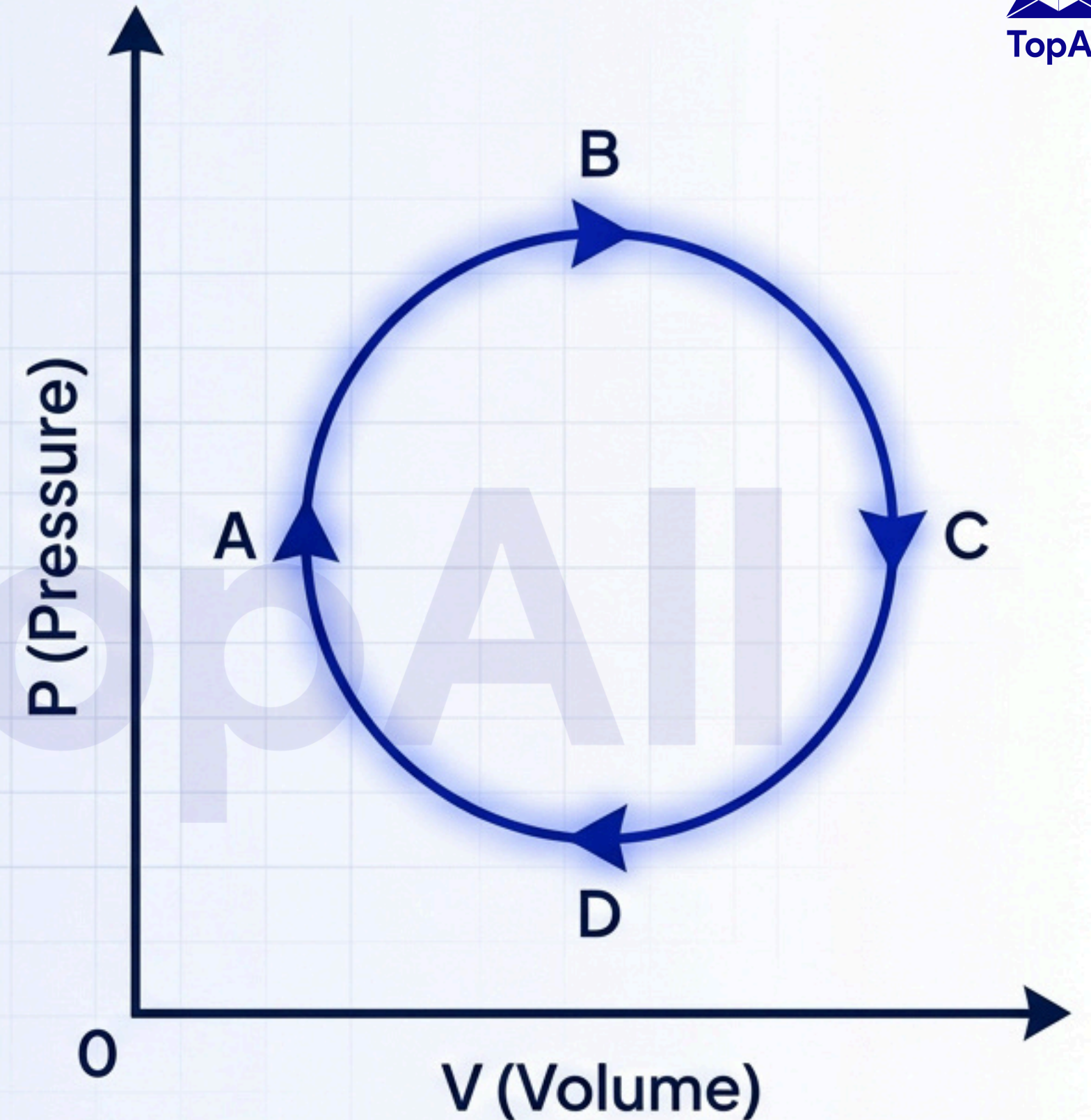


Cyclic Process in Thermodynamics

Chapter 11.8.6

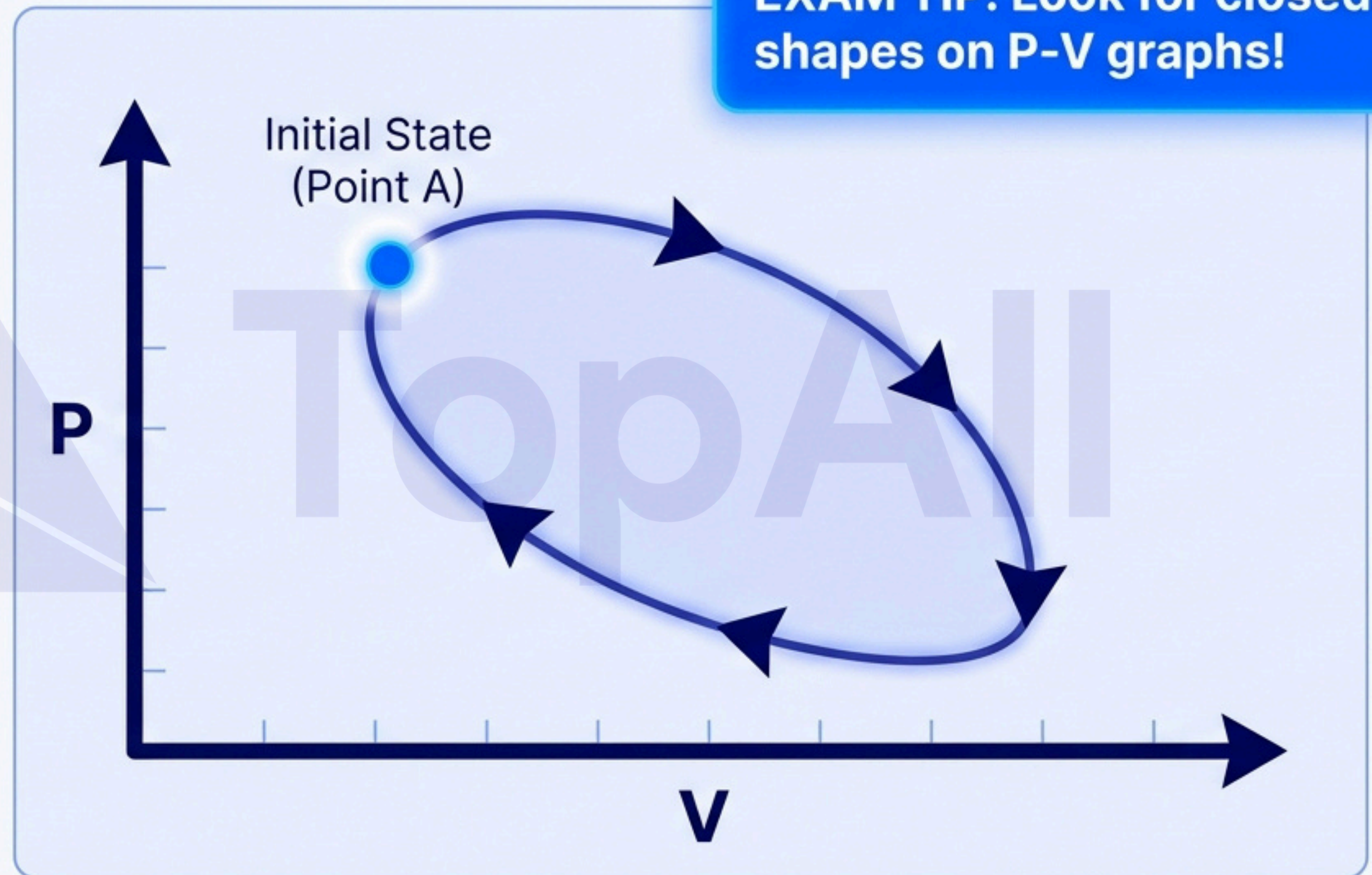
Mastering the cycle: How thermodynamic systems reset, balance heat and work, and power engines.



The Continuous Loop

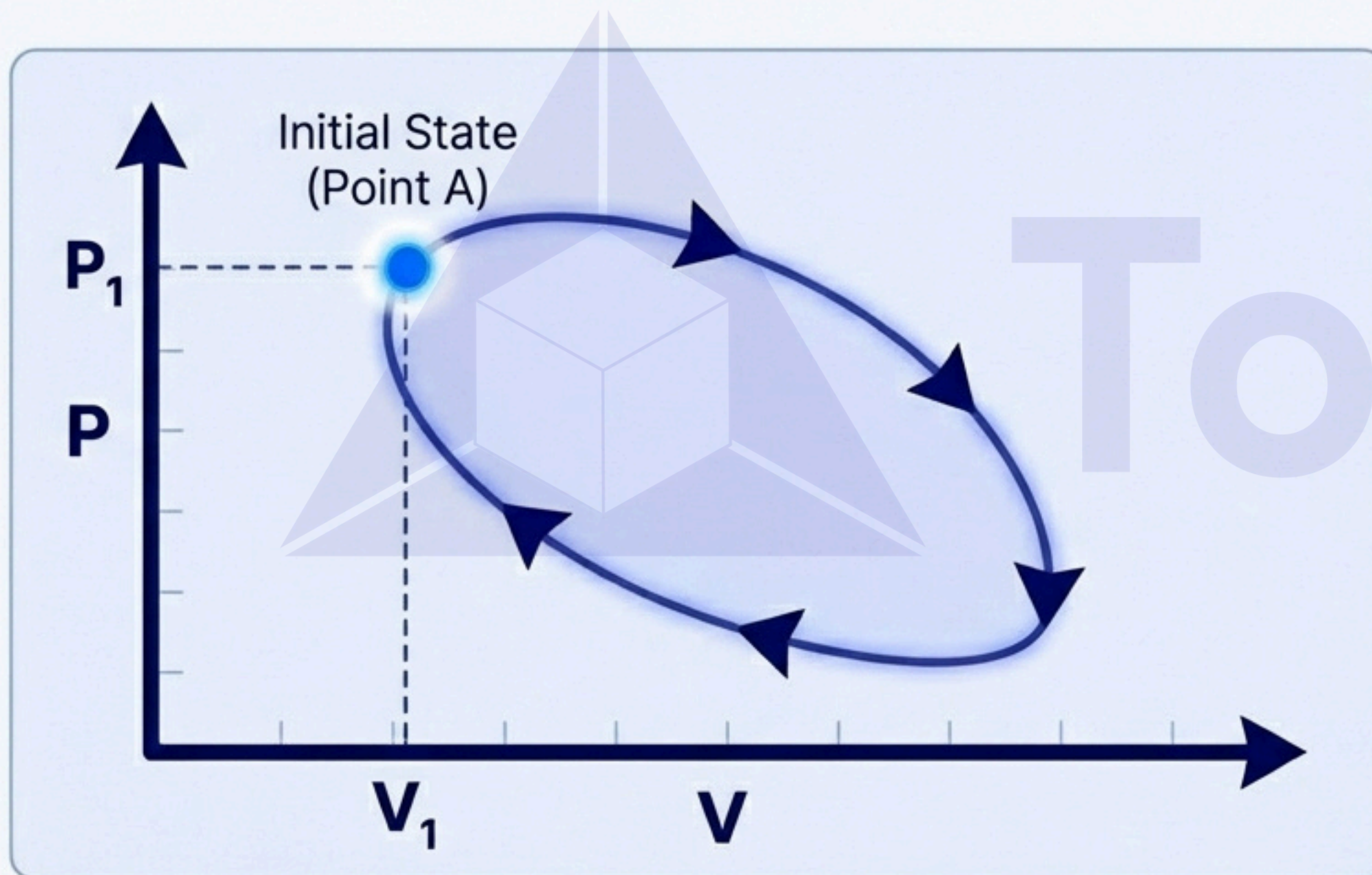
EXAM TIP: Look for closed shapes on P-V graphs!

- A thermodynamic system undergoes a series of changes.
- Ultimately, it returns exactly to its initial state.
- The path on a P-V diagram forms a continuous closed loop.



Everything Returns to Normal

Because the system arrives back at the exact starting point, all state variables reset completely. They depend only on the state, not the path taken.



Pressure: $P_{\text{final}} = P_{\text{initial}}$

Volume: $V_{\text{final}} = V_{\text{initial}}$

Temperature: $T_{\text{final}} = T_{\text{initial}}$



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$$E=mc^2$$



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The Most Important Rule

$$\Delta U = 0$$

Internal Energy (U) is
a state variable.



It relies solely on the
current temperature
and state, not history.



Since Initial State =
Final State, there is
zero net change in
internal energy.

$$U_{\text{final}} - U_{\text{initial}} = 0$$

Balancing Heat and Work

Applying the First Law of Thermodynamics when $\Delta U = 0$...

$$\Delta Q = \cancel{\Delta U} + \Delta W$$

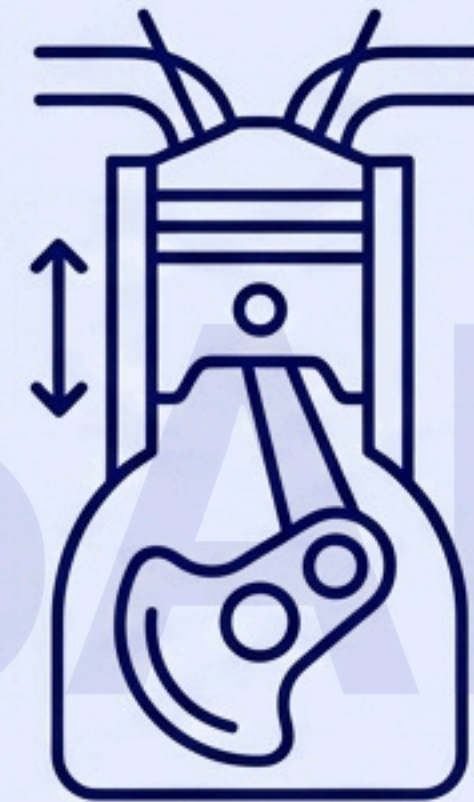
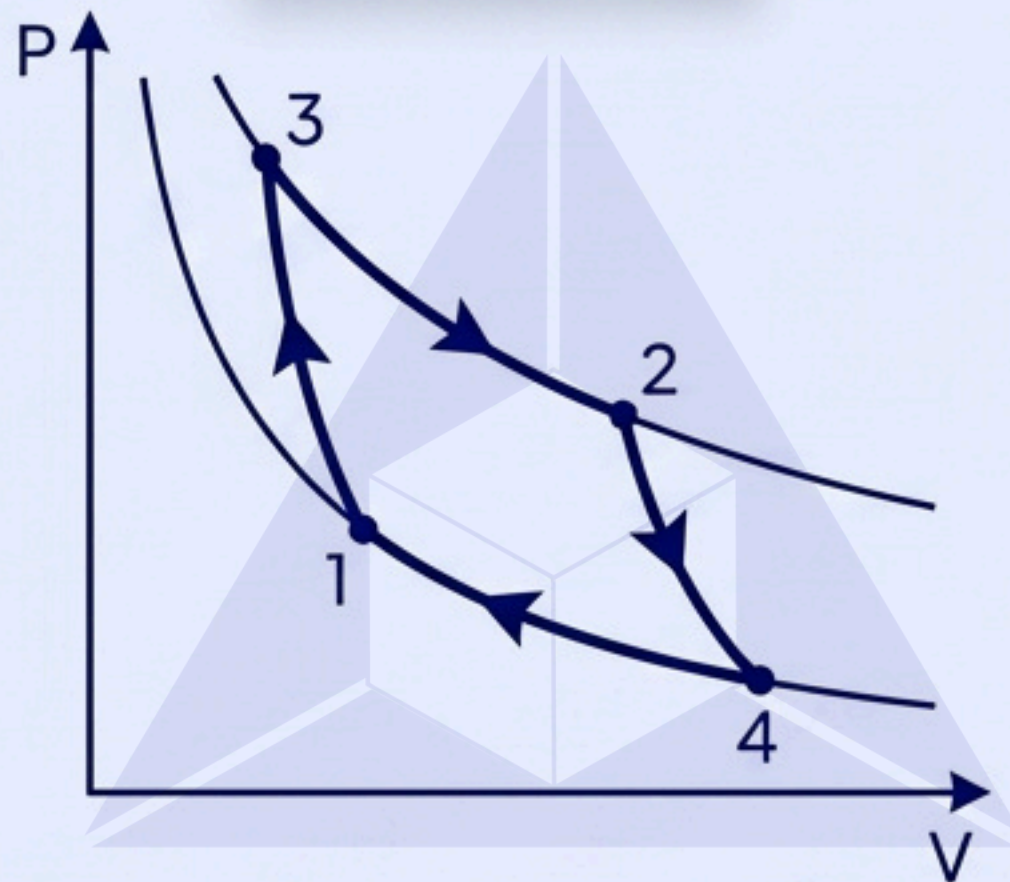


$$\Delta Q = \Delta W$$

- Total heat absorbed by the system = Total work done by the system.
- Net work is the exact area enclosed inside the P-V loop.

Theory in Action

CARNOT CYCLE



- Why do cyclic processes matter? They are the secret to Heat Engines.
- To continuously convert heat into work, the machine must run in cycles.
- It extracts heat, does work, and resets to do it again—infininitely.

Chapter 11.8.6 Summary

Success Panel

The Loop: System always returns exactly to its initial state.

The Rule: $\Delta U = 0$ for one complete cycle.

The Balance: Total heat absorbed equals total work done ($\Delta Q = \Delta W$).

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