

FOCUSED REVIEW

Focused Review: Thermodynamic Processes and PV Diagrams — Algebra-Based

Review the most important ideas, reinforce the essential skills, and confirm you're ready to move on.

 TIME 15–20 minutes	 BEST FOR Focused review	 FINISH WITH Greater confidence
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After this focused review, you'll be able to...

recognize the key concepts, reinforce your problem-solving skills, and continue with greater confidence.

HOW TO USE THIS GUIDE

Work through the stages in order. Write directly in the spaces provided, check your work in the Solutions section, and finish by choosing the next resource that matches your confidence.

Choose how you want to review: work through this guide, follow the online review, or watch the video review.

[Start the Review Online →](#)

[Watch the Video Review →](#)

YOU WILL NEED

Pencil or pen • Calculator if needed • Approximately 15–20 minutes

FR-02 • COURSE ALIGNMENT

Course Alignment

This Physics Sensei Unit Review is an independent learning resource. Use it to reinforce key concepts, prepare for homework, or review before a quiz or exam.

RESOURCE: Physics Sensei Unit Review
UNIT ID: THM-U09
TOPIC: Thermodynamic Processes and PV Diagrams
COURSE LEVEL: Algebra-Based

BEST USED

- ✓ After learning the unit
- ✓ Before starting homework
- ✓ Before a quiz or exam

FR-03 • YOUR REVIEW PLAN

Your Review Plan

Complete these six focused stages in order. Each stage reinforces your understanding and prepares you for a final confidence check.

6 stages • Approximately 15–20 minutes

1 Warm-Up Check Refresh key ideas.	2 Core Concepts Reinforce the essentials.	3 Guided Practice Strengthen key skills.
4 Confidence Check Confirm your understanding.	5 Summary Remember the essentials.	6 Next Step Choose your next step.

PRINTING TIP

For student copies, print double-sided and keep the Solutions section after the student activities so learners attempt each activity before checking their work.

FR-04 • STAGE 1 OF 6

Warm-Up Check

Before you begin, take a minute to reactivate what you already know. This quick warm-up will help you focus on the most important ideas before moving on.

WARM-UP 1**Key Ideas**

Match each process to the equation or condition that defines it.

Identify the process for $\Delta V = 0$, $\Delta P = 0$, $\Delta T = 0$, and $Q = 0$.

WARM-UP 2**Common Mistakes**

Check units before calculating work.

What energy unit results from $\text{Pa} \cdot \text{m}^3$, and how many cubic meters are in 1 L?

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Quick Application

Interpret cycle direction.

A rectangular P – V cycle is clockwise. Is net work by the gas positive or negative?

Ready to strengthen your understanding?

You've refreshed the most important ideas. Now reinforce the concepts you'll use most often.

Continue to Core Concepts →

FR-05 • STAGE 2 OF 6

Core Concepts

Let's reinforce the most important concepts you'll need to solve problems with confidence. Focus on the ideas that appear most often in homework, quizzes, and exams.

KEY CONCEPT 1

Process constraints simplify the algebra

Start by identifying the process. Isochoric gives $W = 0$ because volume is fixed. Isobaric work is $P\Delta V$. For an ideal gas in an isothermal process, $P_1V_1 = P_2V_2$. In an adiabatic process, $Q = 0$.

$$\text{Isochoric: } W = 0 \cdot \text{Isobaric: } W = P\Delta V \cdot \text{Isothermal ideal gas: } P_1V_1 = P_2V_2 \cdot \\ \text{Adiabatic: } Q = 0$$

EXAMPLE If an ideal gas expands isothermally from 2.0 L to 6.0 L and starts at 2.4×10^5 Pa, then $P_2 = 8.0 \times 10^4$ Pa.

SENSEI NOTE Do not use $W = P\Delta V$ when pressure changes significantly along the path.

KEY CONCEPT 2

P–V area gives work and cycle area gives net work

For horizontal segments, calculate the rectangular area $P\Delta V$. For simple piecewise paths, add the signed work from each segment. Vertical segments contribute zero. For a closed rectangular cycle, the magnitude of net work equals the rectangle's area.

$$\text{Horizontal segment: } W = P\Delta V \cdot \text{Rectangular cycle: } |W_{\text{net}}| = \Delta P \Delta V$$

EXAMPLE Between 1.0×10^5 Pa and 3.0×10^5 Pa, and between 2.0 L and 5.0 L, the cycle area is 600 J. Clockwise gives +600 J.

SENSEI NOTE Track the direction of each horizontal segment; compression contributes negative work.

Ready to apply these ideas?

You've reinforced the essential concepts. Now strengthen your problem-solving skills by working through a few guided examples.

[Continue to Guided Practice →](#)

FR-06 • STAGE 3 OF 6

Guided Practice

Now apply the key concepts you've just reviewed. Work through these focused practice activities to reinforce your problem-solving skills before the final confidence check.

PRACTICE 1**Guided Example**

Convert units, then use constant-pressure work.

A gas expands at $1.5 \times 10^5 \text{ Pa}$ from 2.0 L to 5.0 L. Find the work by the gas.

PRACTICE 2**Independent Check**

Compare two constant-pressure expansion paths.

A gas expands by 3.0 L. Path A is at $3.0 \times 10^5 \text{ Pa}$; Path B is at $1.0 \times 10^5 \text{ Pa}$. Find the work for each.

Ready for a confidence check?

You've reinforced the essential skills through focused practice. Now confirm your understanding with two short questions.

Continue to Confidence Check →

FR-07 • STAGE 4 OF 6

Confidence Check

You've reinforced the key concepts and practiced the essential skills. Now confirm you're ready to move forward by completing these short confidence checks.

CONFIDENCE CHECK 1

Isothermal relation

Use $P_1V_1 = P_2V_2$.

An ideal gas starts at 2.4×10^5 Pa and 2.0 L and expands isothermally to 6.0 L. Find the final pressure.

CONFIDENCE CHECK 2

Rectangular cycle work

Use the enclosed area and direction.

A clockwise rectangle spans $\Delta P = 2.0 \times 10^5$ Pa and $\Delta V = 3.0$ L. What is the net work by the gas?

HOW DID IT GO?

I answered ____ of 2 questions correctly.

Use the Solutions section to check your reasoning, then take one final look at the essential ideas.

You've confirmed your understanding.

Take one final look at the essential ideas before choosing your next step.

Continue to Summary →

FR-08 • STAGE 5 OF 6

Summary

Before moving on, take one final look at the essential ideas you'll want to remember.

KEY TAKEAWAY 1**Let the process constraint choose the equation**

Use $W = 0$ for isochoric paths, $W = P\Delta V$ for constant pressure, $P_1V_1 = P_2V_2$ for an ideal-gas isothermal path, and $Q = 0$ for an adiabatic path.

KEY TAKEAWAY 2**Convert P–V geometry into signed energy**

Horizontal segments contribute $P\Delta V$, vertical segments contribute zero, and a closed-loop area gives the magnitude of net cycle work.

MY ONE-SENTENCE SUMMARY

In my own words, the most important idea is:

Ready for your next step?

You've reviewed the essential ideas one last time. Now choose the resource that best matches how confident you feel.

Continue to Next Step →

ANSWER KEY • CHECK AFTER ATTEMPTING

Solutions and Explanations

Use these solutions to check your reasoning—not only your final answer. Focus on the essential explanation behind each result.

WARM-UP • ACTIVITY 1

Key Ideas

Isochoric, isobaric, isothermal, and adiabatic, respectively.

WHY IT WORKS The process name follows directly from the constraint.

WARM-UP • ACTIVITY 2

Common Mistakes

$\text{Pa} \cdot \text{m}^3 = \text{J}$, and $1 \text{ L} = 10^{-3} \text{ m}^3$.

WHY IT WORKS Pressure times volume has energy units, so converting volume correctly is essential.

WARM-UP • ACTIVITY 3

Quick Application

Positive.

WHY IT WORKS Expansion occurs at the higher pressure and compression at the lower pressure.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Guided Example

$$\Delta V = 3.0 \times 10^{-3} \text{ m}^3. W = (1.5 \times 10^5 \text{ Pa})(3.0 \times 10^{-3} \text{ m}^3) = 450 \text{ J}.$$

WHY IT WORKS The path is horizontal, so work is the rectangular P–V area.

PRACTICE 2

Independent Check

Path A: 900 J. Path B: 300 J. Path A does three times as much work.

WHY IT WORKS The volume change is the same, so work scales directly with pressure.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Isothermal relation

$$P_2 = P_1 V_1 / V_2 = 8.0 \times 10^4 \text{ Pa.}$$

WHY IT WORKS For an ideal gas at constant temperature, PV remains constant.

CONFIDENCE CHECK 2

Rectangular cycle work

$$W_{\text{net}} = (2.0 \times 10^5 \text{ Pa})(3.0 \times 10^{-3} \text{ m}^3) = +600 \text{ J.}$$

WHY IT WORKS Clockwise gives positive work, and the rectangle area gives its magnitude.

READINESS GUIDE

2 correct: You're ready to continue. • 1 correct: Review the missed idea, then continue. • 0 correct: Revisit Core Concepts or choose more practice.

FR-09 • STAGE 6 OF 6

Next Step: Continue Learning

Great work! You've completed this focused review. Choose the next resource that best matches how confident you feel.

? I'm Still Unsure Review the focused review again to strengthen the essential concepts. Review Again →	🎯 I Need More Practice Build confidence with additional practice problems. Go to Practice →	✓ I'm Ready Continue to the next topic or learning resource. Continue →
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RECOMMENDED LINKS

[Review this topic again →](#)

[Find additional practice →](#)

[Choose another type of physics help →](#)

Continue reviewing with these companion resources.

[Start the Review Online →](#)

[Watch the Video Review →](#)

PHYSICS HELP THAT MAKES SENSE

A Physics Sensei review never ends at the last question. It always guides you toward the next useful step.

PhysicsSensei.com