

FOCUSED REVIEW

Focused Review: First Law of Thermodynamics — Foundational

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-U08
TOPIC: First Law of Thermodynamics
COURSE LEVEL: Foundational

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**

Energy-transfer signs

Use the convention W = work done by the system. If 200 J of heat enters a gas and the gas does 50 J of work, is Q positive or negative? Is W positive or negative?

WARM-UP 2**Common Mistakes**

Internal energy change

A system receives 300 J of heat and does no work. What happens to its internal energy?

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Quick Application

Compression intuition

A gas is compressed while no heat is exchanged. Does its internal energy tend to increase or decrease?

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**The First Law**

Energy conservation for a thermodynamic system is $\Delta U = Q - W$, where W is work done by the system. Heat added to the system is positive Q ; heat leaving is negative Q .

$$\Delta U = Q - W$$

EXAMPLE If $Q = 500 \text{ J}$ and $W = 120 \text{ J}$, then $\Delta U = 380 \text{ J}$.

SENSEI NOTE Choose and state one sign convention before calculating; most sign mistakes come from switching conventions.

KEY CONCEPT 2**Heat and Work Are Transfers**

Internal energy is a property of the system. Heat and work are ways energy crosses the system boundary; a system does not "contain heat" or "contain work."

$$\Delta U = U_2 - U_1$$

EXAMPLE A hot object can have high internal energy, but heat refers to energy transferred because of a temperature difference.

SENSEI NOTE Ask what crosses the boundary and in which direction.

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**

A gas absorbs 650 J of heat and does 180 J of work. Find ΔU .

Use $\Delta U = Q - W$. Substitute $Q = 650 \text{ J}$ and $W = 180 \text{ J}$.

PRACTICE 2**Independent Check**

A gas releases 150 J of heat while it is compressed. The work done by the gas is -400 J. Find ΔU .

Assign signs first, then apply the first law.

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

Sign of compression

Solve using the first law and the stated sign convention.

An adiabatic compression has $Q = 0$ and $W = -90 \text{ J}$. Find ΔU .

CONFIDENCE CHECK 2

Heat needed

Solve using the first law and the stated sign convention.

A system has $\Delta U = 250 \text{ J}$ and does 75 J of work. Find Q .

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**Energy accounting**

Use $\Delta U = Q - W$ with a declared sign convention.

KEY TAKEAWAY 2**Boundary transfers**

Heat and work describe energy crossing the boundary, not stored quantities.

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. Replace each placeholder with a concise answer and the essential explanation.

WARM-UP • ACTIVITY 1

Key Ideas

Q is positive and W is positive.

WHY IT WORKS Energy entering as heat makes $Q > 0$; expansion work done by the system makes $W > 0$.

WARM-UP • ACTIVITY 2

Common Mistakes

The internal energy increases by 300 J.

WHY IT WORKS With $W = 0$, the first law gives $\Delta U = Q$.

WARM-UP • ACTIVITY 3

Quick Application

Increase.

WHY IT WORKS Compression means work is done on the gas, so W by the system is negative and $\Delta U = -W$ is positive.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Guided Example**

$$\Delta U = 650 \text{ J} - 180 \text{ J} = 470 \text{ J}.$$

WHY IT WORKS Energy entered as heat, but some left as work.

PRACTICE 2**Independent Check**

$$\Delta U = -150 \text{ J} - (-400 \text{ J}) = 250 \text{ J}.$$

WHY IT WORKS Compression transfers more energy into the gas than the heat loss removes.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Sign of compression

$$\Delta U = 90 \text{ J.}$$

WHY IT WORKS $\Delta U = 0 - (-90 \text{ J})$.

CONFIDENCE CHECK 2

Heat needed

$$Q = 325 \text{ J.}$$

WHY IT WORKS $Q = \Delta U + W$.

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](#)