

FOCUSED REVIEW

Focused Review: Entropy and the Second Law — 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-U11
TOPIC: Entropy and the Second Law
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**

State in words what entropy tells you about the number of microscopic arrangements available to a system.

Write a concise response and identify the governing entropy idea.

WARM-UP 2**Common Mistakes**

For an isolated system, decide whether total entropy can decrease, stay constant, or increase.

Write a concise response and identify the governing entropy idea.

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Quick Application

A hot object touches a cold object. Predict the spontaneous direction of heat transfer and the sign of the total entropy change.

Write a concise response and identify the governing entropy idea.

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

Entropy and multiplicity

Entropy measures how many microscopic arrangements are compatible with the same macroscopic state. More accessible arrangements correspond to greater entropy.

$$S = k_B \ln \Omega$$

A gas spreading through a larger available volume has more possible molecular arrangements. Entropy is not simply “disorder”; focus on accessible microstates and energy dispersal.

KEY CONCEPT 2

Second Law of Thermodynamics

For an isolated system, spontaneous processes do not reduce total entropy. Reversible idealizations keep total entropy unchanged; irreversible processes increase it.

$$\Delta S_{\text{total}} \geq 0$$

Heat flowing naturally from hot to cold increases the total entropy of the combined system and surroundings. A local entropy decrease is allowed when the surroundings gain enough entropy that the total does not decrease.

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**

Classify each process as reversible idealization or irreversible: slow frictionless compression; free expansion; heat transfer through a finite temperature difference.

Show your reasoning clearly and include units where applicable.

PRACTICE 2**Independent Check**

Two bodies at different temperatures are placed in thermal contact in an insulated enclosure. Explain why equilibrium is the spontaneous final state using entropy.

Show your reasoning clearly and include units where applicable.

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

Entropy Check

Solve or explain briefly.

Can an isolated system spontaneously move to a state with lower total entropy? Explain.

CONFIDENCE CHECK 2

Entropy Check

Solve or explain briefly.

A process returns a system to its initial state but leaves the surroundings changed. Is that enough to call the process reversible?

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**Entropy and accessible states**

Entropy measures how many microscopic arrangements are compatible with the same macroscopic state.

KEY TAKEAWAY 2**Second-law direction**

For an isolated system, spontaneous processes do not reduce total entropy.

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

Entropy reflects the number of accessible microscopic arrangements; larger multiplicity means larger entropy.

This follows from the definition of entropy and the second-law direction criterion.

WARM-UP • ACTIVITY 2

Common Mistakes

Total entropy of an isolated system cannot decrease. It is unchanged only in the reversible ideal limit and increases for irreversible processes.

This follows from the definition of entropy and the second-law direction criterion.

WARM-UP • ACTIVITY 3

Quick Application

Heat flows from hot to cold. The hot object loses entropy, the cold object gains entropy, and the total entropy increases until equilibrium.

This follows from the definition of entropy and the second-law direction criterion.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Guided Example**

Slow frictionless compression can approach reversible behavior; free expansion and finite-temperature-difference heat transfer are irreversible.

Check signs, absolute temperature, and whether the process is reversible or irreversible.

PRACTICE 2**Independent Check**

The two-body system evolves toward thermal equilibrium because that macrostate has greater total entropy; once equilibrium is reached there is no spontaneous net heat flow.

Check signs, absolute temperature, and whether the process is reversible or irreversible.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Entropy Check

Total entropy of an isolated system cannot decrease. It is unchanged only in the reversible ideal limit and increases for irreversible processes.

Use the total-entropy criterion to justify the result.

CONFIDENCE CHECK 2

Entropy Check

Heat flows from hot to cold. The hot object loses entropy, the cold object gains entropy, and the total entropy increases until equilibrium.

Use the total-entropy criterion to justify the result.

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