

QUICK REVIEW

Quick Review: Thermal Expansion

Refresh the essential thermal-expansion relationships and the sign logic behind heating and cooling.

 TIME 5–10 minutes	 BEST FOR A rapid refresh	 FINISH WITH Key ideas refreshed
--	---	--

After this quick review, you'll be able to...

After this quick review, you'll be able to...

predict expansion or contraction, use the central thermal-expansion relationship, and avoid common sign mistakes.

HOW TO USE THIS GUIDE

Work through the four stages in order. Write directly in the spaces provided, check your work in the Quick Answers 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 5–10 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-U02
TOPIC: Thermal Expansion
COURSE LEVEL: Calculus-based college physics

BEST USED

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

FR-03 • YOUR REVIEW PLAN

Your Review Plan

Complete these four stages to quickly refresh the essential ideas and confirm you're ready to continue.

4 stages • Approximately 5–10 minutes

1 Quick Recall Refresh what you already know.	2 Essential Idea Review the most important concept.
3 Confidence Check Confirm you're ready to move on.	4 Next Step Continue your learning.

PRINTING TIP

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

FR-04 • STAGE 1 OF 4

Quick Recall

Let's quickly refresh what you already know. This short recall activity will bring the most important ideas back to mind before you review them.

QUICK RECALL

Recall Activity

Complete: $\Delta T = \text{---} - \text{---}$. For an ordinary material, heating usually makes ΔL --- , while cooling usually makes ΔL --- .

Ready to refresh the essentials?

Great! Now review the most important idea you'll want to remember.

[Review the Essential Idea →](#)

FR-05 • STAGE 2 OF 4

Essential Idea

Take one last look at the most important concept from this topic. If you remember this idea, the rest will come back much more easily.

ESSENTIAL IDEA

Expansion Coefficient as a Derivative

The instantaneous linear expansion coefficient is $\alpha(T) = (1/L)(dL/dT)$. If α varies with temperature, integrate: $\ln(L/L_0) = \int \alpha(T) dT$. For nearly constant α and small fractional change, $L \approx L_0(1 + \alpha\Delta T)$.

$$\alpha(T) = (1/L)(dL/dT); \ln(L/L_0) = \int \alpha(T) dT$$

EXAMPLE For constant α , the exact integrated form is $L = L_0 e^{\alpha\Delta T}$; the familiar linear formula is its first-order approximation.

SENSEI NOTE State when the constant- α approximation is being used.

Ready to check your memory?

You've refreshed the essential idea. Now see how much you remember before moving on.

Start the Confidence Check →

FR-06 • STAGE 3 OF 4

Confidence Check

You've refreshed the essential idea. Now answer this quick confidence check to confirm you're ready to move on.

CONFIDENCE CHECK

Exact versus linear

For constant α , give the exact integrated expression for L and its first-order approximation.

Ready for your next step?

Great work! You've refreshed the essential idea. Now choose the resource that best matches what you'd like to do next.

Choose Your Next Step →

QUICK ANSWERS • CHECK AFTER ATTEMPTING

Quick Answers and Explanations

Use these concise answers to check your recall and confidence—not only your final response.

QUICK RECALL**Recall Activity**

$\Delta T = T_{\text{final}} - T_{\text{initial}}$. Heating gives a positive ΔT and usually expansion; cooling gives a negative ΔT and usually contraction.

WHY IT WORKS The sign follows directly from final minus initial temperature and $\Delta L = \alpha L_0 \Delta T$.

CONFIDENCE CHECK**CONFIDENCE CHECK****Exact versus linear**

Exact: $L = L_0 e^{\alpha \Delta T}$. First order: $L \approx L_0 (1 + \alpha \Delta T)$.

WHY IT WORKS Keep the negative temperature change through the equation; it represents contraction.

READINESS GUIDE

1 correct: You're ready to continue. • 0 correct: Revisit the Essential Idea or choose more practice.

FR-07 • STAGE 4 OF 4

Next Step: Continue Learning

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

? I'm Still Unsure Review the essential idea again. Review Again →	🎯 I Need More Practice Continue with additional practice for this topic. Go to Practice →	✓ I'm Ready Continue to the next recommended resource. Continue →
---	--	--

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