

FOCUSED REVIEW

Focused Review: Stress, Strain, and Elasticity

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...

explain the key elastic relationships, solve representative deformation problems, and interpret what the results mean physically.

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: MEC-U24
TOPIC: Stress, Strain, and Elasticity
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**

Identify the quantities in a stretching test.

A rod has original length L_0 , area A , pulling force F , and extension ΔL . Name the quantities used to describe loading and deformation.

WARM-UP 2**Common Mistakes**

Decide whether each statement is true or false.

a) Stress is the same as force. b) Strain has no units. c) A stiffer material deforms less under comparable stress.

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Quick Application

Compare two samples qualitatively.

Two samples of the same material have equal length and carry the same force. One has twice the area. Which one experiences less stress?

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

Normal Stress and Strain

For a straight sample pulled or compressed along its length, normal stress is $\sigma = F/A$. Longitudinal strain is $\epsilon = \Delta L/L_0$. Stress has units of pascals; strain is dimensionless.

$$\sigma = F/A \quad \epsilon = \Delta L/L_0$$

EXAMPLE A smaller area under the same force gives a larger stress.

SENSEI NOTE Always divide by the original cross-sectional area for this basic model.

KEY CONCEPT 2

Elasticity and Young's Modulus

Within the linear elastic region, stress is proportional to strain: $\sigma = Y\epsilon$. Young's modulus Y measures stiffness. A larger Y means more stress is required to produce the same strain.

$$\sigma = Y\epsilon$$

EXAMPLE If two materials have the same strain, the one with larger Y carries the larger stress.

SENSEI NOTE Young's modulus is a material property, not a property of the sample dimensions.

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**

Find stress and strain for a simple stretch.

A rod of area $2.0 \times 10^{-4} \text{ m}^2$ is pulled by 400 N and lengthens from 1.00 m to 1.002 m. Find σ and ϵ .

PRACTICE 2**Independent Check**

Use Young's modulus.

A material has $Y = 2.0 \times 10^{11} \text{ Pa}$ and experiences strain 5.0×10^{-4} . Find the stress.

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

Area Effect

Use $\sigma = F/A$.

If the same force is applied to a rod with twice the area, what happens to the stress?

CONFIDENCE CHECK 2

Stiffness

Interpret Young's modulus.

Material A has a larger Young's modulus than Material B. Under the same stress, which has the smaller strain?

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**Stress and strain**

Stress measures load intensity; strain measures fractional deformation.

KEY TAKEAWAY 2**Elastic stiffness**

In the linear elastic region, $\sigma = Y\epsilon$; larger Y means greater stiffness.

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.

WARM-UP • ACTIVITY 1

Key Ideas

Stress uses F/A ; strain uses $\Delta L/L_0$.

WHY IT WORKS The quantities separate applied loading from deformation.

WARM-UP • ACTIVITY 2

Common Mistakes

a) False. b) True. c) True.

WHY IT WORKS Force and stress differ; strain is a ratio; stiffness resists deformation.

WARM-UP • ACTIVITY 3

Quick Application

The sample with twice the area has half the stress.

WHY IT WORKS For fixed F , σ is inversely proportional to A .

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Guided Example**

$$\sigma = 2.0 \times 10^6 \text{ Pa}; \varepsilon = 0.002.$$

WHY IT WORKS Compute F/A and $\Delta L/L_0$ using SI units.

PRACTICE 2**Independent Check**

$$\sigma = Y\varepsilon = 1.0 \times 10^8 \text{ Pa}.$$

WHY IT WORKS Linear elasticity connects stress and strain through Y .

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Area Effect

Stress is cut in half.

WHY IT WORKS Doubling A with fixed F halves F/A .

CONFIDENCE CHECK 2

Stiffness

Material A.

WHY IT WORKS For fixed σ , $\epsilon = \sigma/Y$, so larger Y gives smaller strain.

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