

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: 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 Equations**

Write the axial loading relationships.

State σ , ϵ , Y , and the combined extension relation for a uniform rod.

WARM-UP 2**Common Mistakes**

Identify the incorrect setup.

A student uses total force instead of F/A for stress and uses ΔL instead of $\Delta L/L_0$ for strain. What must be corrected?

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Quick Application

Predict a design change.

For the same material, force, and length, how does doubling area affect extension?

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

Axial Stress and Strain

Normal stress is $\sigma = F/A$ and longitudinal strain is $\epsilon = \Delta L/L_0$. In SI, σ is in pascals and ϵ is dimensionless.

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

EXAMPLE A 1.0 kN load on $5.0 \times 10^{-4} \text{ m}^2$ gives $\sigma = 2.0 \text{ MPa}$.

SENSEI NOTE Area must be perpendicular to the axial force.

KEY CONCEPT 2

Young's Modulus and Extension

In the linear elastic regime, $\sigma = Y\epsilon$. Combining the definitions gives $\Delta L = FL_0/(AY)$.

$$\Delta L = FL_0/(AY)$$

EXAMPLE This equation predicts how geometry and material stiffness affect elongation.

SENSEI NOTE The relation applies only while the material remains approximately linear elastic.

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**

Calculate an extension.

A steel rod has $L_0 = 2.0\text{ m}$, $A = 3.0 \times 10^{-4}\text{ m}^2$, $Y = 2.0 \times 10^{11}\text{ Pa}$, and $F = 1.2 \times 10^4\text{ N}$. Find ΔL .

PRACTICE 2**Independent Check**

Find Young's modulus from measurements.

A sample has stress $6.0 \times 10^7\text{ Pa}$ and strain 3.0×10^{-4} . Find Y .

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

Rod Geometry

Use proportional reasoning.

Keeping F and Y fixed, a rod is twice as long and has twice the area. How does ΔL compare with the original?

CONFIDENCE CHECK 2

Elastic Limit

Interpret the model.

Why should $\sigma = Y\epsilon$ not be used beyond the linear part of a stress-strain graph?

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**Axial relationships**

$\sigma = F/A$ and $\epsilon = \Delta L/L_0$ describe loading and deformation.

KEY TAKEAWAY 2**Linear elastic response**

$\sigma = Y\epsilon$ leads to $\Delta L = FL_0/(AY)$ for a uniform rod.

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 Equations**

$$\sigma = F/A; \epsilon = \Delta L/L_0; Y = \sigma/\epsilon; \Delta L = FL_0/(AY).$$

WHY IT WORKS The combined relation follows directly from the definitions and Hooke-like linear behavior.

WARM-UP • ACTIVITY 2**Common Mistakes**

Use F/A for stress and $\Delta L/L_0$ for strain.

WHY IT WORKS Both quantities normalize by geometry.

WARM-UP • ACTIVITY 3**Quick Application**

Extension is halved.

WHY IT WORKS $\Delta L \propto 1/A$ for fixed F , L_0 , and Y .

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Guided Example**

$$\Delta L = 4.0 \times 10^{-4} \text{ m} = 0.40 \text{ mm.}$$

WHY IT WORKS Substitute SI values into $FL_0/(AY)$.

PRACTICE 2**Independent Check**

$$Y = 2.0 \times 10^{11} \text{ Pa.}$$

WHY IT WORKS Y is the ratio σ/ϵ in the linear region.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Rod Geometry

It is unchanged.

WHY IT WORKS Doubling L_0 and A produces equal factors in numerator and denominator.

CONFIDENCE CHECK 2

Elastic Limit

The stress-strain relation is no longer proportional there.

WHY IT WORKS Y is the slope of the linear elastic portion, not a universal constant across plastic deformation.

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](#)