FOCUSED REVIEW

Focused Review: Springs and Elastic Potential Energy

Review the most important ideas, reinforce the essential skills, and confirm you're ready to move on.

TIME	BEST FOR	FINISH WITH
15–20 minutes	Focused review	Greater confidence

After this focused review, you'll be able to…

calculate spring force, elastic potential energy, spring work, speed, and maximum deformation using Hooke's law and conservation of mechanical energy.

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

Use this independent Physics Sensei Unit Review to reinforce key concepts, prepare for homework, or review before a quiz or exam.

RESOURCE: Physics Sensei Unit Review **UNIT: MEC-U18** **TOPIC: Springs and Elastic Potential Energy** **COURSE LEVEL: College introductory physics • Algebra-Based**	**BEST USED** ✓ **After learning the topic** ✓ Before starting homework ✓ Before a quiz or exam

Explore Physics Sensei Reviews →

Physics Sensei is an independent educational resource. This Unit Review uses Physics Sensei-owned organization, examples, explanations, and practice.

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 — page 4** Refresh key ideas.	2 **Core Concepts — page 6** Reinforce the essentials.	3 **Guided Practice — page 7** Strengthen key skills.
4 **Confidence Check — page 8** Confirm your understanding.	5 **Summary — page 10** Remember the essentials.	6 **Next Step — page 14** 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

Hooke's Law

Use $F_s = -kx$ with units and direction.

A 300 N/m spring is stretched 0.040 m. Find the spring-force magnitude.

WARM-UP 2

Elastic Potential Energy

Use $U_s = \frac{1}{2}kx^2$.

A 160 N/m spring is compressed 0.20 m. Find the stored elastic potential energy.

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Energy Conversion

Use initial and final states.

A 0.80 kg block is released from a 0.10 m compression of a 320 N/m spring. Find its speed at equilibrium.

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 — page 6 →

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

Hooke's Law and Force Graphs

For an ideal spring, force varies linearly with displacement. The slope of an F-versus-x graph is -k. Use signs for direction and magnitudes when only the size of the force is requested.

Fs = -kx; Us = (1/2)kx^2; Ws = -Delta Us.

EXAMPLE A 250 N/m spring stretched 0.080 m exerts a 20 N restoring force.

SENSEI NOTE Do not drop the restoring direction when interpreting a signed coordinate problem.

KEY CONCEPT 2

Elastic Energy and Spring Work

Elastic potential energy is $U_s = \frac{1}{2}kx^2$. The work done by the spring equals the decrease in its potential energy.

(1/2)mvi^2 + (1/2)kxi^2 = (1/2)mvf^2 + (1/2)kxf^2.

EXAMPLE For k = 200 N/m, moving from x = 0.15 m to 0.05 m gives $W_s = 2.00$ J.

SENSEI NOTE Do not use a single endpoint force in W = Fd because spring force changes with position.

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 — page 7 →

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 stored spring energy.

A 300 N/m spring is compressed 0.080 m. Find U_s.

PRACTICE 2

Independent Check

Use energy to find speed.

A 0.50 kg block is released from rest at x = 0.10 m on a 200 N/m spring. Find its speed at equilibrium.

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 — page 8 →

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

Spring Force

Calculate magnitude and direction.

A 240 N/m spring is stretched 0.050 m to the right. Find the spring force.

CONFIDENCE CHECK 2

Energy Scaling

Compare deformation.

If a spring compression doubles, by what factor does U_s change?

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 — page 10 →

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

Use Signed Hooke's Law

$F_s = -kx$; the negative sign encodes restoring direction.

KEY TAKEAWAY 2

Spring Energy Is Quadratic

$U_s = \frac{1}{2}kx^2$ and $W_s = -\Delta U_s$.

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 — page 14 →

ANSWER KEY • CHECK AFTER ATTEMPTING

Solutions and Explanations

Use these solutions to check your reasoning—not only your final answer. Use each answer and explanation to check both the setup and the physical interpretation.

WARM-UP • ACTIVITY 1

Key Ideas

12 N, directed toward equilibrium.

WHY IT WORKS $|F_s| = k|x| = (300)(0.040) = 12$ N.

WARM-UP • ACTIVITY 2

Common Mistakes

3.2 J.

WHY IT WORKS $U_s = \frac{1}{2}(160)(0.20)^2 = 3.2$ J.

WARM-UP • ACTIVITY 3

Quick Application

2.0 m/s.

WHY IT WORKS $\frac{1}{2}kx^2 = \frac{1}{2}mv^2$, so $v = x\sqrt{(k/m)} = 2.0$ m/s.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Guided Example

0.96 J.

WHY IT WORKS $U_s = \frac{1}{2}(300)(0.080)^2 = 0.96$ J.

PRACTICE 2

Independent Check

2.0 m/s.

WHY IT WORKS $\frac{1}{2}kx^2 = \frac{1}{2}mv^2$ gives $v = 0.10\sqrt{(200/0.50)} = 2.0$ m/s.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Spring Turning Point

12 N to the left.

WHY IT WORKS $F_s = -kx$; magnitude = 12 N and direction is toward equilibrium.

CONFIDENCE CHECK 2

Energy Scaling

A factor of 4.

WHY IT WORKS $U_s \propto x^2$.

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	**I Need More Practice**	**I'm Ready**
Review the focused review again to strengthen the essential concepts.	Build confidence with additional practice problems.	Continue to the next topic or learning resource.
Review again: return to Warm-Up Check on page 4.	**Go to Practice →**	**Continue →**

RECOMMENDED LINKS

Review again: return to Warm-Up Check on page 4.

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