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…

explain restoring-force direction, compare spring stiffness, track elastic potential energy, and reason about energy changes between turning points and equilibrium.

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 • Foundational**	**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

Restoring Force Direction

Use equilibrium as the reference.

A spring is stretched to the right of equilibrium. Which direction does the spring force point?

WARM-UP 2

Force and Energy

Separate direction from stored energy.

A spring is compressed and then stretched by the same distance. Which case stores more elastic potential energy?

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Turning Points

Connect motion and energy.

At maximum compression of an ideal horizontal spring system, what is the object's instantaneous speed?

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

Restoring Force and Spring Stiffness

An ideal spring exerts a restoring force toward equilibrium. The magnitude grows with deformation, and a larger spring constant k means a stiffer spring. At equilibrium, x = 0 and the spring force is zero.

Fs = -kx; |Fs| = k|x|; Us = (1/2)kx^2.

EXAMPLE A spring stretched to the right pulls left; compressed to the left, it pushes right.

SENSEI NOTE The negative sign describes direction, not a force that is always numerically negative.

KEY CONCEPT 2

Elastic Potential Energy

A deformed ideal spring stores elastic potential energy. Stretching and compressing by the same magnitude store the same energy. Because the energy depends on x^2, doubling deformation quadruples the stored energy.

Ki + Us,i = Kf + Us,f; maximum deformation is a turning point with v = 0.

EXAMPLE If a deformation doubles from x to 2x, the stored spring energy becomes four times larger.

SENSEI NOTE Do not give spring potential energy the sign of x. Energy is a scalar.

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

Identify direction before magnitude.

A spring is stretched 0.080 m to the right. Without calculating, state the spring-force direction and explain how the force changes if the stretch is doubled.

PRACTICE 2

Independent Check

Compare spring energy using proportional reasoning.

Two identical springs are deformed by x and 2x. Compare their stored elastic potential energies.

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

Restoring Direction

State the physical direction.

A spring is compressed to the left of equilibrium. Where does the spring force point?

CONFIDENCE CHECK 2

Energy Scaling

Use the squared dependence.

A spring's deformation triples. By what factor does its elastic potential energy 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

Force Points Toward Equilibrium

The spring force opposes displacement and increases in magnitude with deformation.

KEY TAKEAWAY 2

Energy Depends on Deformation Squared

Elastic potential energy is $\frac{1}{2}kx^2$, so equal stretch and compression store equal energy.

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

Left, toward equilibrium.

WHY IT WORKS The spring force is restoring: it points opposite the displacement.

WARM-UP • ACTIVITY 2

Common Mistakes

They store the same elastic potential energy.

WHY IT WORKS Elastic potential energy depends on x^2, so equal-magnitude compression and extension store equal energy.

WARM-UP • ACTIVITY 3

Quick Application

Zero.

WHY IT WORKS Maximum compression is a turning point, so the object is momentarily at rest.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Guided Example

The force points left; doubling the stretch doubles the force magnitude.

WHY IT WORKS Hooke's law is linear in displacement magnitude, and the force always points toward equilibrium.

PRACTICE 2

Independent Check

The second spring stores four times as much energy.

WHY IT WORKS Because $U_s \propto x^2$, $(2x)^2/x^2 = 4$.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Spring Turning Point

To the right, toward equilibrium.

WHY IT WORKS The restoring force always opposes displacement.

CONFIDENCE CHECK 2

Energy Scaling

It increases by a factor of 9.

WHY IT WORKS $U_s \propto x^2$, so $3^2 = 9$.

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.

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