

FULL REVIEW

Full Review: Phase Changes and Latent Heat

Review the essential ideas, relationships, and problem-solving tools for phase changes and latent heat.

 TIME 45–60 minutes	 BEST FOR A complete topic review	 FINISH WITH A readiness check
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After this full review, you'll be able to...

recall the essential ideas, apply them to representative problems, and determine what to study next.

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 45–60 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-U04
TOPIC: Phase Changes and Latent Heat
COURSE LEVEL: Foundational introductory 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 six stages in order. Each stage builds on the previous one and prepares you for the final readiness check.

6 stages • Approximately 45–60 minutes

1 Warm-Up Check Activate prior knowledge.	2 Core Concepts Review the essential ideas.	3 Guided Practice Apply what you learned.
4 Confidence Check Confirm your understanding.	5 Summary Review the key ideas.	6 Next Step Continue your learning.

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 moment to see what you already remember. Do not worry about getting everything right. This is only a starting point.

ACTIVITY 1**Recall Activity 1**

Match each phase change with its direction of change.

Melting: solid $\rightarrow$ liquid; freezing: liquid $\rightarrow$ solid; vaporization: liquid $\rightarrow$ gas; condensation: gas $\rightarrow$ liquid; sublimation: solid $\rightarrow$ gas; deposition: gas $\rightarrow$ solid.

ACTIVITY 2**Recall Activity 2**

Decide whether energy is absorbed or released.

Which changes absorb energy: melting, vaporization, sublimation? Which release energy: freezing, condensation, deposition?

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

Use a heating-curve idea in words.

Ice at its melting point absorbs energy while it melts. What happens to its temperature during the phase change?

Ready to strengthen your understanding?

You've refreshed what you already know. Next, reinforce the essential concepts that will help you solve problems with confidence.

Continue to Core Concepts →

FR-05 • STAGE 2 OF 6

Core Concepts

Let's rebuild the key ideas one step at a time. Focus on understanding the relationships before worrying about solving problems.

KEY CONCEPT 1**Phase Changes and Energy**

During a phase change, energy can enter or leave a substance without producing a temperature change. The energy changes the molecular arrangement and intermolecular potential energy. Melting and vaporization require energy; freezing and condensation release it.

$$Q = mL$$

EXAMPLE Ice at 0 °C can absorb energy and melt while remaining near 0 °C.

SENSEI NOTE Do not assume that adding heat always raises temperature. During a phase change, temperature can stay constant.

KEY CONCEPT 2**Latent Heat**

Latent heat measures the energy required per unit mass for a phase change at the transition temperature. Fusion refers to melting/freezing; vaporization refers to liquid/gas changes. The same magnitude of latent heat applies in reverse, but the direction of energy transfer changes.

$$Q = mL$$

EXAMPLE Melting 0.20 kg of ice with $L_f = 334 \text{ kJ/kg}$ requires 66.8 kJ.

SENSEI NOTE Choose L_f for solid ↔ liquid and L_v for liquid ↔ gas. Keep units consistent.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Heating Curves and Phase Regions

On a heating curve, sloped sections represent temperature change within one phase, while flat sections represent phase changes. A complete energy calculation may require several stages, each handled separately. A phase diagram shows which phase is stable for a given temperature and pressure.

$$Q_{\text{total}} = \text{sum of the energy for each stage}$$

EXAMPLE Heating ice, melting it, and then warming the liquid requires three separate energy contributions.

SENSEI NOTE Do not use one formula for an entire multistage process. Identify each physical stage first.

Ready to apply these ideas?

You've reinforced the essential concepts. Now put them into practice by working through guided examples and building your problem-solving confidence.

[Continue to Guided Practice →](#)

FR-06 • STAGE 3 OF 6

Guided Practice

Now it's time to apply what you've reviewed. Work through each activity in order. The examples become gradually more challenging, and each prepares you for the final readiness check.

PRACTICE 1**Worked Example**

Follow the phase-change calculation step by step.

How much energy is needed to melt 0.20 kg of ice at its melting point if $L_f = 334 \text{ kJ/kg}$? Use $Q = mL$.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Break the process into stages before calculating.

A sample of ice is first melted and then the liquid water is warmed. State the two energy stages and the formula used for each.

PRACTICE 3

Independent Problem

Solve independently and show the energy direction.

How much energy is released when 0.050 kg of water vapor condenses if $L_v = 2260 \text{ kJ/kg}$?

Ready to check your understanding?

You've practiced the essential skills with guidance. Now solve a few short problems on your own and confirm you're ready to move forward.

Continue to Confidence Check →

FR-07 • STAGE 4 OF 6

Confidence Check

You've rebuilt the key ideas and practiced them with guidance. Now try these short questions on your own to check your understanding before moving on.

QUICK CHECK 1**Phase-Change Temperature**

Answer in one sentence.

Why can a substance absorb energy during melting without its temperature rising?

QUICK CHECK 2**Choose the Correct Latent Heat**

Identify the relationship you would use.

Which latent heat is used for liquid water changing to vapor?

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Two-Stage Energy

State the stages; no arithmetic is required.

A block of ice below 0 °C is heated until it just finishes melting. What energy stages occur?

HOW DID IT GO?

I answered ____ of 3 questions correctly.

Use the Solutions section to check your reasoning, then take one final look at the essential ideas.

You've checked your understanding.

Take one final look at the essential ideas before deciding what to do next.

Continue to Summary →

FR-08 • STAGE 5 OF 6

Summary

Before moving on, take one final look at the most important ideas from this review.

KEY TAKEAWAY 1

Phase changes can occur at nearly constant temperature

Energy transferred during a phase change changes the state of matter rather than the temperature.

KEY TAKEAWAY 2

Latent heat connects energy and mass

Use $Q = mL$ with the latent heat that matches the phase transition.

KEY TAKEAWAY 3

Multistage processes must be split

Use $Q = mc\Delta T$ for temperature changes and $Q = mL$ for phase changes, then add the stage energies.

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. Replace each placeholder with a concise answer and the essential explanation.

WARM-UP • ACTIVITY 1**Recall Activity 1**

Melting, freezing, vaporization, condensation, sublimation, and deposition connect the solid, liquid, and gas phases.

WHY IT WORKS The phase name tells you the initial and final states.

WARM-UP • ACTIVITY 2**Recall Activity 2**

Melting, vaporization, and sublimation absorb energy. Freezing, condensation, and deposition release energy.

WHY IT WORKS Moving toward a less tightly bound phase requires energy; moving toward a more tightly bound phase releases energy.

WARM-UP • ACTIVITY 3**Recall Activity 3**

The temperature remains approximately constant until the phase change is complete.

WHY IT WORKS During the phase change, added energy changes molecular arrangement rather than raising average kinetic energy.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Worked Example

$$Q = (0.20 \text{ kg})(334 \text{ kJ/kg}) = 66.8 \text{ kJ absorbed.}$$

WHY IT WORKS Latent-heat energy depends on mass and the appropriate latent heat.

PRACTICE 2

Guided Problem

Stage 1: melt the ice using $Q = mL_f$. Stage 2: warm the liquid using $Q = mc\Delta T$. Add the two energy amounts for the total.

WHY IT WORKS A phase-change stage and a temperature-change stage are different physical processes and use different relationships.

PRACTICE 3

Independent Problem

$$Q = (0.050 \text{ kg})(2260 \text{ kJ/kg}) = 113 \text{ kJ released.}$$

WHY IT WORKS Condensation reverses vaporization, so the same magnitude mL_v is transferred out of the substance.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Phase-Change Temperature

The energy changes molecular arrangement and intermolecular potential energy during the phase change rather than increasing temperature.

WHY IT WORKS Temperature tracks average molecular kinetic energy; latent heat is associated primarily with the phase rearrangement.

QUICK CHECK 2

Choose the Correct Latent Heat

Use the latent heat of vaporization: $Q = mL_v$.

WHY IT WORKS Liquid $\leftrightarrow$ gas transitions use L_v .

QUICK CHECK 3

Two-Stage Energy

First warm the solid to the melting point using $Q = mc\Delta T$; then melt it using $Q = mL_f$.

WHY IT WORKS The sample changes temperature before it changes phase, so the process must be split.

READINESS GUIDE

3 correct: You're ready to continue. • 2 correct: Review the missed idea, then continue. • 0–1 correct: Revisit Core Concepts or choose more practice.

FR-09 • STAGE 6 OF 6

Next Step: Continue Learning

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

 I'm Still Unsure Review the key ideas and examples 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 →
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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