

FULL REVIEW

Full Review: Temperature and Thermal Equilibrium

Review the essential ideas, relationships, and problem-solving tools for Temperature and Thermal Equilibrium.

 TIME 45–60 minutes	 BEST FOR A complete topic review	 FINISH WITH A readiness check
---	---	--

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-U01
TOPIC: Temperature and Thermal Equilibrium
COURSE LEVEL: Foundational College 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**

Recall the meanings of temperature, heat, and thermal equilibrium.

Write one accurate sentence for each term and identify which one is measured by a thermometer.

ACTIVITY 2**Recall Activity 2**

Classify statements about thermal state and energy transfer.

Classify: (a) 300 K, (b) 50 J transferred because of a temperature difference, (c) no net thermal transfer.

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

Apply temperature reasoning to a contact situation.

A 60 °C ceramic mug touches a 20 °C metal tray. Predict the initial direction of heat transfer and the equilibrium condition.

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

Temperature Versus Heat

Temperature is a state property that helps predict the direction of spontaneous thermal energy transfer. Heat is energy transferred across a system boundary solely because of a temperature difference. Internal energy belongs to the system; heat describes a process.

Heat transfer direction: higher temperature → lower temperature

EXAMPLE A hot plate transfers energy to a cooler pan; the energy crossing the boundary is heat.

SENSEI NOTE Avoid the phrase contains heat; say has internal energy or receives energy as heat.

KEY CONCEPT 2

Thermal Equilibrium and the Zeroth Law

Two systems in thermal contact reach thermal equilibrium when they have equal temperatures and no net heat transfer occurs between them. The Zeroth Law states that systems separately in equilibrium with the same reference system are in equilibrium with each other.

If A is in equilibrium with C and B is in equilibrium with C, then temperature of A = temperature of B

EXAMPLE A calibrated thermometer is the reference system used to compare temperatures reproducibly.

SENSEI NOTE Equilibrium is about equal temperature, not equal mass, equal internal energy, or motionless particles.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Temperature Scales and Measurement

Celsius and kelvin use equal-sized intervals but different zero points. Kelvin is an absolute scale and must not be reported with a degree symbol. A thermometer must interact with the object, so the reading is trusted only after it settles.

$$\text{Kelvin temperature} = \text{Celsius temperature} + 273.15$$

EXAMPLE 20 °C corresponds to 293.15 K, and a rise of 5 °C is also a rise of 5 K.

SENSEI NOTE Write 300 K, not 300 °K, and do not confuse a temperature with a temperature change.

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**

Use temperature difference to predict transfer and equilibrium.

A $75\text{ }^{\circ}\text{C}$ object is placed in contact with a $15\text{ }^{\circ}\text{C}$ object in an insulated enclosure. Identify the initial transfer direction, the range of the final common temperature, and what ends the net transfer.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Convert between Celsius and kelvin, then interpret the interval.

Convert $-10\text{ }^{\circ}\text{C}$ to kelvins and 310 K to degrees Celsius. State the size of a $12\text{ }^{\circ}\text{C}$ temperature change in kelvins.

PRACTICE 3

Independent Problem

Apply the Zeroth Law to three systems.

A and B never touch. A equilibrates with thermometer C at 298 K ; B later equilibrates with the same thermometer at 298 K . Predict what happens if A and B touch.

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**Choose the Correct Language**

Select the scientifically accurate statement.

Which is correct: the object contains heat, or energy is transferred to the object as heat? Explain briefly.

QUICK CHECK 2**Absolute Temperature**

Convert and label the unit correctly.

What Celsius temperature corresponds to 273.15 K?

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Three-System Reasoning

Use the Zeroth Law.

X and Y are each in equilibrium with Z. Is an initial net heat transfer expected when X touches Y?

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**Temperature Is Not Heat**

Temperature characterizes thermal state; heat is energy transferred because temperatures differ.

KEY TAKEAWAY 2**Equilibrium Is a Shared Temperature**

Thermal equilibrium means equal temperature and no net heat transfer between systems in contact.

KEY TAKEAWAY 3**Kelvin Is Absolute**

Kelvin and Celsius intervals have equal size, but kelvin begins at absolute zero and uses no degree symbol.

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**Recall Activity 1**

Temperature is measured by a thermometer. Heat is transfer caused by a temperature difference. Thermal equilibrium is equal temperature with no net transfer.

WHY IT WORKS These definitions keep state properties separate from transfer processes.

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

(a) temperature, (b) heat transfer, (c) thermal equilibrium.

WHY IT WORKS Each item identifies a numerical state, a transfer process, or an equilibrium condition.

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

Heat initially transfers from the 60 °C mug to the 20 °C tray. Equilibrium occurs when their temperatures are equal.

WHY IT WORKS The temperature difference determines the spontaneous direction.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Worked Example**

Heat transfers from 75 °C to 15 °C. The final common temperature lies between 15 °C and 75 °C. Net transfer ends at equal temperature.

WHY IT WORKS Equilibrium requires a common temperature; without more material data, its exact value is not determined.

PRACTICE 2**Guided Problem**

$-10\text{ }^{\circ}\text{C} = 263.15\text{ K}$; $310\text{ K} = 36.85\text{ }^{\circ}\text{C}$; a $12\text{ }^{\circ}\text{C}$ change equals a 12 K change.

WHY IT WORKS The scales differ by an offset, while their interval sizes are equal.

PRACTICE 3**Independent Problem**

A and B have the same temperature, so no initial net heat transfer is expected when they touch.

WHY IT WORKS A common reference temperature makes the comparison transitive.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Choose the Correct Language

Energy is transferred to the object as heat. Heat is not stored in the object.

WHY IT WORKS Internal energy is stored; heat is energy crossing a boundary because of temperature difference.

QUICK CHECK 2

Absolute Temperature

273.15 K corresponds to 0 °C.

WHY IT WORKS The kelvin scale is offset from Celsius by 273.15.

QUICK CHECK 3

Three-System Reasoning

No. X and Y have equal temperatures because both are in equilibrium with Z.

WHY IT WORKS This is the Zeroth Law applied to three systems.

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 →
--	---	---

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