

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
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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-U01
TOPIC: Temperature and Thermal Equilibrium
COURSE LEVEL: Algebra-Based 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 scale-conversion equations and equilibrium language.

Write formulas for Celsius↔kelvin and Celsius↔Fahrenheit.

ACTIVITY 2

Recall Activity 2

Classify absolute temperatures and temperature changes.

Label each as a value or a change: $25\text{ }^{\circ}\text{C}$, 25 K , $\Delta T = 25\text{ }^{\circ}\text{C}$, $\Delta T = 25\text{ K}$.

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

Compare temperatures stated on different scales.

Object A is 95 °F and B is 30 °C. Which is warmer?

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, Heat, and Equilibrium

Temperature is a state property; heat is energy transferred because temperatures differ. Interacting systems reach thermal equilibrium when their temperatures are equal and no net heat transfer remains.

Higher temperature → lower temperature until equilibrium

EXAMPLE A 40 °C object transfers heat to a 15 °C object until they share a temperature.

SENSEI NOTE Do not treat heat as a quantity stored in the object.

KEY CONCEPT 2

Converting Temperature Scales

Temperature values require both scale factors and offsets. Temperature changes use only the scale factor because offsets cancel. Kelvin is absolute and has no degree symbol.

$$T(\text{K}) = T(^{\circ}\text{C}) + 273.15; T(^{\circ}\text{F}) = (9/5)T(^{\circ}\text{C}) + 32$$

EXAMPLE 68 °F = 20 °C = 293.15 K, while a 10 °C change equals 18 Fahrenheit degrees.

SENSEI NOTE Do not add 273.15 to a temperature change.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Linear Thermometer Calibration

A thermometric property such as length or resistance can be calibrated between two known points. If its response is linear, equal fractions of the property range represent equal fractions of the temperature range.

$$T = T_1 + [(X - X_1)/(X_2 - X_1)](T_2 - T_1)$$

EXAMPLE A sensor halfway between its 0 °C and 100 °C calibration readings indicates 50 °C.

SENSEI NOTE Linear interpolation is valid only when the response is stated or shown to be linear.

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**

Convert through Celsius to compare scales.

Convert 68°F to degrees Celsius and kelvins. Then compare it with 295 K .

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Interpolate a linear thermometer reading.

A resistance thermometer reads $100\ \Omega$ at $0\ ^\circ\text{C}$ and $138.5\ \Omega$ at $100\ ^\circ\text{C}$. Assuming linear response, find the temperature at $119.25\ \Omega$.

PRACTICE 3

Independent Problem

Apply equilibrium reasoning with a common reference.

A equilibrates with C at $290\ \text{K}$ and B equilibrates with C at $290\ \text{K}$. Predict the initial transfer when 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**Convert an Absolute Temperature**

Show the offset and scale factor.

Convert $-4\text{ }^{\circ}\text{F}$ to degrees Celsius and kelvins.

QUICK CHECK 2**Convert a Temperature Change**

Use interval conversion only.

A temperature rises by 25 K . Express the change in Celsius degrees and Fahrenheit degrees.

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Calibrate a Thermometer

Use linear interpolation.

A linear sensor reads $X=4$ at 10°C and $X=10$ at 40°C . What temperature corresponds to $X=7$?

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**Equilibrium Means Equal Temperature**

A temperature difference drives net heat transfer; equality ends it.

KEY TAKEAWAY 2**Values and Changes Convert Differently**

Offsets affect absolute values, while interval conversions use only scale factors.

KEY TAKEAWAY 3**Calibration Maps a Property to Temperature**

A linear calibration uses the same fractional position on the property and temperature ranges.

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

$T(K) = T(^{\circ}C) + 273.15$; $T(^{\circ}F) = (9/5)T(^{\circ}C) + 32$; $T(^{\circ}C) = (5/9)[T(^{\circ}F) - 32]$.

WHY IT WORKS These equations encode the scale offsets and interval ratios.

WARM-UP • ACTIVITY 2

Recall Activity 2

25 °C and 25 K are values; $\Delta T = 25$ °C and $\Delta T = 25$ K are changes. A 25 °C change equals 25 K.

WHY IT WORKS A temperature difference is independent of the chosen zero point.

WARM-UP • ACTIVITY 3

Recall Activity 3

95 °F = 35 °C, so A is warmer than B at 30 °C.

WHY IT WORKS Converting to a common scale reveals the ordering.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Worked Example**

$68\text{ }^{\circ}\text{F} = 20\text{ }^{\circ}\text{C} = 293.15\text{ K}$; therefore 295 K is warmer.

WHY IT WORKS Both values are compared on the absolute kelvin scale.

PRACTICE 2**Guided Problem**

The fraction is $(119.25 - 100)/(138.5 - 100) = 0.50$, so $T = 50\text{ }^{\circ}\text{C}$.

WHY IT WORKS Linear response makes the resistance fraction equal the temperature fraction.

PRACTICE 3**Independent Problem**

No initial net heat transfer occurs because A and B have equal temperatures.

WHY IT WORKS The Zeroth Law transfers the equality through reference C.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Convert an Absolute Temperature

$$-4\text{ }^{\circ}\text{F} = -20\text{ }^{\circ}\text{C} = 253.15\text{ K.}$$

WHY IT WORKS The Fahrenheit offset is removed before multiplying by 5/9.

QUICK CHECK 2

Convert a Temperature Change

$$25\text{ K} = 25\text{ }^{\circ}\text{C of change} = 45\text{ Fahrenheit degrees of change.}$$

WHY IT WORKS Kelvin and Celsius intervals match; Fahrenheit intervals are 9/5 larger.

QUICK CHECK 3

Calibrate a Thermometer

$X=7$ is halfway from 4 to 10, so T is halfway from $10\text{ }^{\circ}\text{C}$ to $40\text{ }^{\circ}\text{C}$: $25\text{ }^{\circ}\text{C}$.

WHY IT WORKS Both the sensor property and temperature are at the same 0.50 fraction.

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