

FULL REVIEW

Full Review: Heat, Specific Heat, and Calorimetry

Review the essential ideas, relationships, and problem-solving tools for heat, specific heat, and calorimetry.

 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-U03
TOPIC: Heat, Specific Heat, and Calorimetry
COURSE LEVEL: Foundational 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**Meaning Match**

Complete the activity, then check your reasoning in the Solutions section.

Match each idea with its meaning.

ACTIVITY 2**Sign Check**

Complete the activity, then check your reasoning in the Solutions section.

State whether Q is positive or negative.

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Quick Calculation

Complete the activity, then check your reasoning in the Solutions section.

A 2.0 kg sample with $c = 500 \text{ J/(kg}\cdot^\circ\text{C)}$ warms by 3.0°C . Find Q .

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

Heat and Temperature Change

Heat is energy transferred because of a temperature difference. For a substance that stays in one phase, the energy needed for a temperature change depends on its mass, specific heat, and temperature change.

$$Q = mc\Delta T$$

EXAMPLE $Q = mc\Delta T$. A larger mass or larger specific heat requires more energy for the same ΔT .

SENSEI NOTE Do not treat heat and temperature as the same quantity. Heat is energy transfer; temperature describes thermal state.

KEY CONCEPT 2

Specific Heat

Specific heat c tells how much energy is needed to raise 1 kg of a material by 1 °C (or 1 K). Materials with larger c change temperature less for the same energy input per kilogram.

$$C = mc$$

EXAMPLE Water has a large specific heat, so it warms and cools more slowly than many metals.

SENSEI NOTE Use kilograms when c is in J/(kg·°C), and keep units consistent.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Calorimetry and Energy Balance

In an insulated calorimetry situation, energy released by warmer objects is absorbed by cooler objects. The total heat transfer for the chosen system is zero.

$$\Sigma Q = 0$$

EXAMPLE For two objects: $Q(\text{hot}) + Q(\text{cold}) = 0$.

SENSEI NOTE Choose signs from temperature change: warming gives $\Delta T > 0$ and cooling gives $\Delta T < 0$.

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**

Solve the problem. Show your setup before checking the solution.

A 0.50 kg sample with $c = 900 \text{ J/(kg}\cdot^{\circ}\text{C)}$ warms from 20°C to 30°C . Find the heat absorbed.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Solve the problem. Show your setup before checking the solution.

A 0.20 kg object releases 2400 J while cooling by 20 °C. Find its specific heat.

PRACTICE 3

Independent Problem

Solve the problem. Show your setup before checking the solution.

Equal masses of two materials receive the same heat. Material A has twice the specific heat of B. Compare their temperature changes.

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

Heat or Temperature?

Answer before checking the solution.

Choose the correct statement.

QUICK CHECK 2

Use the Formula

Answer before checking the solution.

A 1.0 kg sample with $c = 400 \text{ J/(kg}\cdot^{\circ}\text{C)}$ gains 2000 J. Find ΔT .

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Energy Balance

Answer before checking the solution.

In an insulated cup, a hot object loses 600 J. How much heat does the cooler material gain?

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**Core relation**

For one substance with constant specific heat and no phase change, $Q = mc\Delta T$.

KEY TAKEAWAY 2**Thermal response**

Large mass or large specific heat means a smaller temperature change for a given energy transfer.

KEY TAKEAWAY 3**Calorimetry balance**

For an insulated system, add all heat transfers and set the total equal to zero.

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

Meaning Match

heat → energy transferred; specific heat → energy needed per kilogram per degree; calorimetry → using energy balance to study heat exchange

WHY IT WORKS These three ideas organize nearly every calorimetry problem.

WARM-UP • ACTIVITY 2

Sign Check

An object warms: Q is positive. An object cools: Q is negative.

WHY IT WORKS The sign follows whether the object absorbs or releases energy.

WARM-UP • ACTIVITY 3

Quick Calculation

$$Q = (2.0)(500)(3.0) = 3000 \text{ J.}$$

WHY IT WORKS Use $Q = mc\Delta T$ and multiply mass, specific heat, and temperature change.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Worked Example

$\Delta T = 10\text{ }^{\circ}\text{C}$. $Q = mc\Delta T = (0.50)(900)(10) = 4500\text{ J}$. The sample absorbs 4.5 kJ.

WHY IT WORKS A positive temperature change gives positive Q .

PRACTICE 2

Guided Problem

Use $|Q| = mc|\Delta T|$. $c = 2400/[(0.20)(20)] = 600\text{ J/(kg}\cdot^{\circ}\text{C)}$.

WHY IT WORKS Using magnitudes is convenient when the problem asks only for c .

PRACTICE 3

Independent Problem

Because $\Delta T = Q/(mc)$, A changes temperature by half as much as B.

WHY IT WORKS For fixed Q and m , ΔT is inversely proportional to c .

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Heat or Temperature?

Heat is energy transferred between systems; temperature is not energy transferred.

WHY IT WORKS The quantities are related but not interchangeable.

QUICK CHECK 2

Use the Formula

$$\Delta T = Q/(mc) = 2000/(1.0 \times 400) = 5.0 \text{ }^{\circ}\text{C}.$$

WHY IT WORKS Rearrange $Q = mc\Delta T$.

QUICK CHECK 3

Energy Balance

It gains 600 J, so Q (cold) = +600 J.

WHY IT WORKS Energy conservation requires the transfers to be equal in magnitude and opposite in sign.

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