

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: 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**Equation Recall**

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

Write the two equations that organize this unit.

ACTIVITY 2**Sign Reasoning**

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

A metal cools from 90 °C to 30 °C. What sign does its Q have?

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

One-Step Calculation

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

How much heat raises 0.250 kg of water by 4.0 °C? Use $c = 4186 \text{ J}/(\text{kg} \cdot ^\circ\text{C})$.

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**Sensible Heat: $Q = mc\Delta T$**

When a substance remains in one phase and c is approximately constant, the heat transfer associated with a temperature change is $Q = mc(T_f - T_i)$. The sign is built into ΔT .

$$Q = mc\Delta T$$

EXAMPLE For 0.200 kg of water warmed 5.0 °C: $Q = (0.200)(4186)(5.0) \approx 4.19 \times 10^3 \text{ J}$.

SENSEI NOTE Keep mass and specific-heat units compatible before substituting.

KEY CONCEPT 2**Specific Heat and Thermal Inertia**

Specific heat c measures thermal response per unit mass. For fixed Q and m , $\Delta T = Q/(mc)$, so a larger c produces a smaller temperature change.

$$C = mc$$

EXAMPLE Equal masses receiving equal heat: the sample with half the c has twice the ΔT .

SENSEI NOTE Do not confuse specific heat c with heat capacity $C = mc$.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3**Calorimetry: $\Sigma Q = 0$**

For an insulated calorimeter with negligible heat loss, the algebraic sum of heat transfers is zero. Write one $Q = mc(T_f - T_i)$ term for each participating object and solve for the unknown.

$$\Sigma Q = 0$$

EXAMPLE Mixing 0.100 kg water at 80 °C with 0.200 kg water at 20 °C gives $T_f = 40$ °C when heat loss is neglected.

SENSEI NOTE Use one common final equilibrium temperature, but each object keeps its own initial temperature, mass, and c .

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 0.300 kg aluminum sample, $c = 900 \text{ J/(kg}\cdot\text{°C)}$, warms from 20 °C to 50 °C . Find Q .

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

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

Mix 0.100 kg water at 80 °C with 0.200 kg water at 20 °C in an insulated cup. Find T_f .

PRACTICE 3

Independent Problem

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

A 0.050 kg metal at 100 °C is placed in 0.100 kg water at 20 °C. The final temperature is 24 °C. Find the metal specific heat. Use $c_{\text{water}} = 4186 \text{ J}/(\text{kg}\cdot^\circ\text{C})$.

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

Solve for Heat

Answer before checking the solution.

A 0.50 kg material with $c = 800 \text{ J/(kg}\cdot\text{°C)}$ cools by 10 °C . Find Q .

QUICK CHECK 2

Solve for Temperature Change

Answer before checking the solution.

A 2.0 kg sample with $c = 500 \text{ J/(kg}\cdot\text{°C)}$ absorbs 6000 J. Find ΔT .

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Calorimetry Check

Answer before checking the solution.

Why must an ideal two-object final temperature lie between the initial temperatures?

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**Model each object**

Use $Q = mc(T_f - T_i)$ for each object that changes temperature without a phase change.

KEY TAKEAWAY 2**Conserve energy**

For an insulated calorimeter, $\Sigma Q = 0$.

KEY TAKEAWAY 3**Check the result**

Signs and the location of T_f between initial temperatures provide fast error checks.

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

Equation Recall

$Q = mc\Delta T$ and $\Sigma Q = 0$ for an insulated calorimetry system.

WHY IT WORKS The first models each object; the second connects the objects.

WARM-UP • ACTIVITY 2

Sign Reasoning

$\Delta T = 30 - 90 = -60\text{ }^{\circ}\text{C}$, so $Q < 0$.

WHY IT WORKS Cooling means the object releases energy.

WARM-UP • ACTIVITY 3

One-Step Calculation

$Q = (0.250)(4186)(4.0) = 4.19 \times 10^3\text{ J}$.

WHY IT WORKS Convert grams to kilograms when needed.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Worked Example**

$$\Delta T = 30\text{ }^{\circ}\text{C}. Q = (0.300)(900)(30) = 8100\text{ J}.$$

WHY IT WORKS Positive Q means the sample absorbed heat.

PRACTICE 2**Guided Problem**

Same c cancels: $0.100(T_f - 80) + 0.200(T_f - 20) = 0$. Thus $0.300T_f = 12.0$ and $T_f = 40\text{ }^{\circ}\text{C}$.

WHY IT WORKS Check that T_f lies between the two initial temperatures.

PRACTICE 3**Independent Problem**

Heat gained by water = $(0.100)(4186)(4) = 1674.4\text{ J}$. Set $|Q_{\text{metal}}|$ equal to this: $c_{\text{metal}} = 1674.4 / [(0.050)(76)] \approx 441\text{ J/(kg}\cdot^{\circ}\text{C)}$.

WHY IT WORKS Write the full energy balance before solving for the unknown c .

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Solve for Heat

$$Q = (0.50)(800)(-10) = -4000 \text{ J.}$$

WHY IT WORKS The negative sign represents heat released.

QUICK CHECK 2

Solve for Temperature Change

$$\Delta T = 6000 / [(2.0)(500)] = 6.0 \text{ }^{\circ}\text{C.}$$

WHY IT WORKS Isolate ΔT algebraically before substituting.

QUICK CHECK 3

Calorimetry Check

One object must cool while the other warms until they reach equilibrium; without another energy source, the final temperature cannot exceed both or fall below both.

WHY IT WORKS This is a fast physical reasonableness check.

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