FULL REVIEW

Full Review: Kirchhoff's Rules and Multiloop Circuits — Foundational

Review the essential ideas, relationships, and problem-solving tools for Kirchhoff's Rules and Multiloop Circuits.

TIME	BEST FOR	FINISH WITH
45–60 minutes	A complete topic review	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: EME-U08** **TOPIC: Kirchhoff's Rules and Multiloop Circuits** **COURSE LEVEL: Foundational**	**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

What physical quantity is conserved at a circuit junction?

Explain your reasoning and record your response.

ACTIVITY 2

Recall Activity 2

A calculated branch current is negative. What does its sign tell you?

Explain your reasoning and record your response.

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

A 12 V rise balances 5 V and 4 V drops. What is the remaining drop?

Explain your reasoning and record your response.

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

Junction rule

Charge conservation requires the total current entering a junction to equal the total leaving it.

$$\sum I_{¿} = \sum I_{out}$$

EXAMPLE If 3 A enters and 1 A leaves along one wire, the other outgoing current is 2 A.

SENSEI NOTE Choose reference arrows before assigning current signs.

KEY CONCEPT 2

Loop rule

Energy conservation requires the sum of voltage rises and drops around a closed steady-state loop to be zero.

$$\sum \Delta V = 0$$

EXAMPLE A 12 V rise balances drops of 4 V, 5 V, and 3 V.

SENSEI NOTE A resistor is a drop when traversed in the assumed current direction.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Sign convention

Across a resistor along current, the potential change is negative; opposite current, positive. Across an ideal source from negative to positive terminal, potential rises.

$$\Delta V_R = -IR$$

EXAMPLE For I = 2 A through R = 3 Ω, the voltage change along current is –6 V.

SENSEI NOTE A negative solved current means the true direction opposes the assumed arrow.

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

At a junction 3 A enters and 1 A leaves. Find the other outgoing current.

Show the circuit equations, substitutions, and result.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

In a closed loop, a 12 V source opposes 4 V and 5 V drops. Find the third voltage drop.

Show the circuit equations, substitutions, and result.

PRACTICE 3

Independent Problem

For three parallel branches with $I_1=(12-V)/2$, $I_2=(6-V)/3$, and $I_3=-V/4$, find V and the three currents.

Show the circuit equations, substitutions, and result.

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

Check your understanding

If a calculated current is negative, what does that mean?

Write your answer before consulting the solutions.

QUICK CHECK 2

Check your understanding

Why must the net potential change around a closed steady-state loop vanish?

Write your answer before consulting the solutions.

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Check your understanding

Verify junction conservation for 30/13 A, –6/13 A, and –24/13 A.

Write your answer before consulting the solutions.

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

Junction rule

Charge conservation requires the total current entering a junction to equal the total leaving it.

KEY TAKEAWAY 2

Loop rule

Energy conservation requires the sum of voltage rises and drops around a closed steady-state loop to be zero.

KEY TAKEAWAY 3

Sign convention

Across a resistor along current, the potential change is negative; opposite current, positive. Across an ideal source from negative to positive terminal, potential rises.

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

Electric charge.

WHY IT WORKS This result follows from charge or energy conservation with a consistent sign convention.

WARM-UP • ACTIVITY 2

Recall Activity 2

The actual current is opposite the assumed arrow.

WHY IT WORKS This result follows from charge or energy conservation with a consistent sign convention.

WARM-UP • ACTIVITY 3

Recall Activity 3

3 V.

WHY IT WORKS This result follows from charge or energy conservation with a consistent sign convention.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1

Worked Example

2 A leaves.

WHY IT WORKS This result follows from charge or energy conservation with a consistent sign convention.

PRACTICE 2

Guided Problem

12 – 4 – 5 – V = 0, so V = 3 V.

WHY IT WORKS This result follows from charge or energy conservation with a consistent sign convention.

PRACTICE 3

Independent Problem

$I_1+I_2+I_3=0$ gives V=96/13 V; I_1=30/13 A, I_2=–6/13 A, I_3=–24/13 A.

WHY IT WORKS This result follows from charge or energy conservation with a consistent sign convention.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

The current flows opposite to the assumed direction.

WHY IT WORKS This result follows from charge or energy conservation with a consistent sign convention.

QUICK CHECK 2

A charge returns to its starting potential energy; the signed rises and drops balance.

WHY IT WORKS This result follows from charge or energy conservation with a consistent sign convention.

QUICK CHECK 3

Their algebraic sum is zero.

WHY IT WORKS This result follows from charge or energy conservation with a consistent sign convention.

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	**I Need More Practice**	**I'm Ready**
Review the key ideas and examples again.	Continue with additional practice for this topic.	Continue to the next recommended resource.
Review Again →	**Go to Practice →**	**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 →

TEMPLATE-ONLY PRODUCTION FIELDS — DELETE BEFORE EXPORTING

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