

FULL REVIEW

Full Review — Acceleration and Constant-Acceleration Motion — Algebra-Based

Review the essential ideas, relationships, and problem-solving tools for Acceleration and Constant-Acceleration Motion.

 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 Topic Review is an independent learning resource. Use it to reinforce key concepts, prepare for homework, or review before a quiz or exam.

Related Unit Review: If you need to review the complete unit material, review [Motion in One Dimension here →](#)

RESOURCE: Physics Sensei Topic Review
TOPIC ID: MEC-U03-T02
TOPIC: Acceleration and Constant-Acceleration Motion
PARENT UNIT: MEC-U03 — Motion in One Dimension
COURSE LEVEL: Algebra-Based

BEST USED

- ✓ After learning the topic
- ✓ 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 equation before doing arithmetic.

Which constant-acceleration equation gives final velocity from v_0 , a , and t ?

ACTIVITY 2**Recall Activity 2**

Identify the incorrect assumption.

Why is it wrong to make acceleration positive just because an object is speeding up?

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

Choose the equation that avoids an unnecessary variable.

You know v_0 , v , a , and need displacement. Which kinematic equation is most direct?

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**Velocity–Time Relationship**

For constant acceleration, velocity changes linearly with time. The slope of a velocity–time graph equals acceleration, so the sign of the slope gives the sign of a .

$$v = v_0 + at$$

EXAMPLE From $v_0 = +3$ m/s with $a = +4$ m/s² for 2 s, $v = +11$ m/s.

SENSEI NOTE A negative acceleration can increase speed when velocity is also negative.

KEY CONCEPT 2**Displacement under Constant Acceleration**

Displacement accumulates while velocity changes. The constant-acceleration displacement equation combines the initial velocity contribution with the additional displacement caused by acceleration.

$$\Delta x = v_0 t + \frac{1}{2}at^2$$

EXAMPLE From rest with $a = +2$ m/s² for 3 s, $\Delta x = 9$ m.

SENSEI NOTE The $\frac{1}{2}$ factor belongs to the acceleration contribution to displacement.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Time-Free Kinematic Relation

When time is not known or not needed, eliminate it to relate velocities, acceleration, and displacement directly. This is especially useful for stopping-distance and launch problems.

$$v^2 = v_0^2 + 2a\Delta x$$

EXAMPLE A car slows from 18 m/s to rest with $a = -3 \text{ m/s}^2$; the equation gives a stopping displacement of +54 m.

SENSEI NOTE Squaring velocity removes its sign, so determine the physically appropriate velocity direction separately when needed.

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 the velocity–time equation first, then displacement.

A bike has $v_0 = +6 \text{ m/s}$ and $a = +1.5 \text{ m/s}^2$ for 4 s. Find v and Δx .

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Guided Problem

Use the time-free equation and keep the acceleration signed.

A car slows from +20 m/s to +8 m/s over 42 m. Find the constant acceleration.

PRACTICE 3

Independent Problem

Treat vertical motion with upward positive.

A ball is thrown upward from a balcony at +12 m/s. Using $a = -9.8 \text{ m/s}^2$, find its displacement when its velocity first reaches 0.

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**Position after Acceleration**

Use the displacement equation.

An object starts at $+2 \text{ m/s}$ and accelerates at $+3 \text{ m/s}^2$ for 2 s . What displacement occurs?

QUICK CHECK 2**Free-Fall Sign Convention**

Take upward as positive.

A ball is thrown upward at $+14 \text{ m/s}$. Using $a = -9.8 \text{ m/s}^2$, what is its velocity after 1.0 s ?

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Stopping Distance

Use $v^2 = v_0^2 + 2a\Delta x$.

A car at +15 m/s brakes with $a = -5 \text{ m/s}^2$. What stopping displacement is required?

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**Choose an Equation Strategically**

For constant acceleration, choose the kinematic equation containing your knowns and desired unknown while minimizing extra variables.

KEY TAKEAWAY 2**Signs Carry Direction**

Define the positive direction once. Keep the signs of displacement, velocity, and acceleration consistent with that axis.

KEY TAKEAWAY 3**Match the Equation to the Known Quantities**

The constant-acceleration equations are equivalent descriptions. Choose the one that uses your knowns and desired unknown without introducing an unnecessary variable.

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

$$v = v_0 + at.$$

WHY IT WORKS This is the direct velocity–time equation for constant acceleration.

WARM-UP • ACTIVITY 2

Recall Activity 2

The sign of acceleration gives its direction, not whether speed grows. Speed increases when v and a have the same sign.

WHY IT WORKS Speed depends on the magnitude of velocity; direction information is carried by signs.

WARM-UP • ACTIVITY 3

Recall Activity 3

$$v^2 = v_0^2 + 2a\Delta x.$$

WHY IT WORKS That equation includes v_0 , v , a , and Δx but not t .

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Worked Example**

$$v = 6 + (1.5)(4) = +12 \text{ m/s}; \Delta x = (6)(4) + \frac{1}{2}(1.5)(4^2) = 36 \text{ m}.$$

WHY IT WORKS Both equations use the same signed acceleration and elapsed time.

PRACTICE 2**Guided Problem**

$$\text{Use } v^2 = v_0^2 + 2a\Delta x: 64 = 400 + 84a, \text{ so } a = -4.0 \text{ m/s}^2.$$

WHY IT WORKS The time-free kinematic equation directly connects velocity change, acceleration, and displacement.

PRACTICE 3**Independent Problem**

$$\text{Use } 0 = 12^2 + 2(-9.8)\Delta y, \text{ giving } \Delta y \approx +7.35 \text{ m}.$$

WHY IT WORKS At the top, $v = 0$ while acceleration remains downward; the time-free relation directly gives the rise.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Position after Acceleration

$$\Delta x = (2)(2) + \frac{1}{2}(3)(2^2) = 10 \text{ m.}$$

WHY IT WORKS Initial motion contributes 4 m and acceleration contributes 6 m.

QUICK CHECK 2

Free-Fall Sign Convention

$$v = 14 - 9.8(1.0) = +4.2 \text{ m/s.}$$

WHY IT WORKS The ball is still moving upward because its velocity remains positive after 1.0 s.

QUICK CHECK 3

Stopping Distance

$$0 = 225 - 10\Delta x, \text{ so } \Delta x = 22.5 \text{ m.}$$

WHY IT WORKS The time-free equation is direct because initial/final velocities and acceleration are known.

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