

FOCUSED REVIEW

Focused Review: Kinetic Theory of Gases — Algebra-Based

Review the most important ideas, reinforce the essential skills, and confirm you're ready to move on.

 TIME 15–20 minutes	 BEST FOR Focused review	 FINISH WITH Greater confidence
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After this focused review, you'll be able to...

After this review, you'll be able to calculate microscopic pressure and molecular speeds, and connect absolute temperature to average translational kinetic energy.

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 15–20 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-U07
TOPIC: Kinetic Theory of Gases
COURSE LEVEL: Algebra-Based

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 focused stages in order. Each stage reinforces your understanding and prepares you for a final confidence check.

6 stages • Approximately 15–20 minutes

1 Warm-Up Check Refresh key ideas.	2 Core Concepts Reinforce the essentials.	3 Guided Practice Strengthen key skills.
4 Confidence Check Confirm your understanding.	5 Summary Remember the essentials.	6 Next Step Choose your next step.

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 minute to reactivate what you already know. This quick warm-up will help you focus on the most important ideas before moving on.

WARM-UP 1**Symbols and Units**

Identify N/V , m , mean-square speed, M , and Boltzmann constant.

Write the physical meaning and SI unit of each quantity.

WARM-UP 2**Common Mistakes**

Find the unit error.

A student substitutes $M = 28$ into $\text{rms speed} = \sqrt{3RT/M}$ for nitrogen.

FR-04 • WARM-UP CHECK CONTINUED

WARM-UP 3

Quick Application

Use a speed ratio.

For one gas, T changes from 300 K to 1200 K. Predict the rms-speed factor.

Ready to strengthen your understanding?

You've refreshed the most important ideas. Now reinforce the concepts you'll use most often.

Continue to Core Concepts →

FR-05 • STAGE 2 OF 6

Core Concepts

Let's reinforce the most important concepts you'll need to solve problems with confidence. Focus on the ideas that appear most often in homework, quizzes, and exams.

KEY CONCEPT 1

Pressure from Mean-Square Speed

For an ideal gas with isotropic molecular motion, one-third of the total mean-square speed contributes, on average, to motion normal to any wall. Combining number density, molecular mass, and mean-square speed gives the pressure.

$$P = (1/3)(N/V)m\langle v^2 \rangle$$

EXAMPLE If N/V doubles while molecular mass and mean-square speed stay fixed, pressure doubles.

SENSEI NOTE Do not replace mean-square speed with $\langle v \rangle$ squared; the average of the square is not generally the square of the average.

KEY CONCEPT 2

Temperature, Energy, and RMS Speed

Average translational kinetic energy is proportional to absolute temperature. Substituting average translational kinetic energy = $(1/2)m\langle v^2 \rangle$ gives the rms-speed relation; the molar form is often convenient.

$$v_{\text{rms}} = \sqrt{3RT/M}$$

EXAMPLE For oxygen at 300 K with $M = 0.032 \text{ kg/mol}$, rms speed $\approx 484 \text{ m/s}$.

SENSEI NOTE Convert molar mass from g/mol to kg/mol before using R .

Ready to apply these ideas?

You've reinforced the essential concepts. Now strengthen your problem-solving skills by working through a few guided examples.

[Continue to Guided Practice →](#)

FR-06 • STAGE 3 OF 6

Guided Practice

Now apply the key concepts you've just reviewed. Work through these focused practice activities to reinforce your problem-solving skills before the final confidence check.

PRACTICE 1**RMS Speed of Nitrogen**

Calculate a characteristic molecular speed.

Find rms speed for nitrogen at 300 K using $R = 8.314 \text{ J/(mol}\cdot\text{K)}$ and $M = 0.028 \text{ kg/mol}$.

PRACTICE 2**Temperature from Speed**

Rearrange the rms-speed relation.

A gas with molar mass 0.032 kg/mol has rms speed $= 600 \text{ m/s}$. Solve for T .

Ready for a confidence check?

You've reinforced the essential skills through focused practice. Now confirm your understanding with two short questions.

Continue to Confidence Check →

FR-07 • STAGE 4 OF 6

Confidence Check

You've reinforced the key concepts and practiced the essential skills. Now confirm you're ready to move forward by completing these short confidence checks.

CONFIDENCE CHECK 1

Pressure Scaling

Use the pressure equation.

N/V triples while rms speed falls to one-half its original value. What is the final-to-initial pressure ratio?

CONFIDENCE CHECK 2

Energy Scaling

Use average translational kinetic energy $\propto T$.

If T increases by 25%, by what percent does average translational kinetic energy change?

HOW DID IT GO?

I answered ____ of 2 questions correctly.

Use the Solutions section to check your reasoning, then take one final look at the essential ideas.

You've confirmed your understanding.

Take one final look at the essential ideas before choosing your next step.

Continue to Summary →

FR-08 • STAGE 5 OF 6

Summary

Before moving on, take one final look at the essential ideas you'll want to remember.

KEY TAKEAWAY 1**Pressure tracks mean-square motion**

P depends on number density, molecular mass, and mean-square speed.

KEY TAKEAWAY 2**Temperature fixes average kinetic energy**

average translational kinetic energy = $(3/2)$ Boltzmann constant T and rms speed scales as $\sqrt{T/M}$.

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

Key Ideas

N/V is number density; m is molecular mass; mean-square speed is mean-square speed; M is molar mass; Boltzmann constant is Boltzmann's constant.

WHY IT WORKS Keeping microscopic and molar quantities distinct prevents unit and factor errors.

WARM-UP • ACTIVITY 2

Common Mistakes

The error is using 28 g/mol as 28 kg/mol. Use $M = 0.028$ kg/mol.

WHY IT WORKS The R-based formula requires SI molar mass in kg/mol.

WARM-UP • ACTIVITY 3

Quick Application

The rms speed doubles.

WHY IT WORKS $\sqrt{(1200/300)} = \sqrt{4} = 2$.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Guided Example**

rms speed = $\sqrt{(3(8.314)(300)/0.028)} \approx 5.17 \times 10$ squared m/s.

WHY IT WORKS The molar form combines the molecular-mass and Boltzmann-constant factors into R and M.

PRACTICE 2**Independent Check**

$T = M \text{rms speed squared} / (3R) \approx (0.032)(600 \text{ squared}) / (3 \times 8.314) \approx 462 \text{ K.}$

WHY IT WORKS Rearranging first keeps units and the squared speed organized.

SOLUTIONS • CONFIDENCE CHECK

CONFIDENCE CHECK 1

Pressure Scaling

the final-to-initial pressure ratio = $3(1/2)$ squared = $3/4$.

WHY IT WORKS Pressure is proportional to number density times rms speed squared for a fixed molecular mass.

CONFIDENCE CHECK 2

Energy Scaling

Average translational kinetic energy increases by 25%.

WHY IT WORKS average translational kinetic energy is directly proportional to absolute temperature.

READINESS GUIDE

2 correct: You're ready to continue. • 1 correct: Review the missed idea, then continue. • 0 correct: Revisit Core Concepts or choose more practice.

FR-09 • STAGE 6 OF 6

Next Step: Continue Learning

Great work! You've completed this focused review. Choose the next resource that best matches how confident you feel.

? I'm Still Unsure Review the focused review again to strengthen the essential concepts. Review Again →	🎯 I Need More Practice Build confidence with additional practice problems. Go to Practice →	✓ I'm Ready Continue to the next topic or learning 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.

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[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