

FULL REVIEW

Full Review: Kinetic Theory of Gases — Foundational

Review the essential ideas, relationships, and problem-solving tools for Kinetic Theory of Gases.

 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...

After this review, you'll be able to build the microscopic gas model, explain pressure and temperature, interpret speed distributions, and apply rms-speed scaling.

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-U07 TOPIC: Kinetic Theory of Gases COURSE LEVEL: Foundational	BEST USED ✓ After learning the unit ✓ Before starting homework ✓ Before a quiz or exam
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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**Microscopic Variables**

Identify the microscopic origin of pressure, temperature, and molecular speed.

Write one sentence for each: wall collisions, average translational kinetic energy, and a distribution of molecular speeds.

ACTIVITY 2**Recognize the Model**

Classify each statement as a valid ideal-gas assumption or not.

Molecules move randomly; collisions are brief and elastic; intermolecular forces are negligible except during collisions.

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Temperature Scaling

Predict before calculating.

For the same gas, what happens to rms speed if absolute temperature becomes four times larger?

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**Molecular Model and Pressure**

Ideal-gas molecules move randomly and collide elastically. Each wall collision changes molecular momentum and gives the wall an impulse. Averaged over many collisions, that momentum transfer produces pressure.

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

EXAMPLE If mean-square molecular speed increases while N/V is unchanged, pressure increases in the same proportion.

SENSEI NOTE Macroscopic pressure is a statistical average of countless microscopic impacts.

KEY CONCEPT 2**Temperature as Molecular Energy**

Absolute temperature sets average translational kinetic energy. This relation is the same for every monatomic ideal-gas molecule, regardless of molecular species.

$$K_{\text{avg}} = 3/2 k_B T$$

EXAMPLE At 600 K, the average translational kinetic energy is twice its value at 300 K.

SENSEI NOTE Equal temperature means equal average translational kinetic energy, not equal molecular speed.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Speed Distribution and RMS Speed

Molecules do not all move at one speed. Their speeds span a distribution. Heating shifts the distribution toward larger speeds, while a heavier molecular mass shifts characteristic speeds downward.

$$v_{\text{rms}} = \sqrt{3k_{\text{B}}T/m}$$

EXAMPLE Quadrupling T for the same gas doubles rms speed; quadrupling molecular mass at the same T halves rms speed.

SENSEI NOTE Rms speed is a characteristic value derived from mean-square speed, not the most common speed.

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**Temperature-Ratio Example**

Use rms speed $\propto \sqrt{T}$ for one gas.

A gas changes from 250 K to 400 K. Find the rms-speed ratio and interpret it.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2

Molecular-Mass Comparison

Use rms speed $\propto 1/\sqrt{m}$ at fixed temperature.

Gas A molecules have one-fourth the mass of gas B molecules. Compare their rms speeds.

PRACTICE 3

Microscopic Pressure

Reason from the pressure relation.

N/V stays fixed while rms speed rises by 20%. By what factor does mean-square speed—and therefore pressure—change?

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

Equal Temperature

Compare energy and speed.

Two gases have the same temperature but different molecular masses. What is equal, and what is generally different?

QUICK CHECK 2

Heating a Gas

Use the distribution picture.

When an ideal gas is heated, does every molecule become faster? State the statistically correct interpretation.

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Pressure from Motion

Connect rms speed to pressure.

At fixed N/V and molecular mass, what happens to pressure if rms speed doubles?

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**Pressure is momentum transfer**

Wall collisions turn microscopic momentum changes into macroscopic pressure.

KEY TAKEAWAY 2**Temperature is an energy scale**

Average translational kinetic energy is proportional to absolute temperature.

KEY TAKEAWAY 3**Molecular speeds are distributed**

Characteristic speeds rise with $\sqrt{T}$ and fall with $\sqrt{m}$.

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

Recall Activity 1

Pressure comes from wall-collision momentum transfer; temperature tracks average translational kinetic energy; molecular speeds vary across a distribution.

WHY IT WORKS Kinetic theory replaces a single-speed picture with statistical molecular motion.

WARM-UP • ACTIVITY 2

Recall Activity 2

All three are standard ideal-gas assumptions in the kinetic model.

WHY IT WORKS These assumptions allow simple statistical connections between microscopic motion and macroscopic variables.

WARM-UP • ACTIVITY 3

Recall Activity 3

The rms speed doubles.

WHY IT WORKS rms speed $\propto \sqrt{T}$, so $\sqrt{4} = 2$.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Worked Example**

the rms-speed ratio = $\sqrt{(400/250)} \approx 1.26$, so rms speed increases about 26%.

WHY IT WORKS The square-root dependence makes speed grow more slowly than temperature.

PRACTICE 2**Guided Problem**

Gas A has twice the rms speed of gas B.

WHY IT WORKS One-fourth the mass gives a factor $1/\sqrt{(1/4)} = 2$.

PRACTICE 3**Independent Problem**

A 20% speed increase gives a mean-square-speed factor $(1.20)^2 = 1.44$, so pressure rises by 44%.

WHY IT WORKS With N/V and m fixed, pressure is proportional to rms speed squared = mean-square speed.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Equal Temperature

Average translational kinetic energy is equal; characteristic speeds differ, with the lighter gas faster.

WHY IT WORKS Temperature fixes average kinetic energy, while rms speed also depends on molecular mass.

QUICK CHECK 2

Heating a Gas

The speed distribution shifts toward higher speeds; individual molecules still exchange speeds through collisions.

WHY IT WORKS Temperature describes a statistical ensemble, not identical motion of every molecule.

QUICK CHECK 3

Pressure from Motion

Pressure becomes four times larger.

WHY IT WORKS At fixed density and mass, $P \propto$ rms speed squared.

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