

FULL REVIEW

Full Review: Ideal Gas Law

Review the essential ideas, relationships, and problem-solving tools for Ideal Gas Law.

 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-U06
TOPIC: Ideal Gas Law
COURSE LEVEL: Calculus-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 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**

Define P , V , n , T , and R .

Identify P , V , n , T , and R ; distinguish state variables from process constraints; recognize $PV = nRT$ as an equation of state.

ACTIVITY 2**Recall Activity 2**

Why is $dP/P = -dV/V$ not a general ideal-gas relation?

It follows only for fixed n and an isothermal process.

FR-04 • WARM-UP CHECK CONTINUED

ACTIVITY 3

Recall Activity 3

For fixed n , differentiate $PV = nRT$.

For fixed n , differentiate $PV = nRT$.

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**Ideal Gas Law and State Variables**

The ideal gas law is an equation of state connecting equilibrium variables P , V , n , and T . It constrains states but does not specify the process between them.

$$PV = nRT$$

EXAMPLE Given any three state variables at equilibrium, the fourth follows from the equation of state.

SENSEI NOTE An equation of state describes states, not the path.

KEY CONCEPT 2**Units and Absolute Temperature**

Temperature must be absolute and the units of R must be compatible with P and V . In SI, $\text{Pa}\cdot\text{m}^3$ is a joule.

$$R = 8.314 \text{ J}/(\text{mol}\cdot\text{K}) = 8.314 \text{ Pa}\cdot\text{m}^3/(\text{mol}\cdot\text{K})$$

EXAMPLE With P in Pa and V in m^3 , both PV and nRT have units of energy.

SENSEI NOTE Use dimensional consistency as a check.

FR-05 • CORE CONCEPTS CONTINUED

KEY CONCEPT 3

Differential Changes of State

For fixed n , differentiating the equation of state relates infinitesimal changes between neighboring equilibrium states. Process constraints simplify the relation.

$$P dV + V dP = nR dT \text{ (fixed } n\text{)}$$

EXAMPLE For an isothermal change, $dT = 0$, so $dP/P = -dV/V$.

SENSEI NOTE Do not treat differentials as finite changes without justification.

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**

Write the relevant relationship, apply the stated constraint, and show the reasoning.

For fixed n and an isothermal change, $P dV + V dP = 0$. Dividing by PV gives $dP/P = -dV/V$.

FR-06 • GUIDED PRACTICE CONTINUED

PRACTICE 2**Guided Problem**

Write the relevant relationship, apply the stated constraint, and show the reasoning.

Identify knowns and constraints → choose the relation → solve symbolically → substitute if needed → check units and trend.

PRACTICE 3**Independent Problem**

Write the relevant relationship, apply the stated constraint, and show the reasoning.

For fixed n and constant volume, relate dP/P to dT/T .

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

Ideal-Gas Readiness Check

Use the stated variables and constraints.

What thermodynamic role does $PV = nRT$ play?

QUICK CHECK 2

Ideal-Gas Readiness Check

Use the stated variables and constraints.

For fixed n , what is the differential form of $PV = nRT$?

FR-07 • CONFIDENCE CHECK CONTINUED

QUICK CHECK 3

Ideal-Gas Readiness Check

Use the stated variables and constraints.

For a fixed- n isothermal change, how are dP/P and dV/V related?

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**Ideal Gas Law**

The ideal gas law is an equation of state connecting equilibrium variables P , V , n , and T . It constrains states but does not specify the process between them.

KEY TAKEAWAY 2**Ideal Gas Law**

Temperature must be absolute and the units of R must be compatible with P and V . In SI, $\text{Pa}\cdot\text{m}^3$ is a joule.

KEY TAKEAWAY 3**Ideal Gas Law**

For fixed n , differentiating the equation of state relates infinitesimal changes between neighboring equilibrium states. Process constraints simplify the relation.

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

Identify P , V , n , T , and R ; distinguish state variables from process constraints; recognize $PV = nRT$ as an equation of state.

WHY IT WORKS Use the ideal-gas law together with the stated constraints and consistent units.

WARM-UP • ACTIVITY 2

Recall Activity 2

It follows only for fixed n and an isothermal process.

WHY IT WORKS Use the ideal-gas law together with the stated constraints and consistent units.

WARM-UP • ACTIVITY 3

Recall Activity 3

$P dV + V dP = nR dT$.

WHY IT WORKS Use the ideal-gas law together with the stated constraints and consistent units.

SOLUTIONS • GUIDED PRACTICE

PRACTICE 1**Worked Example**

For fixed n and an isothermal change, $P dV + V dP = 0$. Dividing by PV gives $dP/P = -dV/V$.

WHY IT WORKS Use the ideal-gas law together with the stated constraints and consistent units.

PRACTICE 2**Guided Problem**

With $dV = 0$, $dP/P = dT/T$.

WHY IT WORKS Use the ideal-gas law together with the stated constraints and consistent units.

PRACTICE 3**Independent Problem**

It is the ideal-gas equation of state.

WHY IT WORKS Use the ideal-gas law together with the stated constraints and consistent units.

SOLUTIONS • CONFIDENCE CHECK

QUICK CHECK 1

Ideal-Gas Readiness Check

$$P dV + V dP = nR dT.$$

WHY IT WORKS Use the ideal-gas law together with the stated constraints and consistent units.

QUICK CHECK 2

Ideal-Gas Readiness Check

$$dP/P = -dV/V.$$

WHY IT WORKS Use the ideal-gas law together with the stated constraints and consistent units.

QUICK CHECK 3

Ideal-Gas Readiness Check

For fixed n and an isothermal change, $P dV + V dP = 0$. Dividing by PV gives $dP/P = -dV/V$.

WHY IT WORKS Use the ideal-gas law together with the stated constraints and consistent units.

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