



BitWith Bite

PHYSICS WORKSHEET



First Law of Thermodynamics

Chapter: Thermodynamics · Level ★★★ · Time: 30 min

SCORE

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Name _____ Class _____ Date _____

AFTER THIS WORKSHEET YOU CAN

- ✓ Understand: The First Law Statement
- ✓ Understand: Internal Energy (U)
- ✓ Understand: Sign Conventions
- ✓ Understand: Special Cases



Section A · Concept Check

• BEGINNER

4 × 1 = 4

- 1 A gas absorbs 1000 J of heat and does 400 J of work. Find ΔU .

- 2 A gas has 250 J of work done on it with no heat exchange (adiabatic). Find ΔU .

- 3 What does 'isothermal' mean, and what does it imply about ΔU for an ideal gas?

- 4 In an isochoric (constant volume) process, a gas absorbs 400 J of heat. Find ΔU .



Section B · Problem Solving

• INTERMEDIATE

4 × 3 = 12

- 5 A gas releases 150 J of heat while doing 50 J of work on its surroundings. Find ΔU .

- 6 Why can't a machine produce more energy output than the energy put into it, according to the first law?

- 7 A balloon expands, doing 120 J of work on the surrounding air, while absorbing 120 J of heat. Find ΔU .

- 8 What happens to a gas's internal energy during rapid adiabatic compression ($Q=0$, work done ON the gas)?



Section C · Challenge

• CHALLENGE

2 × 2 = 4

- 9 Why is 'internal energy' different from 'heat'?

- 10 A system undergoes a full cycle and returns to its starting state. What must be true about its total ΔU over the cycle?



Reflection — the most useful thing I learned: _____

✂ ANSWER KEY – FOLD OR CUT BEFORE HANDING OUT

1 = 600 J 2 = $Q=0$, $W=-250$, $\Delta U=0-(-250)=250$ J 3 = Constant temperature; it implies $\Delta U=0$ for an ideal gas 4 = Since $W=0$, $\Delta U=Q=400$ J | 5 = $Q=-150$, $W=50$, $\Delta U=-150-50=-200$ J 6 = Energy cannot be created; the first law requires that all energy changes be fully accounted for by heat and work exchanged 7 = $\Delta U=120-120=0$ J 8 = It increases, since compression adds energy to the system with no heat escaping | 9 = Internal energy is the system's total stored energy at any moment; heat is energy specifically in transit due to a temperature difference 10 = It must equal 0, since internal energy is a state function that returns to its original value