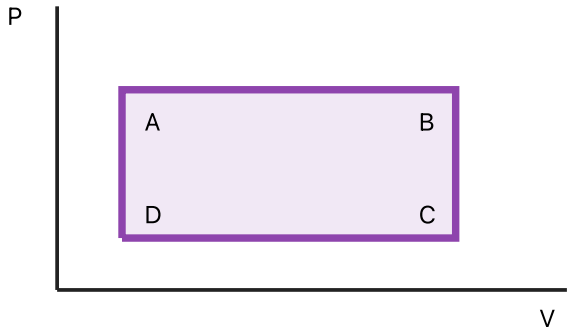
THERMO DAY 15: UNIT 9 REVIEW & P–V TRANSLATION WORKSHOP

CED 9.1–9.6 · Skill 1.B · featured FRQ: TBR

MODEL MAP

Particle model	State/equation	Energy process
$KE_{avg} = \frac{3}{2}k_B T$	$PV = nRT$	$\Delta U = Q + W_{on}$
$v_{rms} = \sqrt{3k_B T/m}$	$U = \frac{3}{2}nRT$	$W_{by} = \int P\,dV$
collisions create pressure	$Q = mc\Delta T$	$e = W_{out}/Q_H$, $\Delta S \geq 0$

RETRIEVAL Without notes, identify the equation and one common error for each row.



GRAPH READ For the clockwise rectangle A→B→C→D→A, identify the process type and sign of work on every leg.

MIXED QUANTITATIVE REVIEW

1. A 0.30 mol gas at 300 K occupies 0.025 m³. Find P.

2. A gas absorbs 600 J and does 220 J of work. Find ΔU.

3. A 0.20 kg metal sample with $c = 450\ \mathrm{J/(kg\cdot K)}$ warms by 35 K. Find Q.

4. A clockwise rectangle spans 100 kPa by 0.50 m³. Find work per cycle.

5. An engine absorbs 1.80 kJ and exhausts 1.20 kJ. Find efficiency.

FEATURED TRANSLATION FRQ

A monatomic ideal gas follows A→B→C on the P–V graph: A→B is isochoric heating; B→C is isobaric expansion. Given $P_A = 100\ \text{kPa}$, $P_B = P_C = 200\ \text{kPa}$, $V_A = V_B = 1.0\ \text{m}^3$, and $V_C = 1.5\ \text{m}^3$:

1. Sketch and label the path.
2. Find W_{by} for each leg and total.
3. Use $T \propto PV$ to find T_B/T_A and T_C/T_A.
4. If $T_A = 300\ \text{K}$ and $n = 40\ \text{mol}$, describe the direction of heat transfer on each leg.
5. Write a claim comparing ΔU_{AB} and ΔU_{BC}, supported by the temperature ratios.

EXPERIMENTAL DESIGN & EXPLANATION

Lab design. Describe how to test $P \propto 1/V$ for a fixed amount of gas at constant temperature. Identify controls, measurements, a linearized graph, and one uncertainty reduction.

Misconception synthesis. Correct both claims: “metal is colder because it feels colder” and “an adiabatically compressed gas cannot warm because no heat entered.”

Second Law. Explain why energy conservation alone does not determine whether a proposed process occurs spontaneously.