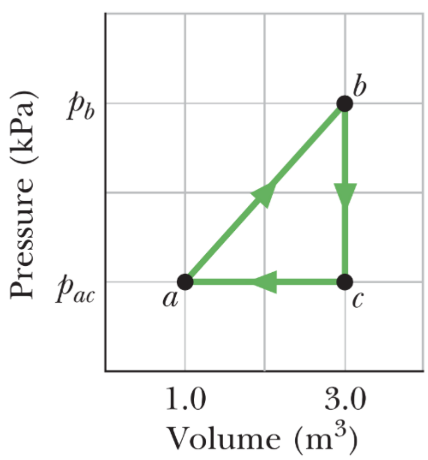
**CHAPTER 19 | Ideal Gases**

1 | A quantity of ideal gas at $10.0°C$ and $100\ kPa$ occupies a volume of $2.50\ m^3$.
(a) How many moles of the gas are present? $(Ans: 106\ mol)$
(b) If the pressure is now raised to $300\ kPa$ and the temperature is raised to $30.0°C$, how much volume does the gas occupy? Assume no leaks. $(Ans: 0.892\ m^3)$

2 | Air that initially occupies $0.140\ m^3$ at a gauge pressure of $103.0\ kPa$ is expanded isothermally to a pressure of $101.3\ kPa$ and then cooled at constant pressure until it reaches its initial volume. Compute the work done by the air. (Gauge pressure is the difference between the actual pressure and atmospheric pressure.)
$(Ans: 5.60 \times 10^3\ J)$

3 | A sample of an ideal gas is taken through the cyclic process $abca$ shown in the figure. The scale of the vertical axis is set by $p_b = 7.5\ kPa$ and $p_{ac} = 2.5\ kPa$. At point $a$, $T_a = 200\ K$.
(a) How many moles of gas are in the sample?
$(Ans: 1.5\ mol)$
What are
(b) the temperature of the gas at point $b$,
$(Ans: 1.8 \times 10^3\ K)$
(c) the temperature of the gas at point $c$, and
$(Ans: 6.0 \times 10^2\ K)$
(d) the net energy added to the gas as heat during the cycle? $(Ans: 5.0 \times 10^3\ J)$




$R = 8.31\ J/mol \cdot K$

**CHAPTER 19 | The Molar Specific Heats of an Ideal Gas**

1 | The temperature of $3.00\ mol$ of an ideal diatomic gas is increased by $40.0°C$ without the pressure of the gas changing.

(a) How much energy is transferred to the gas as heat? $(Ans: 3.49 \times 10^3\ J)$

(b) What is the change in the internal energy of the gas? $(Ans: 2.49 \times 10^3\ J)$

(c) How much work is done by the gas? $(Ans: 997\ J)$

2 | When $20.9\ J$ was added as heat to a particular ideal gas, the volume of the gas changed from $50.0\ cm^3$ to $100\ cm^3$ while the pressure remained at $1.00\ atm$.

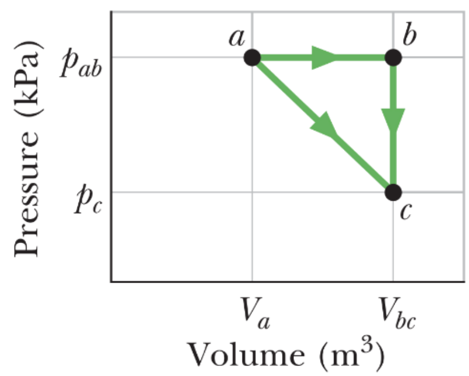
(a) By how much did the internal energy of the gas change? $(Ans: 15.9\ J)$

If the quantity of gas present was $2.00 \times 10^{-3}\ mol$, find

(b) $C_P$ $(Ans: 34.4\ J/mol \cdot K)$ and

(c) $C_V$. $(Ans: 26.1\ J/mol \cdot K)$

3 | One mole of an ideal diatomic gas goes from $a$ to $c$ along the diagonal path in the figure. The scale of the vertical axis is set by $p_{ab} = 5.0$ kPa and $p_c = 2.0$ kPa, and the scale of the horizontal axis is set by $V_{bc} = 4.0\ m^3$ and $V_a = 2.0\ m^3$. During the transition,




(a) what is the change in internal energy of the gas, $(Ans: -5.0 \times 10^3\ J)$ and

(b) how much energy is added to the gas as heat? $(Ans: 2.0 \times 10^3\ J)$

(c) How much heat is required if the gas goes from $a$ to $c$ along the indirect path $abc$? $(Ans: 5.0 \times 10^3\ J)$

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$R = 8.31\ J/mol \cdot K$

**CHAPTER 19 | The Molar Specific Heats of an Ideal Gas**

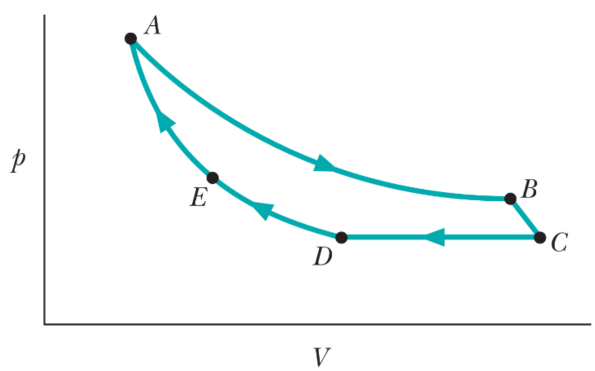
1 | Suppose $1.00\ L$ of a gas with $\gamma = 1.30$, initially at $273\ K$ and $1.00\ atm$, is suddenly compressed adiabatically to half its initial volume. Find its final

(a) pressure $(Ans: 2.46\ atm)$ and

(b) temperature. $(Ans: 336\ K)$

(c) If the gas is then cooled to $273\ K$ at constant pressure, what is its final volume? $(Ans: 0.406\ L)$

2 | Figure below shows a cycle consisting of five paths: $AB$ is isothermal at $300\ K$, $BC$ is adiabatic with work $= 5.0\ J$, $CD$ is at a constant pressure of $5\ atm$, $DE$ is isothermal, and $EA$ is adiabatic with a change in internal energy of $8.0\ J$. What is the change in internal energy of the gas along path $CD$? $(Ans: -3.0\ J)$




3 | The figure shows two paths that may be taken by a gas from an initial point $i$ to a final point $f$. Path 1 consists of an isothermal expansion (work is $50\ J$ in magnitude), an adiabatic expansion (work is $40\ J$ in magnitude), an isothermal compression (work is $30\ J$ in magnitude), and then an adiabatic compression (work is $25\ J$ in magnitude). What is the change in the internal energy of the gas if the gas goes from point $i$ to point $f$ along path 2? $(Ans: -15.0\ J)$