To get full credit: Show your work and EXPLAIN answers not based on calculation.

Exercises 2.1-2.3, and 2.8 from the 9th Edition of Atkins and de Paula.

Exercise A. Calculate ΔU, q, w, and the final temperature (T_f) for a process that compresses one mole of CO_2 isothermally and reversibly from 25 L and 20.0 degrees Celsius to 0.250 L. Treat CO_2 as an ideal gas.

Problem 1. Repeat Exercise A, but treating CO_2 as a van der Waals gas.

Exercise B. Given one mole of an ideal gas with $C_{V,m} = 5R/2$, initially at 300. K and 30.0 bar. A process carries it to a final pressure of 1.00 bar. Calculate ΔU, q, w, and the final temperature (T_f) if the process is:

Case	Process
a	adiabatic and reversible
b	adiabatic into an evacuated container
c	isothermal against a constant opposing pressure of 1.00 bar

Note: 1 bar = 100,000 Pascal (Pa) = 0.9869 atmospheres

Problem 2. As Exercise B, but for the following conditions: for an ideal gas

Case	Process
d	isothermal and reversible
e	isothermal into an evacuated container
f	adiabatic against a constant opposing pressure of 1.00 bar
g	at constant volume
h	heating at constant pressure to a volume 10.0 times the initial volume followed by cooling at constant volume until the final pressure falls to 1.00 bar

Exercise C. Compute ΔH for the processes in Exercise B (still assuming ideal gases).

Problem 3. Compute ΔH for the processes in Problem 2 (still assuming ideal gases).

Problem 4. Consider a very non-ideal gas composed of Na^+ in a container. Assume that, somehow, they don't react and don't stick to the walls of their container.

If described by the van der Waals equation of state, what would be the values of a and b relative to that of neutral Ne, which has the same number of electrons?