

Answer on Question #39270, Physics, Molecular Physics

The volume of a gas is reduced by compressing it under adiabatic conditions. If the work done on the gas is 200 J, find the change in internal energy of the gas and also the amount of heat absorbed by the gas.

Solution:

An adiabatic process is one in which no heat is gained or lost by the system. The first law of thermodynamics with $Q=0$ shows that all the change in internal energy is in the form of work done.

A system that contracts under adiabatic conditions does negative work, so the internal energy increases.

Then, according to the first law of thermodynamics,

$$\Delta U = Q - W = -W$$

where ΔU is the change in the internal energy of the system and W is work done by the system. Any work (W) done must be done at the expense of internal energy U , since no heat Q is being supplied from the surroundings.

$$\Delta U = 200 \text{ J}$$

Answer. Internal energy increases by the value $\Delta U = 200 \text{ J}$; amount of heat absorbed by the gas $Q = 0$.