Task. If the heat enter to a system is 400 joule, find increase in its internal energy if the work done is 100 joule.

Solution. By the first law of thermodynamics the change ΔU of internal energy of the system is equal to the difference of the heat ΔQ added to the system and work ΔW done by the system:

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

In our case

$$\Delta Q = 400 \ joule,$$

and

$$\Delta W = 100 \ joule,$$

whence the internal energy increases by

$$\Delta U = \Delta Q - \Delta W = 400 - 100 = 300 \ joule.$$