First Law of Thermodynamics

What is the change in internal energy of a system if the *surroundings* (**a**) transfer 235 J of heat and 128 J of work to the system? (**b**) absorb 145 J of heat from the system while doing 98 J of work on the system? (**c**) exchange no heat, but receive 1.07 kJ of work from the system?

Solution:

All of the problems revolve around the definition of the First Law of Thermodynamics.
In each case, the direction of heat and work relative to the system must be determined.

$\Delta U = q + w$

(a) $q = 235$ J (system is endothermic); $w = 128$ J (system has work done *on* it)
$\Delta U = 235\text{ J} + 128\text{ J} = 363\text{ J}$

(b) $q = -145$ J (system is exothermic); $w = 98$ J (system has work done *on* it)
$\Delta U = -145\text{ J} + 98\text{ J} = -47\text{ J}$

(c) $q = 0$; $w = -1070$ J (system does work on surroundings)
$\Delta U = 0 + (-1070\text{ J}) = -1070\text{ J}$