Self- Assessment Before and After Facilitating Session.
Topic: First Law Volume 4-2

Thermal Physics PHY630
Facilitators's Name: ____________________
Your Name: ___________________________

Name: ____
Self Assessment - Preparatory

	Please use the following codes and please mark your selection. **1=- Strongly Disagree: 2=Disagree 3 = Unsure/Undecided 4=Agree 5 = Strongly Agree**	Before peer teaching						After peer teaching				
		SD				SA		SD				SA
1.	I have read the chapter before coming to the discussion session today.	1	2	3	4	5		1	2	3	4	5
2.	I can write the energy balance for the first law as $\begin{matrix}\textit{Energy gain}\\ \textit{by a system}\end{matrix} - \begin{matrix}\textit{Energy lost}\\ \textit{by a system}\end{matrix} = \begin{matrix}\textit{Total energy change}\\ \textit{withinthe system}\end{matrix}$. Mathematically, I can represent it by writing, $\boldsymbol{E_{in} - E_{out} = DE_{sys}}$,in units of kilojoule OR $\dot{E}_{in} - \dot{E}_{out} = \Delta\dot{E}_{sys}$ in units of kilowatt or alternatively, $\boldsymbol{e_{in} - e_{out} = De_{sys}}$ in units of kilojoule per kilogram. Note that the energy change within the system , means the difference between the system's initial energy and final energy, $\boldsymbol{DE_{sys} = E_{final} - E_{initial} = E_2 - E_1}$.	1	2	3	4	5		1	2	3	4	5
3.	I can rewrite the energy gain by the system by replacing it with the interaction energies , $\begin{matrix}\textit{Energy gain}\\ \textit{by a system}\end{matrix}$ or $\boldsymbol{E_{in}}$ is the sum of the heat received, $\boldsymbol{Q_{in}}$, the work done on the system, $\boldsymbol{W_{in}}$, and the energy of the mass flowing into the system, $\boldsymbol{E_{mass,in}}$. On the other hand, the energy lost by the system can be written the same way, $\begin{matrix}\textit{Energy lost}\\ \textit{by a system}\end{matrix}$ or $\boldsymbol{E_{out}}$ is the sum of the heat lost, $\boldsymbol{Q_{out}}$, the work done by the system, $\boldsymbol{W_{out}}$, and the energy of the mass flowing leaving the system, $\boldsymbol{E_{mass,out}}$. Mathematically, the expression is, $\boldsymbol{E_{in} = Q_{in} + W_{in} + E_{mass,in}}$ ***and*** $\boldsymbol{E_{out} = Q_{out} + W_{out} + E_{mass,out}}$. Notice that the energy interactions Q, W and E_{mass} are the cause for the energy change within a system. If there aren't any energy crossing into and out of a system's boundary that is, $\boldsymbol{E_{in} = E_{out} = 0}$, then the system's total energy remains unchanged, $\boldsymbol{DE_{sys} = 0}$ ***and hence*** $\boldsymbol{E_2 = E_1}$.	1	2	3	4	5		1	2	3	4	5
4.	I am very familiar with the symbols $\dot{Q} = \frac{Q}{t}$, $\dot{W} = \frac{W}{t}$, $\Delta\dot{E}_{sys} = \frac{\Delta E_{sys}}{t}, (kW); w = \frac{W}{m}$, $q = \frac{Q}{m}$, $e = \frac{E}{m}(\frac{kJ}{kg})$.	1	2	3	4	5		1	2	3	4	5
5.	I am aware that the energies of a system is the sum of its thermal energy associated with its temperature, $U = mcT$, (where c is the system's specific heat) its kinetic energy associated with its speed, $KE = \frac{m\vec{n}^2}{2000}$ and its potential energy associated with its vertical position, $PE = \frac{mgy}{1000}$. Hence the energy change within the system is $DE_{sys} = (U_2 - U_1) + (KE_2 - KE)_1 + (PE_2 - PE)_1 = DU + DKE + DPE$. Note that $DU = mcDT$, $DKE = \frac{m(\vec{n}_2^{\,2} - \vec{n}_1^{\,2})}{2000}$ and	1	2	3	4	5		1	2	3	4	5

Self- Assessment Before and After Facilitating Session.
Topic: First Law Volume 4-2

Thermal Physics PHY630
Facilitators's Name: ____________________
Your Name: ___________________________

	Please use the following codes and please mark your selection. **1=- Strongly Disagree: 2=Disagree 3 = Unsure/Undecided 4=Agree 5 = Strongly Agree**	Before peer teaching						After peer teaching				
	$DPE = \frac{mg(y_2 - y_1)}{1000} = \frac{mgy}{1000}$. Note that in most cases the specific internal energy, u, can be obtained by reading the property table and that the expression $u = cDT$ is only valid in the compressed liquid or superheated vapor phases only.											
6.	I realize that I can write all the expressions for the first law in units of kilojoule, kilowatts or kilojoule per kilogram. Hence the energy balance can be expressed as: $\underset{\textit{by a system}}{\textit{Energy gain}} - \underset{\textit{by a system}}{\textit{Energy lost}} = \underset{\textit{within the system}}{\textit{Total energy change}}$. Or mathematically, $E_{in} - E_{out} = DE_{sys}$ in kJ, or $\dot{E}_{in} - \dot{E}_{out} = D\dot{E}_{sys}$, in kW, or $e_{in} - e_{out} = De_{sys}$ in kJ/kg. Alternatively, it can written as $(Q_{in} - Q_{out}) + (W_{in} - W_{out}) + (E_{mass,in} - E_{mass,out}) = DU + DKE + DPE$ in kJ or $\left(\dot{Q}_{in} - \dot{Q}_{out}\right) + \left(\dot{W}_{in} - \dot{W}_{out}\right) + \left(\dot{E}_{mass,in} - \dot{E}_{mass,out}\right) = D\dot{U} + D\dot{KE} + D\dot{PE}$ in kW or $(q_{in} - q_{out}) + (w_{in} - w_{out}) + (J_{mass,in} - J_{mass,out}) = Du + Dke + Dpe$.	1	2	3	4	5		1	2	3	4	5
7.	I am aware that a stationary system means: ***DKE = 0 and DPE = 0***. So, ***DE_{sys} = DU in kJ***, $\Delta\dot{E}_{sys} = \Delta\dot{U}$ in kW and ***De_{sys} = Du in kJ/kg***,	1	2	3	4	5		1	2	3	4	5
8.	I know that a closed system means ***$E_{mass,in}$ = 0 and $E_{mass,out}$ = 0*** or $\dot{E}_{mass,in} = \dot{E}_{mass,out} = 0$ or $J_{mass,in} = J_{mass,out} = 0$.	1	2	3	4	5		1	2	3	4	5
9.	Hence, for a stationary closed system, the first law of thermodynamics energy balance can be written in any of the following ways: $(Q_{in} - Q_{out}) + (W_{in} - W_{out}) = DU$ or $\left(\dot{Q}_{in} - \dot{Q}_{out}\right) + \left(\dot{W}_{in} - \dot{W}_{out}\right) = D\dot{U}$ or $(q_{in} - q_{out}) + (w_{in} - w_{out}) = Du$.	1	2	3	4	5		1	2	3	4	5
10.	I know that for closed system undergoing an isochoric (constant volume) process, the boundary work done, ***W_b = 0***, & since the total work done is $(W_{in} - W_{out}) = W_{others,in} - W_b$, hence $(Q_{in} - Q_{out}) + W_{others,in} = DU$. Note that $W_{others,in} = W_{pw} + W_{elec}$ where ***W_{pw}*** is the work done by a paddle-wheel (like a fan) and ***W_{elec}*** is the electrical work done by a resistor or a heating element. Note also that the electrical work done is the product of the current through the resistor, ì, the potential difference across the resistor, V, and the amount of time the current is allowed to pass, ***t. Hence the electrical work done by a resistor is W_e = Vì t/1000 in kW.*** Another important fact to realize is that W_{out} is W_b for an	1	2	3	4	5		1	2	3	4	5

Self- Assessment Before and After Facilitating Session.
Topic: First Law Volume 4-2

Thermal Physics PHY630
Facilitators's Name: ____________________
Your Name: ___________________________

	Please use the following codes and please mark your selection. **1=- Strongly Disagree: 2=Disagree 3 = Unsure/Undecided 4=Agree 5 = Strongly Agree**	Before peer teaching						After peer teaching				
	expansion process in a piston-cylinder device.											
11.	I realize that for closed system undergoing an isobaric (constant pressure) process, the volume will change and hence I need to consider the boundary work done by the system. Recall that the boundary work done is obtained by summing over the infinitesimal work done to move a piston form its initial to its final position. Mathematically, the boundary work done is, $W_b = \int PdV = P\int dV = P(V_2 - V_1) = P_2V_2 - P_1V_1$ where the constant pressure P = P_1 = P_2. Again, since the total work done, for an expansion process is, $(W_{in} - W_{out}) = W_{others,in} - W_b$, hence the energy balance can be written as $(Q_{in} - Q_{out}) + W_{others,in} = W_b + DU = P_2V_2 - P_1V_1 + U_2 - U_1 = (U_2 + P_2V_2) - (U_1 + P_1V_1)$. Recall that in chapter 2 we had define the enthalpy of a system as ***H = U + PV***. Hence, we can write $(Q_{in} - Q_{out}) + W_{others,in} = (U_2 + P_2V_2) - (U_1 + P_1V_1) = H_2 - H_1 = m(h_2 - h_1)$ Note that $W_{others,in} = W_{pw} + W_{lece}$. So, in units of kilojoule per kilogram, the first law for a stationary-closed system undergoing an isobaric process is $(q_{in} - q_{out}) + w_{others,in} = h_2 - h_1$. CAUTION: This expression is ONLY VALID when P_2 = P_1 in a process.	1	2	3	4	5		1	2	3	4	5
12.	I know that for a stationary-closed system undergoing a cyclic (starts and end at the same state) process, the total energy for the final and initial states are the same, hence D***E*** $_{sys}$ **=** D***U = 0***. Due to this, the energy balance can be written as $(Q_{in} - Q_{out}) + (W_{in} - W_{out}) = 0$. This means that $Q_{in} - Q_{out} = W_{out} - W_{in}$. The physical interpretation of this is very significant since many engineering devices operate in a cycle. This expression clearly indicates that if the left side of the expression is positive then the right side must also be positive and vice-versa. In other words, for a system such as water in a turbine *to produce work and hence electricity*, a net amount of heat must be transferred into the system . On the other hand, i*n order to have a net amount of heat transferred out of a system* such as an air conditioner, a net amount of work must be done on the system .	1	2	3	4	5		1	2	3	4	5
13.	I am aware that for a stationary-closed system undergoing an adiabatic (no heat transfer, Q = 0) process, the energy balance can be written as $W_{in} - W_{out} = DU.$ Hence, for a system in a piston-cylinder-device to expand (spontaneous expansion) which means that work is done by the system (**W_{in} = 0**), D***U must be negative.*** In other words, *expansion will make the thermal energy of the system to drop* since the energy had to be used to do work in the expansion process. As a result, a drop in temperature will be recorded. On the other hand, if the piston is pushed down (**W_{out} = 0**), work is being done on the system resulting in an *increase in the system's thermal energy*. As a result, an increase in temperature will be observed.	1	2	3	4	5		1	2	3	4	5
14.	I am aware that an open system (control volume) involves mass flowing in & out of a system.	1	2	3	4	5		1	2	3	4	5
15.	I know that mass is conserved in a CV process and the mass balance is $Mass\ entering - Mass\ leaving = Total\ mass\ change\ within\ the\ system$ or $m_{in} - m_{out} = Dm_{sys}$, (kg) OR	1	2	3	4	5		1	2	3	4	5

	Please use the following codes and please mark your selection. **1=- Strongly Disagree: 2=Disagree 3 = Unsure/Undecided 4=Agree 5 = Strongly Agree**	Before peer teaching						After peer teaching				
	$\dot{m}_{in} - \dot{m}_{out} = \Delta\dot{m}_{sys}$; (kg/s). So, if 20 kg enters while only 5 kg of mass leaves the boundaries of a system, then the system's mass has increased by 15 kg.											
16.	I can show using fluid flowing in a cylinder of length, ℓ, and moving with a speed of $\vec{n}$, that the mass flow rate (amount of mass flowing through a perpendicular surface area in one second), $\dot{m} = \frac{\dot{V}}{u} = \frac{\ell A}{ut} = \frac{\vec{n}A}{u}$; (kg/s): where $\vec{n}$ = ℓ/t = velocity or position change in one second; m/s; A = surface area, m^2, $\dot{V}$ = volume flow rate, m^3/s; and ν = specific volume, m^3/kg. Note that the volume flow rate, $\dot{V}$, is obtained by using the idea of total volume and specific volume and just dividing them by clock reading or elapsed time, *t.* $\dot{V} = \dot{m}u$.	1	2	3	4	5		1	2	3	4	5
17.	I realize that I can write all the expressions for the first law in units of kilowatts or kilojoule per kilogram. Hence the energy balance can be expressed in the following ways: $\underset{\text{by a system}}{\text{Energy gain}} - \underset{\text{by a system}}{\text{Energy lost}} = \underset{\text{within the system}}{\text{Total energy change}}$. Or mathematically, $E_{in} - E_{out} = DE_{sys}$ in kJ, or $\dot{E}_{in} - \dot{E}_{out} = D\dot{E}_{sys}$, in kW, or $e_{in} - e_{out} = De_{sys}$ in kJ/kg. Alternatively, it can be written as $\left(\dot{Q}_{in} - \dot{Q}_{out}\right) + \left(\dot{W}_{in} - \dot{W}_{out}\right) + \left(\dot{E}_{mass,in} - \dot{E}_{mass,out}\right) = D\dot{U} + D\dot{KE} + D\dot{PE}$ in kW or $(q_{in} - q_{out}) + (w_{in} - w_{out}) + (J_{mass,in} - J_{mass,out}) = Du + Dke + Dpe$.	1	2	3	4	5		1	2	3	4	5
18.	I can write the total energy for the flowing mass as the sum of both energy of the moving mass and the energy required to do work in crossing the boundary of a system. Hence the moving mass into the system carries an energy of $J_{mass,in} = (u + ke + pe + Pu)_{in}$ while the outgoing mass has energy, $J_{mass,out} = (u + ke + pe + Pu)_{out}$. Replacing the term $u + Pu$ by the enthalpy, *h*, then, $J_{mass} = h + ke + pe$. Note that the kinetic energy is $ke = \frac{\vec{v}^2}{2000}$ and the potential energy is $pe = \frac{gy}{1000}$.	1	2	3	4	5		1	2	3	4	5
19.	I realize that processes in thermodynamics are mostly processes that operate for long periods of time. Hence we need to consider properties that are steady over that long period during which devices operate. So, we will always consider steady-state flow, where properties remain constant over a long period of time. The most important consequence for the situation is: No change in properties within the system's boundary. Hence, the total energy, the	1	2	3	4	5		1	2	3	4	5

Self- Assessment Before and After Facilitating Session.
Topic: First Law Volume 4-2

Thermal Physics PHY630
Facilitators's Name: ____________________
Your Name: ___________________________

	Please use the following codes and please mark your selection. **1=- Strongly Disagree: 2=Disagree 3 = Unsure/Undecided 4=Agree 5 = Strongly Agree**	Before peer teaching						After peer teaching				
	mass and total volume MUST remain constant throughout the process. Then, $m_{in} = m_{out}$, since $Dm_{sys} = 0$ (kg) OR $\dot{m}_{in} = \dot{m}_{out}$ (kg/s) and $D\dot{E}_{sys} = 0$, (kW). The mass flow rate can be written in terms of the mass velocity, the perpendicular surface area and the specific volume of the mass. An expression for this is $\left(\frac{\vec{v}A}{u}\right)_{in} = \left(\frac{\vec{v}A}{u}\right)_{out}$, (kg/s)											
20.	I can now write the energy balance for steady flow CV as $\dot{Q}_{in} - \dot{Q}_{out} + \dot{W}_{in} - \dot{W}_{out} + \sum(\dot{m}q)_{in} - \sum(\dot{m}q)_{out} = 0$, (kW). Rearranging the expression, I can write the energy balance for steady flow CV as $\dot{Q}_{in} - \dot{Q}_{out} + \dot{W}_{in} - \dot{W}_{out} = \sum(\dot{m}q)_{out} - \sum(\dot{m}q)_{in}$, (kW) or in units of kJ/kg, it is $q_{in} - q_{out} + w_{in} - w_{out} = \sum(q)_{out} - \sum(q)_{in}$. Note that the right side of this expression represents the energy of the moving mass. If the mass is not flowing, then the right side is zero and the expression is similar to the stationary closed system discussed before. The summation in the expression is needed to safeguard you against making assumptions that each inlet or outlet carries the same energy. Each inlet has a unique energy that must be distinguished from other inlets or outlets. If there are 2 inlets and one outlet and if state 1, state 2 and state 3 are used to label the inlets and outlet respectively, then the energy balance is $\dot{Q}_{in} - \dot{Q}_{out} + \dot{W}_{in} - \dot{W}_{out} = \dot{m}_3 q_3 - \dot{m}_1 q_1 - \dot{m}_2 q_2$ and the mass balance is $\dot{m}_1 + \dot{m}_2 = \dot{m}_3$	1	2	3	4	5		1	2	3	4	5
21.	For a single stream (one inlet and one outlet only) steady flow CV, the mass balance is $\dot{m}_1 = \dot{m}_2$ and the energy balance is $\dot{Q}_{in} - \dot{Q}_{out} + \dot{W}_{in} - \dot{W}_{out} = (\dot{m}q)_2 - (\dot{m}q)_1 = \dot{m}(q_2 - q_1)$. In terms of the mass flow total energy, it is $\dot{Q}_{in} - \dot{Q}_{out} + \dot{W}_{in} - \dot{W}_{out} = \dot{m}(q_2 - q_1) = \dot{m}(h_2 - h_1 + ke_2 - ke_1 + pe_2 - pe_1) = \dot{m}(\Delta h + \Delta ke + \Delta pe)$ or in units of kJ/kg, it is $q_{in} - q_{out} + w_{in} - w_{out} = q_{out} - q_{in} = Dh + Dke + Dpe$ where $q = \frac{\dot{Q}}{\dot{m}}$, & $w = \frac{\dot{W}}{\dot{m}}$ Note that the kinetic and potential energy changes for the flowing mass are $Dke = \frac{\vec{v}_2^{\,2} - \vec{v}_1^{\,2}}{2000}$, (kJ/kg) and $Dpe = \frac{gy}{1000}$, (kJ/kg) , respectively where y is the vertical distance.	1	2	3	4	5		1	2	3	4	5
22.	I know that a nozzle is an engineering device that increases the velocity of a fluid which means that the outlet velocity is higher than the inlet velocity ($v_2 > v_1$, $P_2 < P_1$). On the other hand, a diffuser increases the pressure at the expense	1	2	3	4	5		1	2	3	4	5

Self- Assessment Before and After Facilitating Session.
Topic: First Law Volume 4-2

Thermal Physics PHY630
Facilitators's Name: ____________________
Your Name: ___________________________

	Please use the following codes and please mark your selection. **1=- Strongly Disagree: 2=Disagree 3 = Unsure/Undecided 4=Agree 5 = Strongly Agree**	Before peer teaching						After peer teaching				
	of reduced velocity at the outlet ($P_2 > P_1$, $v_2 < v_1$). The first Law energy balance is $0+0=Dh+Dke+0$. Rewriting this expression, it becomes $-\Delta h = \Delta ke$ or can be rewritten as $h_2 - h_1 = ke_1 - ke_2 = \frac{\vec{v}_1^{\,2} - \vec{v}_2^{\,2}}{2000}$, (kJ/kg). This relation is useful in determining the final enthalpy (enthalpy at the outlet) when the kinetic energies (the velocities) are known). But the initial enthalpy must also be determined by examining the temperature of the fluid at the inlet. Using the inlet absolute temperature (in units of kelvin) and the property table, the inlet enthalpy can be estimated or if need be calculated using the interpolation technique. Once the inlet enthalpy is determined, the energy balance is then used to obtain the outlet enthalpy. Finally, the outlet temperature can be determined in the opposite manner that the inlet enthalpy was determined. In some cases, the ideal gas equation of state must be used to determine the specific volume for the system whenever the outlet or inlet area has to be determined. Recall that the ideal gas equation of state is $Pu = RT$, (kJ/kg) and the mass balance is $\left(\frac{\vec{v}A}{u}\right)_{in} = \left(\frac{\vec{v}A}{u}\right)_{out}$ **. The temperature obtained using the energy balance along with the mass balance and the ideal gas equation of state are used to determine the inlet or outlet surface area, A.**												
23.	I am aware that the cross-sectional surface area of a nozzle decreases ($A_2 < A_1$) in the flow direction for subsonic flows.	1	2	3	4	5		1	2	3	4	5
24.	I know that a turbine is a device in a power plant ($W = W_{out}$ since $W_{in} = 0$) that reduces pressure of a fluid.	1	2	3	4	5		1	2	3	4	5
25.	I know that fans, pumps (for liquid) & compressors (for gas) are used to increase pressure of a fluid.	1	2	3	4	5		1	2	3	4	5
26.	I am aware that for turbines ($W = W_{out}$), compressors & pumps ($W = W_{in}$): **$q = 0$, $Dpe = 0$, $Dke = 0$**, (kJ/kg). Then the energy balance is: $0+0-w_{out} = Dh+Dke+Dpe$ (for turbines) and, $0+w_{in}-0 = Dh+Dke+Dpe$ (for compressors). In most cases, the turbines and compressors are considered as adiabatic devices and hence no heat transfer is involved. But in real situations, these devices are not one hundred percent adiabatic and hence must be treated accordingly when writing the energy balance.	1	2	3	4	5		1	2	3	4	5
27.	I know that a throttling valve is a flow-restricting device that will cause large pressure drop in a fluid. For a throttling valve, the pressure and temperature P & T drops significantly. The assumptions made are **$q = 0$, $w = 0$, $Dpe = 0$, and $Dke = 0$,** So the energy balance is $0+w_{in}-0 = Dh+0+0$. Hence the inlet and outlet enthalpies are equal, **$h_1 = h_2$**, (kJ/kg)	1	2	3	4	5		1	2	3	4	5
28.	I am aware that mixing chambers (eg. T-elbow, Y-elbow or simply a tank with two inlets and a single outlet.) are used to mix masses together. The assumptions made are normally **$w = 0$, $Dke = 0$, and $Dpe = 0$**, Then using state 1, state 2 and state 3 to label the inlets and outlet respectively and using the mass balance $\dot{m}_{inlet} = \dot{m}_{outlet}$, it can be written that $\dot{m}_1 + \dot{m}_2 = \dot{m}_3$. The energy balance is $\dot{Q}_{in} - \dot{Q}_{out} + \dot{W}_{in} - \dot{W}_{out} = \dot{m}_3 q_3 - \dot{m}_1 q_1 - \dot{m}_2 q_2$. (kW)	1	2	3	4	5		1	2	3	4	5

Self- Assessment Before and After Facilitating Session.
Topic: First Law Volume 4-2

Facilitators's Name: ____________________
Your Name: ___________________________

	Please use the following codes and please mark your selection. **1=- Strongly Disagree: 2=Disagree 3 = Unsure/Undecided 4=Agree 5 = Strongly Agree**	Before peer teaching						After peer teaching				
29.	I realize that for heat exchangers are used to supply heat to a system from a surrounding or to reject heat form the system to the surrounding. The energy balance is $\dot{Q}_{in} - \dot{Q}_{out} + 0 = \sum(\dot{m}h)_{exit} - \sum(\dot{m}h)_{inlet}$ since w **= 0,** D***ke* = 0** and D***pe* = 0.** If the system is chosen to include everything then ***q* = 0** and the energy balance reduces to $\sum(\dot{m}h)_{exit} = \sum(\dot{m}h)_{inlet}$ Rewriting the energy balance and using state 1 (inlet), state 2 (outlet), state 3 (inlet) and state 4 (outlet) respectively to represent the inlets and outlets, then the energy can be written as $\dot{m}_2 h_2 + \dot{m}_4 h_4 = \dot{m}_1 h_1 + \dot{m}_3 h_3$. The mass balance for this case is $\dot{m}_1 = \dot{m}_2$ and $\dot{m}_3 = \dot{m}_4$. Replacing $\dot{m}_1 = \dot{m}_2$ and $\dot{m}_3 = \dot{m}_4$ in the energy balance, the expression becomes $\dot{m}_1 h_2 + \dot{m}_3 h_4 = \dot{m}_1 h_1 + \dot{m}_3 h_3$ and can be further simplified by combining the mass flow rates as shown in the following: $\dot{m}_1(h_2 - h_1) = \dot{m}_3(h_3 - h_4)$. In the case when only one of the inlet-outlet combination is chosen to include the heat transfer, then the energy balance after choosing state 1 (inlet) and state 2 (outlet) as the inlet and outlet for the system, is, $\dot{Q}_{in} - \dot{Q}_{out} + 0 = \dot{m}_2 h_2 - \dot{m}_1 h_1 = \dot{m}_1(h_2 - h_1)$ since $\dot{m}_1 = \dot{m}_2$. Details of the use of this energy balance can be shown when examples are done.	1	2	3	4	5		1	2	3	4	5
30.	I know that for fluid in pipes or ducts, ***q* = 0,** w **= 0,** D***ke* =0,** D***pe* = 0**., (kJ/kg), ***So h*₁ = *h*₂**.	1	2	3	4	5		1	2	3	4	5