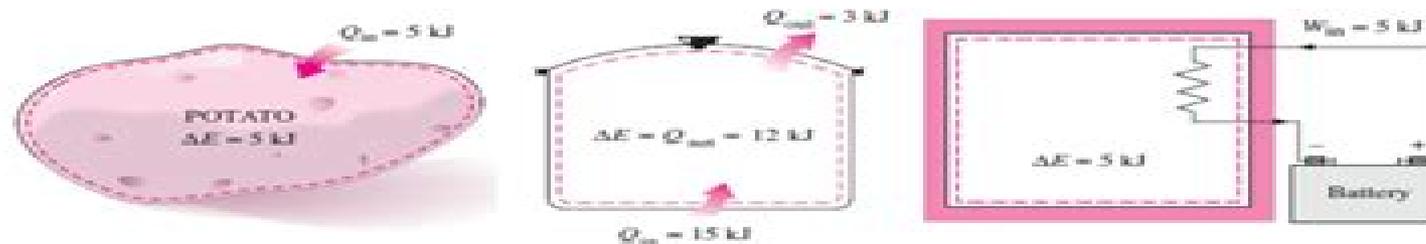


FIRST LAW OF THERMODYNAMICS

1. Energy can neither be created nor be destroyed; it can only change its form.
2. It is also called "The conservation of energy principle".



ENERGY BALANCE

The net change (increase or decrease) in the total energy of the system during a process is equal to the difference between the total energy entering and the total energy leaving the system during that process.

$$\left(\begin{array}{c} \text{Total energy} \\ \text{entering the system} \end{array} \right) - \left(\begin{array}{c} \text{Total energy} \\ \text{leaving the system} \end{array} \right) = \left(\begin{array}{c} \text{Change in the total} \\ \text{energy of the system} \end{array} \right)$$

$$E_{in} - E_{out} = \Delta E_{system}$$

The above relation is called "Energy balance".

Energy change (ΔE_{system})

For a simple compressible system,

$$E = U + KE + PE$$

$$\Delta E = \Delta U + \Delta KE + \Delta PE$$

$$\Delta E = m(u_2 - u_1) + \frac{1}{2} m (V_2^2 - V_1^2) + mg(z_2 - z_1)$$

For a simple compressible stationary system:

$$\Delta KE = \Delta PE = 0$$

$$\Delta E = \Delta U = m(u_2 - u_1)$$

For steady flow process,

$$\Delta E = 0$$

Fundamentals Of Thermodynamics Solution Chapter 4

John Alfred Valentine Butler



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carried out at the Moscow Institute of Electronic Engineering over the past decade Extensive summaries of published data are also included In the course of our work we have made extensive use of modern computing methods which allowed solutions to be obtained to many problems *Essentials of Engineering Thermodynamics* Clement Kleinstreuer,2021-03-10 Explore the theories applications and core concepts of thermodynamics This hands on guide lays out the critical thermodynamics concepts rules and governing equations for engineering students and professionals Developed by an experienced academic to reduce information overload in his classroom *Essentials of Engineering Thermodynamics Principles and Applications* reinforces each topic through concept questions and representative problems with detailed worked out solutions Figures and illustrations throughout tie each subject to the real world You will gain a clear understanding of the laws of thermodynamics that drive our understanding of energy systems and their daily applications Coverage includes Basic thermodynamics concepts Energy transfer modes The first law of thermodynamics Macroscale mass and energy balances Transient closed systems Steady open uniform flow devices The second law of thermodynamics The T s diagram and entropy calculations Exergy or minimizing energy waste Open and closed power cycles Reversed closed cycles *Chemical Engineering Thermodynamics* Jack Winnick,1996-11-29 The aim of this contemporary textbook is to show students that thermodynamics is a useful tool not just a series of theoretical exercises Written in a conversational style the text presents the second law in a totally new manner there is no reliance on statistical arguments instead it is developed as a natural consequence of physical experience Students are not required to write complex iterative computer programs to solve phase equilibrium problems techniques are presented which enable use of readily available math packages The book also explores electrochemical systems such as batteries and fuel cells Included in the extensive amount of examples are those which demonstrate the use of thermodynamics in practical design situations *Engineering Fundamentals for Professional Engineers' Examinations* Lloyd M. Polentz,1979 ***British Chemical Engineering*** ,1959

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