

Some Thermal/Fluid Science Definitions

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property: A property is a macroscopic characteristic of a system. Some examples are: mass m , temperature T , internal energy u , etc. To assign a property, one need not know the history of the system. In contrast, work W is *not* a property because one needs to know the system history to know how much work has been done on a system. Properties are classified as either *extensive properties* or *intensive properties*.

extensive property: A property whose value is the sum of the values of all parts of the system (e.g. mass, volume...).

intensive property: A property whose value is independent of the size of the system (e.g. temperature, density, specific internal energy...).

state: The condition of a system as defined by its properties. Not all possible properties are needed to know the state of a system. Rather, a subset of all possible properties determines the state of the system. Once the state is known, all other properties can then be computed. For a *simple compressible substance* (what we will consider in this course), two independent properties are needed to define the state of a system.

phase: A quantity of matter that is homogeneous in both chemical composition and physical structure. For example, liquid water, or ice, or steam.

pure substance: A substance that is uniform and invariable in chemical composition. A pure substance can be composed of more than one phase.

process: A transformation from one state to another state.

thermodynamic cycle: A sequence of processes that ends at the initial state of the system.

closed system: A closed system is a system where the mass within the system boundary is constant. Everything else within the system may change, but the total mass must remain constant. In contrast to the control volume which is described next, the closed system can have a volume which changes. The classic example of this is the piston problem, where the system boundary is defined by the face of the piston and the walls of the cylinder (there are no valves in this type of piston/cylinder problem). As the piston moves in the cylinder, the volume of the system changes, but the mass of the system never changes.

control volume: A control volume is a system where the volume and boundaries of the system are fixed. Mass may flow in and out of the system. The total mass of the

system may increase, decrease or remain the same. But, the volume must remain fixed. An example of this would be a gas turbine analysis, where we draw the system boundary as a box around the whole turbine. Air enters the compressor from the front and air and combustion products exit the rear of the turbine. But, the system boundary remains fixed to the turbine and does not change in size or shape.

isolated system: A closed system which does not interact with its environment. (e.g. no work or heat transfer crosses its boundaries).

quasiequilibrium process: A process whereby the system does depart from equilibrium, but only by an infinitesimal amount. Hence, all states that the system passes through can be considered to be equilibrium states.