



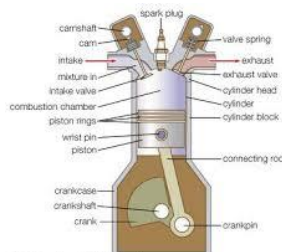
Basic Thermodynamics Concepts

- To examine energy and its relation to matter, we have to define what matter or energy we are focusing on
- **Systems**
 - a region enclosed by an imaginary boundary (*control surface*)
 - can be rigid/flexible, stationary/moving; fixed size/shrinking/expanding;...
 - the boundary separates “our stuff” or “our device” or “our space” from
 - the rest of the world/universe (called the *environment* or *surroundings*)

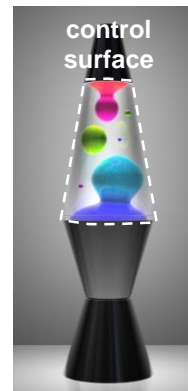


Closed System

- If we want to focus on a fixed piece of stuff (*matter*), we used a **Closed System**
 - system where not mass can cross the system boundary/control surface
 - also called a **Control Mass**



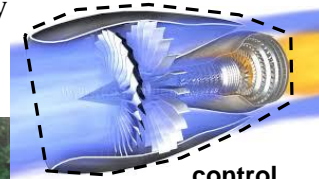
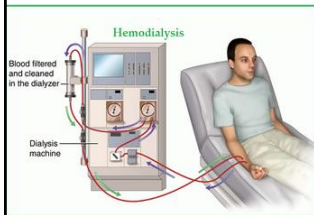
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Open System

- If we want to focus on a device that has matter entering and/or leaving, then our control surface can define some volume of space we care about (i.e., around the device) = **Open System**
 - matter can pass through boundary
 - also called a **Control Volume**



control surface

Systems 3
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Isolated System

- What else can cross a system boundary besides mass?
 - energy via heat transfer
 - energy via work
- If nothing passes through C.S., we have an **Isolated System**



Systems 4
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