

MECH0003 Topic Notes  
UCL

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# Chapter 1

## Basic Concepts

What is dimension?

- Any physical quantity
- Magnitude measured in units

What are primary dimensions and secondary dimensions?

- Primary dimensions (fundamental) are ones that are independent and thus cannot be broken into constituent measurements
- Secondary dimensions (derived) are ones that can be expressed in terms of primary dimensions

What is an open system?

- Allows mass and energy to cross its boundary
- Does not always mean there is a controlled volume

What is a closed system?

- Only allows energy to cross its boundary

What is meant by the "surroundings" of a system?

- The mass or region outside the system

What is a control volume?

- May involve fixed, moving, real and imaginary boundaries (which must be drawn using dotted lines)

What is an intensive property?

- Those that are independent of the mass of a system, such as temperature, pressure, and density.

What is an extensive property?

- Those whose values depend on the size (extent) of the system

What is a specific property?

- Extensive properties per unit mass

What is meant by "continuum"?

- The continuum idealization allows us to treat properties as point functions and to assume the properties vary continually in space with no jump discontinuities.
- This idealization is valid as long as the size of the system we deal with is large relative to the space between the molecules.

What is equilibrium?

- A state of balance

What is thermal equilibrium?

- When temperature is uniform in system

What is mechanical equilibrium?

- No changes in pressure anywhere in system with time

What is phase equilibrium?

- When the mass of 2 phases in a system reaches equilibrium

What is chemical equilibrium?

- If the chemical composition of a system does not change with time

What is a simple compressible system?

- If a system involves no electrical, magnetic, gravitational, motion and surface tension effects

What is the state postulate?

- The state of a simple compressible system is completely specified by 2 independent, intensive properties

What is a process?

- Any change that a system undergoes from one equilibrium to another
- To describe a process completely, we must specify the initial and final states, as well as the path it follows, and the interactions with the surroundings

What is a path?

- The series of states through which a system passes during a process

What is a Quasistatic process?

- When a process proceeds in such a manner that the system remains infinitesimally close to an equilibrium state at all times

What is an isothermal process?

- A process during which  $T$  remains constant

What is an isobaric process?

- A process during which  $P$  remains constant

What is an isochoric process?

- A process during which the specific volume  $v$  remains constant

What is a cycle?

- A process during which the initial and final states are identical

What does the term "steady" mean?

- No change with time
- The opposite of steady is transient

What is a steady-flow process?

- A process during which a fluid flows through a control volume steadily

What is the 0th law of thermodynamics?

- If 2 bodies are in thermal equilibrium with a 3rd body, they are also in thermal equilibrium with each other
- If 2 bodies have the same temperature they are in thermal equilibrium

What is the ice point?

- A mixture of ice and water that is in equilibrium with air saturated with vapour at 1 atm

What is the steam point?

- A mixture of liquid water and water vapour (with no air) in equilibrium at 1 atm

What is the Kelvin scale?

- Temperature scale starting from absolute zero

What is pressure?

- The normal force exerted by a fluid per unit area

What is absolute pressure?

- Actual pressure at a given position measured against vacuum

What is Gage pressure?

- Difference between absolute pressure and local atm pressure

What is vacuum pressure?

- Pressures below atm