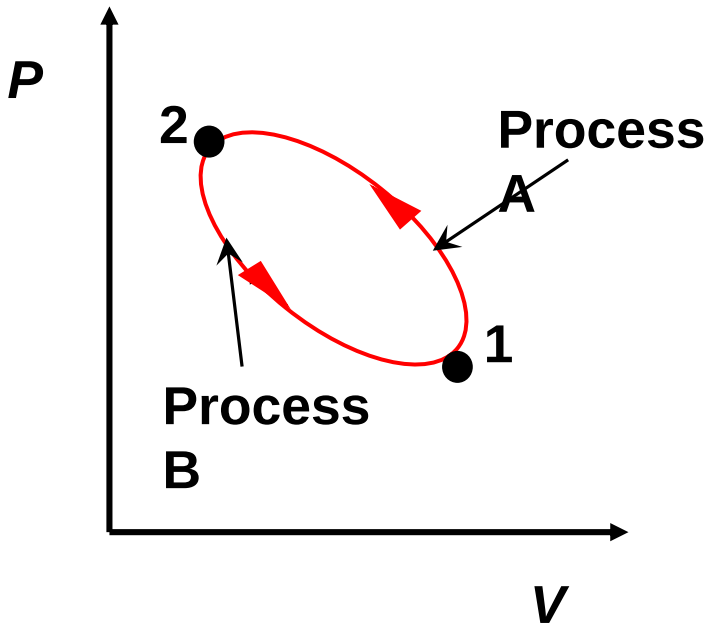
CLB 20703 Chemical Engineering Thermodynamics

Chapter 1:

Basic Concepts in Thermodynamics

1.3 SYSTEM

- A system is said to have undergone a cycle if it returns to its initial state at the end of the process
- For a cycle, the initial and final states are identical.



1.6 TEMPERATURE

Property \ Unit	SI	ES
Temperature scale	^{o}C	^{o}F
Absolute temperature scale	K	R
Melting point	$0^{o}C$	$32^{o}F$
Boiling point	$100^{o}C$	$212^{o}C$

Relation between temperature scales:

$T(^{o}F) = 1.8T(^{o}C) + 32$ (^{o}C to ^{o}F)
$T(K) = T(^{o}C) + 273.15$ (^{o}C to K)
$T(R) = T(^{o}F) + 459.67$ (^{o}F to R)
$T(R) = 1.8T(K)$ (K to R)

1.6 TEMPERATURE

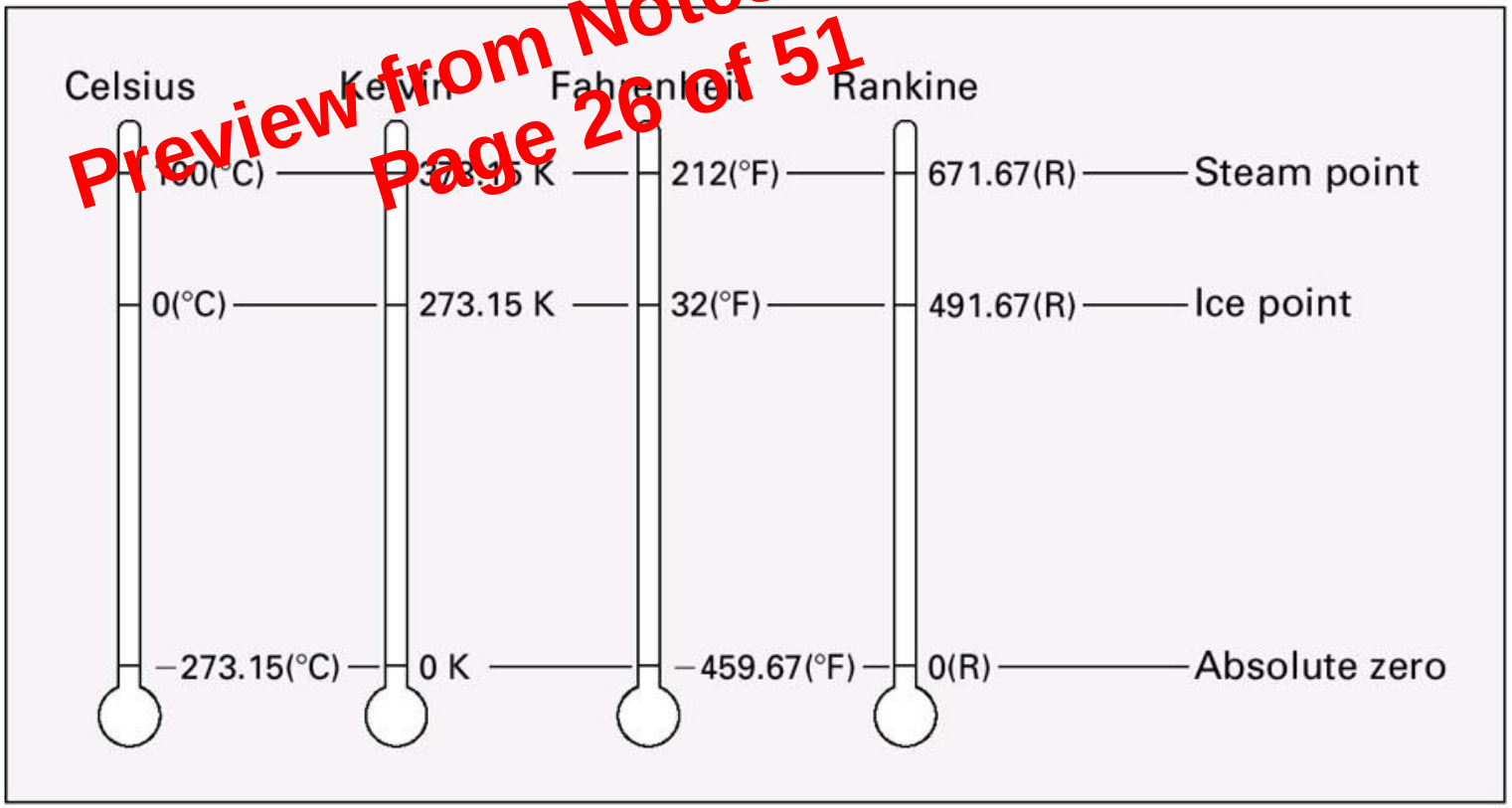


Figure 1.1: Relations among temperature scales.

1.7 PRESSURE

- Absolute Pressure - The actual pressure at a given position. Measured relative to absolute vacuum (absolute zero).
- Gage Pressure - The difference between absolute pressure and local atmospheric pressure.
- Vacuum Pressure – Pressure below atmospheric pressure.

Absolute P must be used in Thermodynamics calculations

1.8 WORK

Path function

- Work, as heat, is path function ➔ its magnitude depend on the path followed during a process as well as the end states.
- Path functions have inexact differentials designated by the symbol δ - a differential amount of heat or work is represented by δQ or δW, respectively:

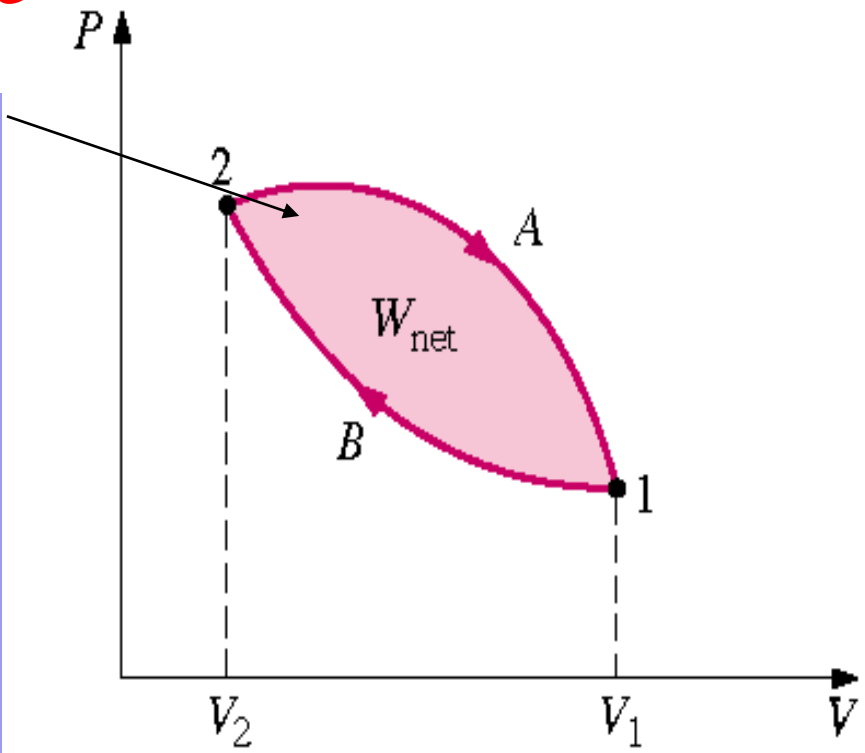
$$\int_1^2 \delta W = W_{12}$$

- The total work is obtained by adding the differential amounts of work (δW) done along the way or can represented by the area under the followed path.

1.8 WORK

Net work for a cycle

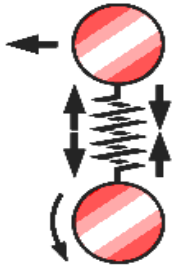
The cycle shown produces a net work output because the work done by the system during the expansion process (area under path A) is greater than the work done on the system during the compression part of the cycle (area under path B), and the difference between these two is the net work done during the cycle (the pink area) = W_{net}



1.9 ENERGY

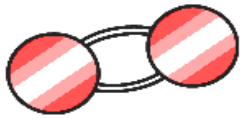
Microscopic Energy

- The sum of microscopic energies ➔ internal energy, U.



SENSIBLE AND LATENT ENERGY

- Phase change of a system such as liquid phase changes to gas phase.



CHEMICAL ENERGY

- Atom bonding in a molecule in chemical reactions.

NUCLEAR ENERGY

- Strong bonds within the nucleus of atoms.