Chemistry 3.2
Molecular Spectroscopy

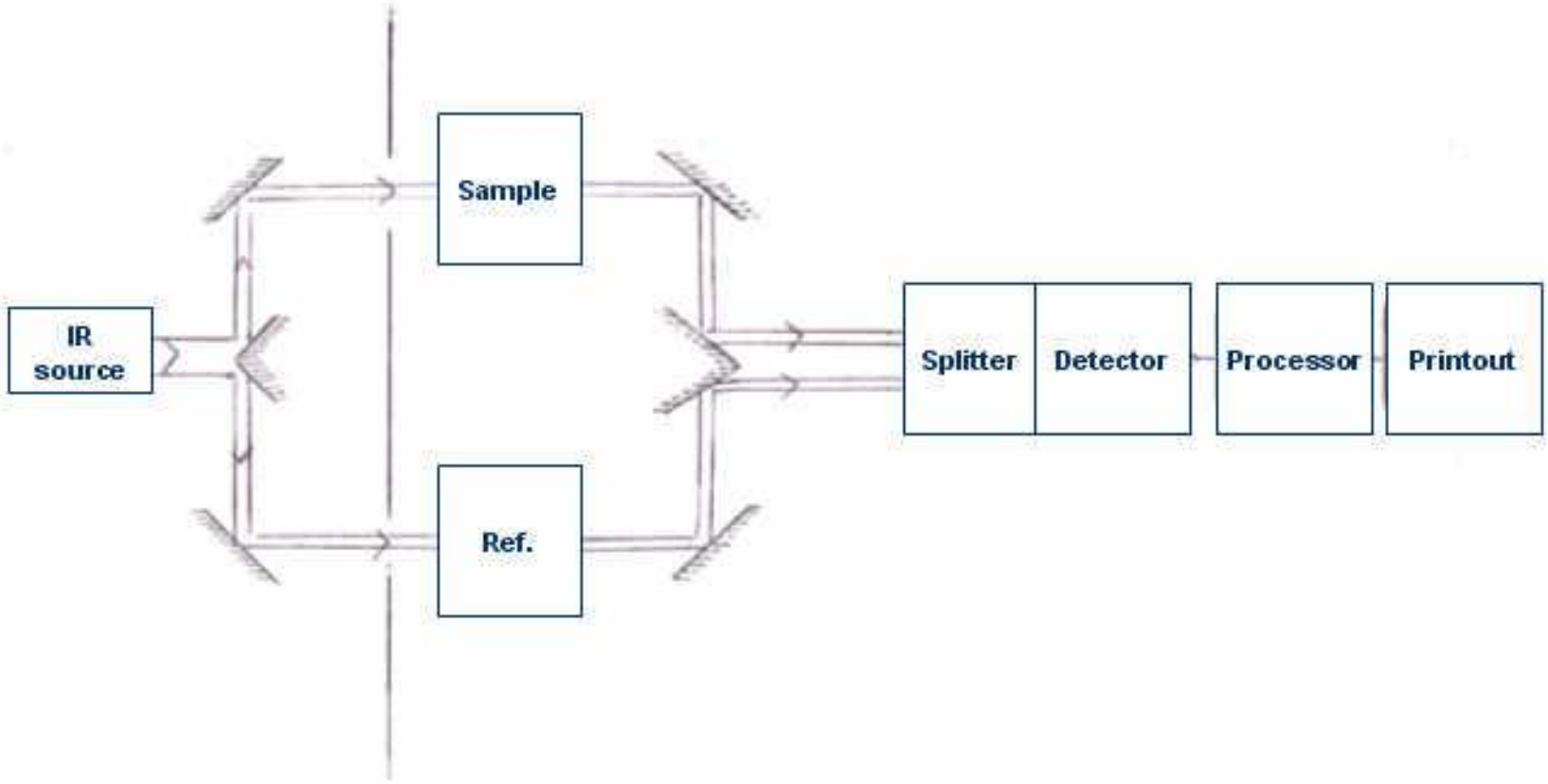
Infrared Spectroscopy (IR)

Chemical fingerprint

- When a substance is exposed to electromagnetic radiation with a specific energy, the substance is “excited” from the ground state to an excited state.
- Because of the difference in bonding interactions, the profile of the absorptions correspond to different functional group in organic compounds

Infrared Spectroscopy

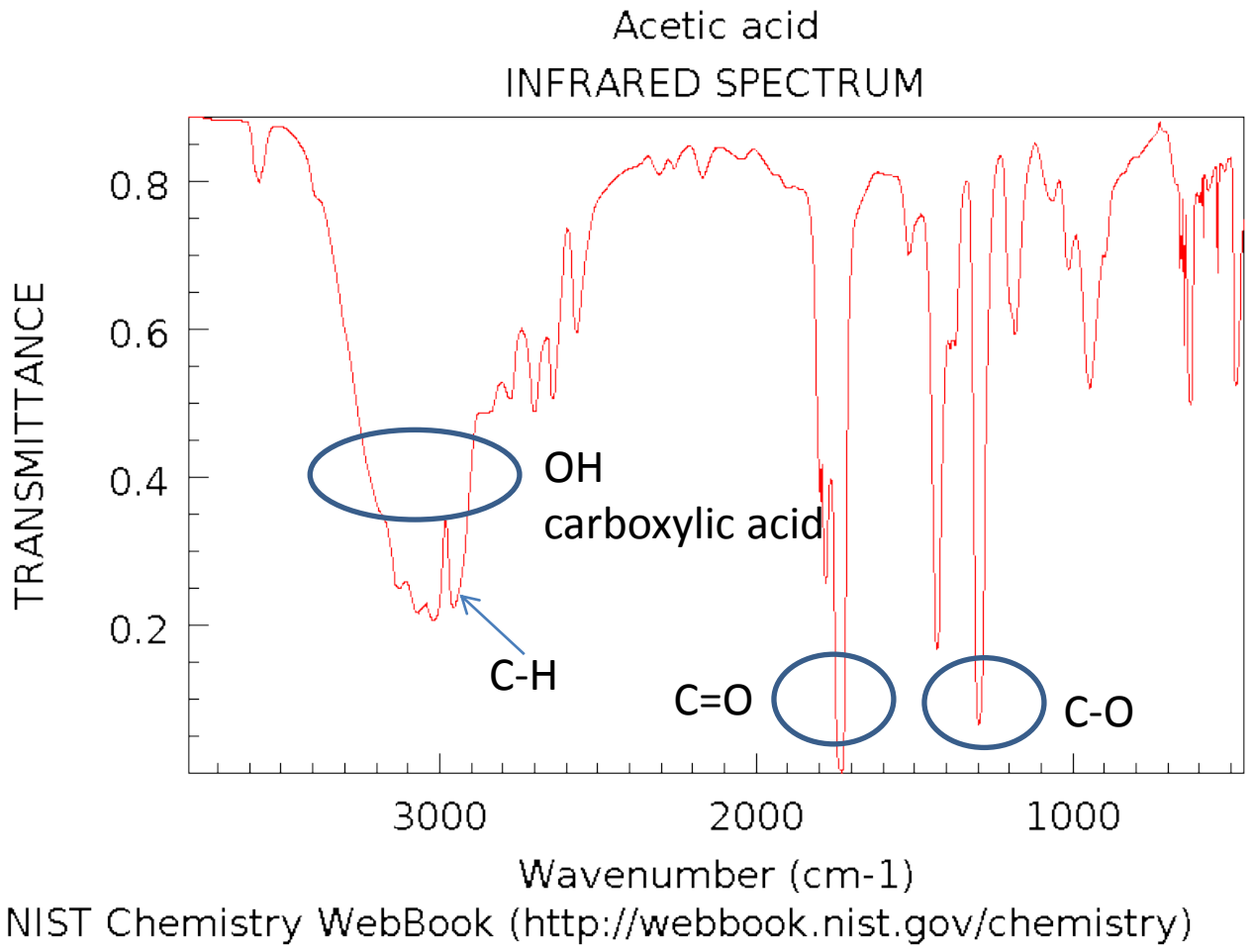
- In infrared spectroscopy, the sample (and reference) as exposed to a beam of infrared laser
- A detector is placed on the other side to measure how much light is transmitted
- The computer then produces a graph of wavenumber (cm^{-1}) vs transmission
  - Wavenumber is proportional to energy


IR source
Sample
Ref.
Splitter
Detector
Processor
Printout

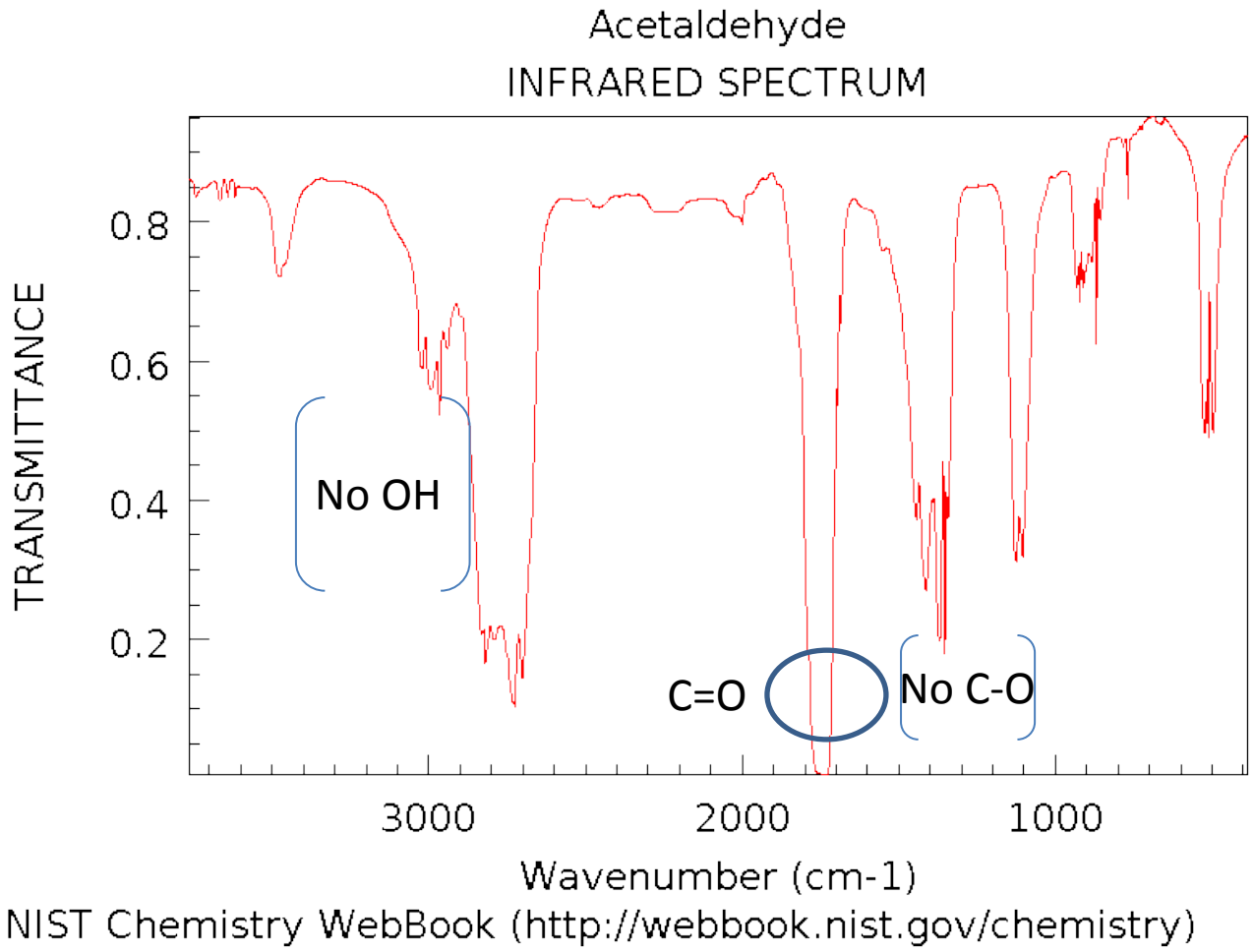
IR Absorption regions

Bond Present	Wavenumber cm^{-1}
-OH (Alcohol)	3700 – 3200
-OH (Carboxylic acid)	3600 – 2500 (broad peak)
N-H	3500 – 3100
C-H	3100 – 2800
C=O	1850 – 1600
C=C	1680 – 1600
C-O	1250 - 1050

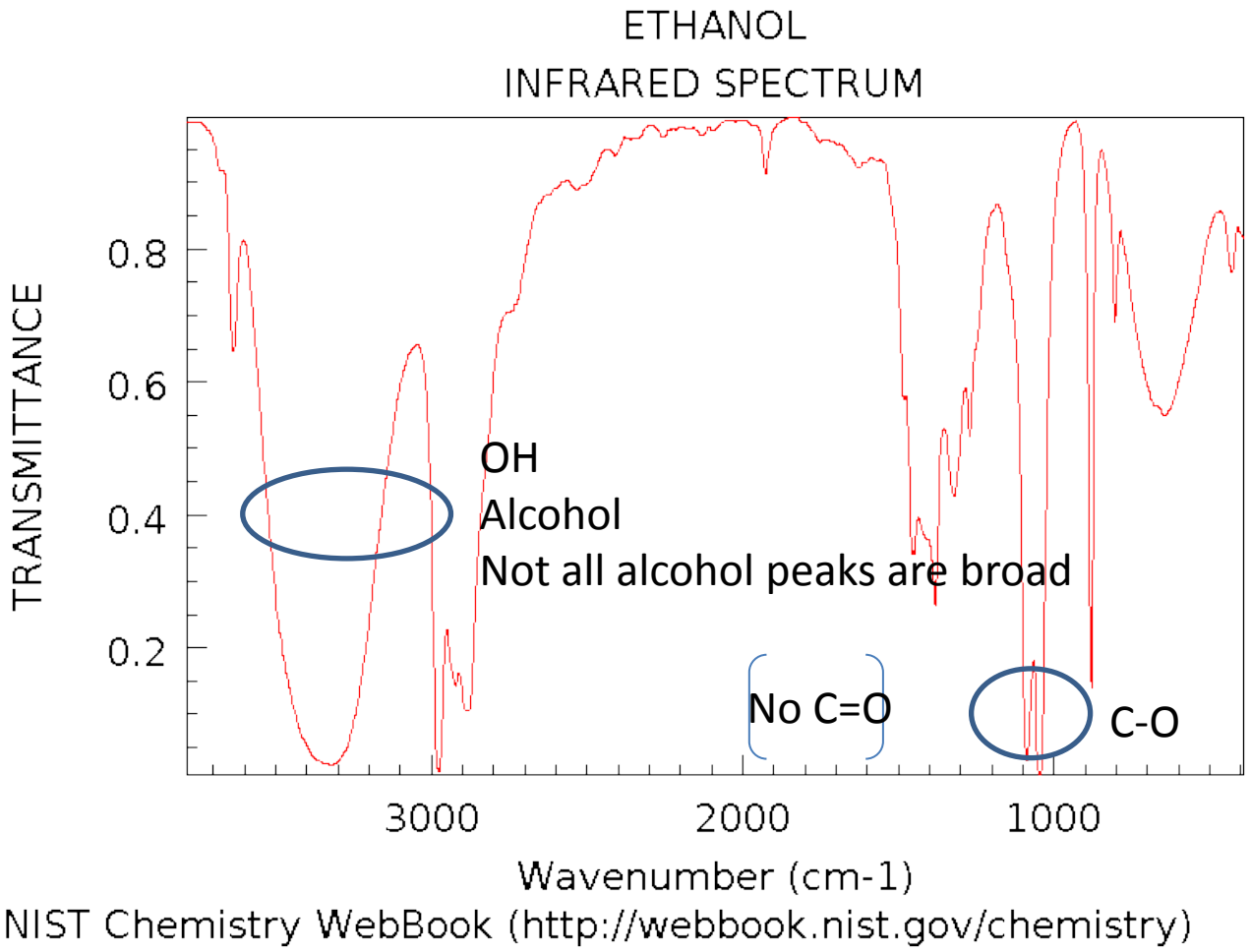
Carboxylic acid



Aldehyde


Acetaldehyde
INFRARED SPECTRUM
TRANSMITTANCE
0.8
0.6
0.4
0.2
No OH
C=O
No C-O
3000
2000
1000
Wavenumber (cm-1)
NIST Chemistry WebBook (http://webbook.nist.gov/chemistry)

Alcohol


ETHANOL
INFRARED SPECTRUM
TRANSMITTANCE
0.8
0.6
0.4
0.2
OH
Alcohol
Not all alcohol peaks are broad
No C=O
C-O
3000
2000
1000
Wavenumber (cm-1)
NIST Chemistry WebBook (http://webbook.nist.gov/chemistry)