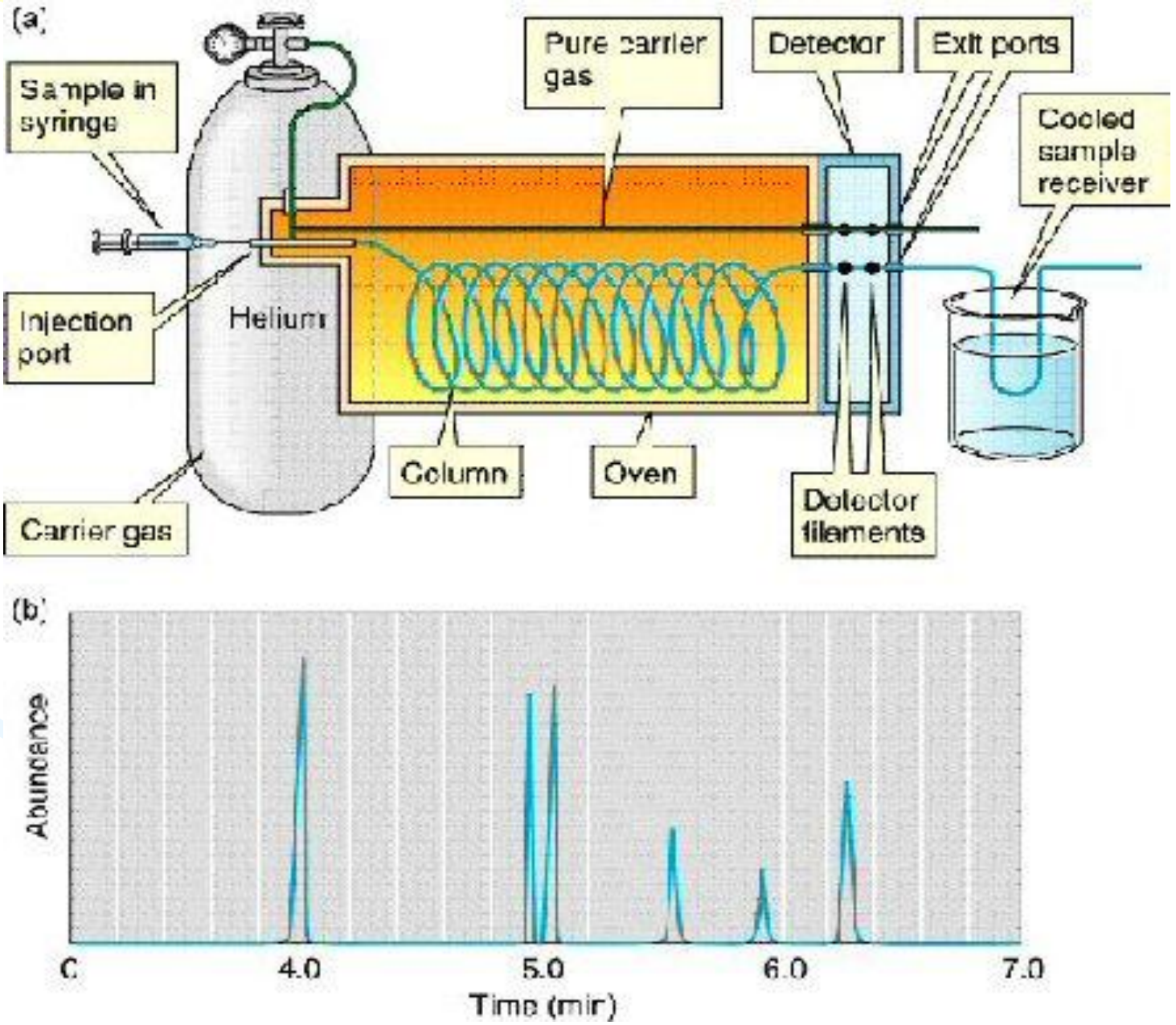
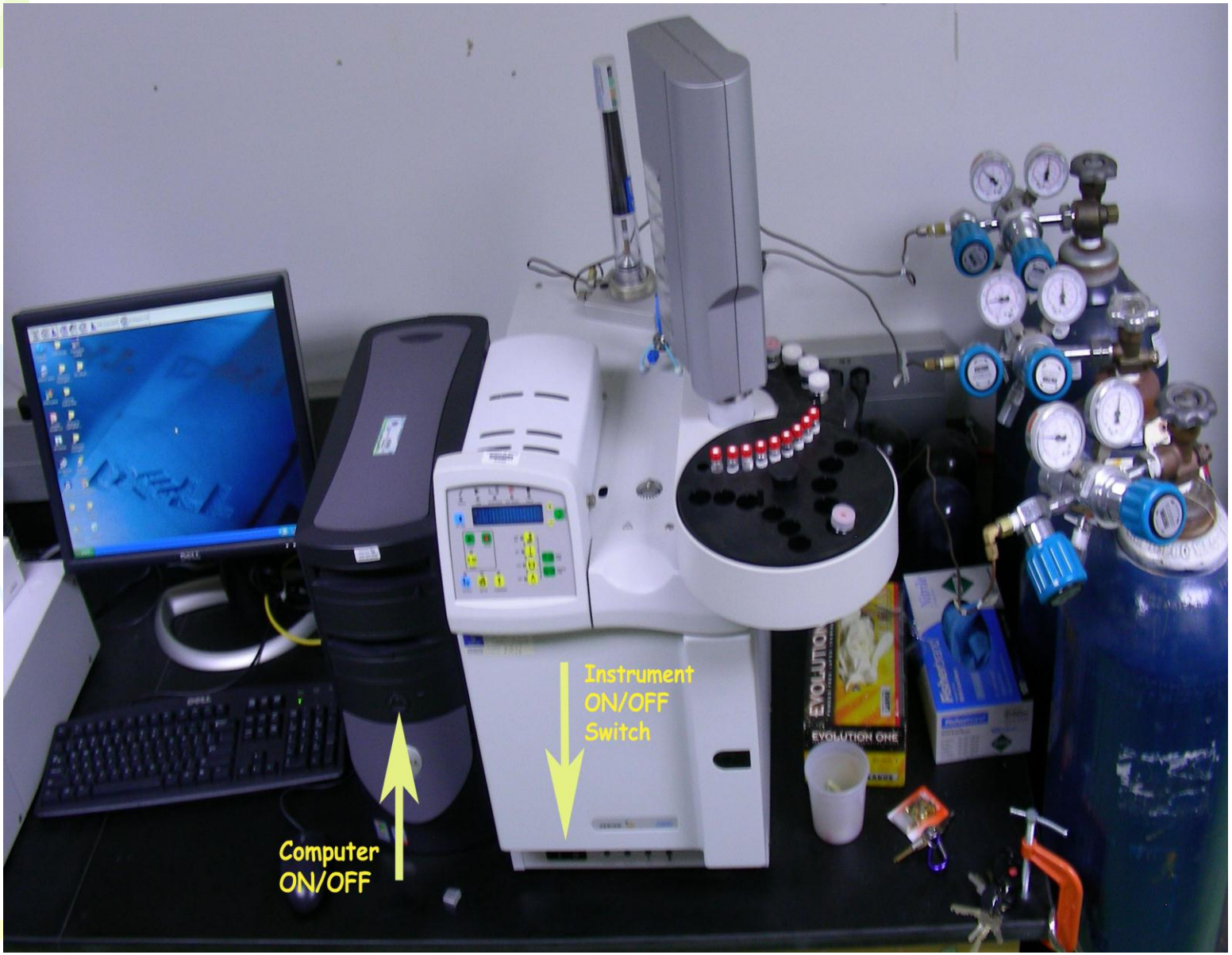
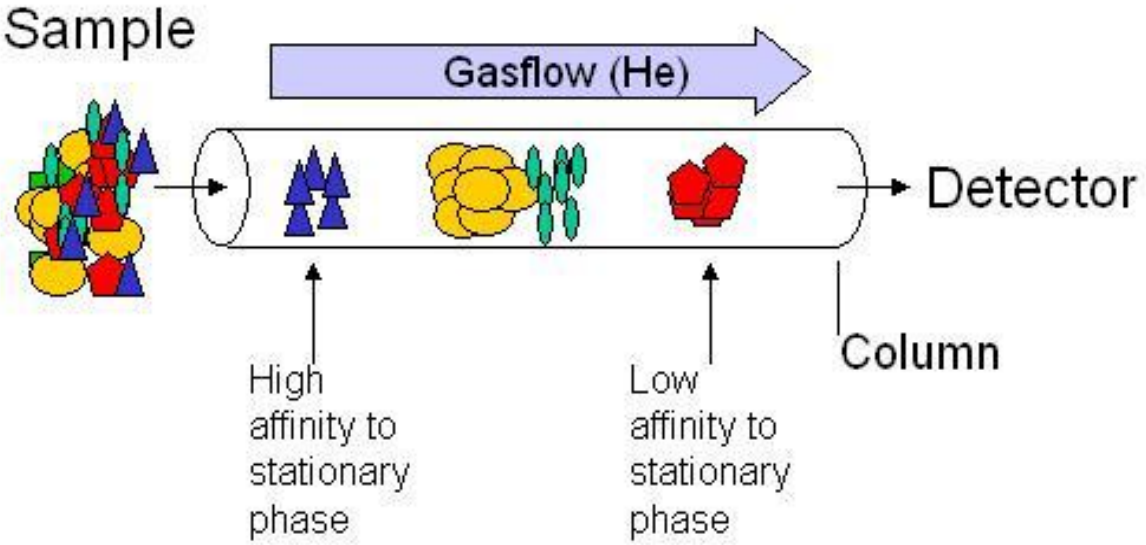
GAS CHROMATOGRAPHY

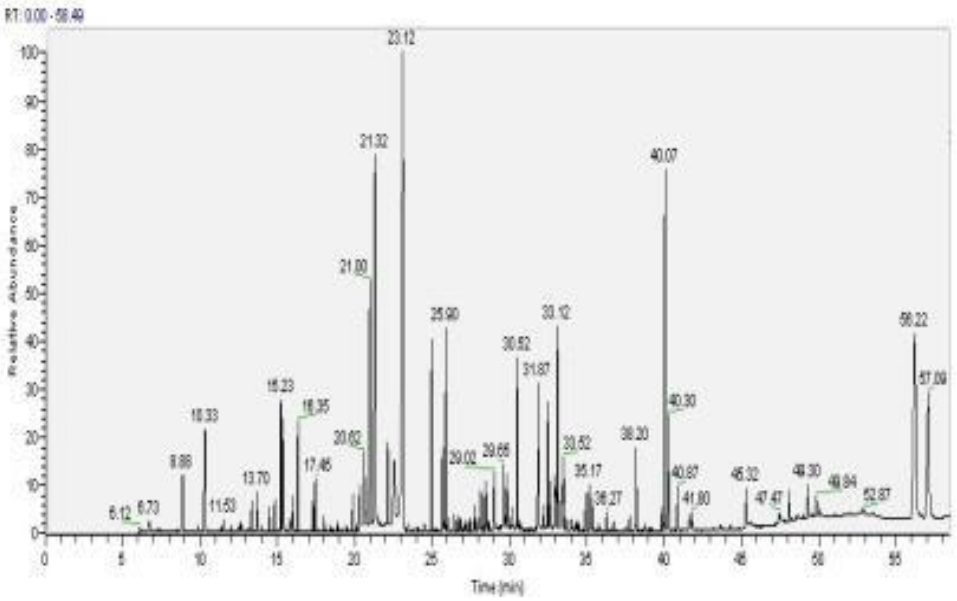

(a)
Sample in syringe
Pure carrier gas
Detector
Exit ports
Cooled sample receiver
Injection port
Helium
Column
Oven
Detector filaments
Carrier gas
(b)
Abundance
0
4.0
5.0
6.0
7.0
Time (min)


Instrument
ON/OFF
Switch
Computer
ON/OFF

A


Sample
Gasflow (He)
Detector
Column
High affinity to stationary phase
Low affinity to stationary phase

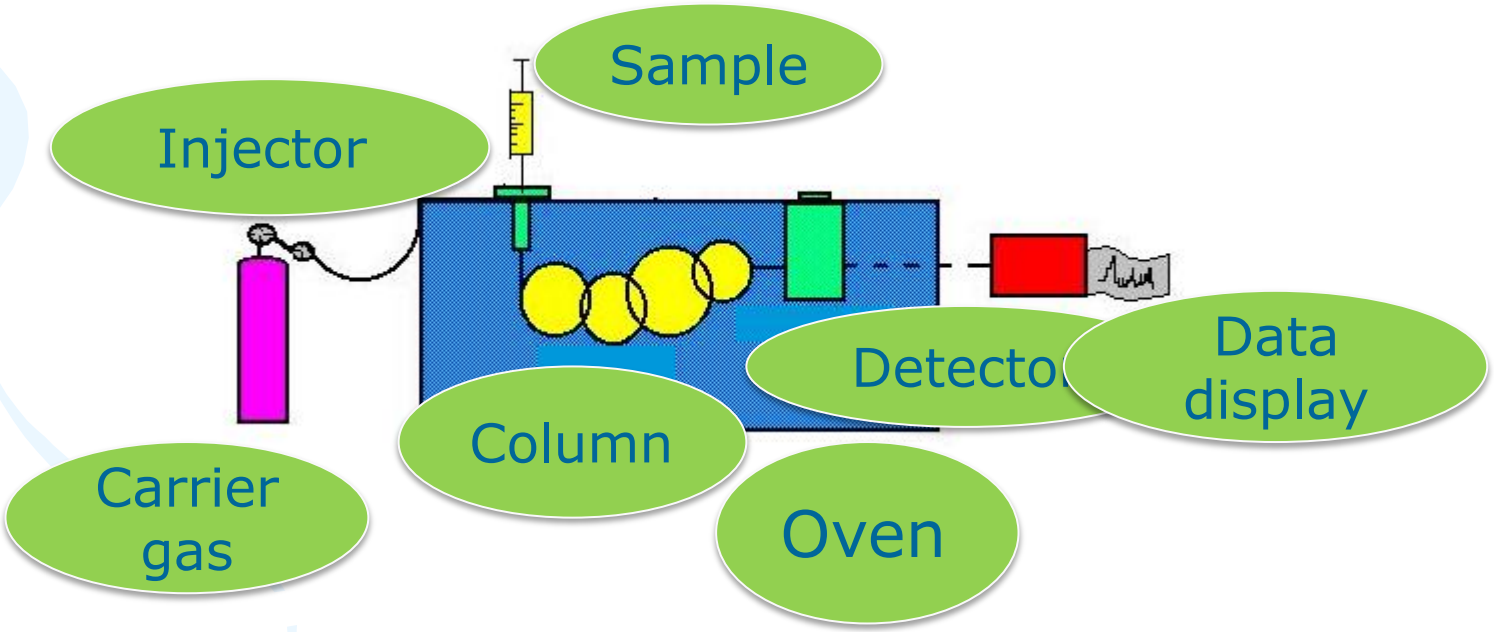
B


Relative Abundance
Time (min)

Gas Chromatography

- Principals of Separation
  - Column is selected, packed with Liquid Phase, and installed.
  - Sample injected with microliter syringe into the injection port where it is vaporized and mixed into the Carrier Gas stream (helium, nitrogen, argon).
  - Sample vapor becomes partitioned between Moving Gas Phase and Stationary Liquid Phase.
  - The time the different compounds in the sample spend in the Vapor Phase is a function of their boiling point.
  - The more volatile (Low Boiling Point / Higher Vapor Pressure) compounds arrive at the end of the column first and pass into the detector

Concepts and Methodology



Gas Chromatography

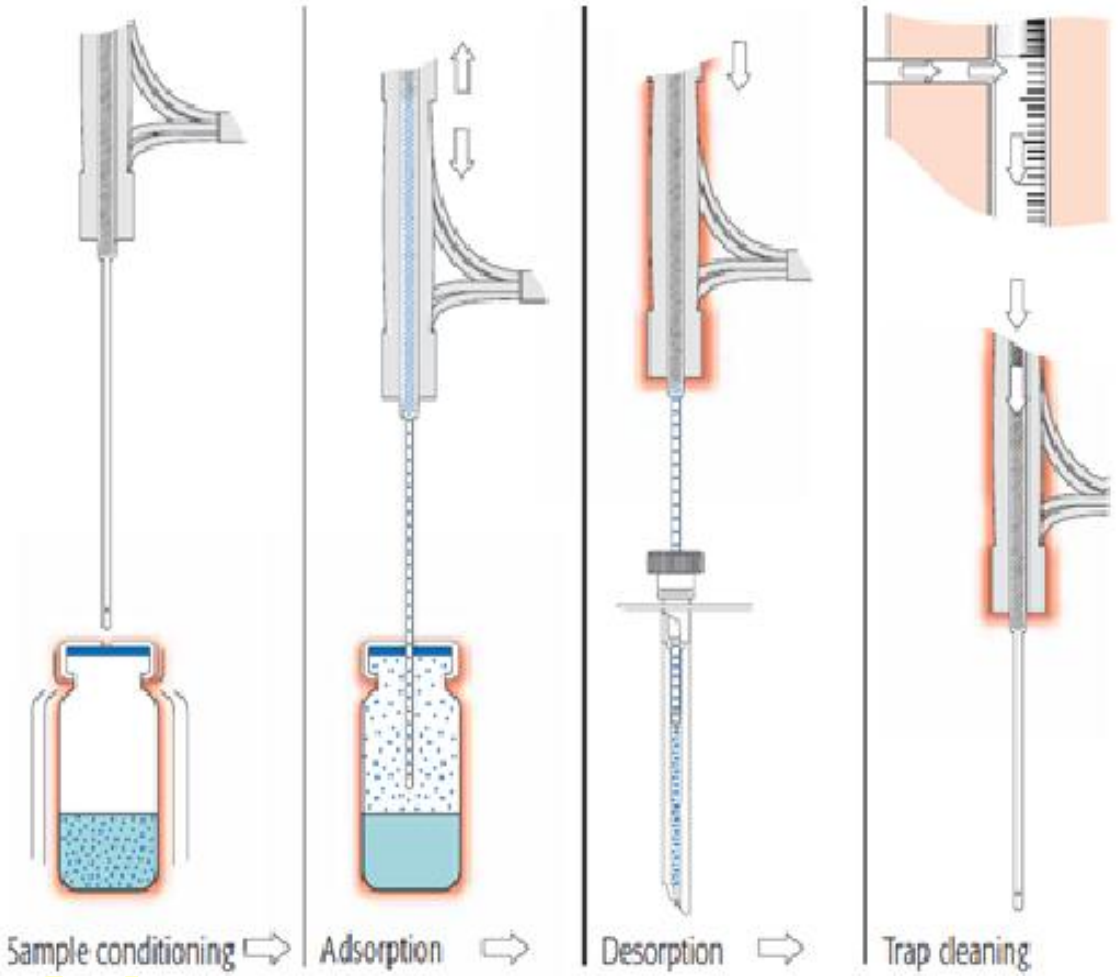
- Gas Chromatograph
  - Microliter Syringe
  - Heated injection port with rubber septum for inserting sample
  - Heating chamber with carrier gas injection port
  - Oven containing copper, stainless steel, or glass column.
  - Column packed with the Stationary Liquid Phase (GLC) a non-volatile liquid, wax, or low melting solid-high boiling hydrocarbons, silicone oils, waxes or polymeric esters, ethers, and amides
  - Liquid phase is coated onto a support material, generally crushed firebrick

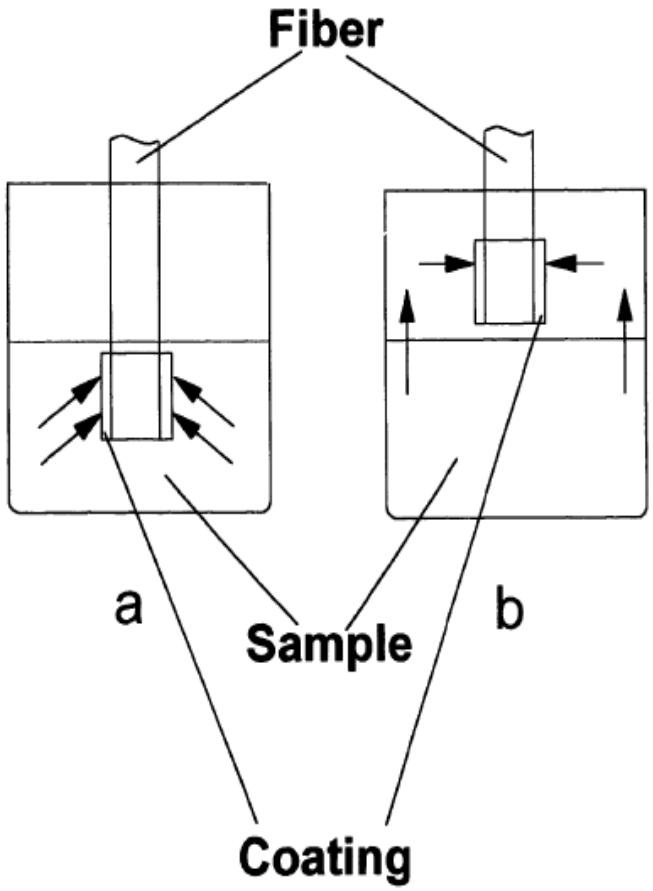
Sample extraction

- Solid-Phase Microextraction (SPME)
- coated fibers are used to isolate and concentrate analytes into a solid coating material. After extraction; the fibers are transferred, with the help of t like handling device, to analyt instruments for analysis.

Sample extraction

- Solid-Phase Microextraction (SPME)



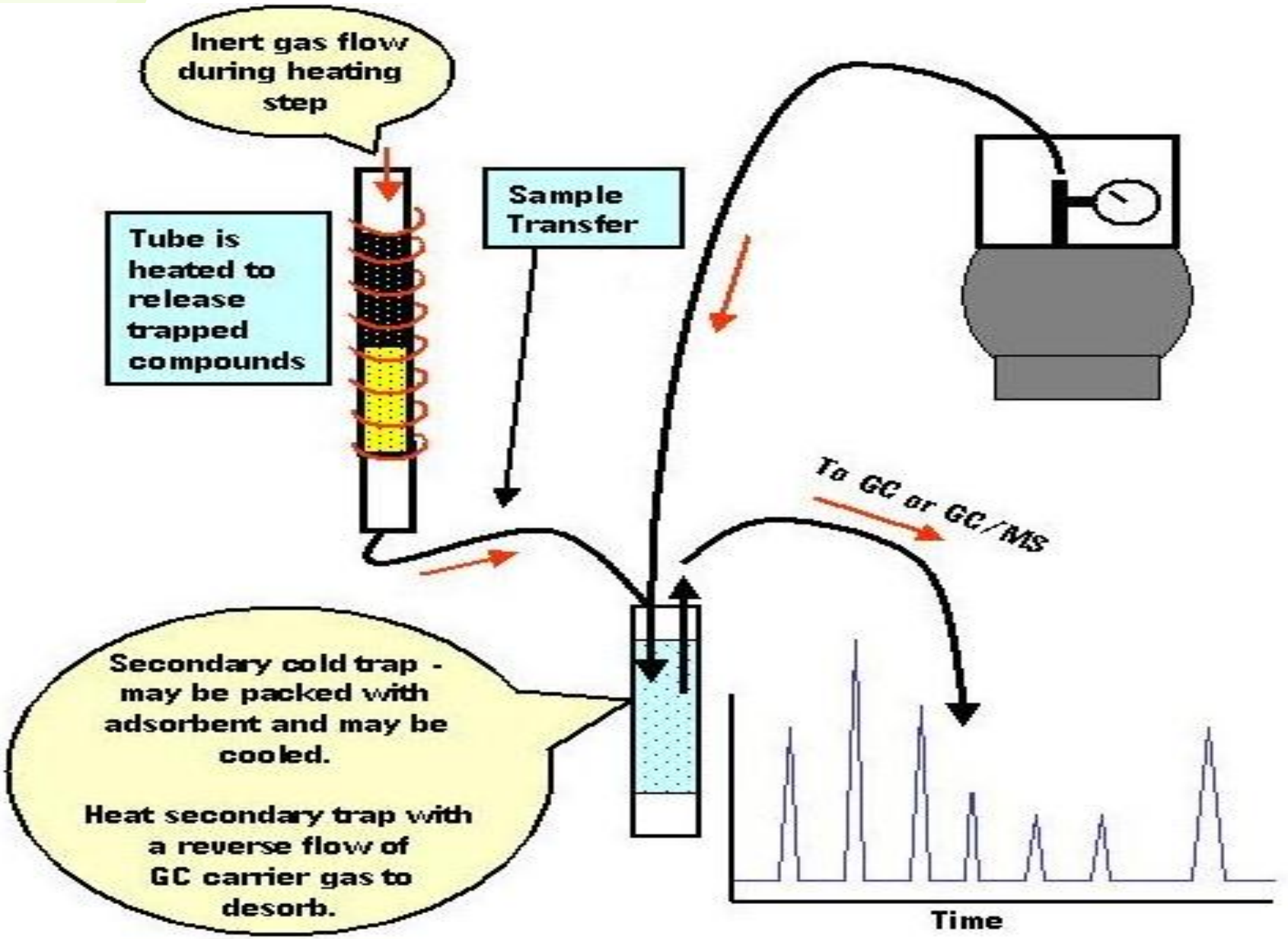


Sample extraction

- Thermal desorption

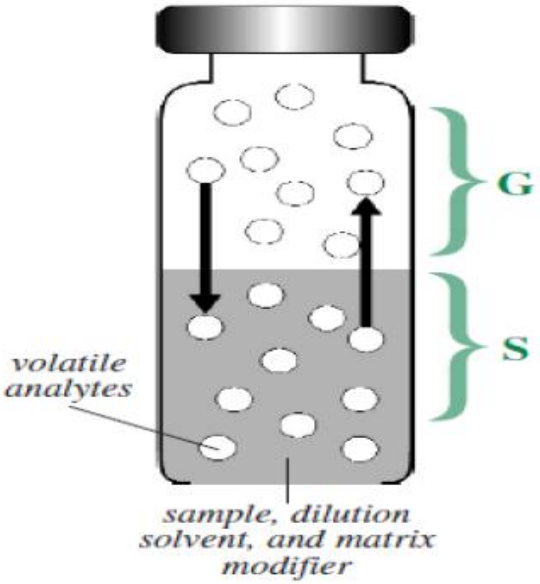
It is a widely used technique for extracting and isolating volatile and semivolatile compounds from various matrices. Used for air monitoring , analysis of soil, polymers, packaging materials, foods, flavors and cosmetics

Thermal desorption

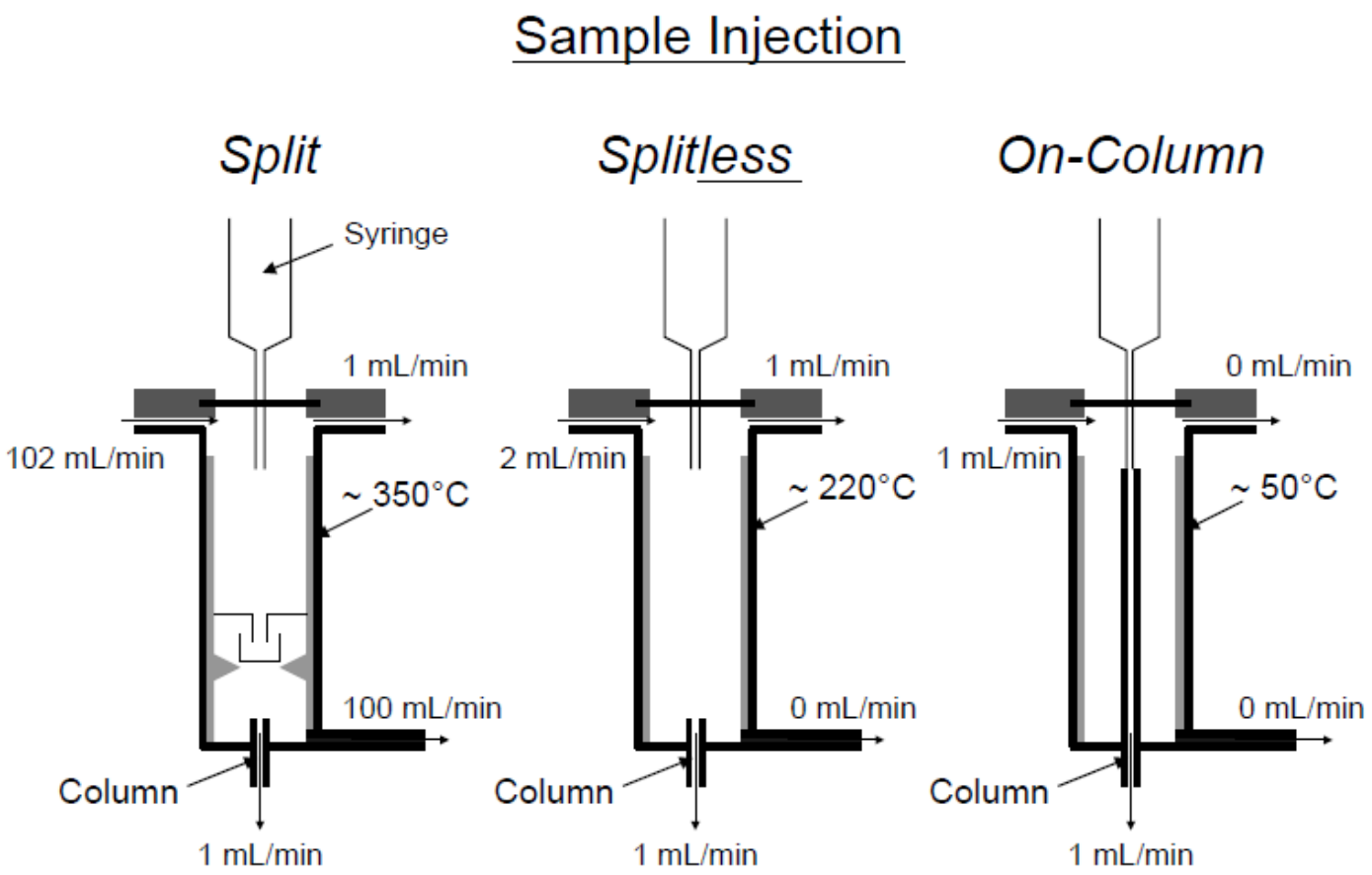


Static headspace

- The sample is placed in a sealed vial then it is heated.
- The volatile components migrate out of the sample matrix into the headspace of the vial.
- Then a portion of the headspace is sampled and transferred to a GC for analysis



Sample injection



Factors Affecting Separation

- Boiling Points of Components in Sample
  - Low boiling point compounds have higher vapor pressures.
  - High boiling point compounds have lower vapor pressures requiring more energy to reach equilibrium vapor pressure, i.e., atmospheric pressure.
  - Boiling point increases as molecular weight increases.
- Flow Rate of Carrier Gas
- Choice of Liquid Phase
  - Molecular weights, functional groups, and polarities of component molecules are factors in selecting liquid phase.
- Length of Column
  - Similar compounds require longer columns than dissimilar compounds. Isomeric mixtures often require quite long columns