

## BRIEF BACKGROUND ON USING THE GAS CHROMATOGRAPH (GC)

### CATALYTIC METHANATION EXPERIMENT

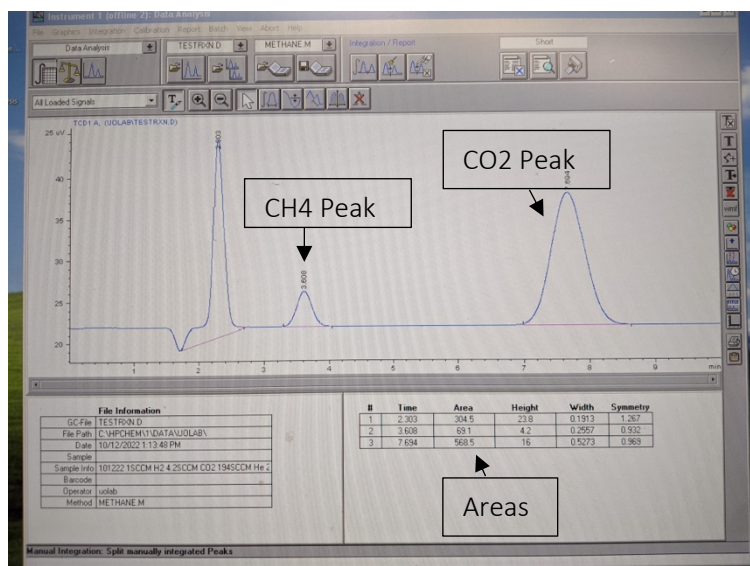
Ch En 479

Gas chromatography is a tool used to analyze the chemical constituents in a sample. When done properly, the quantity of individual compounds in the sample can be determined. The process works by injecting the sample into a carrier gas (the mobile phase) and passing the carrier-gas/sample mixture through a *stationary phase*. The stationary phase is a layer of material with certain properties (e.g., polarity, charge, etc.). This layer of material can be coated onto the inner walls of a capillary tube or onto solid particles packed into a tube. The tube/stationary-phase combination is called a *column*, so a gas chromatograph can be composed of *packed columns* and/or *capillary columns*. Figure 1 is a picture of one of the gas chromatographs in the UO Lab.



Figure 1 Gas chromatograph in the UO Lab.

The columns are selected to separate the individual compounds in a sample so that they exit the GC at different times. This separation is done by selecting the stationary phase in the column so that it interacts with (i.e., attracts) each component in the sample differently. Components that are highly attractive to the stationary phase will be slowed down in the column compared to those with weak or no attractions. Multiple columns may be placed in a GC, and complicated flow patterns can be used by isolating different columns at different times using valves, to effectively separate compounds in the sample.



A detector is found at the outlet of the GC to determine the amount of material exiting as a function of time. The readout from the GC is a series of peaks (see Figure 2), and the integral of the peaks (the area under the curve) is related to the amount of material that exited the apparatus during the time the peak was detected and recorded. *Calibration* is required to determine what the areas and peaks mean quantitatively.

Calibration is done by injecting a sample with known composition (i.e., identity and volume/mole fraction of the compounds in the sample) and recording the areas that are produced by the apparatus. The GC in this lab consists of one column to separate the components exiting the reactor. The readout records several peaks, but only the CO<sub>2</sub> and CH<sub>4</sub> peaks used for analysis. Helium, the carrier gas does not show up as a peak. Videos on the UO Lab website explains how to run the experiment and view the output.

Calibration of the Instrument has been completed for you. Those calibrations are also provided on the UO Lab website.