Gas Unit Prep

Converts gas units from ppm to mass per cubic meter.

Where, "mass" is either mg for methane or g for carbon dioxide.

Explanation of Variables

Function Name

`gas_unit_prep()`

Input Variables

`ChamON_data`: This dataset is compiled using the site based `.m` scripts (e.g., `NGBN_STMB_12Jun2019_DataAnalysis.m`) and is generally found in a `.mat` (e.g., `NGBN_STMB_MATFILE.mat`) file that is created by the aforementioned .m file. Within this dataset is an *n* by 9 by *nchams*, where *n* is the number of rows in the dataset, 9 represents the number of columns, and *nchams* is the number of chamber enclosures performed at that site. These data are all numeric and are only timestamped with relative seconds within the chamber enclsoure.

NOTE: `ChamON_data` **must** maintain the defined format above and **must** contain the gas measurements in ppm in columns 3 and 7 for methane and carbon dioxide, respectively.

`temp`: Temperature (℃) during measurement

`pressure`: Pressure (Pa) during measurement

Output Variables

prepped_ChamON: This is a matrix object that contains all of the input data from `ChamON_data` as well as two new columns (columns 10 and 11) that contain the gas in units of mass per cubic meter for methane and carbon dioxide, respectively.

Step 01: Establish temperature and pressure in the correct units

Based on a given temperature and pressure, ensure that temperature is expressed in Kelvin and pressure expressed in Pascals. Additionally, the constants are defined here as well.

```
function prepped_ChamON = gas_unit_prep(ChamON_data, temp, pressure)

% constants
r_gas_constant = 8.31446261815324; % Ideal gas constant: R [kg m2 s-2 K-1 mol-1] % sou
mm_dry_air = 0.0289652; % Molar mass of dry air: M [kg mol-1] % source: https://en.wik

% default values for temp, press (i.e., STP conditions), and gas_type
if ~exist("temp", "var")
    temp = 25;
end

if ~exist("pressure", "var")
```

```
    pressure = 10E05;
end

% check input and convert input temp to kelvin
if temp >= -20 && temp <= 125
    temp_K = temp + 273.15;
else
    warning("The input temperature is either invalid or was mistkanely entered in degr
end
```

Step 02: Quantify the density of air

The density of air is required in order to complete conversion of the gas ration to the concentatrion. The density of air represented in the entire chamber is determined by the following:

$$\rho_{air} = \frac{P\,M}{R\,T},$$

where $\rho_{air} = \text{density of air}\ (\text{kg m}^{-3})$, $M = \text{molar mass of dry air}(\text{kg mol}^{-1})$, $R = \text{universal gas constant}$ $(\text{kg m}^2\,\text{s}^{-2}\,\text{K}^{-1}\,\text{mol}^{-1})$, and $T = \text{temperature (K)}$.

```
rho_air = ( pressure * mm_dry_air ) / (r_gas_constant * temp_K);
```

Step 03: Multiply the gas ratio by weight by the volume of air to get concentration

```
% isolate the gas ratios from the input data
ch4_ppmw = ChamON_data(:,3,:);
co2_ppmw = ChamON_data(:,7,:);

conc_ch4_mgm3 = ch4_ppmw * rho_air;
conc_co2_mgm3 = co2_ppmw * rho_air;
```

Step 03: Add mass concentrations to input matrix

The converted values are added here as the tenth and eleventh columns for methane and carbon dioxide, respectively.

```
[~, ~, nchams] = size(ChamON_data);

% Add the converted cgs concentrations to the main numeric array
 for idx = 1:nchams
        ChamON_data(:,10,idx)    = conc_ch4_mgm3(:,1,idx);
        ChamON_data(:,11,idx)    = conc_co2_mgm3(:,1,idx);
 end
```

```
prepped_ChamON = ChamON_data;
```