Mixing Ratio

From the user, an air temperature (T), a dewpoint temperature (T_d), and a station pressure (p_{sta}) are given.

The calculation of the mixing ratio is quite involved. In order to calculate the mixing ratio, a saturaded vapor pressure (e_s) must be computed for values of air temperature, and an actual vapor pressure (e) must be computed for values of dewpoint temperature. But before the vapor pressures can be computed, the air temperature and/or dewpoint temperature must be converted to degrees Celsius $(°\mathrm{C})$.

To see how to convert temperatures see the link below:

http://www.srh.noaa.gov/elp/wxcalc/formulas/tempConvert.pdf

Next, station pressure (p_{sta}) must be converted to millibars (mb) or hectorPascals (hPa).

To convert the vapor pressure to other units, see the link below:

http://www.srh.noaa.gov/elp/wxcalc/formulas/pressureConversion.pdf

Finally, the actual mixing ratio (w) and/or the saturated mixing ratio (w_s) can be calculated using the formula below:

$$w = 621.97 \times \frac{e}{p_{sta} - e} \qquad w_s = 621.97 \times \frac{e_s}{p_{sta} - e_s}$$

For a bounus answer, after calculating both the actual mixing ratio and the saturated mixing ratio, the relative humidity (rh) can be calculated using the equation below:

$$rh = \frac{w}{w_s} \times 100$$