Lab Report for Molecular Weight of a Gas

Data and Observations

1. Mass of foil and flask filled with air _________________ g
2. Temperature of dry air in flask _________________ °C
3. Barometric pressure ______________ mm Hg (torr) = ______________ atm
4. Density of dry air at experimental temperature and pressure __________ g/L
   = __________ g/mL
5. Mass of foil and flask filled with CO₂, after first twenty minutes _________________ g
6. Mass of foil and flask filled with CO₂, after second fifteen minutes _________________ g
7. Mass of foil and flask filled with CO₂, after additional five min (if needed) _________________ g
8. Temperature of CO₂ in flask _______________ °C = _______________ K
9. Mass of flask filled with water _________________ g (with foil)
10. Temperature of water ______________ °C
11. Density of water at above temperature ______________ g/mL

Calculations and Analysis

• The volume of the flask is equal to the volume of water in the flask. This volume is calculated from the mass and the density of the water. The mass of the water is the difference between the mass (flask + foil + water) and the mass (empty flask + foil). However, since the mass of the water is much larger than the mass of air displaced by the water the mass of water can be approximated as the difference between the mass (flask + foil + water) (#9 on Data Sheet) and the mass (flask + foil + air) (#1 on Data Sheet). The density of water at different temperatures is tabulated above.

• The mass of dry air in the flask is calculated from the volume of the flask and the density of dry air at the recorded temperature and pressure. The density of dry air at different combinations of temperature and pressure is tabulated above.

• The mass of the empty flask is equal to the difference between the mass (flask + foil + air) (#1 on Data Sheet) and the calculated mass of dry air.

• The mass of carbon dioxide in the flask is determined by subtracting the mass of the empty flask from the largest value of mass (flask + foil + carbon dioxide) (the largest value of #6 or #7 on the Data Sheet).
• The molecular weight of carbon dioxide is calculated using Equation (2).

• The percentage error can be calculated using the following formula.

\[
\text{Percentage Error} = \frac{|(\text{Experimental Value}) - (\text{Theoretical Value})|}{(\text{Theoretical Value})} \times 100
\]

For each calculation, show your work and put a box around each answer.

1. Volume of flask

2. Mass of dry air in flask

3. Mass of empty flask
4. Mass of carbon dioxide in flask

5. Experimental molecular weight

6. Percentage Error
Questions and Conclusions

1. Because the mass of the flask with water exceeds the amount that can be weighed on the digital balances, the triple-beam-balance is used, which only weighs to ±0.01 g. Why doesn't using this balance affect the number of significant digits to which the experimental molecular weight of carbon dioxide can be reported?

2. Why can we neglect the mass of the air in the flask when obtaining the mass of the water in the flask (as we do when weighing most things) but not neglect the mass of the air when we calculate the mass of carbon dioxide in the flask?
3. Suggest a possible source of error that would account for any discrepancy between your experimentally determined molecular weight and the theoretical molecular weight.