1 density $= \dfrac{1.59\text{ g}}{0.850\text{ L}} = 1.871\text{ g/L}$, and mass of 1 mol $= 1.871\ \dfrac{\text{g}}{\text{L}} \times 22.4\text{ L} = 41.9\text{ g}$

empirical mass of $CH_2 = 12.0 + 2 \times 1.0 = 14.0\text{ g}$

$N = \dfrac{41.9\text{ g}}{14.0\text{ g}} = 2.99$. Therefore the molecular formula $= 3 \times (CH_2) = \boxed{\mathbf{C_3H_6}}$.

2. moles N = 30.4 g x $\frac{1\ mol}{14.0\ g}$ = 2.17 mol | 1

moles O = 69.6 g x $\frac{1\ mol}{16.0\ g}$ = 4.35 mol | 2

and empirical formula = **$NO_2$** , empirical mass = 14.0 + 2 x 16.0 = 46.0 g

molar mass = 4.11 $\frac{g}{L}$ x 22.4 L = 92.1 g

N = $\frac{92.1\ g}{46.0\ g}$ = 2.0 . Therefore the molecular formula = 2 x ($NO_2$) = $\boxed{N_2O_4}$ .

3. Empirical mass of $C_5H_{11}$ = 71.0 g

molar mass = $\frac{3.91\ g}{0.0275\ mol}$ = 142 g/mol

N = $\frac{142\ g}{71.0\ g}$ = 2.0. Therefore the molecular formula = 2 x ($C_5H_{11}$) = **$C_{10}H_{22}$**.

4. density = $\frac{0.522\ g}{0.450\ L}$ = 1.16 g/L , and mass of 1 mol = 1.16 $\frac{g}{L}$ x 22.4 L = 26.0 g

empirical mass = 1 x 12.0 + 1 x 1.0 = 13.0 g

N = $\frac{26.0\ g}{13.0\ g}$ = 2.0 . Therefore the molecular formula = 2 x (CH) = $\boxed{C_2H_2}$ .

5. Percentage O = 100% – 42.9% = 57.1%

moles C = 42.9 g x $\frac{1\ mol}{12.0\ g}$ = 3.58 mol | 1

moles O = 57.1 g x $\frac{1\ mol}{16.0\ g}$ = 3.57 mol | 1

empirical formula = CO and empirical mass = 28.0 g

molar mass = $\frac{1.68\ g}{0.0600\ mol}$ = 28.0 g/mol

N = $\frac{28.0\ g}{28.0\ g}$ = 1 and the molecular formula is $\boxed{CO}$

6. moles Si = 33.0 g x $\frac{1\ mol}{28.1\ g}$ = 1.17 mol | 1

moles F = 67.0 g x $\frac{1\ mol}{19.0\ g}$ = 3.53 mol | 3

empirical formula = $SiF_3$ and empirical mass = 85.1 g

molar mass = 7.60 $\frac{g}{L}$ x 22.4 L = 1.70 x $10^2$ g

N = $\frac{1.70 \times 10^2\ g}{85.1\ g}$ = 2.0 and the molecular formula = 2 x ($SiF_3$) = $\boxed{Si_2F_6}$

7. moles B = 78.3 g x $\frac{1\ mol}{10.8\ g}$ = 7.25 mol | 1

moles H = 21.7 g x $\frac{1\ mol}{1.0\ g}$ = 21.7 mol | 3

empirical formula = $BH_3$ and empirical mass = 13.8 g

molar mass = 0.986 x 28.0 g = 27.6 g

N = $\frac{27.6\ g}{13.8\ g}$ = 2.0 and the molecular formula = 2 x ($BH_3$) = $\boxed{B_2H_6}$

8. empirical mass = 14.0 g

density = $\frac{0.938\ \text{g}}{0.500\ \text{L}}$ = 1.876 g/L and mass of 1 mol = 1.876 $\frac{\text{g}}{\text{L}}$ x 22.4 L = 42.0 g

N = $\frac{42.0\ \text{g}}{14.0\ \text{g}}$ = 3.0 and molecular formula = 3 x ($CH_2$) = $\boxed{\mathbf{C_3H_6}}$

9. empirical mass = 16.0 g ; molar mass = 3 x 16.0 g = 48.0 g

N = $\frac{48.0\ \text{g}}{16.0\ \text{g}}$ = 3.0 and molecular formula = 3 x (O) = $\boxed{\mathbf{O_3}}$