10. 60% O_2 (31.99 kg/Kmol)

$m_{O_2} = 60 \text{ kmol} \cdot 31.99 \text{ kg/kmol} = 1919.4 \text{ kg}$

40% CO_2 (44.01 kg/Kmol)

$m_{CO_2} = 40 \text{ kmol} \cdot 44.01 \text{ kg/Kmol} = 1760.4 \text{ kg}$

$M_m = 1760.4 \text{ kg} + 1919.4 \text{ kg} = 3679.8 \text{ kg}$

$mf_{O_2} = \frac{1919.4}{3679.8} =$

$mf_{CO_2} = \frac{1760.4}{3679.8} =$

$N_m = 60 \text{ Kmol} + 40 \text{ Kmol} = 100 \text{ Kmol}$

$M_m = \frac{3679.8 \text{ kg}}{100 \text{ Kmol}} \quad 36.79 \text{ kg/Kmol}$

$R_m = \frac{8.314 \text{ kJ/Kmol} \cdot \text{K}}{36.79 \text{ kg/Kmol}} = 0.226 \text{ kJ/kg} \cdot \text{K}$

13. 6 Kmol H_2 2 kmol N_2

$M_{H_2} = 2.016$ kg/Kmol $M_{N_2} = 28.013$ Kg/Kmol

$m_{H_2} = 6 \text{ Kmol} \cdot 2.016 \text{ Kg/Kmol} = 12.1 \text{ Kg}$

$m_{N_2} = 2 \text{ Kmol} \cdot 28.013 \text{ Kg/Kmol} = 56.03 \text{ Kg}$

$M_m = 12.1 + 56.03 = 68.13 \text{ Kg}$

$N_m = 6 + 2 = 8 \text{ Kmol}$

$M_m = \dfrac{68.13 \text{ Kg}}{8 \text{ Kmol}} = 8.52 \text{ Kg/Kmol}$

$R_m = \dfrac{8.314 \text{ KJ/Kmol} \cdot \text{K}}{8.52 \text{ kg/Kmol}} = .978 \text{ KJ/Kg} \cdot \text{K}$

Rami Switzer

1. The mass fractions will be the same, but the mole fraction will be determined by the mole number of each component.

2. No, the Real gas mixture takes into account the compressibility of gases while ideal gas mixtures have identicle proportions of mole, pressure, and volume.

3.

CO_2

$C = 12 kg/mol$

$O_2 = 16 \times 2 = 32 kg/mol$

$mass = 12 + 32 = 44 kg/kmol$

N_2O

$N_2 = 14 \times 2 = 28 g/mol$

$O = 16 kg/mol$

$mass = 16 + 28 = 44 kg/kmol$

} Table A-1 in book

$N_C = \frac{12 kg}{12 kg/kmol} = 1 kmol$

$N_{N_2} = \frac{28 kg}{28 kg/kmol} = 1 kmol$

$N_{O_2} = \frac{32 kg}{32 kg/kmol} = 1 kmol$

$N_O = \frac{16 kg}{16 kg/kmol} = 1 kmol$

$y_C, y_{O_2}, y_{N_2}, y_O = .25$, Therefore it's true

4. Taking the arithmetic average doesn't determine the average molar mass. The gases must have the same mole number and fraction for that to work.

5. The apparent molar mass is the total mass of the mixture divided by the sum of mole numbers.

6. The mass of each component must be known to find the mole number to then find the mole fraction.

59. 60% CH_4

25% C_3H_8

15% C_4H_{10}

Inlet = 100 KPa at 20°C

Outlet = 1000 KPa

a) $$M_m = \frac{1}{\left(\frac{.25}{44.097} + \frac{.60}{16.043} + \frac{.15}{58.124}\right)} = 21.906 \text{ Kg/Kmol}$$

$$R_m = \frac{8.3147 \text{ KJ/Kmol} \cdot K}{21.906 \text{ Kg/Kmol}} = 0.380 \text{ KJ/Kg}$$

$$W_{rev} = (0.380)(290)\left(\ln\left(\frac{1000}{100}\right)\right) = 256.2 \text{ KJ/Kg}$$

b) $q - w = 256.2$ KJ/Kg

30. CO_2, 20kPa (44.01 Kg/kmol)
O_2, 30kPa (31.99 Kg/Kmol)
N_2, 50 KPa (28.013 Kg/Kmol)

$mm = 20 + 30 + 50 = 100$ kPa

$y_{CO_2} = 20kPa/100kPa = 0.2$
$y_{O_2} = 30kPa/100kPa = 0.3$
$y_{N_2} = 50kPa/100kPa = 0.5$

$M_m = (.2)(44.01) + (.3)(31.99) + (.5)(28.013) = \boxed{32.41 \text{ Kg/Kmol}}$

$mf_{CO_2} = (.2)(44.01/32.41) = .272$
$mf_{O_2} = (.3)(31.99/32.41) = .296$
$mf_{N_2} = (.5)(28.01/32.41) = .433$

$R_m = \frac{8.314 \text{ KJ/Kmol}\cdot K}{32.41 \text{ Kg/Kmol}} = \boxed{.257 \text{ KJ/Kg}\cdot K}$

$C_{vm} = (0.272)(0.657 \text{ KJ/Kg}\cdot K) + (0.296)(0.658 \text{ KJ/Kg}\cdot K) + (0.433)(0.743 \text{ KJ/Kg}\cdot K) = \boxed{0.743 \text{ KJ/Kg}\cdot K}$

$C_{pm} = (0.272)(0.846 \text{ KJ/Kg}\cdot K) + (0.296)(0.918 \text{ KJ/Kg}\cdot K) + (0.433)(1.039 \text{ KJ/Kg}\cdot K) = \boxed{0.95 \text{ KJ/Kg}\cdot K}$

$K_m = \frac{0.743}{0.95} = \boxed{.78 \text{ KJ/Kg}\cdot K}$