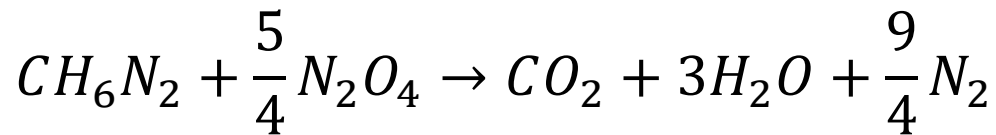


PS8

Liquid methylhydrazine (CH_6N_2) reacts with liquid dinitrogen tetroxide (N_2O_4) to give gaseous carbon dioxide (CO_2), gaseous water (H_2O), and gaseous nitrogen (N_2) at 25°C and 1 atm. For the reaction, the standard heats of formation and the entropies of formation at 25°C are provided. What is the Gibbs free energy for the reaction at 25°C ?

	ΔH_{298} (kJ/mol)	S_{298} (J/mol.K)
$\text{CH}_6\text{N}_2(\text{l})$	54.14	165.94
$\text{N}_2\text{O}_4(\text{l})$	9.08	304.38
$\text{CO}_2(\text{g})$	-393.51	213.785
$\text{H}_2\text{O}(\text{g})$	-241.83	188.835
$\text{N}_2(\text{g})$	0	191.56

PS8



$$\Delta H_{298} = 1(-393.51) + 3(-241.83) + \frac{9}{4}(0) - 1(54.14) - \frac{5}{4}(9.08) = -1184.49 \frac{\text{kJ}}{\text{mol}}$$

$$\Delta S_{298} = 1(213.785) + 3(188.836) + \frac{9}{4}(191.56) - 1(165.94) - \frac{5}{4}(304.39) = 664.88 \frac{\text{J}}{\text{molK}}$$

$$\Delta G_T = \Delta H_T - T\Delta S_T$$

$$= -1184.49 - 298 \left(\frac{664.88}{1000} \right) = -1382.62 \frac{\text{kJ}}{\text{mol}}$$