



approximately 17.34×10^{12} moles per year in the world and 5.63×10^{12} moles per year in the United States [56].

Table 6. Gasoline Exhaust Products per Vehicle Mile Traveled (Grams and Moles)

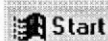
Exhaust Product	Emissions			
	Grams	Percent of Total	Moles	Percent of Total
Carbon Dioxide (CO ₂)	272.38	69.38	6.19	49.01
Water Vapor (H ₂ O)	109.42	27.88	6.08	48.14
Methane (CH ₄)	0.08	0.02	<0.01	0.07
Nitrogen Oxides (NO _x) and Nitrous Oxide (N ₂ O)	0.87	0.22	0.02	0.16
Carbon Monoxide (CO)	9.00	2.29	0.32	2.53
Nonmethane Hydrocarbons (C _n H _m)	0.86	0.21	0.01	0.09

Notes: Gasoline refers to unleaded gasoline in this report. Estimates are based on the Environmental Protection Agency's Mobile 5a model for emissions produced by hydrocarbon combustion in automotive engines. Nitrogen oxides include primarily nitric oxide and nitrogen dioxide. One mole of gas is equal to the amount of substance that contains as many elementary units (6.023×10^{23} molecules or atoms as there are atoms in 12 grams of carbon-12. Normally, emissions are reported in grams per vehicle mile traveled. However, reporting in moles is preferable because greenhouse gas heat absorption is directly related to the number of molecules of gas.

Source: Decision Analysis Corporation, "Measurement of Emissions: Greenhouse Gas Estimates for Alternative Transportation Fuels," unpublished final report prepared for the Energy Information Administration (Vienna, VA, December 1995).

Table 7 and Figure 3 show the total carbon dioxide emissions per VMT for the entire fuel cycle for different fuels. For the entire fuel cycle, CNG has the lowest

Done



Double Solitaire at http://...

Alternatives to Traditi...

CHEMICAL AND PHYSICAL INFORMATION

TABLE 3-3. Major Components of Gasoline^a

Component	Percentage Composition ^b	Component
<i>n</i> -alkanes		<u>Other possible components</u>
C ₅	3.0	octane enhancers
C ₆	11.6	methyl t-butyl ether (MTBE)
C ₇	1.2	t-butyl alcohol (TBA)
C ₉	0.7	ethanol
C ₁₀ -C ₁₃	0.8	methanol
total of <i>n</i> -alkanes	17.3	antioxidants
branched alkanes		<i>N,N'</i> -dialkylphenylenediamines
C ₄	2.2	2,6-dialkyl and 2,4,6-trialkylphenols
C ₅	15.1	butylated methyl, ethyl and dimethyl phenols
C ₆	8.0	triethylene tetramine di(monononylphenolate)
C ₇	1.9	metal deactivators
C ₈	1.8	<i>N,N'</i> -disalicylidene-1,2-ethanediamine
C ₉	2.1	<i>N,N'</i> -disalicylidene-propanediamine
C ₁₀ -C ₁₃	1.0	<i>N,N'</i> -disalicylidene-cyclohexanediamine
total of branched	32.0	disalicylidene-N-methyl-dipropylene-triamine
cycloalkanes		ignition controllers
C ₆	3.0	tri- <i>o</i> -cresylphosphate (TOCP)
C ₇	1.4	icing inhibitors
C ₈	0.6	isopropyl alcohol
total of cycloalkanes	5.0	detergents/dispersants
olefins		alkylamine phosphates
C ₆	1.8	poly-isobutene amines
total of olefins	1.8	long chain alkyl phenols
aromatics		long chain alcohols
benzene	3.2	long chain carboxylic acids
toluene	4.8	long chain amines
xylene	6.6	corrosion inhibitors
ethylbenzene	1.4	carboxylic acids
C ₃ -benzenes	4.2	phosphoric acids
C ₄ -benzenes	7.6	sulfonic acids
others	2.7	
total aromatics	30.5	

^aAdapted from Air Force 1989^bPercent by weightaromatics $C_n H_{2n-2}$ alkanes $C_n H_{2n+2}$

Gasoline C = 86.6% by wt Avg.