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| **Environmental Enlightenment #184** By Ami Adini - Reissued May 18, 2015   |  | | --- | | This is a SHORT, LIGHT and SIMPLE newsletter. Its purpose is to rekindle in the initiated terminology they have once learned, and enlighten the uninitiated on terms they may have heard but never known the meaning of. | | |  | | --- | | **Combustion of Fossil Fuel – A Global Impact** | | My colleague, Jim Jacobs, a renowned environmental scientist with Environmental Bio-Systems of northern California, enlightened me on that every gallon of gasoline when burned generates 20 pounds of carbon dioxide (CO2) that is released to the atmosphere.  Gasoline is a complex mixture of over 500 hydrocarbons that may have between 5 to 12 carbons.  Given below are illustrations of three molecules of the gasoline family. | |  | | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image002.jpg |  | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image004.jpg |  | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image006.jpg |  | | |  | | |  |  |  | | --- | --- | --- | | Take propylbenzene for example: | |  | |  | 9 carbons (C) and 12 hydrogens (H) |  | |  | Thus:  C9H12 |  | | Upon combustion, hydrocarbon molecules convert to carbon dioxide (CO2) and water (H2O) | | | | |  | | |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image008.jpg |  | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image010.jpg |  | | |  | | Every carbon atom engages two oxygens. Every two hydrogen atoms capture one oxygen. Thus, one propylbenzene molecule will become: | |  | | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | **C9H12** | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image011.gif | **9 CO2** | **+** | **6 H2O** |  | | | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image012.jpg |  | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image013.jpg |  | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image014.jpg |  | | |  | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | One (1) molecule of propylbenzene | | | | | | |  | Converts to: | | | | | |  |  | Nine (9) molecules of Carbon Dioxide | | | | |  |  |  | Plus | | | |  |  |  |  | Six (6) molecules of Water | | |  |  |  |  |  |  | | Mass is amount of matter.  Atoms are little particles of matter.   Every atom has its own characteristic mass.  You can measure the atomic mass in any unit of your choice: be it gram, pound or kernels of olives.  For our purpose we select a system where hydrogen atom represents one (1) unit of mass. | | | | | | | |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | |  |  |  |  |  |  |  | |  | In this system:   * The mass of the hydrogen atom is 1 * The mass of the carbon atom is (approx) 12 * The mass of the oxygen atom is (approx) 16 | | | | | | |  | The mass of the C9H12 molecule will be: | | | | | | |  |  | C9H12 Mass   =    9 x 12    +   12 x 1   =    120 | | | | | |  | The mass of a CO2 molecule will be: | | | | | | |  |  | CO2 Mass   =    1 x 12    +   2 x 16   =    44 | | | | | |  | We now see that | | | | | | |  |  | the combustion of 1 molecule of propylbenzene | | | | | |  |  |  | that has 120 units of mass | | | | |  |  |  |  | yields | | | |  |  |  |  |  | 9 molecules of carbon dioxide | | |  |  |  |  |  |  | with a combined mass of 9 x 44  =  396 mass units. | |  |  |  |  |  |  |  | |  | The ratio is: | | | | | | |  |  | | | | | | |  |  | 396 / 120    =   3.3 | | | | | |  |  | | | | | | |  | It means: | | | | | | |  |  | | | | | | |  |  | Burning of one (1) pound of propylbenzene generates three and three-tenths (3.3) pounds of carbon dioxide | | | | | |  |  | | | | | | |  | One gallon of gasoline weighs (approx) 6.7 pounds. | | | | | | |  | If gasoline was all propylbenzene: | | | | | | |  |  | For every gallon of gasoline (6.7 pounds) combusted  we would generate 3.3 x 6.7 = 22.1 pounds of CO2 | | | | | |  |  |  |  |  |  |  | | | | | | | | |  | | | | | | | Another fact to note is that all fossil fuel, be it petroleum, coal or natural gas, is hydrocarbons, and that in the burning of hydrocarbons we tie free oxygen to the products of the combustion.  In the above example, combustion of one molecule of propylbenzene (120 atomic mass units) ties 24 atoms of oxygen (having 16 atomic mass units each).  Thus a total of 24 x 16 = 384 atomic mass units of oxygen get tied up in the CO2 and H2O generated by the combustion.   |  |  | | --- | --- | | The ratio is: | | |  | 384 / 120     =    3.2 |   We get that for every gallon of gasoline (6.7 pounds) combusted there’s 3.2 x 6.7 = 21.4 pounds of free oxygen eliminated from the air and engaged in bondage with water and carbon dioxide  Nature can break down the CO2 and water back to their elemental components and release the captured oxygen to the atmosphere. HOWEVER, Nature never equipped itself to free up the oxygen at the rate that we are now tying it up.  One can therefore conclude that before the rest of the world starts mass driving of cars, building power plants and heating homes with gas it would behoove its more advanced societies to strive hard in the quest after non-hydrocarbon-based fuels.  As the old way is leading into cul de sac, we see global efforts accelerating to solve this fast-becoming acute problem of survival for the inhabitants of Earth. | | | | | | | http://amiadini.com/NewsletterArchive/150518-NL184/envEnl-184_clip_image015.jpg | | | | | | | | | You can find past issues of our "Environmental Enlightenment" at [amiadini.com](http://www.amiadini.com/) Wealth of information about environmental site assessments in the real estate transactions and issues concerning assessment and cleanup of contamination in the subsurface soil and groundwater. |  |  | | --- | | Call me if you have any questions. There are **no obligations.**  Ami Adini Environmental Services, Inc. Environmental Consultants & General Engineering Contractors California Lic. #1009513 A B HAZ ASB **818-824-8102**; [**mail@amiadini.com**](mailto:mail@amiadini.com) [www.amiadini.com](http://amiadini.com/)  Ami Adini is a veteran environmental practitioner with over 40 years of experience. He carries a Bachelor of Science degree (B.Sc.) in Mechanical Engineering including academic credits in Nuclear and Chemical Engineering and postgraduate education in these fields. His career includes design and construction of nuclear plant facilities, chemical processing plants and hazardous wastewater treatment systems. He is a former California Registered Environmental Assessor Levels I & II in the 1988-2012 registry that certified environmental professionals in the assessment and remediation of environmentally impacted land, and a Registered Environmental Professional (REP) since 1989 with the National Registry of Environmental Professionals (NREP). He is a California Business & Professions Code Qualifying Responsible Managing Officer (RMO) in the General Engineering Contractor classification with Hazardous Substance Removal and Asbestos certifications, and president of AMI ADINI ENVIRONMENTAL SERVICES, INC. (AAES), a general engineering contractor and consulting firm specializing in environmental site assessments, rehabilitation of contaminated sites and removal of environmental risks from real-estate transactions. (Contact Ami for a complete resume.) **AAES provides practical solutions to environmental concerns using the highest standards of ethics and integrity while providing its clients with maximum return on their investments.** | |