I'm not a robot

This page describes what cracking is, and the differences between catalytic cracking, thermal cracking and steam cracking used in the petrochemical industry. What is cracking? Cracking is the name given to breaking up large hydrocarbon molecules into smaller and more useful bits. This is achieved by using high pressures and temperatures without a catalyst, or lower temperatures and pressures in the presence of a catalyst. The source of the large hydrocarbon molecules is often the naphtha fraction or the gas oil fraction from the fractional distillation of crude oil (petroleum). These fractions are obtained from the distillation process as liquids, but are re-vaporised before cracking. There isn't any single unique reaction happening in the cracker. The hydrocarbon molecules are broken up in a fairly random way to produce mixtures of smaller hydrocarbons, some of which have carbon-carbon double bonds. One possible reaction involving the hydrocarbon C15H32 might be: Or, showing more clearly what happens to the various atoms and bonds: This is only one way in which this particular molecule might break up. The ethene and propene are important materials for making plastics or producing other organic chemicals. The octane is one of the molecules found in petrol (gasoline). Catalytic cracking Modern cracking uses zeolites as the catalyst. These are complex aluminosilicates, and are large lattices of aluminium, silicon and oxygen atoms carrying a negative charge. They are, of course, associated with positive ions such as sodium ions. You may have come across a zeolite if you know about ion exchange resins used in water softeners. The alkane is brought into contact with the catalyst at a temperature of about 500°C and moderately low pressures. The zeolites used in catalytic cracking are chosen to give high percentages of hydrocarbons with between 5 and 10 carbon atoms - particularly useful for petrol (gasoline). It also produces high proportions of branched alkanes and aromatic hydrocarbons like benzene. For UK A level (and equivalent) purposes, you aren't expected to know how the catalyst works, but you may be expected to know that it involves an ionic intermediate. Also found in: Thesaurus, Medical, Idioms, Encyclopedia, Wikipedia. (krăk′ĭng)n. Decomposition of a complex substance by the application of steam, a catalyst, or heat, especially the breaking of petroleum molecules into shorter molecules to extract low-boiling fractions such as gasoline.adj. Excellent; great: had a cracking time at the dance.adv. Used as an intensive: a cracking good show.American Heritage® Dictionary of the English Language, Fifth Edition. Copyright © 2016 by Houghton Mifflin Harcourt Publishing Company. Published by Houghton Mifflin Harcourt Publishing Company. All rights reserved. ('krækɪŋ) adj1. (prenominal) informal fast; vigorous (esp in the phrase a cracking pace)2. get cracking informal to start doing something quickly or do something with increased speedadv, adjinformal Brit first-class; excellent: a cracking good match. n (Chemistry) the process in which molecules are cracked, esp the oil-refining process in which heavy oils are broken down into hydrocarbons of lower molecular weight by heat or catalysis. See also catalytic crackerCollins English Dictionary – Complete and Unabridged, 12th Edition 2014 © HarperCollins Publishers 1991, 1994, 1998, 2000, 2003, 2006, 2007, 2009, 2011, 2014 ('kræk ŋ) n. 1. (in the distillation of petroleum) the process of breaking down complex hydrocarbons into simpler compounds with lower boiling points, as gasoline. Compare catalytic cracking. adv. 2. extremely; unusually: a cracking good race. adj. 3. done with precision; smart: a cracking salute. Random House Kernerman Webster's College Dictionary, © 2010 K Dictionaries Ltd. Copyright 2005, 1997, 1991 by Random House, Inc. All rights reserved.The process used in the petroleum industry to convert large-chain hydrocarbon molecules to smaller ones. The process uses heat and catalysts.Dictionary of Unfamiliar Words by Diagram Group Copyright © 2008 by Diagram Visual Information Limited Noun1.cracking - a sudden sharp noise; "the crack of a whip"; "he heard the cracking of the ice"; "he can hear the snap of a twig"noise - sound of any kind (especially unintelligible or dissonant sound); "he enjoyed the street noises"; "they heard indistinct noises of people talking"; "during the firework display that ended the gala the noise reached 98 decibels"2.cracking - the act of cracking something3.cracking - the process whereby heavy molecules of naphtha or petroleum are broken down into hydrocarbons of lower molecular weight (especially in the oil-refining process)hydrocracking - the process whereby hydrocarbon molecules of petroleum are broken down into kerosene and gasolene by the addition of hydrogen under high pressure in the presence of a catalystAdj.1.cracking - very good; "he did a bully job"; "a neat sports car"; "had a great time at the party"; "you look simply smashing"bang-up, bully, corking, dandy, nifty, not bad, peachy, slap-up, smashing, swell, groovy, keen, great, neatcolloquialism - a colloquial expression; characteristic of spoken or written communication that seeks to imitate informal speechgood - having desirable or positive qualities especially those suitable for a thing specified; "good news from the hospital"; "a good report card"; "when she was good she was very very good"; "a good knife is one good for cutting"; "this stump will make a good picnic table"; "a good check"; "a good joke"; "a good exterior paint"; "a good secretary"; "a good dress for the office"Based on WordNet 3.0, Farlex clipart collection. © 2003-2012 Princeton University, Farlex Inc. ['krækɪŋ]A. N1. (Chem) [of petroleum] → craqueo m2. (= cracks) → grietas fpl, agrietamiento mB. ADJ (Brit)1. (= very fast) at a cracking speed or pace → a toda pastilla2. (= excellent) → de órdagoC. ADV (Brit) this book is a cracking good read → este libro es superamenoCollins Spanish Dictionary - Complete and Unabridged 8th Edition 2005 © William Collins Sons & Co. Ltd. 1971, 1988 © HarperCollins Publishers 1992, 1993, 1996, 1997, 2000, 2003, 2005 ['krækɪŋ] (British) adj (= great, brilliant) → super inv (= very fast) at a cracking pace → à toute vitesseCollins English/French Electronic Resource. © HarperCollins Publishers 2005Collins German Dictionary – Complete and Unabridged 7th Edition 2005. © William Collins Sons & Co. Ltd. 1980 © HarperCollins Publishers 1991, 1997, 1999, 2004, 2005, 2007Collins Italian Dictionary 1st Edition © HarperCollins Publishers 1995 Want to thank TFD for its existence? Tell a friend about us, add a link to this page, or visit the webmaster's page for free fun content. Link to this page: This trick, a bad habit, the cracking of his fingers, always soothed him, and gave precision to his thoughts, so needful to him at this juncture.Suddenly she heard a faint sound: it was King Frost springing from tree to tree, and cracking his fingers as he went.They came forward, evidently still afraid of Montgomery, but still more afraid of my cracking red whip-lash; and after some fumbling and hesitation, some whip-cracking and shouting, they lifted him gingerly, carried him down to the beach, and went splashing into the dazzling welter of the sea. Chemguide: Core Chemistry 14 - 16Cracking long hydrocarbons to make smaller useful ones This page is about how you can break longer hydrocarbons into more useful shorter ones. It looks at a simple experiment to demonstrate cracking in the lab as well as some industrial details. Two important words Alkanes are hydrocarbons which only contain carbon-carbon single bonds. Alkenes are hydrocarbons which contain a carbon-carbon double bond. Why crack hydrocarbons? There are two problems with the output from fractional distillation: The proportions of the various fractions that you get aren't in the same proportion that you ideally need to meet demand. In particular, you need a lot more shorter hydrocarbons in order to meet the demand for petrol (gasoline) than there are in crude oil. The hydrocarbons in crude oil are mainly alkanes and, apart from burning, these aren't actually very reactive. Cracking produces molecules containing a carbon-carbon double bond (alkenes) and these are much more reactive and can be turned into useful products. What happens during cracking? Big molecules are broken at a carbon-carbon single bond. For example, consider the molecule nonane, C9H20. We always draw these hydrocarbons as if they were tidy straight chains, but they aren't. They can rotate freely about all the carbon-carbon single bonds, and can take up all sorts of different shapes. That's why I have drawn this random one above. But we write them tidily as: Now imagine it gets broken here: That would produce these two fragments: But these fragments aren't viable as they stand. If you think about the carbon atoms in the two CH2 groups at the broken ends, each of those carbon atoms is only forming 3 bonds - 1 to another carbon atom, and 2 to two hydrogen atoms. There needs to be some rearranging of the atoms. If a hydrogen atom from the far right CH3 group transfers to the CH2 group at the end of the left-hand fragment, you get this: The two carbon atoms in the right-hand fragment can satisfy their bonding requirements by forming a double bond. So you have ended up with a smaller alkane, and a usefully reactive alkene. Should you want to write an ordinary equation for this, it would be C9H20 C7H16 + C2H4 There's no reason, of course, why the nonane should only break at this point. It might break off a 3-carbon fragment from the right-hand end instead, so you could get: C9H20 C6H14 + C3H6 The structural formula for C3H6 is CH2=CHCH3. It is different alkene. There are other possibilities, including it breaking more than once. Don't worry about this! A simple exam question might just give you this partial equation and ask you to complete it. C15H32 C12H26 + ? It will be a balanced equation. Count the carbons and hydrogens on the left-hand side, and add a new hydrocarbon with enough of each to balance it. In this case, you need to add another 3 carbon atoms and 6 hydrogens. C15H32 C12H26 + C3H6 A simple demonstration of cracking in the lab "Liquid paraffin" is a colourless oily liquid which contains alkane molecules with around 20 carbon atoms. It is mainly used medically as a laxative. You can crack it easily by passing its vapour over a range of very hot catalysts including pumice stone, broken porcelain bits or aluminium oxide. You can show that an alkene (with a carbon-carbon double bond) is formed by collecting the gases produced over water and testing them. A simple experimental set-up would look like this. You start by heating the catalyst very strongly until it is really hot. Then flick the Bunsen back to the liquid paraffin to produce some vapour. Then back to the catalyst - and keep on repeating this. You can discard the first test tube of gas collected because it will just be air expanded out of the horizontal tube on heating, or simply don't collect the first gas that comes through. When you have several tubes of gas collected, you remove the delivery tube from the water, and then stop heating.It is essential to remove the delivery tube from the water before you stop heating, otherwise there is a risk of the water "sucking back" into the very hot test tube and cracking it. Testing the gas to show that it contains an alkene When the oil is cracked, you will have a mixture of products including shorter alkanes and probably more than one alkene. Most of these will have boiling points high enough that they will just condense to liquids in the water, and form a very thin invisible layer on top. The gases will consist mainly of small alkenes like ethene. There are two simple tests you can do: Set light to the gas. Small alkenes burn with a more yellowy flame than small alkanes. Shake the gas with bromine water. Alkenes decolourise the bromine water. We will look at the chemistry of this when we talk about alkenes on another page. The video shows this happening. It doesn't name the catalyst, but I suspect it is aluminium oxide. It is probably unlikely that you will need to know about the effect on acidified potassium manganate(VII) solution, but check your syllabus. Cracking industrially Most UK syllabuses just mention catalytic cracking. Check your syllabus to see if it also mentions steam cracking. Some syllabuses don't specify which version of cracking they want - in which case, look at past papers and mark schemes. There is also another method known as thermal cracking. No syllabus I have looked at mentions that. Catalytic cracking Catalytic cracking uses a zeolite as the catalyst. At this level, they are often just treated as a mixture of aluminium oxide (alumina) and silicon dioxide (silica). Catalytic cracking frequently uses the gas oil (diesel oil) fraction from crude oil fractional distillation. The gas oil is vaporised and brought into contact with the catalyst at a temperature of about 500°C and moderately low pressures. The zeolites used in catalytic cracking are chosen to give high percentages of hydrocarbons with between 5 and 10 carbon atoms, particularly useful for petrol (gasoline), as well as alkenes. Steam cracking Steam cracking is useful because it produces a high proportion of alkenes (hydrocarbons with carbon-carbon double bonds) in the cracked mixture. It uses the naphtha or (sometimes) gas oil fraction as the feedstock as well as more simple hydrocarbons like ethane, propane or butane. These are vaporised and mixed with steam and passed through a reactor heated to about 800 - 900°C. The pressure of the mixture is around 1 atmosphere. The gas flow is very, very fast so that the mixture only remains in the reactor for less than a second. This is to prevent the hydrocarbons cracking to produce carbon. The steam plays no chemical part in the process, serving mainly to dilute the organic feedstock. This helps to prevent the formation of carbon. noun (1)adverb (1)adjective (1)View synonyms for cracking(in the distillation of petroleum or the like) the process of breaking down certain hydrocarbons into simpler ones of lower boiling points by means of excess heat, distillation under pressure, etc., in order to give a greater yield of low-boiling products than could be obtained by simple distillation.extremely; unusually.We saw a cracking good match at the stadium.done with precision; smart.A cracking salute from the honor guard.informal (prenominal) fast; vigorous (esp in the phrase a cracking pace )informal to start doing something quickly or do something with increased speed“Collins English Dictionary — Complete & Unabridged” 2012 Digital Edition © William Collins Sons & Co. Ltd. 1979, 1986 © HarperCollins Publishers 1998, 2000, 2003, 2005, 2006, 2007, 2009, 2012informal first-class; excellent“Collins English Dictionary — Complete & Unabridged” 2012 Digital Edition © William Collins Sons & Co. Ltd. 1979, 1986 © HarperCollins Publishers 1998, 2000, 2003, 2005, 2006, 2007, 2009, 2012the process in which molecules are cracked, esp the oil-refining process in which heavy oils are broken down into hydrocarbons of lower molecular weight by heat or catalysis See also catalytic cracker“Collins English Dictionary — Complete & Unabridged” 2012 Digital Edition © William Collins Sons & Co. Ltd. 1979, 1986 © HarperCollins Publishers 1998, 2000, 2003, 2005, 2006, 2007, 2009, 2012The process of breaking down complex chemical compounds by heating them. Sometimes a catalyst is added to lower the amount of heat needed for the reaction. Cracking is used especially for breaking petroleum molecules into shorter molecules and to extract low-boiling fractions, such as gasoline, from petroleum.See also hydrocrackingIdiomsExamples have not been reviewed.It’s hard to fathom how a biographer intent on cracking the code of one of rock’s seminal bands can do so with so much contempt for the culture that spawned it.They are cracking down, arresting, torturing and killing national aid workers and human rights activists.The Nigerian government responded by brutally cracking down on the protesters.“A once great American City, Los Angeles, has been invaded and occupied by Illegal Aliens and Criminals,” he wrote, blaming Democratic politicians for not cracking down earlier.Passenger confusion has prompted the European Union's largest consumer group to push for fairer and more consistent hand luggage rules, and caused one government to start cracking down on airlines over bag charges.Definitions and idiom definitions from Dictionary.com Unabridged, based on the Random House Unabridged Dictionary, © Random House, Inc. 2023Idioms from The American Heritage® Idioms Dictionary copyright © 2002, 2001, 1995 by Houghton Mifflin Harcourt Publishing Company. Published by Houghton Mifflin Harcourt Publishing Company.crackiecrackjawBrowse#aabbccddeeffgghhiijjkkllmmnnooppqqrrssttuuvvwwxxyyzzAboutCareersContact usCookies, terms, & privacyHelpFollow usGet the Word of the Day every day!© 2025 Dictionary.com, LLC Cracking is defined as a process, wherein complex organic molecules namely long chain hydrocarbons or kerogens are broken down into smaller molecules namely light hydrocarbons. It is caused by the breaking of carbon-carbon bonds. The rate of catalyst greatly depends upon the factors such as the presence of catalyst and temperature. Cracking of hydrocarbons is illustrated in the below diagram. In petroleum refining, this process is used in the production of petrol, diesel, and gasoline. In chemistry, it is a process of breaking down large alkane into simpler alkenes and alkanes. Similarly, cracking of hydrocarbons includes breaking down of a complex long chain of hydrocarbons into smaller ones. Cracking in Organic Chemistry During this process, it involves numerous chemical reactions based on free radicals. Some vital reactions that take place are stated below. Initiation: Here a single molecule breaks down into 2 free radicals. Only a smaller portion of freed radicals undergoes initiation, but it is sufficient to produce free radicals that are necessary to carry forward the entire reaction. CH3CH3 → 2 CH3 Abstraction of Hydrogen: Here the second molecule becomes a free radical as it removes a hydrogen atom from another molecule. CH3• + CH3CH3 → CH4 + CH3CH2• Radical Decomposition: Here free radicals break into other free radical and an alkane. This reaction gives rise to alkene products. CH3CH2• → CH2=CH2 + H Radical Addition: This reaction results in the formation of aromatic products. Here radical reacts with an alkene to produce a free radical. CH3CH2• + CH2=CH2 → CH3CH2CH2CH2• Termination: Here 2 radicals react with each other to form products that are not free radicals. This reaction results in two forms namely recombination and disproportionation. CH3• + CH3CH2• → CH3CH2CH3 CH3CH2• + CH3CH2• → CH2=CH2 + CH3CH3 Types of Cracking FCC: Fluid Catalytic Cracking: It is mainly used in petroleum refiners. This process involves the conversion of high molecular weight, high boiling hydrocarbons into olefinic, gases, gasoline and other products. Hydro cracking: It is a catalytic cracking process, where it uses hydro cracking to break C – C bonds. Products produced by this process include diesel, jet fuel, and LPG. Steam Cracking: It is a petrochemical process that involves the breakdown of saturated hydrocarbons into smaller unsaturated hydrocarbons. Thermal Cracking: It is a process that involves breaking of large non-volatile hydrocarbons into gasoline. Cracking is a reaction in which greater saturated hydrocarbon molecules are broken down into smaller, more functional hydrocarbon molecules, some of which are unsaturated: alkanes are the initial starting hydrocarbons. Cracking items contain alkanes and alkenes, part of a separate group of homologues. Cracking is a chemical process which is used in oil refining. To produce by-products such as cooking oil, ethanol, liquefied petroleum gas, diesel fuel, jet fuel and other petroleum distillates, cracking removes large hydrocarbon molecules in raw crude oil. Cracking is the mechanism of petrochemistry, petroleum geology, and organic chemistry whereby complicated organic molecules such as kerogens or long-chain hydrocarbons are broken down into simpler molecules such as light hydrocarbons by breaking carbon bonds in the precursors. For two key reasons, cracking is important: It helps balance the availability of fractions with the demand for them. When cracking transforms bigger hydrocarbons into smaller hydrocarbons, the fuel supply is increased. That helps to balance demand with supply. Cracking is the term given for splitting up large clusters of hydrocarbons into smaller and more functional pieces. This is accomplished by using high pressures and temperatures in the presence of a catalyst, without a catalyst, or lower temperatures and pressures. It is only one way this particular molecule could break up. Put your understanding of this concept to test by answering a few MCQs. Click ‘Start Quiz’ to begin! Select the correct answer and click on the “Finish” buttonCheck your score and answers at the end of the quiz Visit BYJU’S for all Chemistry related queries and study materials 0 out of 0 arewrong 0 out of 0 are correct 0 out of 0 are Unattempted View Quiz Answers and Analysis