



Hydrocarbon Chemistry

Eric E. Johnson
ericejohnson.com



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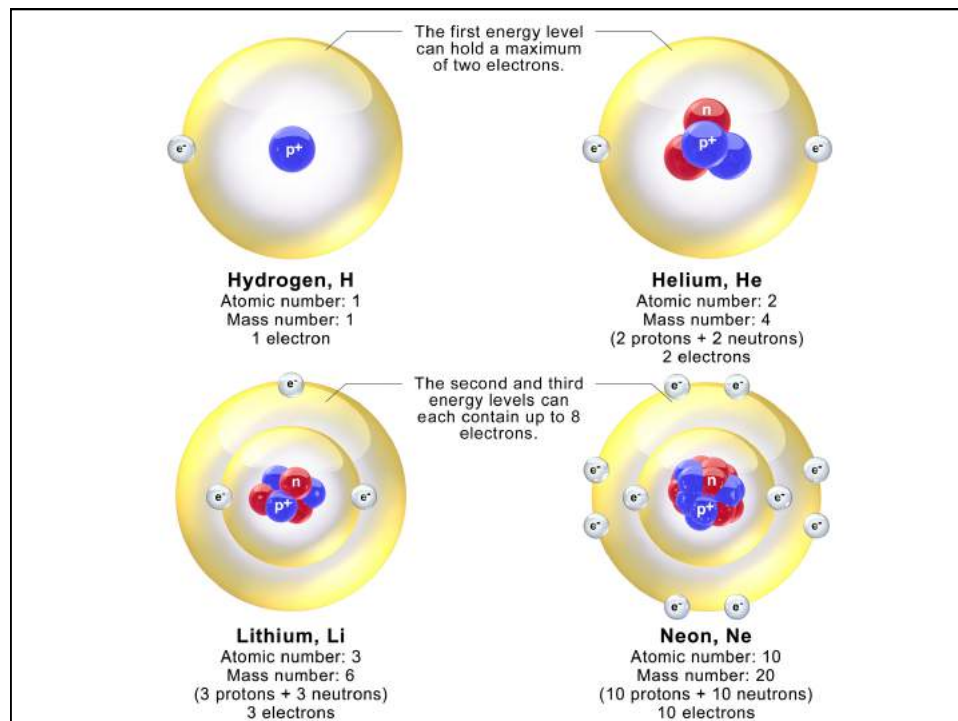
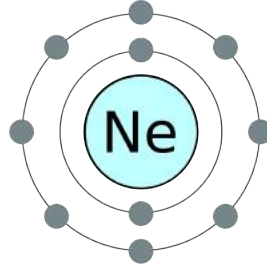
Chemistry

Chemistry revolves around an atom's electrons. An atom's valence electrons determine how that atom combines with other atoms to form molecules.

On a ball-and-stick model, this can be conceptualized and the number of holes in the ball that can serve as connection points, through bonds, to other atoms.

10: Neon

2,8



The first energy level can hold a maximum of two electrons.

Hydrogen, H
Atomic number: 1
Mass number: 1
1 electron

Helium, He
Atomic number: 2
Mass number: 4
(2 protons + 2 neutrons)
2 electrons

The second and third energy levels can each contain up to 8 electrons.

Lithium, Li
Atomic number: 3
Mass number: 6
(3 protons + 3 neutrons)
3 electrons

Neon, Ne
Atomic number: 10
Mass number: 20
(10 protons + 10 neutrons)
10 electrons

Valence electrons

An atom's electrons fill up the lowest levels first before occupying the next level.

Valence electrons are electrons in the atom's outer shell.

An atom "wants" to fill up its outer shell with the full number of electrons for that shell.

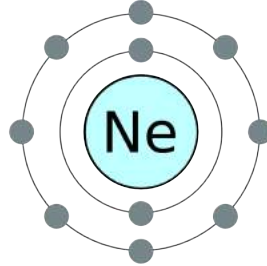
Really, it's more that such a configuration of electrons is more stable.

For our purposes, the first three shells are "filled up" at 2, 8, 8. (Although it's actually more complicated than that.)

hydrogen 1 H 1.008																		helium 2 He 4.0026																	
lithium 3 Li 6.941		beryllium 4 Be 9.0122												boron 5 B 10.811		carbon 6 C 12.011		nitrogen 7 N 14.007		oxygen 8 O 15.999		fluorine 9 F 18.998		neon 10 Ne 20.180											
sodium 11 Na 22.990		magnesium 12 Mg 24.305												aluminum 13 Al 26.982		silicon 14 Si 28.086		phosphorus 15 P 30.974		sulfur 16 S 32.065		chlorine 17 Cl 35.453		argon 18 Ar 39.948											
potassium 19 K 39.098		calcium 20 Ca 40.078		scandium 21 Sc 44.956		titanium 22 Ti 47.88		vanadium 23 V 50.942		chromium 24 Cr 51.996		manganese 25 Mn 54.938		iron 26 Fe 55.845		cobalt 27 Co 58.933		nickel 28 Ni 58.69		copper 29 Cu 63.546		zinc 30 Zn 65.38		gallium 31 Ga 69.723		germanium 32 Ge 72.61		arsenic 33 As 74.922		selenium 34 Se 78.96		bromine 35 Br 79.904		krypton 36 Kr 83.8	
rubidium 37 Rb 85.468		strontium 38 Sr 87.62		yttrium 39 Y 88.906		zirconium 40 Zr 91.224		niobium 41 Nb 92.906		molybdenum 42 Mo 95.94		technetium 43 Tc 98		ruthenium 44 Ru 101.07		rhodium 45 Rh 101.07		palladium 46 Pd 106.42		silver 47 Ag 107.87		cadmium 48 Cd 112.41		indium 49 In 114.82		tin 50 Sn 118.71		antimony 51 Sb 121.76		tellurium 52 Te 127.60		iodine 53 I 126.905		xenon 54 Xe 131.29	
cesium 55 Cs 132.91		barium 56 Ba 137.33		lanthanum 57-70 * 71-88		hafnium 72 Hf 178.49		tantalum 73 Ta 180.95		tungsten 74 W 183.84		rhenium 75 Re 186.21		osmium 76 Os 190.23		iridium 77 Ir 192.22		platinum 78 Pt 195.08		gold 79 Au 196.97		mercury 80 Hg 200.59		thallium 81 Tl 204.38		lead 82 Pb 207.2		bismuth 83 Bi 208.98		polonium 84 Po 209		astatine 85 At 210		radon 86 Rn 222	
francium 87 Fr 223		radium 88 Ra 226		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118	
* Lanthanide series		lanthanum 57 La 138.91		cerium 58 Ce 140.12		praseodymium 59 Pr 140.91		neodymium 60 Nd 144.24		promethium 61 Pm 144.91		samarium 62 Sm 150.36		europium 63 Eu 151.96		gadolinium 64 Gd 157.25		terbium 65 Tb 158.93		dysprosium 66 Dy 162.50		holmium 67 Ho 164.93		erbium 68 Er 167.26		thulium 69 Tm 168.93		ytterbium 70 Yb 173.05		lutetium 71 Lu 174.967		actinide series 89-102 ** 103-118			
** Actinide series		actinium 89 Ac 227		thorium 90 Th 232.04		protactinium 91 Pa 231.04		uranium 92 U 238.03		neptunium 93 Np 237		plutonium 94 Pu 244		americium 95 Am 243		curium 96 Cm 247		berkelium 97 Bk 247		californium 98 Cf 251		einsteinium 99 Es 252		fermium 100 Fm 257		mendelevium 101 Md 258		nobelium 102 No 259		actinide series 89-102 ** 103-118		actinide series 89-102 ** 103-118			

10: Neon

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17: Chlorine **2,8,7**

* Lanthanide series

** Actinide series

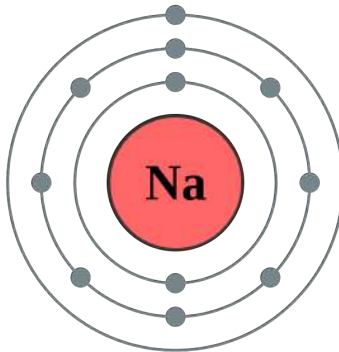
17: Chlorine **2,8,7**

Hydrogen																Helium																															
1																2																															
H																He																															
1.008																4.0026																															
Lithium			Beryllium													Boron			Carbon			Nitrogen			Oxygen			Fluorine			Neon																
3			4													5			6			7			8			9			10																
Li			Be													B			C			N			O			F			Ne																
6.941			9.0122													10.811			12.011			14.007			15.999			18.998			20.180																
11			12													13			14			15			16			17			18																
Na			Mg													Al			Si			P			S			Cl			Ar																
22.990			24.304													26.982			28.086			30.974			32.065			35.453			39.948																
Potassium		Calcium												Scandium		Titanium		Vanadium		Chromium		Manganese		Iron		Cobalt		Nickel		Copper		Zinc		Gallium		Germanium		Arsenic		Selenium		Bromine		Krypton			
19		20												21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36			
K		Ca												Sc		Ti		V		Cr		Mn		Fe		Co		Ni		Cu		Zn		Ga		Ge		As		Se		Br		Kr			
39.098		40.078												44.956		47.883		50.942		51.996		54.938		55.845		58.933		58.933		63.546		63.546		65.38		69.723		72.64		74.922		78.96		79.904		83.80	
37		38												39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54			
Rb		Sr												Y		Zr		Nb		Mo		Tc		Ru		Rh		Pd		Ag		Cd		In		Sn		Sb		Te		I		Xe			
85.468		87.62												88.906		91.224		92.906		95.94		98		101.07		101.07		106.42		107.87		112.41		114.82		118.71		121.76		127.60		131.29					
55		56												57-70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86	
Cs		Ba												* Lu		Hf		Ta		W		Re		Os		Ir		Pt		Au		Hg		Tl		Pb		Bi		Po		At		Rn			
132.91		137.33												174.927		178.49		180.95		183.84		186.21		188.91		190.22		193.08		196.97		200.59		204.38		207.2		208.98		208.98		222					
87		88												89-102		103		104		105		106		107		108		109		110		111		112		113		114		115		116		118			
Fr		Ra												** **		Lr		Rf		Db		Sg		Bh		Hs		Mt		Uun		Uuu		Uub		Nh		Fl		Mc		Lv		Ts		Og	
223		226												262		261		263		265		267		269		271		273		275		277		281		283		285		287		291					

* Lanthanide series													
57	58	59	60	61	62	63	64	65	66	67	68	69	70
La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb
138.91	140.12	140.91	144.24	144.91	150.36	151.96	157.25	158.93	162.50	164.93	167.26	168.93	173.04
89	90	91	92	93	94	95	96	97	98	99	100	101	102
Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No
227	232.04	231.04	238.03	237.04	244	243	247	247	251	252	257	259	259

11: Sodium

2,8,1



Hydrogen																Helium																			
H																He																			
1.008																4.0026																			
Lithium			Beryllium						Boron			Carbon			Nitrogen			Oxygen			Fluorine			Neon											
Li			Be						B			C			N			O			F			Ne											
6.941			9.0122						10.811			12.011			14.007			15.999			18.998			20.180											
11			12						13			14			15			16			17			18											
Sodium			Magnesium						Aluminum			Silicon			Phosphorus			Sulfur			Chlorine			Argon											
Na			Mg						Al			Si			P			S			Cl			Ar											
22.990			24.305						26.982			28.086			30.974			32.065			35.453			39.948											
Potassium		Calcium		Scandium		Titanium		Vanadium		Chromium		Manganese		Iron		Cobalt		Nickel		Copper		Zinc		Gallium		Germanium		Arsenic		Selenium		Bromine		Krypton	
K		Ca		Sc		Ti		V		Cr		Mn		Fe		Co		Ni		Cu		Zn		Ga		Ge		As		Se		Br		Kr	
39.098		40.078		44.956		47.883		50.942		51.996		54.938		55.845		58.933		58.933		63.546		65.38		69.723		72.631		74.922		78.96		83.80		83.80	
37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54	
Rubidium		Strontium		Yttrium		Zirconium		Niobium		Molybdenum		Technetium		Ruthenium		Rhodium		Palladium		Silver		Cadmium		Indium		Tin		Antimony		Tellurium		Iodine		Xenon	
Rb		Sr		Y		Zr		Nb		Mo		Tc		Ru		Rh		Pd		Ag		Cd		In		Sn		Sb		Te		I		Xe	
85.468		87.62		88.906		91.224		92.906		95.94		98		101.07		101.07		106.32		106.32		107.868		112.41		117.42		118.71		121.76		127.60		131.29	
55		56		57-70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85	
Cesium		Barium		* * *		Lanthanum		Hafnium		Tantalum		Tungsten		Rhenium		Osmium		Iridium		Platinum		Gold		Mercury		Thallium		Lead		Bismuth		Polonium		Astatine	
Cs		Ba		* * *		Lu		Hf		Ta		W		Re		Os		Ir		Pt		Au		Hg		Tl		Pb		Bi		Po		At	
132.91		137.33		137.33		174.967		178.49		180.95		183.84		186.21		190.23		192.22		195.08		196.967		200.59		204.38		208.98		208.98		209		210	
87		88		89-102		89-102		102		104		106		108		110		112		114		116		118		120		122		124		126		128	
Francium		Radium		* * *		Actinium		Thorium		Protactinium		Uranium		Neptunium		Plutonium		Americium		Curium		Berkelium		Californium		Einsteinium		Fermium		Mendelevium		Nobelium		Lawrencium	
Fr		Ra		* * *		Ac		Th		Pa		U		Np		Pu		Am		Cm		Bk		Cf		Es		Fm		Md		Lv		Ts	
223		226		227		227		232		231.04		238.03		237.05		244		243		247		247		251		252		257		259		261		261	

* Lanthanide series											
Lanthanum		Cerium		Praseodymium		Neodymium		Promethium		Samarium	
La		Ce		Pr		Nd		Pm		Sm	
138.91		140.12		140.91		144.24		144.91		150.36	
57		58		59		60		61		62	
Europium		Gadolinium		Terbium		Dysprosium		Holmium		Erbium	
Eu		Gd		Tb		Dy		Ho		Er	
151.96		157.25		158.93		162.50		164.93		167.26	
63		64		65		66		67		68	
Ytterbium		Lutetium		Hafnium		Tantalum		Rhenium		Osmium	
Yb		Lu		Hf		Ta		Re		Os	
173.05		174.967		178.49		180.95		186.21		190.23	
70		71		72		73		74		75	
Francium		Radium		Actinium		Thorium		Protactinium		Uranium	
Fr		Ra		Ac		Th		Pa		U	
223		226		227		232		231.04		238.03	

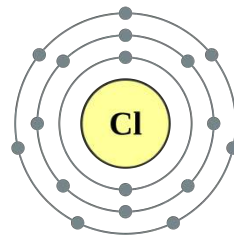
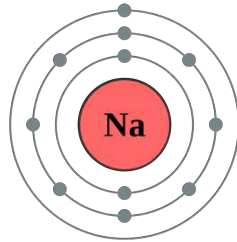
** Actinide series											
Actinium		Thorium		Protactinium		Uranium		Neptunium		Plutonium	
Ac		Th		Pa		U		Np		Pu	
227		232.04		231.04		238.03		237.05		244	
89		90		91		92		93		94	
Americium		Curium		Berkelium		Californium		Einsteinium		Fermium	
Am		Cm		Bk		Cf		Es		Fm	
243		247		247		251		252		257	

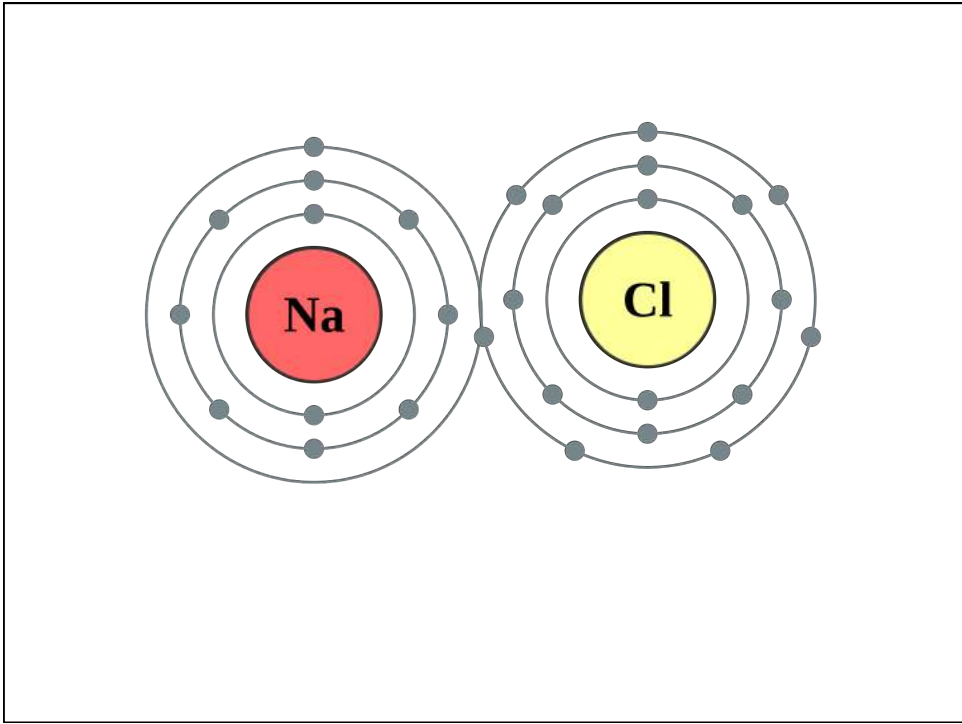
11: Sodium

2,8,1

17: Chlorine

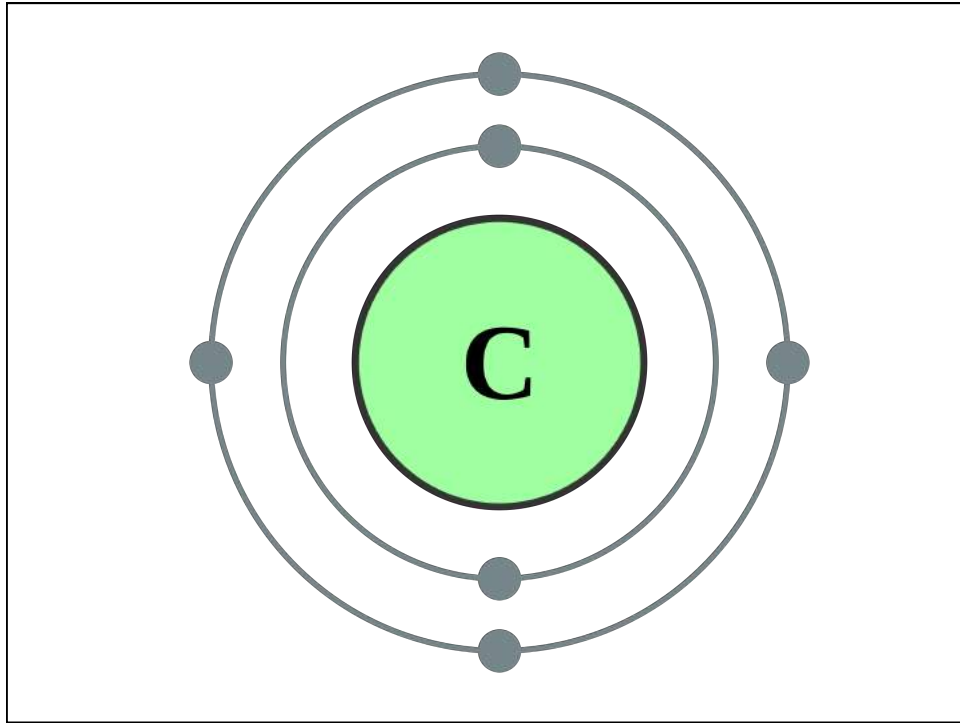
2,8,7



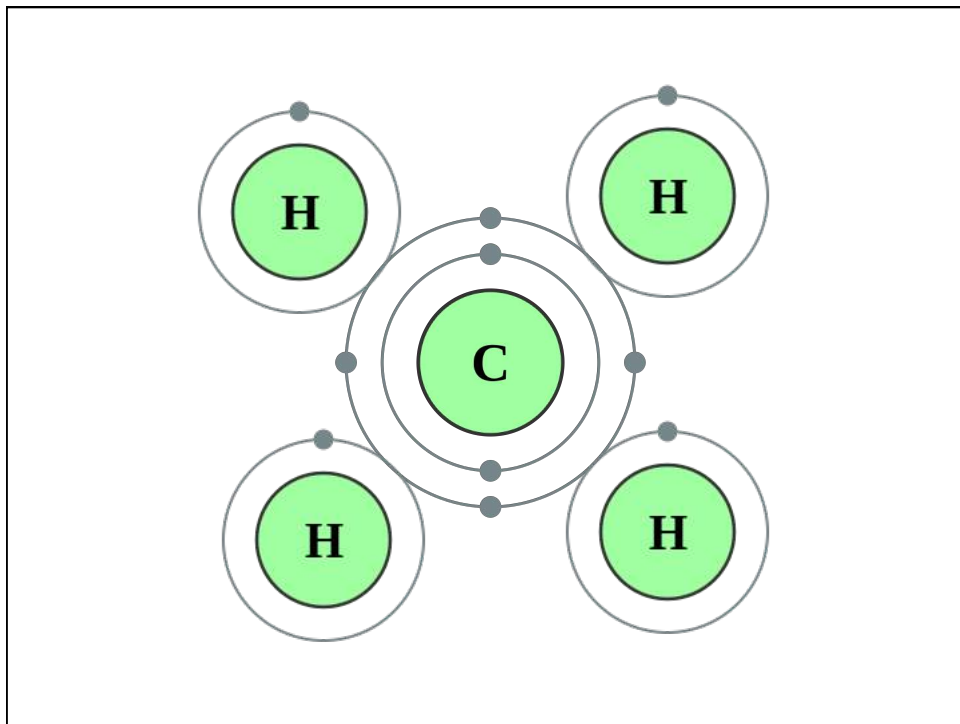
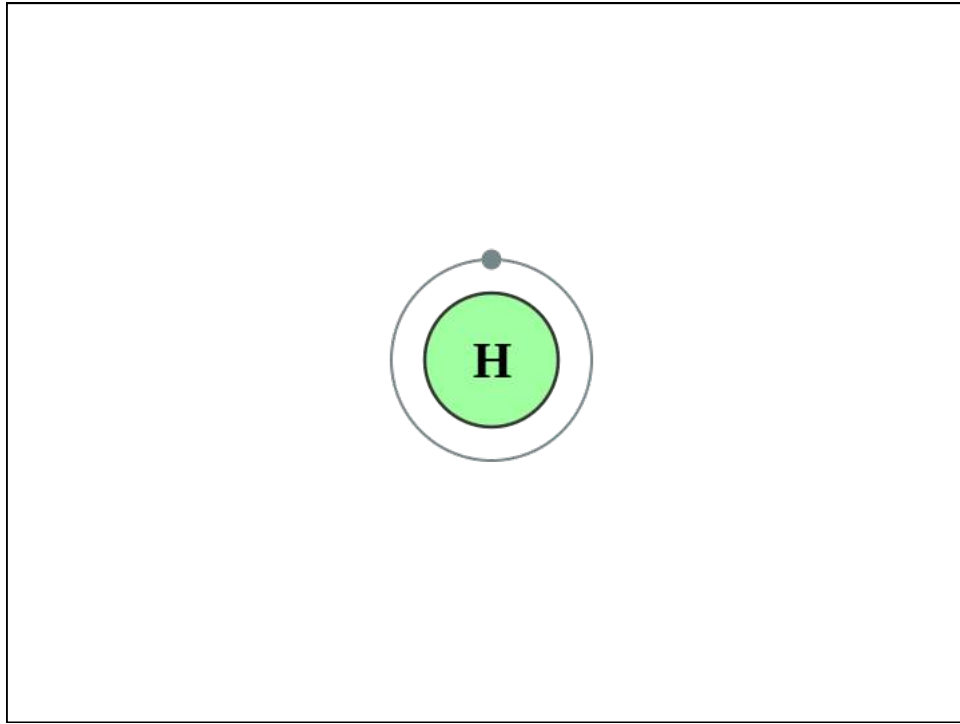


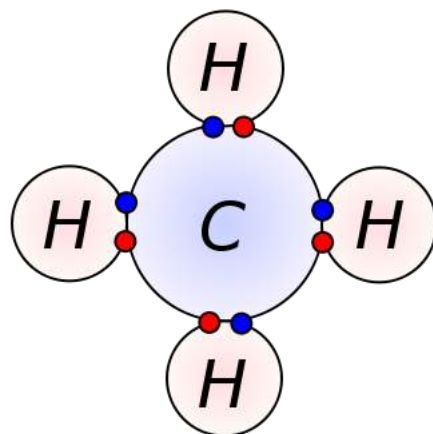
Hydrogen																Helium																					
H																He																					
1.008																4.0026																					
3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18							
Li		Be		B		C		N		O		F		Ne		Na		Mg		Al		Si		P		S		Cl		Ar							
6.941		9.0122		10.811		12.011		14.007		15.999		18.998		20.180		22.990		24.305		26.982		28.086		30.974		32.065		35.453		39.948							
11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26							
K		Ca		Sc		Ti		V		Cr		Mn		Fe		Co		Ni		Cu		Zn		Ga		Ge		As		Se		Br		Kr			
39.098		40.078		44.956		47.88		50.942		51.996		54.938		55.845		58.933		58.933		63.546		65.38		69.723		72.63		74.922		78.94		79.904		83.80			
37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54			
Rb		Sr		Y		Zr		Nb		Mo		Tc		Ru		Rh		Pd		Ag		Cd		In		Sn		Sb		Te		I		Xe			
85.468		87.62		88.906		91.224		92.906		95.94		98		101.07		101.07		106.42		107.87		112.41		114.82		118.71		127.46		126.905		131.29		132.905			
55		56		57-70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86	
Cs		Ba		* *		Lu		Hf		Ta		W		Re		Os		Ir		Pt		Au		Hg		Tl		Pb		Bi		Po		At		Rn	
132.91		137.33		137.33		174.927		178.49		180.948		183.84		186.21		190.23		190.22		195.08		196.967		200.59		204.38		208.98		208.98		210		210		222	
87		88		89-102		103		104		105		106		107		108		109		110		111		112		113		114		115		116		117		118	
Fr		Ra		* *		Lr		Rf		Db		Sg		Bh		Hs		Mt		Uun		Uuu		Uub		Nh		Fl		Mc		Lv		Ts		Og	
102		103		103		103		103		103		103		103		103		103		103		103		103		103		103		103		103		103		103	

* Lanthanide series											
57											
La											
138.905											
58											
Ce											
140.12											
59											
Pr											
140.908											
60											
Nd											
144.24											
61											
Pm											
144.913											
62											
Sm											
150.36											
63											
Eu											
151.964											
64											
Gd											
157.25											
65											
Tb											
158.925											
66											
Dy											
162.50											
67											
Ho											
164.930											
68											
Er											
167.259											
69											
Tm											
168.930											
70											
Yb											
173.054											
71											
Lu											
174.967											
72											
Hf											
178.49											
73											
Ta											
180.948											
74											
W											
183.84											
75											
Re											
186.21											
76											
Os											
190.23											
77											
Ir											
192.22											
78											
Pt											
195.08											
79											
Au											
196.967											
80											
Hg											
200.59											
81											
Tl											
204.38											
82											
Pb											
207.2											
83											
Bi											
208.98											
84											
Po											
209											
85											
At											
210											
86											
Rn											
222											
87											
Fr											
223											
88											
Ra											
226											
89-102											
* *											
103											
Lr											
103											
Rf											
103											
Db											
103											
Sg											
103											
Bh											
103											
Hs											
103											
Mt											
103											
Uun											
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103											
Nh											
103											
Fl											
103											
Mc											
103											
Lv											
103											
Ts											
103											
Og											
103											



Hydrogen																		Helium																																									
1 H 1.008																		2 He 4.0026																																									
Lithium				Beryllium				Boron				Carbon				Nitrogen				Oxygen				Fluorine				Neon																															
3 Li 6.941				4 Be 9.0122				5 B 10.811				6 C 12.011				7 N 14.007				8 O 15.999				9 F 18.998				10 Ne 20.180																															
Sodium				Magnesium				Aluminum				Silicon				Phosphorus				Sulfur				Chlorine				Argon																															
11 Na 22.990				12 Mg 24.305				13 Al 26.982				14 Si 28.086				15 P 30.974				16 S 32.065				17 Cl 35.453				18 Ar 39.948																															
Potassium		Calcium		Scandium		Titanium		Vanadium		Chromium		Manganese		Iron		Cobalt		Nickel		Copper		Zinc		Gallium		Germanium		Arsenic		Selenium		Bromine		Krypton																									
19 K 39.098		20 Ca 40.078		21 Sc 44.956		22 Ti 47.88		23 V 50.942		24 Cr 51.996		25 Mn 54.938		26 Fe 55.845		27 Co 58.933		28 Ni 58.693		29 Cu 63.546		30 Zn 65.38		31 Ga 69.723		32 Ge 72.64		33 As 74.922		34 Se 78.96		35 Br 79.904		36 Kr 83.80																									
Rubidium		Strontium		Yttrium		Zirconium		Niobium		Molybdenum		Technetium		Ruthenium		Rhodium		Palladium		Silver		Cadmium		Indium		Tin		Antimony		Tellurium		Iodine		Xenon																									
37 Rb 85.468		38 Sr 87.62		39 Y 88.906		40 Zr 91.224		41 Nb 92.906		42 Mo 95.94		43 Tc 98		44 Ru 101.07		45 Rh 101.07		46 Pd 106.42		47 Ag 107.87		48 Cd 112.41		49 In 114.82		50 Sn 118.71		51 Sb 121.76		52 Te 127.6		53 I 126.905		54 Xe 131.29																									
Cesium		Barium		* 57-70		Lanthanum		Hafnium		Tantalum		Tungsten		Rhenium		Osmium		Iridium		Platinum		Gold		Mercury		Thallium		Lead		Bismuth		Polonium		Astatine																									
55 Cs 132.91		56 Ba 137.33		* * 89-102		57 La 138.905		72 Hf 178.49		73 Ta 180.948		74 W 183.84		75 Re 186.21		76 Os 190.23		77 Ir 192.22		78 Pt 195.08		79 Au 196.967		80 Hg 200.59		81 Tl 204.38		82 Pb 207.2		83 Bi 208.98		84 Po 209		85 At 210		86 Rn 222																							
Francium		Radium		* * 89-102		Lr		Rf		Db		Sg		Bh		Hs		Mt		Uun		Uuu		Uub		Nh		Fl		Mc		Lv		Ts		Og																							
87 Fr 102		88 Ra 125		* * 89-102		103 Lr 103		104 Rf 104		105 Db 105		106 Sg 106		107 Bh 107		108 Hs 108		109 Mt 109		110 Uun 110		111 Uuu 111		112 Uub 112		113 Nh 113		114 Fl 114		115 Mc 115		116 Lv 116		117 Ts 117		118 Og 118																							
* Lanthanide series		57 La 138.91		58 Ce 140.12		59 Pr 140.91		60 Nd 144.24		61 Pm 144.91		62 Sm 150.36		63 Eu 151.96		64 Gd 157.25		65 Tb 158.93		66 Dy 162.50		67 Ho 164.93		68 Er 167.26		69 Tm 168.93		70 Yb 173.05		* Actinide series		89 Ac 122		90 Th 232.04		91 Pa 231.04		92 U 238.03		93 Np 237		94 Pu 244		95 Am 243		96 Cm 247		97 Bk 247		98 Cf 251		99 Es 252		100 Fm 257		101 Md 258		102 No 259	



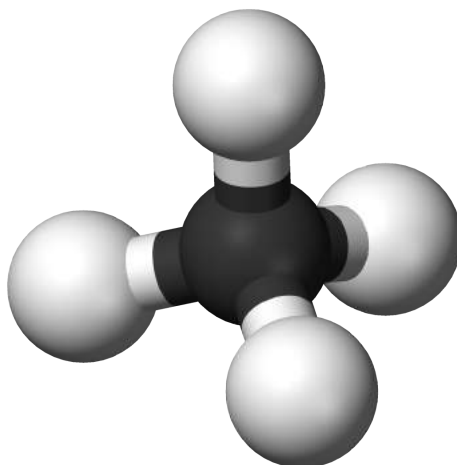


- Electron from hydrogen
- Electron from carbon

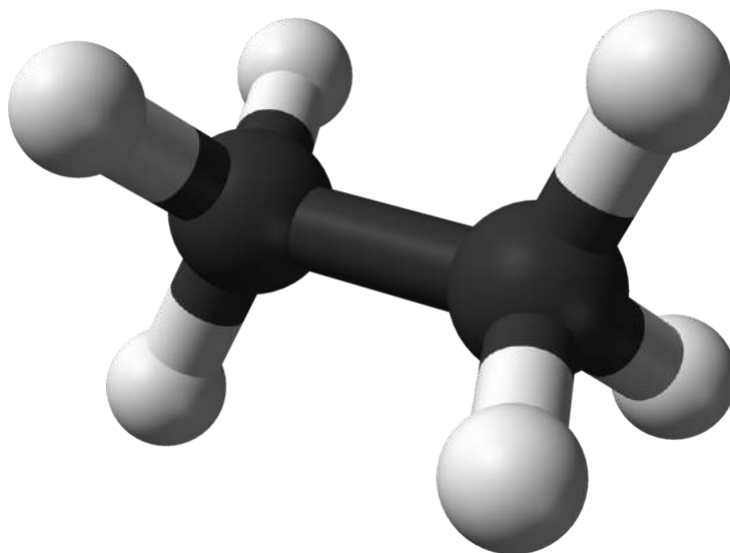
Hydrocarbons

Hydrocarbons are molecules composed entirely of carbon atoms and hydrogen atoms.

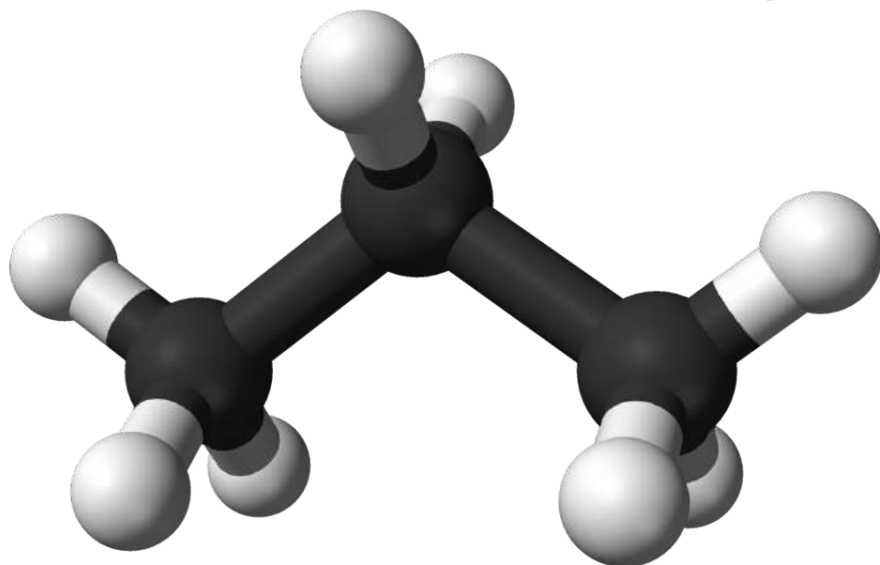
Methane



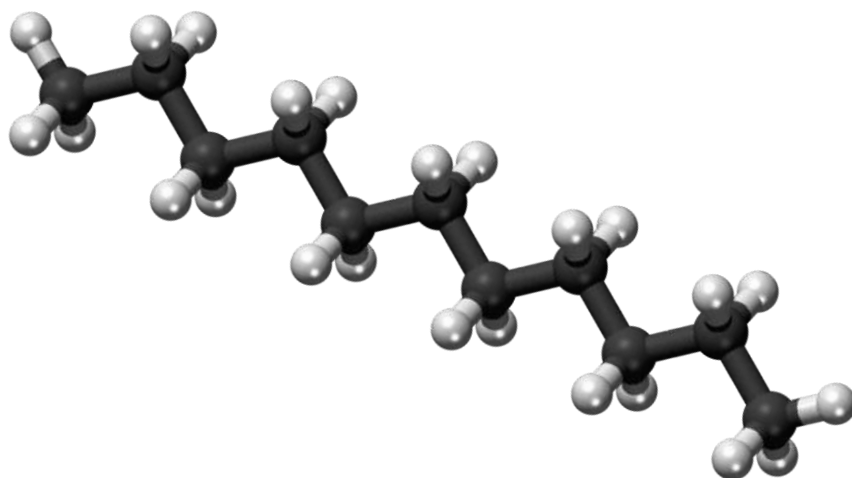
Ethane



Propane



Undecane

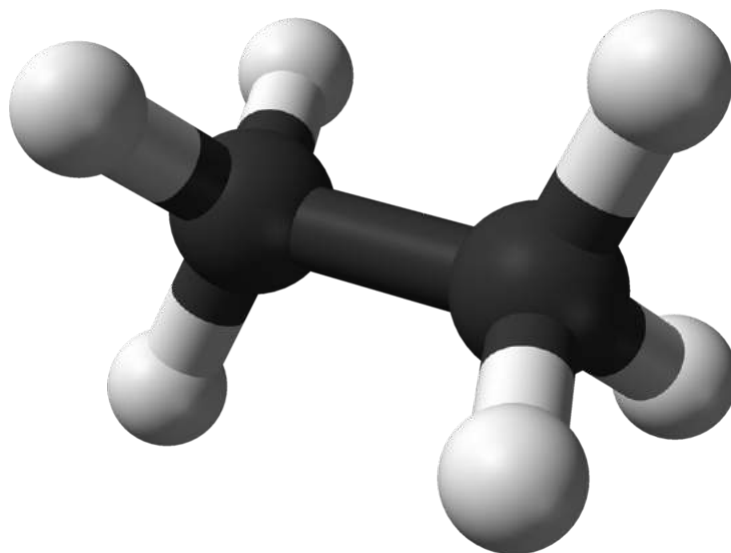


Hydrocarbons

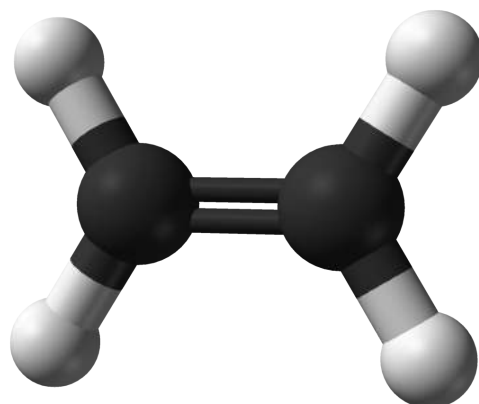
Hydrocarbons are molecules composed entirely of carbon atoms and hydrogen atoms.

A carbon atom is capable of bonding not only to hydrogen atoms but also to other carbon atoms, so there are essentially limitless varieties of hydrocarbons.

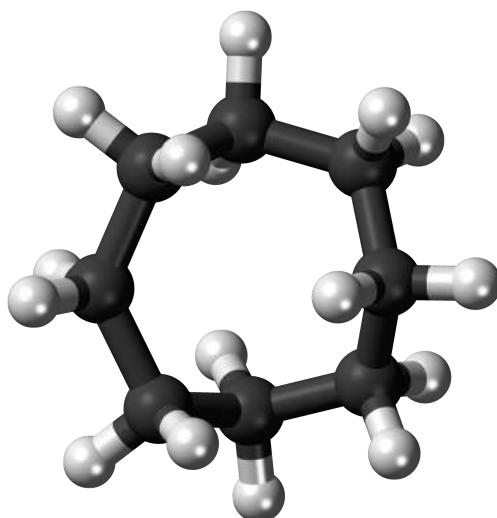
Ethane



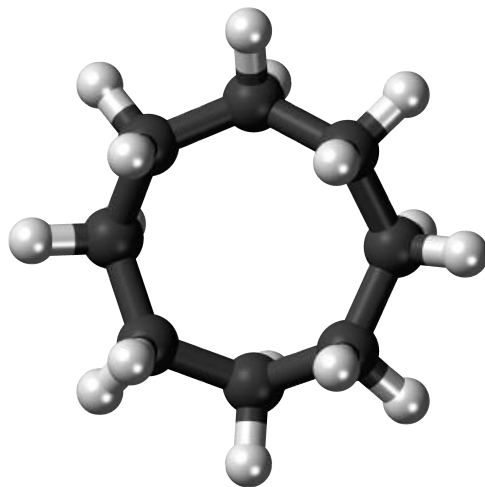
Ethylene



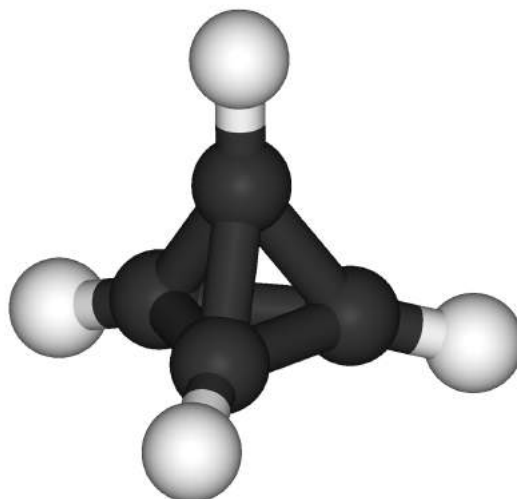
Cyclooctane



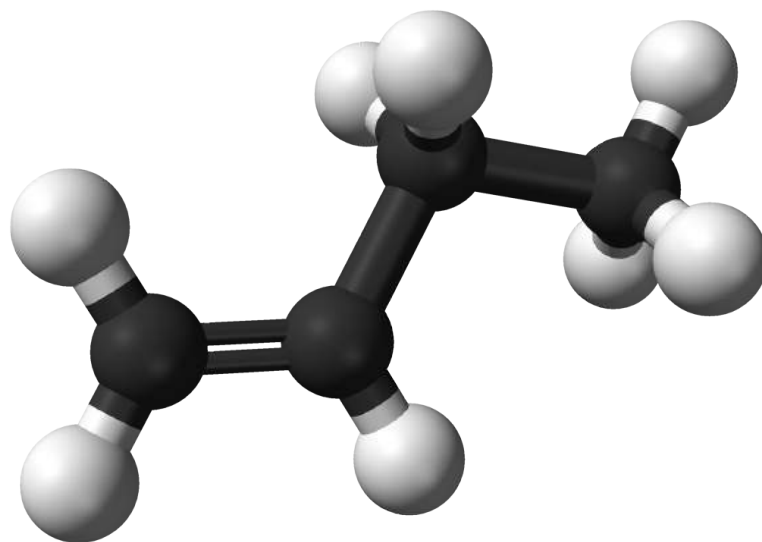
Cyclooctane



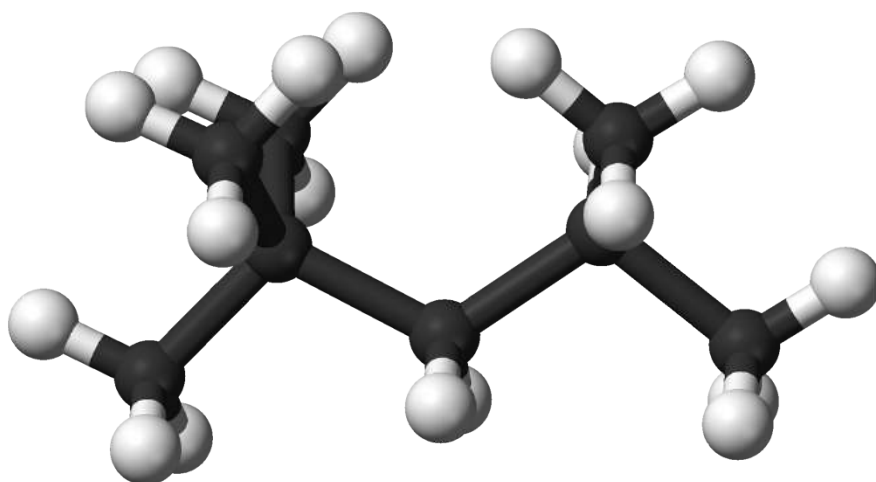
Tetrahydrane

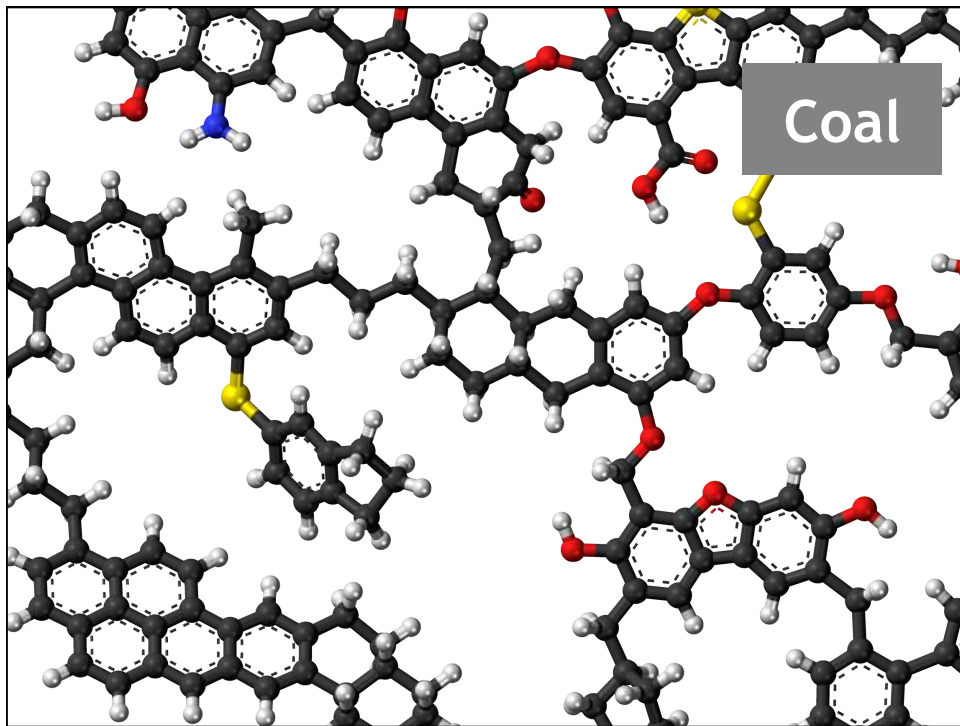
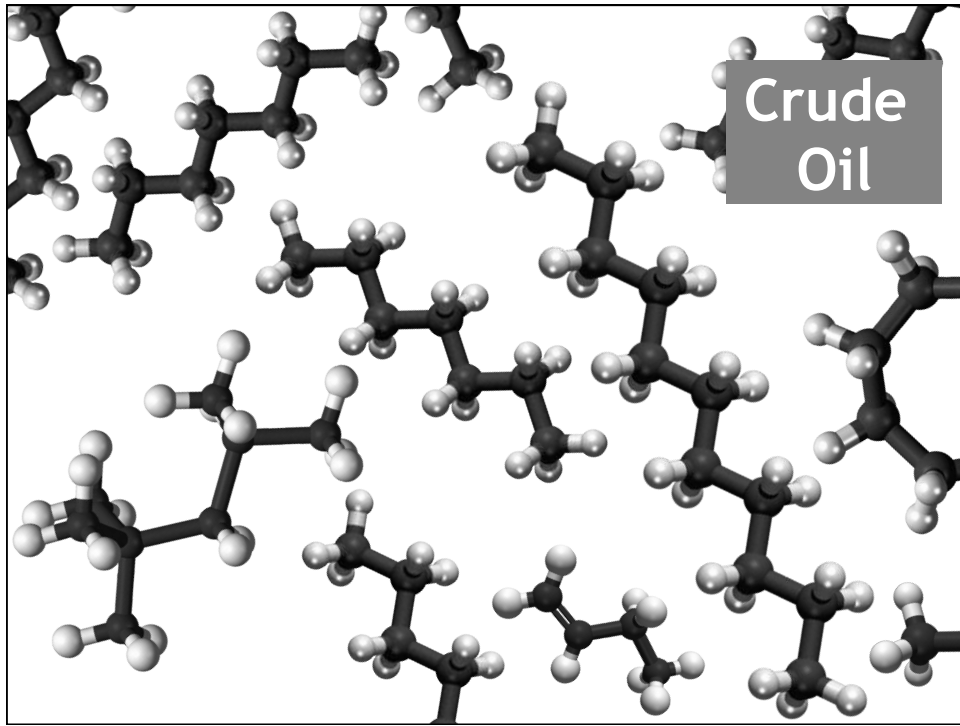


Ethylethylene



Isooctane





Some types of hydrocarbons by chemical bonds

Alkanes - only single bonds, no rings

Cycloalkanes - online single bonds, 1 ring

Alkenes - at least one carbon-carbon
double bond

Alkynes - at least one carbon-carbon
triple bond

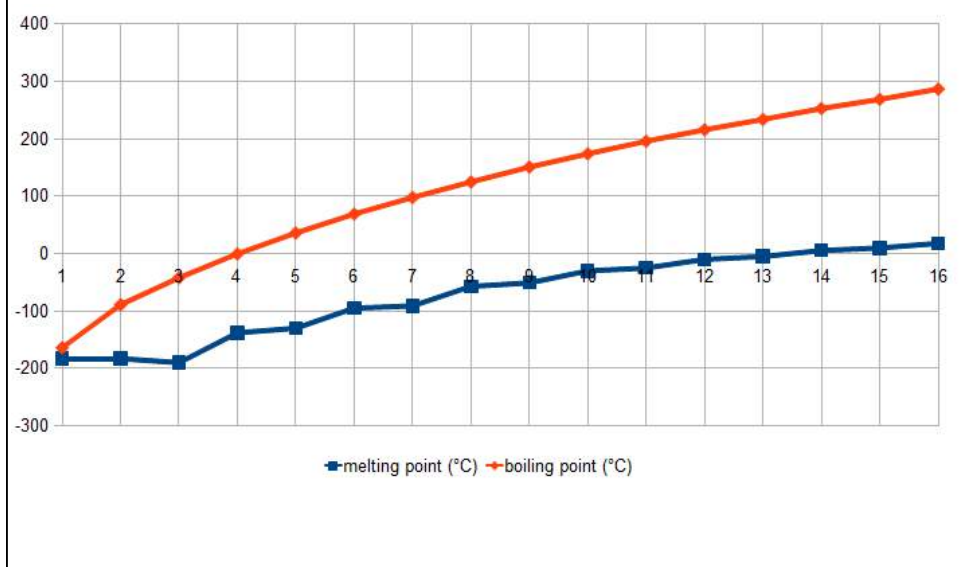
Some types of alkanes by melting, boiling point

Gas - e.g., methane, propane




Liquid - e.g., hexane, heptane, octane

Wax - e.g., triacontane, pentacosane,
heptatriacontane

Some types of alkanes by melting, boiling point

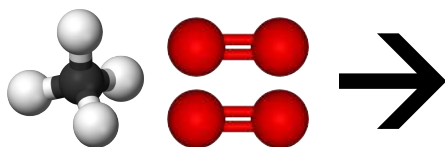
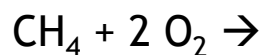


Alkanes by numbers of carbon atoms	1	2	3	4	5	6	7	8	9	20	30	40
	CH ₄	C ₂ H ₆	C ₃ H ₈	C ₄ H ₁₀	C ₅ H ₁₂	C ₆ H ₁₄	C ₇ H ₁₆	C ₈ H ₁₈	C ₉ H ₂₀	C ₂₀ H ₄₂	C ₃₀ H ₆₂	C ₄₀ H ₈₂
	methane	ethane	propane	butane	pentane	hexane	heptane	octane	decane	icosane	triacontane	tetracontane

	1	CH ₄	methane	GASES
	2	C ₂ H ₆	ethane	
	3	C ₃ H ₈	propane	
	4	C ₄ H ₁₀	butane	
	5	C ₅ H ₁₂	pentane	LIQUIDS
	6	C ₆ H ₁₄	hexane	
	7	C ₇ H ₁₆	heptane	
	8	C ₈ H ₁₈	octane	
	9	C ₉ H ₂₀	decane	WAXES
	20	C ₂₀ H ₄₂	icosane	
	30	C ₃₀ H ₆₂	triacontane	
	40	C ₄₀ H ₈₂	tetracontane	

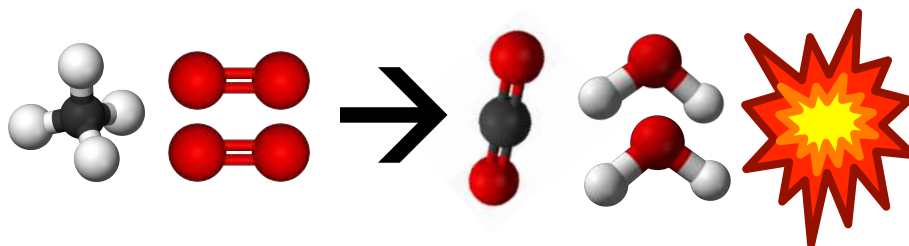
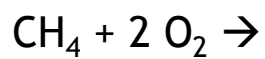
Combustion of hydrocarbons

Combustion of methane:



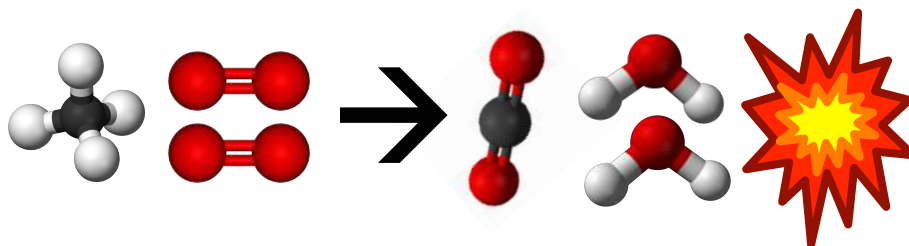
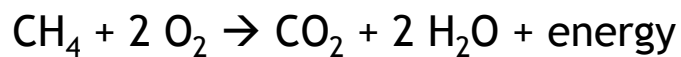
Combustion of hydrocarbons

Combustion of methane:



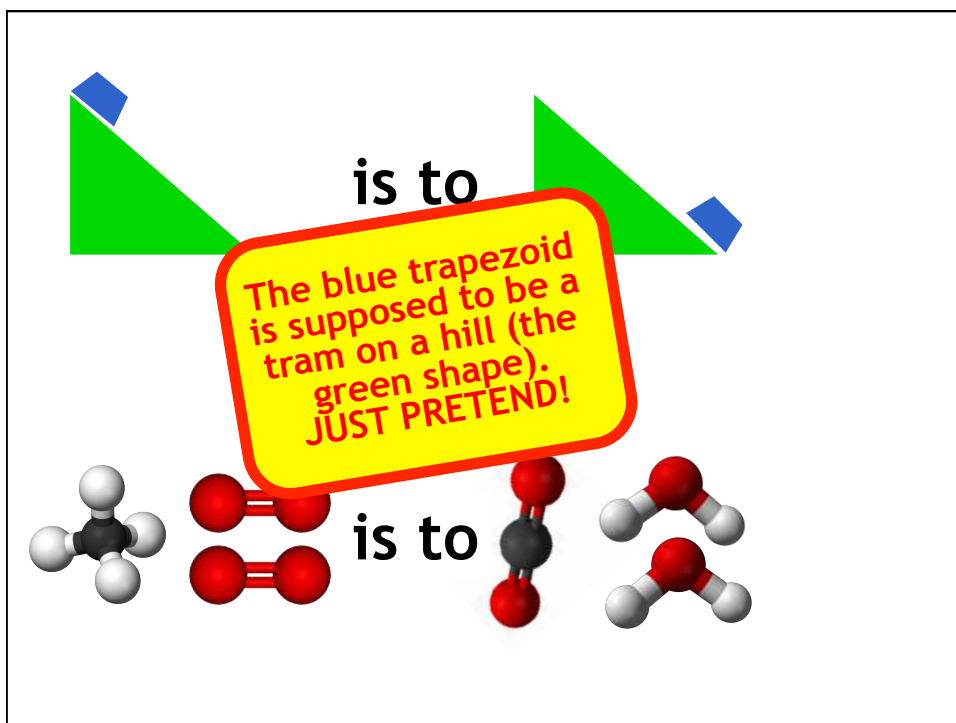
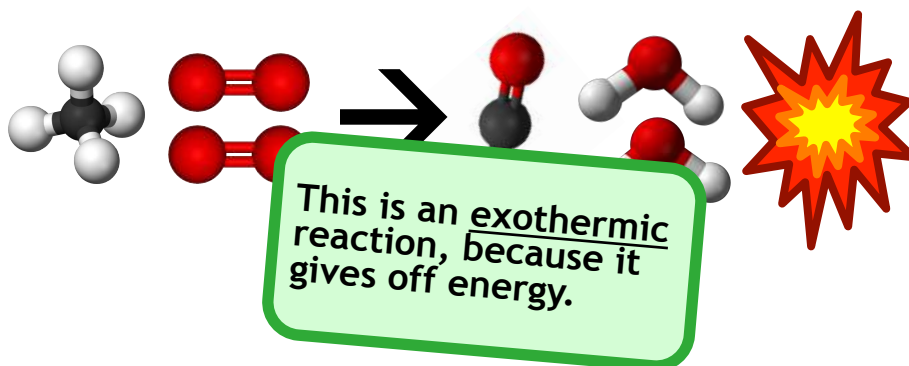
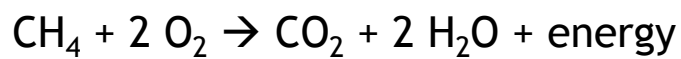
Combustion of hydrocarbons

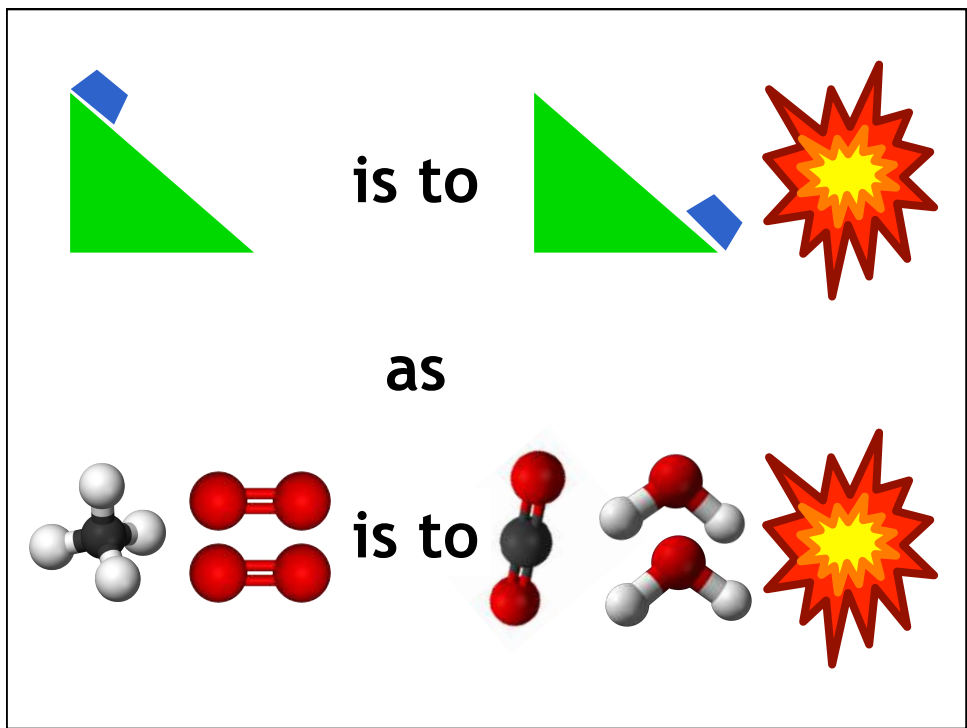
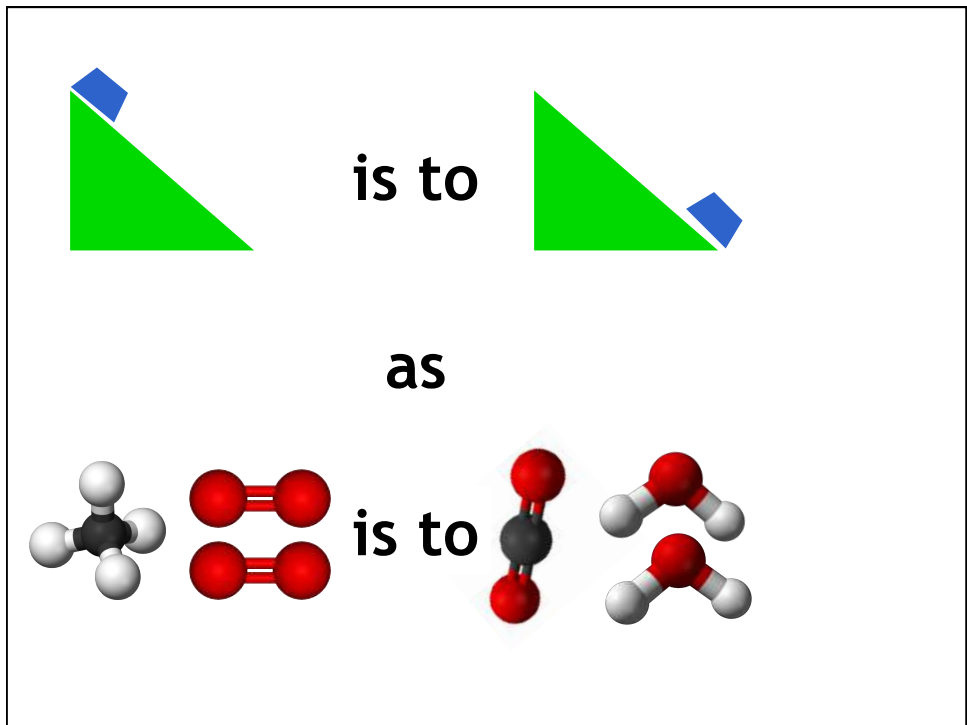
Combustion of methane:



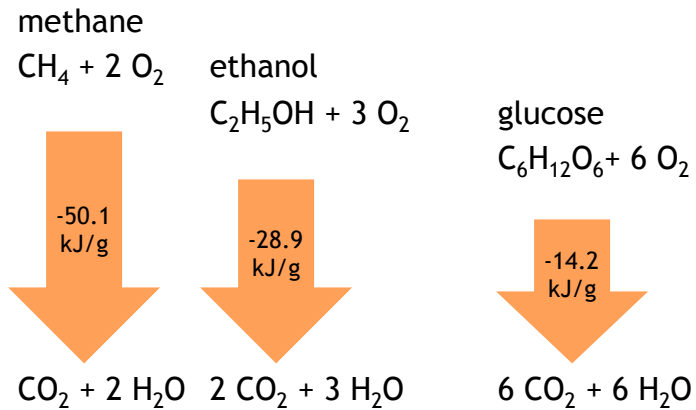
Combustion of hydrocarbons

Combustion of methane:



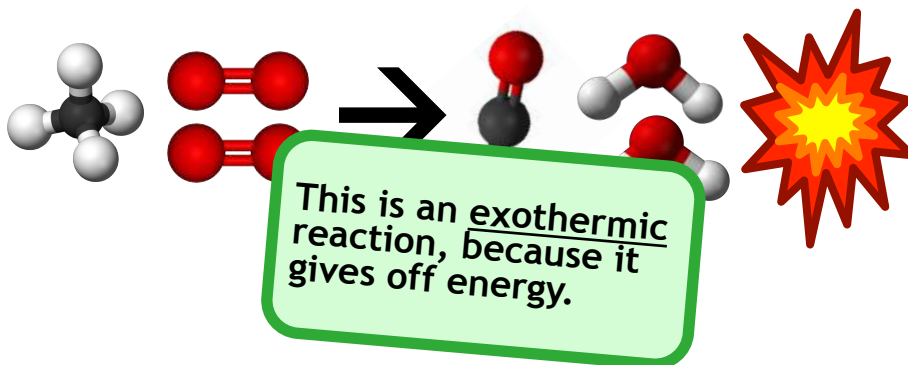
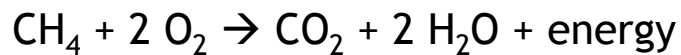


Energy differences



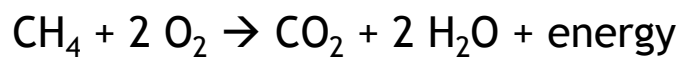
Combustion of hydrocarbons

Combustion of methane:



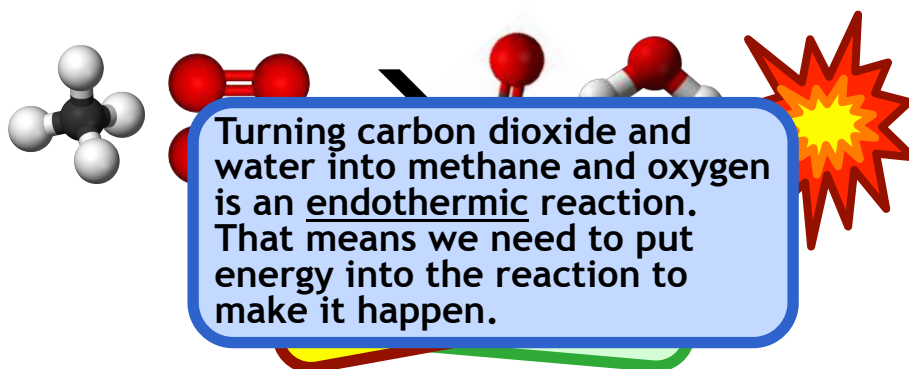
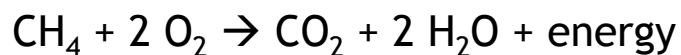
Combustion of hydrocarbons

Combustion of methane:



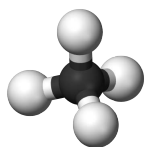
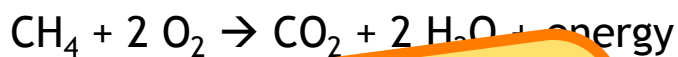
Combustion of hydrocarbons

Combustion of methane:



Combustion of hydrocarbons

Combustion of methane:



What could supply the energy needed to turn more stable molecules with less energetic bonds into less stable bonds with energetic hydrogen-carbon bonds?
The sun!



Some types of hydrocarbons by chemical bonds

Alkanes - only single bonds, no rings

Cycloalkanes - online single bonds, 1 ring

Alkenes - at least one carbon-carbon double bond

Alkynes - at least one carbon-carbon triple bond

Some types of hydrocarbons by chemical bonds

Alkanes - only single bonds, no rings

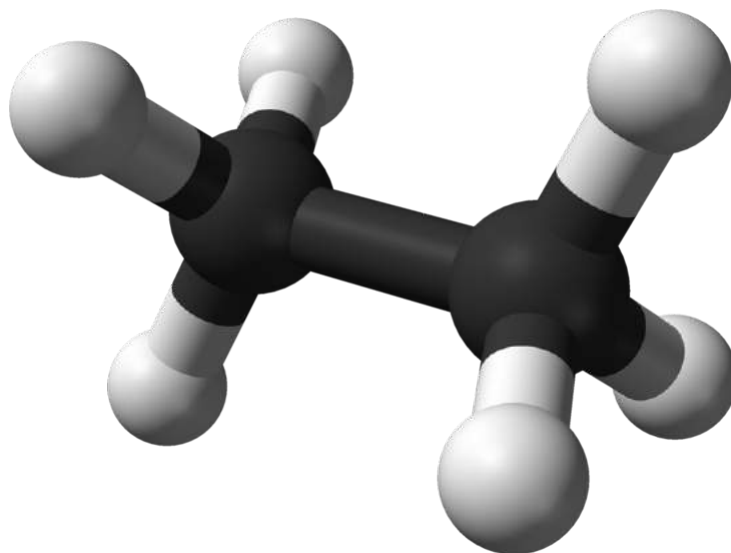
Cycloalkanes - online single bonds, 1 ring

Alkenes - at least one carbon-carbon
double bond

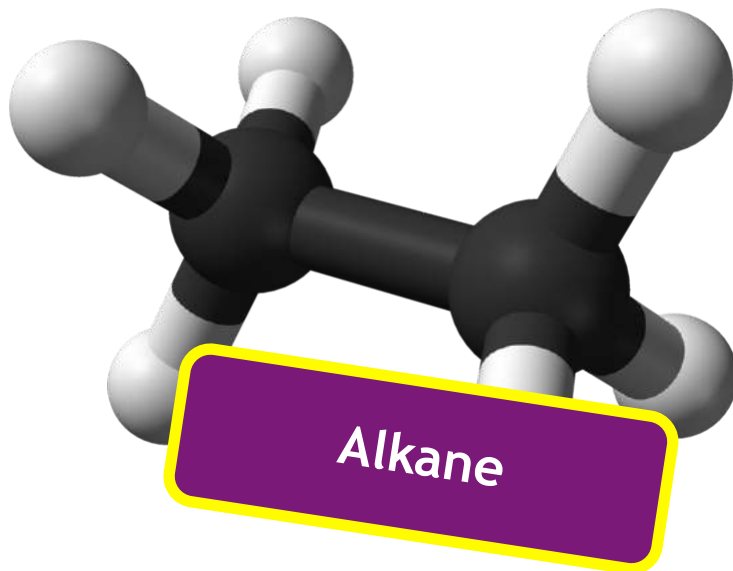
Alkynes - at least one carbon-carbon
triple bond

Can you
categorize the
following?

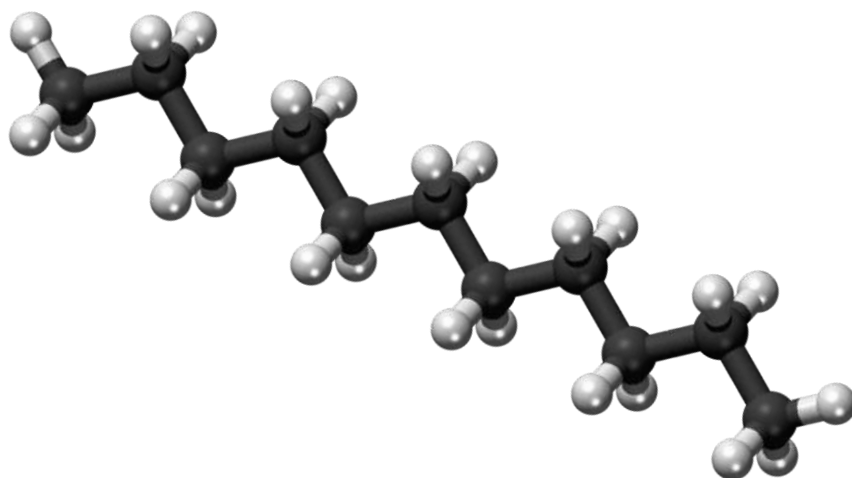
Ethane



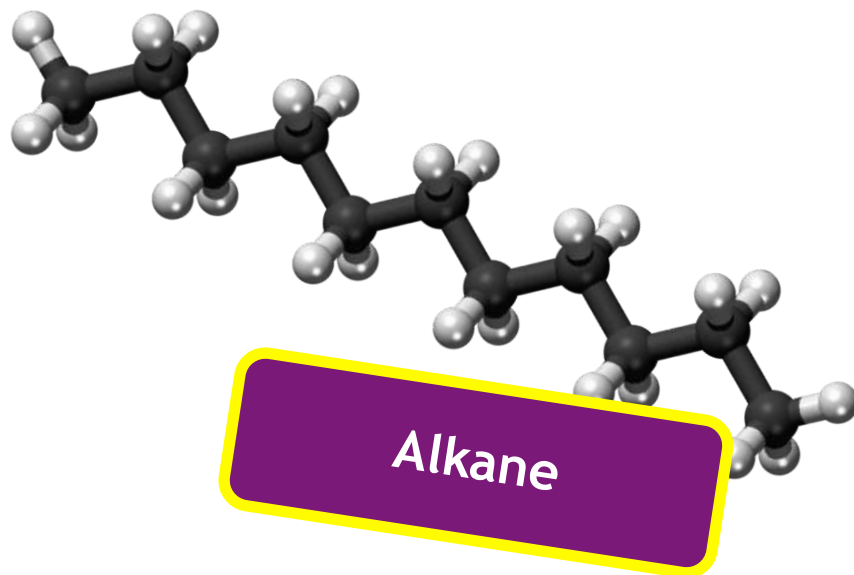
Ethane



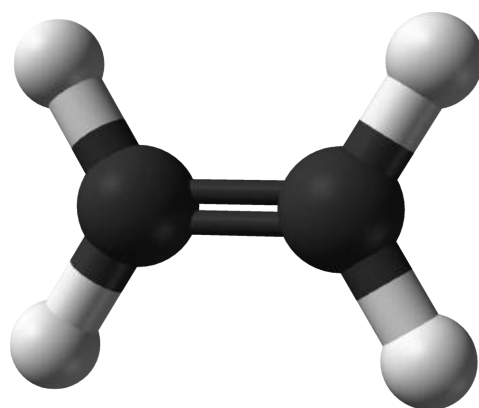
Undecane



Undecane



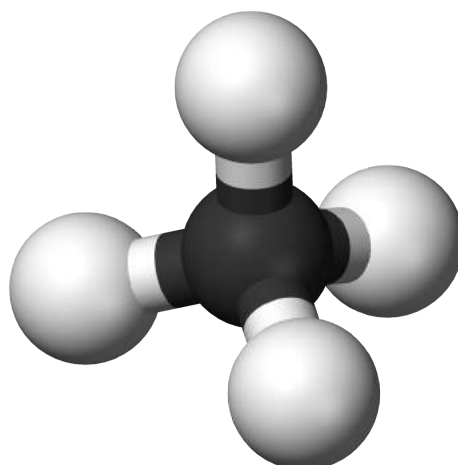
Ethylene



Ethylene



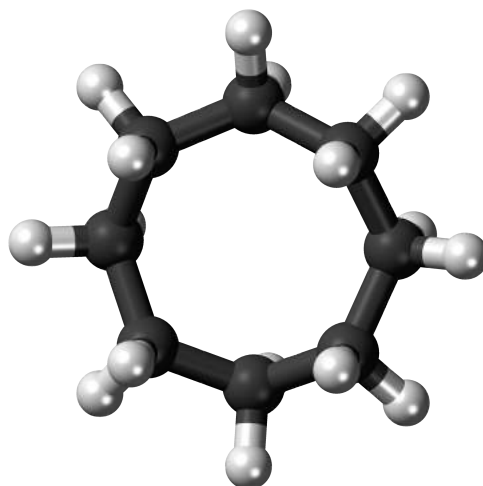
Methane



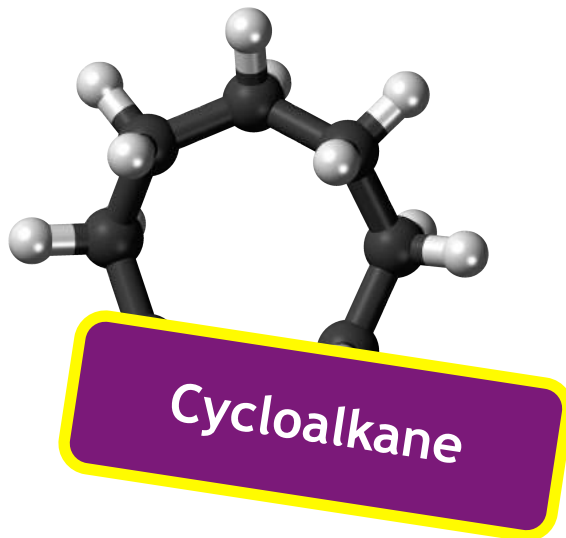
Methane



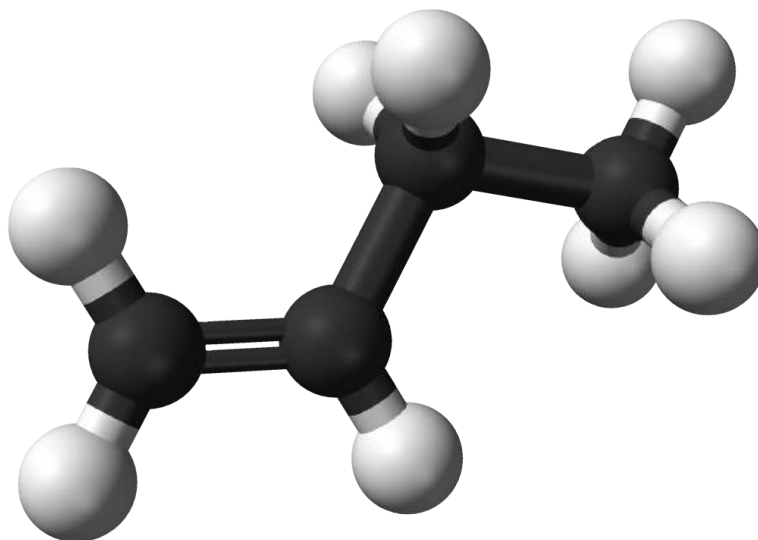
Cyclooctane



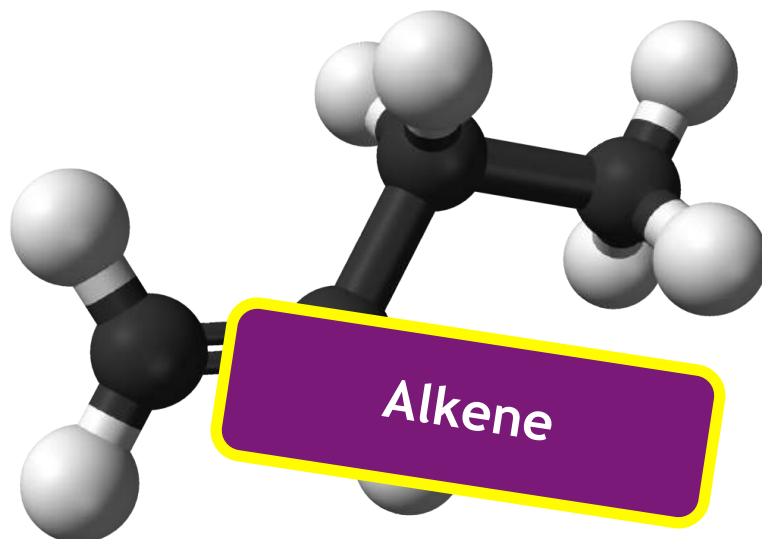
Cyclooctane



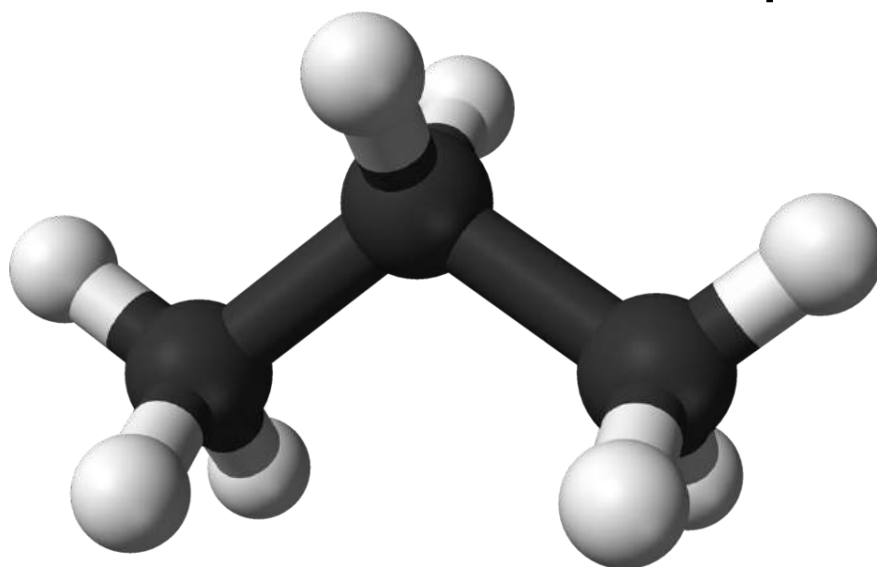
Ethylethylene



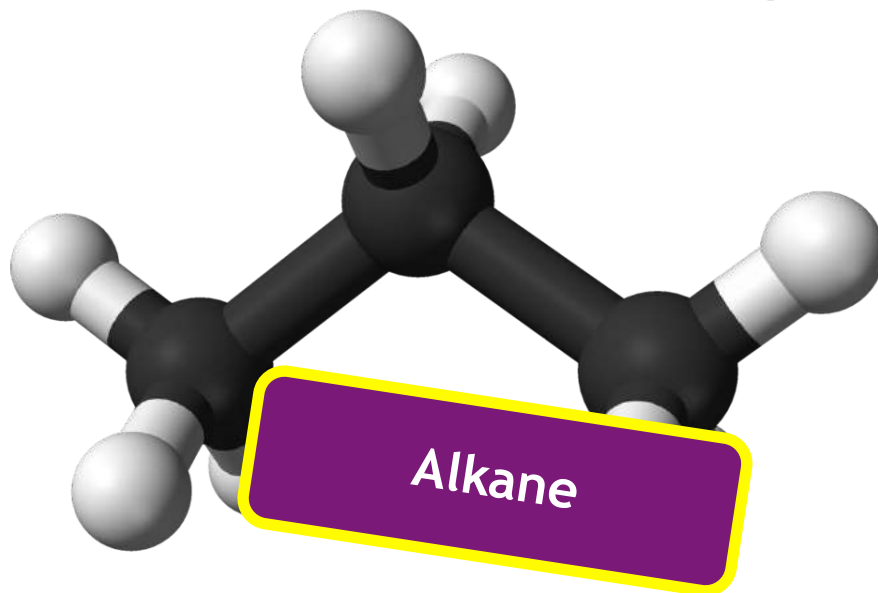
Ethylethylene



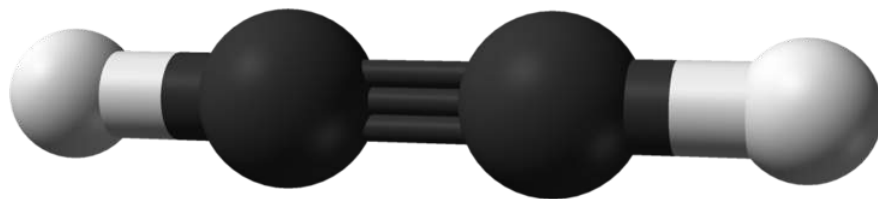
Propane



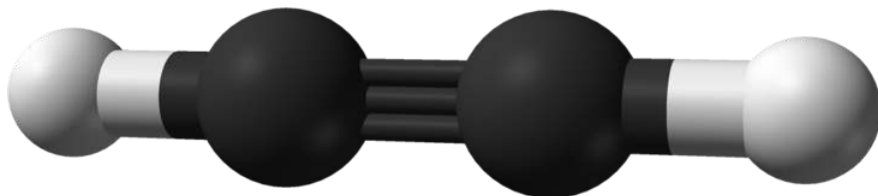
Propane



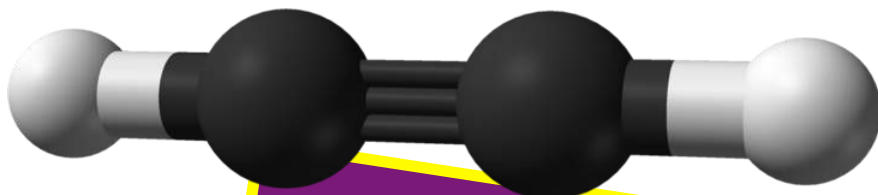
What is this?



Acetylene (a/k/a ethyne)

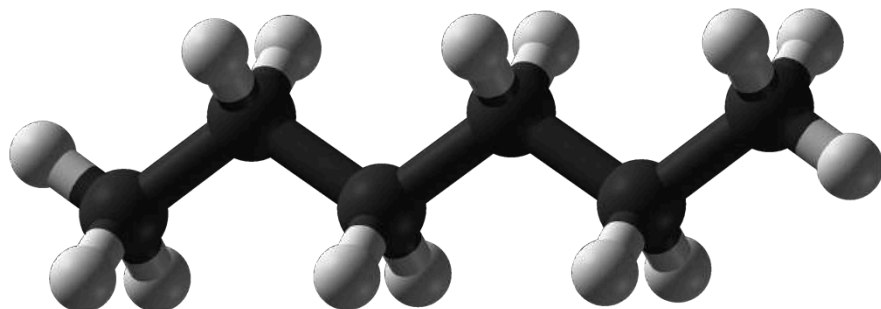


Acetylene (a/k/a ethyne)

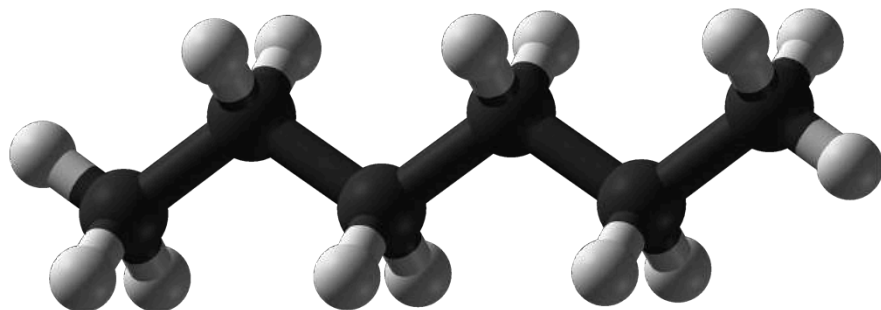


Alkyne

What is this?



Hexane






Hexane



Alkanes by numbers of carbon atoms	1	CH ₄	methane
	2	C ₂ H ₆	ethane
	3	C ₃ H ₈	propane
	4	C ₄ H ₁₀	butane
	5	C ₅ H ₁₂	pentane
	6	C ₆ H ₁₄	hexane
	7	C ₇ H ₁₆	heptane
	8	C ₈ H ₁₈	octane
	9	C ₉ H ₂₀	decane
	20	C ₂₀ H ₄₂	icosane
30	C ₃₀ H ₆₂	triacontane	
40	C ₄₀ H ₈₂	tetracontane	

Can you categorize these?

	1	CH_4	methane	GASES
	2	C_2H_6	ethane	
	3	C_3H_8	propane	
	4	C_4H_{10}	butane	
	5	C_5H_{12}	pentane	LIQUIDS
	6	C_6H_{14}	hexane	
	7	C_7H_{16}	heptane	
	8	C_8H_{18}	octane	
	9	C_9H_{20}	decane	
	20	$\text{C}_{20}\text{H}_{42}$	icosane	WAXES
	30	$\text{C}_{30}\text{H}_{62}$	triacontane	
	40	$\text{C}_{40}\text{H}_{82}$	tetracontane	

Credits

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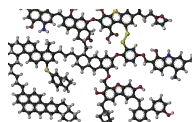


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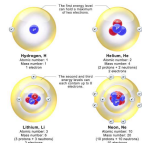
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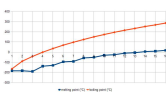
Molecule models, periodic table, and gas cylinder picture by others. Sunoco gas pump picture, candles picture, explosion illustration, and oil-and-gas-law course logo photo-illustration by EEJ.



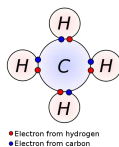
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<https://en.wikipedia.org/wiki/Alkane#/media/File:AlkaneBoilingMeltingPoint.png> Melting (blue) and boiling (orange) points of the first 16 n-alkanes in °C. Techstepp. CC BY-SA 3.0 File:AlkaneBoilingMeltingPoint.png

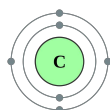


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17: Chlorine 2,8,7



https://commons.wikimedia.org/wiki/File:Electron_shell_017_Chlorine.svg
 Electron shell diagram for Chlorine, the 17th element in the periodic table of elements. Pumbaa (original work by Greg Robson) - Application: (generated by script) CC BY-SA 2.0 uk



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 Electron shell diagram for carbon, the 6th element in the periodic table of elements. Pumbaa (original work by Greg Robson) - File:Electron shell 006 Carbon.svg CC BY-SA 2.0 uk File:Electron shell 006 Carbon - no label.svg

11: Sodium 2,8,1



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 Electron shell diagram for sodium, the 11th element in the periodic table of elements. Pumbaa (original work by Greg Robson) - File:Electron shell 011 sodium.png CC BY-SA 2.0 uk File:Electron shell 011 Sodium.svg

10: Neon 2,8



Electron shell diagram for Neon, the 10th element in the periodic table of elements. Greg Robson CC BY-SA 2.0 uk File:Electron shell 010 neon.png, https://commons.wikimedia.org/wiki/File:Electron_shell_010_neon.png#/media/File:Electron_shell_010_neon.png



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