

Introduzione alla Chimica Organica

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Chimica Organica: Chimica dei composti del carbonio

Argomenti di interesse della chimica organica:

- Struttura, proprietà chimico-fisiche, sintesi e reattività dei composti del carbonio
- Meccanismi delle reazioni organiche
- Catalizzatori
- Polimeri organici
- Supramolecole e macromolecole naturali e di sintesi
- Relazione struttura/attività

Oggetti di uso quotidiano legati alla chimica organica:

- Cibi
- Materiali (es. plastica, resine, gomme, tessuti)
- Farmaci
- Coloranti

Strumenti e tecniche per lo studio della chimica organica:

- Metodi di separazione e purificazione (es. distillazione, cromatografia)
- Tecniche di caratterizzazione e analisi (es. spettroscopie UV-Vis, di fluorescenza, spettrometria di massa, NMR, analisi elementare)

Il Carbonio e gli altri elementi di interesse della Chimica Organica

Group number,
U.S. system → 1A 2A
IUPAC system → (1) (2)

Period number → 1

1	H Hydrogen 1.0079
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KEY

79	→ Atomic number	Metals
Au	→ Symbol	Semimetals
Gold	→ Name	Nonmetals
196.9665	→ Atomic mass	

An element

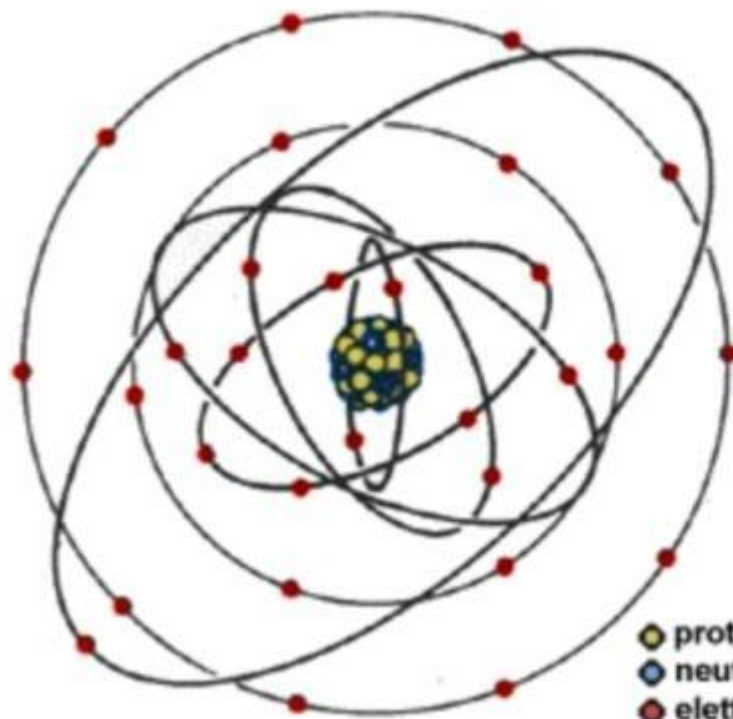
													3A (13)	4A (14)	5A (15)	6A (16)	7A (17)	8A (18)
1																		He Helium 4.0026
2	Li Lithium 6.941	Be Beryllium 9.0122											B Boron 10.811	C Carbon 12.011	N Nitrogen 14.0064	O Oxygen 15.9994	F Fluorine 18.9984	Ne Neon 20.1797
3	Na Sodium 22.9898	Mg Magnesium 24.3050	3B (3)	4B (4)	5B (5)	6B (6)	7B (7)	8B (8)	8B (9)	8B (10)	1B (11)	2B (12)	Al Aluminum 26.9815	Si Silicon 28.0855	P Phosphorus 30.9738	S Sulfur 32.066	Cl Chlorine 35.4527	Ar Argon 39.948
4	K Potassium 39.0983	Ca Calcium 40.078	Sc Scandium 44.9559	Ti Titanium 47.88	V Vanadium 50.9415	Cr Chromium 51.9961	Mn Manganese 54.9380	Fe Iron 55.847	Co Cobalt 58.9332	Ni Nickel 58.693	Cu Copper 63.546	Zn Zinc 65.39	Ga Gallium 69.723	Ge Germanium 72.61	As Arsenic 74.9216	Se Selenium 78.96	Br Bromine 79.904	Kr Krypton 83.80
5	Rb Rubidium 85.4678	Sr Strontium 87.62	Y Yttrium 88.9059	Zr Zirconium 91.224	Nb Niobium 92.9064	Mo Molybdenum 95.94	Tc Technetium (98)	Ru Ruthenium 101.07	Rh Rhodium 102.9055	Pd Palladium 106.42	Ag Silver 107.8682	Cd Cadmium 112.411	In Indium 114.82	Sn Tin 118.710	Sb Antimony 121.757	Te Tellurium 127.60	I Iodine 126.9045	Xe Xenon 131.29
6	Cs Cesium 132.9054	Ba Barium 137.327	La Lanthanum 138.9055	Hf Hafnium 178.49	Ta Tantalum 180.9479	W Tungsten 183.85	Re Rhenium 186.207	Os Osmium 190.2	Ir Iridium 192.22	Pt Platinum 195.08	Au Gold 196.9665	Hg Mercury 200.59	Tl Thallium 204.3833	Pb Lead 207.2	Bi Bismuth 208.9804	Po Polonium (209)	At Astatine (210)	Rn Radon (222)
7	Fr Francium (223)	Ra Radium 227.0278	Ac Actinium (227)	Rf Rutherfordium (261)	Db Dubnium (262)	Sg Seaborgium (263)	Bh Bohrium (262)	Hs Hassium (265)	Mt Meitnerium (266)	Ds Darmstadtium (271)	Rg Roentgenium (277)	Cn Copernicium (277)		114 — (285)		116 — (289)		

Numbers in parentheses are mass numbers of radioactive isotopes.

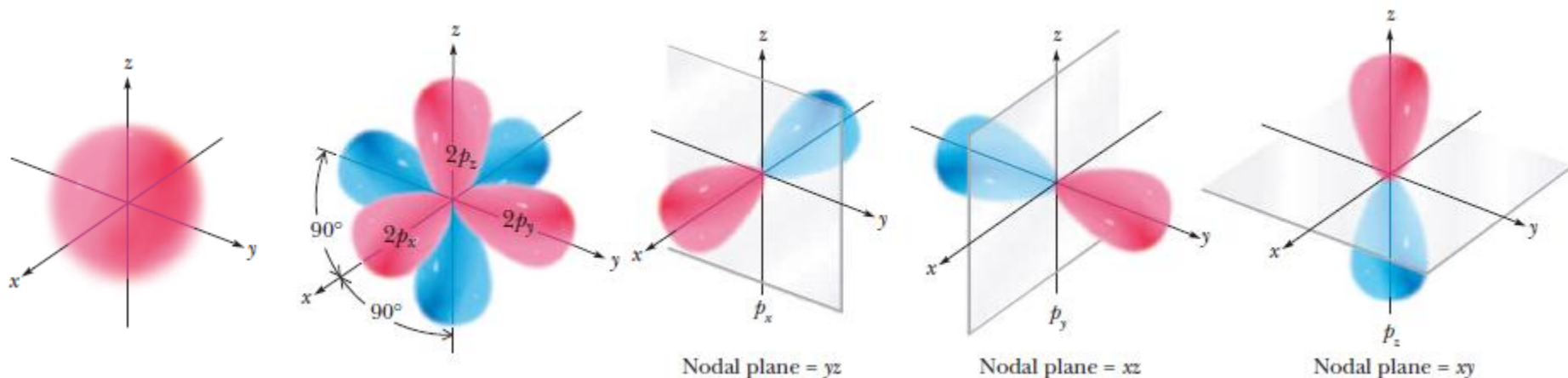
Lanthanides
Actinides

6	Ce Cerium 140.115	Pr Praseodymium 140.9076	Nd Neodymium 144.24	Pm Promethium (145)	Sm Samarium 150.36	Eu Europium 151.965	Gd Gadolinium 157.25	Tb Terbium 158.9253	Dy Dysprosium 162.50	Ho Holmium 164.9303	Er Erbium 167.26	Tm Thulium 168.9342	Yb Ytterbium 173.04	Lu Lutetium 174.967
7	Th Thorium 232.0381	Pa Protactinium 231.0359	U Uranium 238.0289	Np Neptunium (237)	Pu Plutonium (244)	Am Americium (243)	Cm Curium (247)	Bk Berkelium (247)	Cf Californium (251)	Es Einsteinium (252)	Fm Fermium (257)	Md Mendelevium (258)	No Nobelium (259)	Lr Lawrencium (260)

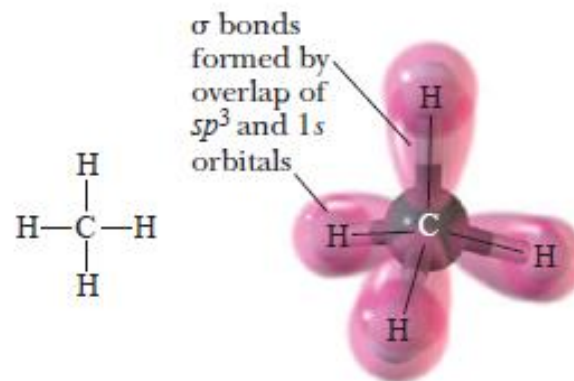
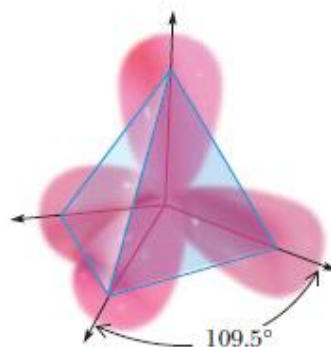
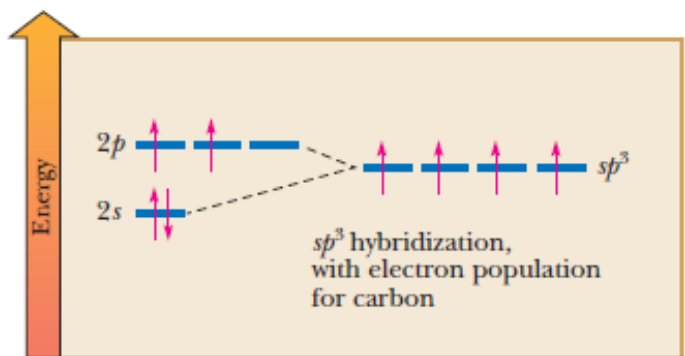
L'ibridazione del carbonio in chimica organica



6	12.011
4197 3827	2.5
C	
[He]2s ² 2p ²	2,±4
2.25	

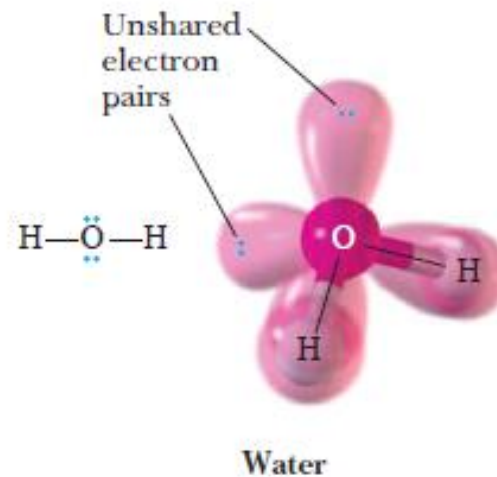
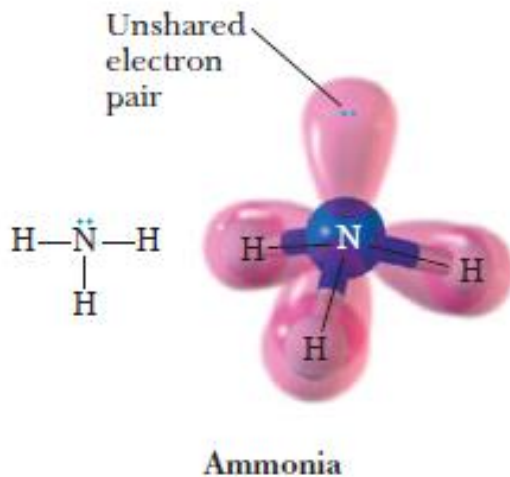


L'ibridazione del carbonio: sp^3

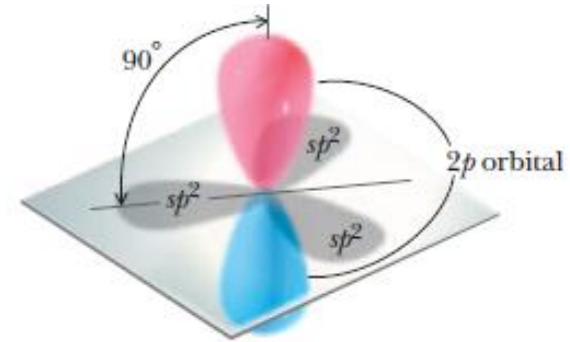
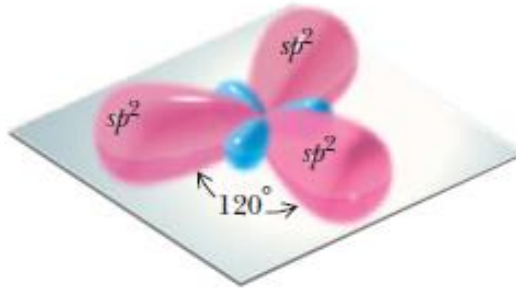
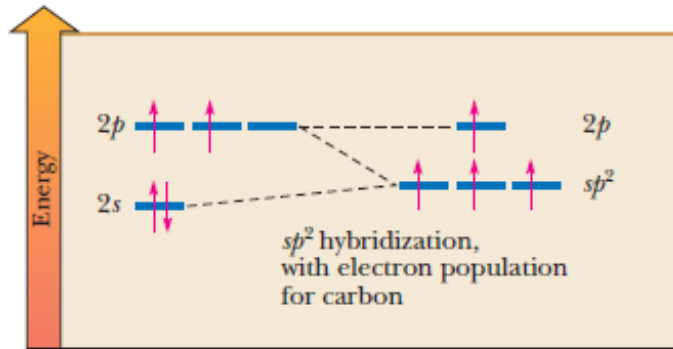


Geometria Tetraedrica

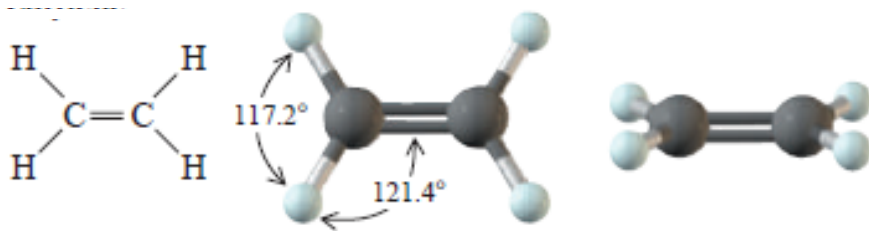
Altri esempi di ibridazione sp^3



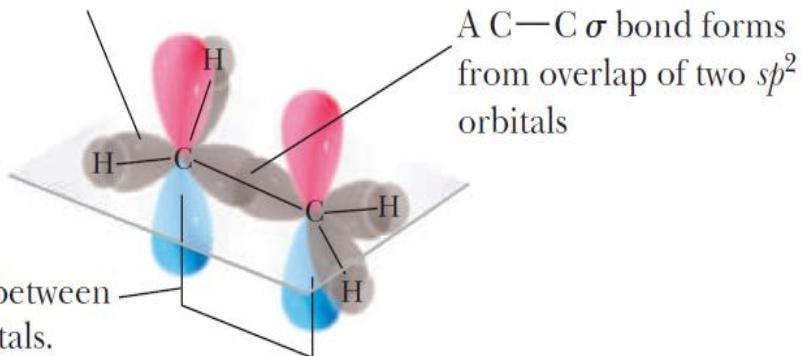
L'ibridazione del carbonio: sp^2



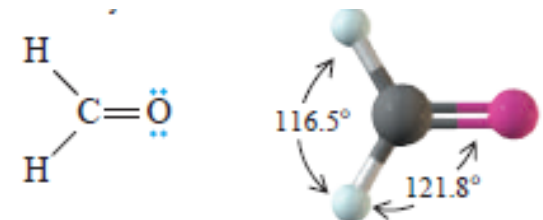
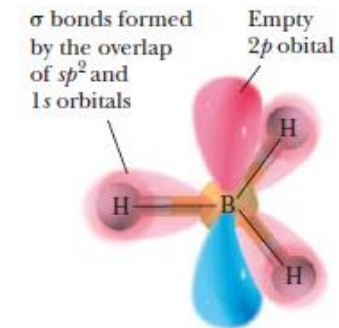
Molecole Planari



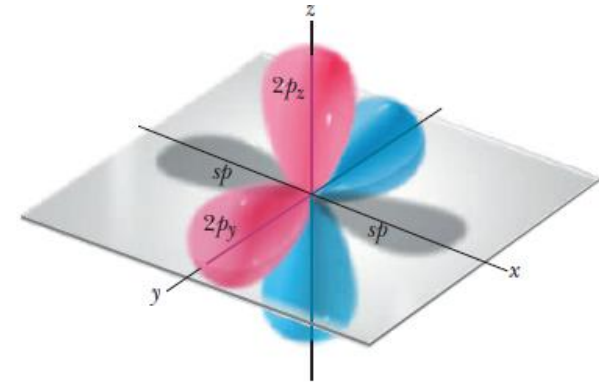
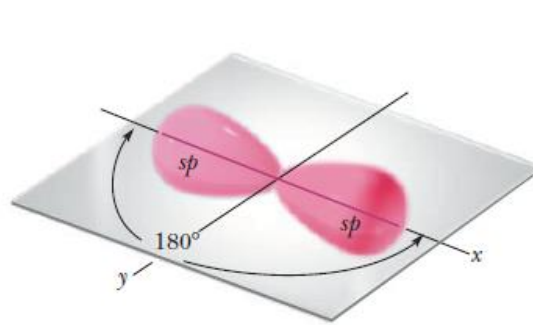
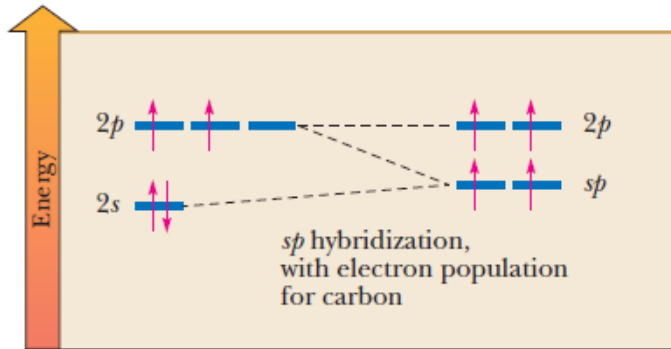
Four C—H σ bonds form from overlap of a C sp^2 and a H $1s$ orbital. See one here.



Altri esempi di ibridazione sp^2



L'ibridazione del carbonio: sp



Molecole lineari

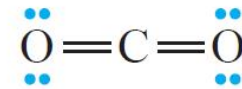
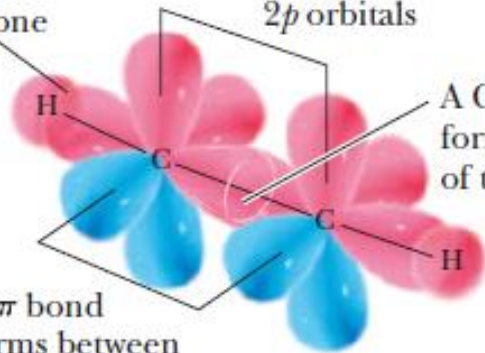
Altri esempi di ibridazione sp

Two C—H σ bonds form from overlap of a C sp and a H $1s$ orbital. See one here.

A π bond forms between these two $2p$ orbitals

A C—C σ bond forms from overlap of two sp orbitals

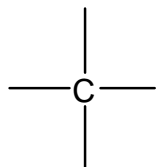
A π bond forms between these two $2p$ orbitals



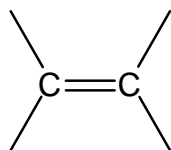
Gruppi funzionali e classi di composti organici (1)

Gruppi funzionali: gruppi di atomi legati in maniera definita che mostrano caratteristiche chimiche e fisiche ben definite

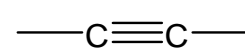
- Permettono di suddividere i composti organici in classi diverse
- Sono siti di reazioni chimiche caratteristiche
- Servono come base per la nomenclatura



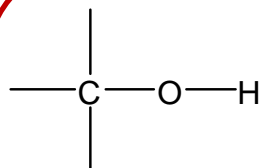
Alcani



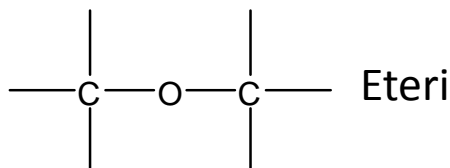
Doppio legame
Alcheni



Triplo legame
Alchini



Gruppo ossidrile
Alcoli e dioli



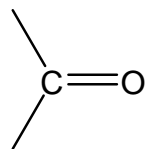
Eteri



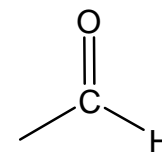
Epossidi



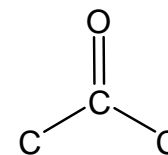
Alogenuri alchilici



Gruppo carbonile

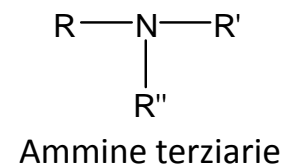
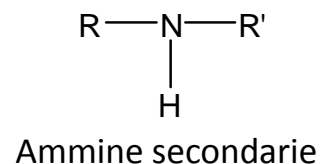
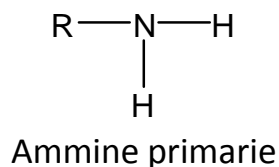
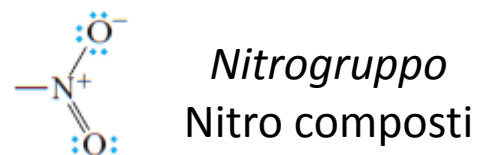
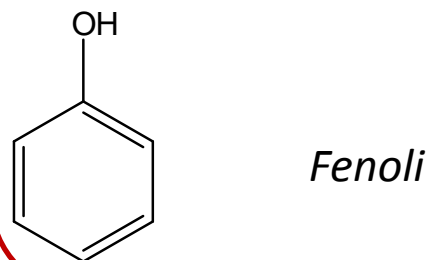
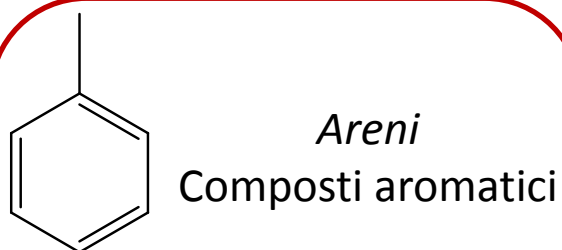
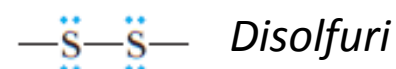
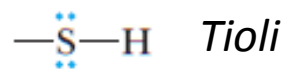
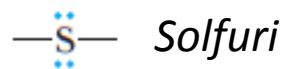
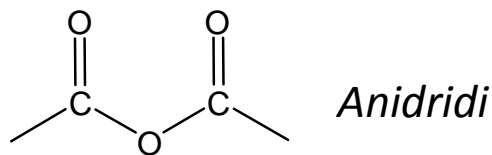
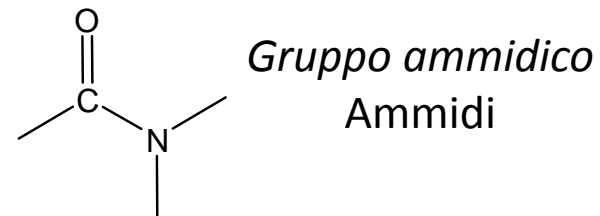
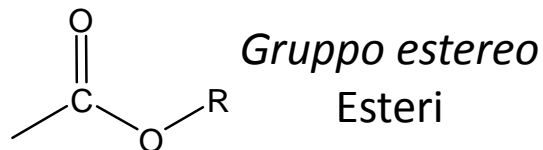
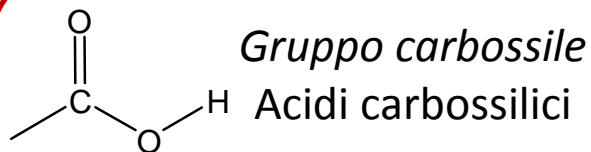


Aldeidi

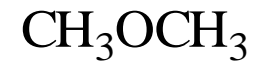
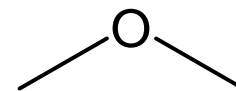
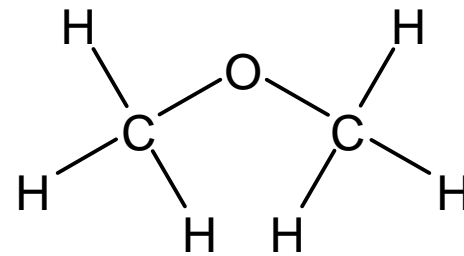
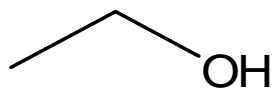
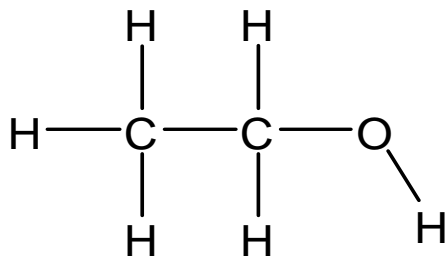


Chetoni

Gruppi funzionali e classi di composti organici (2)



Come scrivere le strutture organiche



Le reazioni di ossido-riduzione in chimica organica

Compound	Formula	Oxidation Number
Carbon dioxide	$\text{O}=\text{C}=\text{O}$	+4 (most oxidized)
Acetic acid	$\text{H}_3\text{C}-\text{C}\begin{matrix} \nearrow \text{O} \\ \searrow \text{OH} \end{matrix}$	+3
Carbon monoxide	$:\text{C}\equiv\text{O}:$	+2
Formic acid	$\text{H}-\text{C}\begin{matrix} \nearrow \text{O} \\ \searrow \text{OH} \end{matrix}$	+2
Acetone	$\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_3$	+2
Acetaldehyde	$\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$	+1
Formaldehyde	$\text{H}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$	0

Compound	Formula	Oxidation Number
Acetylene	$\text{HC}\equiv\text{CH}$	-1
Ethanol	$\text{H}_3\text{C}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\text{OH}$	-1
Ethene	$\text{H}_2\text{C}=\overset{\text{H}}{\underset{\text{H}}{\text{C}}}$	-2
Ethane	$\text{H}_3\text{C}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\text{H}$	-3
Methane	$\text{H}-\overset{\text{H}}{\underset{\text{H}}{\text{C}}}-\text{H}$	-4 (least oxidized)