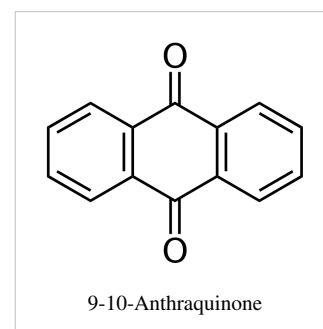
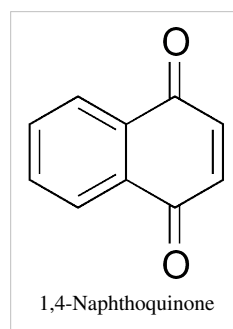
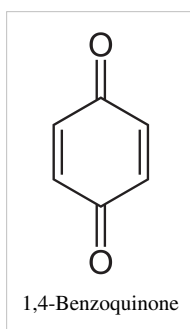
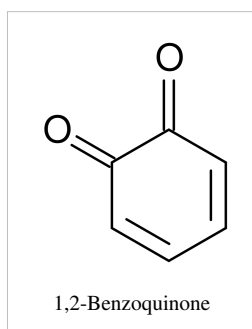


Quinone

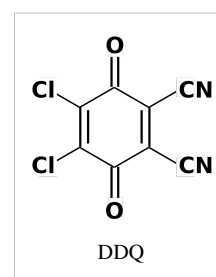
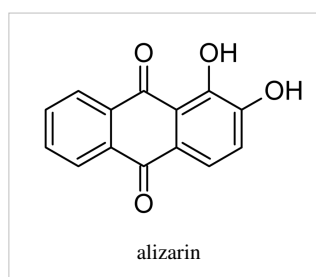
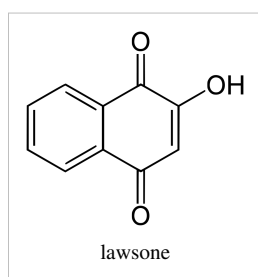
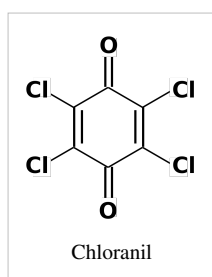
A **quinone** is a class of organic compounds that are formally derived from aromatic compounds (such as benzene or naphthalene) by exchanging an even number of $-\text{CH}=\text{}$ groups by $-\text{C}(=\text{O})-$ groups, with any necessary rearrangement of double bonds, resulting in a fully conjugated cyclic dione structure. The class includes derivatives of heterocyclic aromatic compounds.^[1]

The prototypical member of the class are 1,4-benzoquinone or cyclohexadienedione, often called simply **quinone** (whence the name of the class). Other important examples are 1,2-benzoquinone (*ortho-quinone*), 1,4-naphthoquinone and 9,10-anthraquinone.

Quinones are often oxidised derivatives of aromatic compounds and are often readily made from reactive aromatic compounds with electron-donating substituents such as phenols and catechols which increase the nucleophilicity of the ring and contributes to the large redox potential needed to break aromaticity. (Quinones are conjugated but not aromatic). Quinones are electrophilic Michael acceptors stabilised by conjugation. Depending on the quinone and the site of reduction, reduction can either rearomatise the compound or break the conjugation. Conjugate addition nearly always breaks the conjugation.



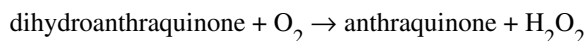
The term **quinone** is also used more generally for a large class of compounds formally derived from aromatic quinones through replacement of some hydrogen atoms by other atoms or radicals.



Occurrence and uses

Production of hydrogen peroxide

A large scale industrial application of quinones is for the production of hydrogen peroxide. 2-Alkylanthraquinones are hydrogenated to the corresponding hydroquinones (quinizarins), which then transfer H₂ to oxygen:



In this way, several billion kilograms of H₂O₂ are produced annually.^[2]

Biochemistry

Derivatives of quinones are common constituents of biologically relevant molecules (e.g. Vitamin K₁ is phylloquinone). Others serve as electron acceptors in electron transport chains such as those in photosystems I & II of photosynthesis, and aerobic respiration.

A natural example of the oxidation of hydroquinone to quinone is in the spray of bombardier beetles; hydroquinone is reacted with hydrogen peroxide to produce a fiery blast of steam, a strong deterrent in the animal world.

Quinones can be partially reduced to quinols. Many natural or synthetic quinones show a biological or pharmacological activity, and some of them show antitumoral activity.^[3]

Dyes

Many natural and artificial coloring substances (dyes and pigments) are quinone derivatives. They are second only to azo dyes in importance as dyestuffs, with particular emphasis on blue colors. Alizarin (2,3-dihydroxy-9,10-anthraquinone), extracted from the madder plant, was the first natural dye to be synthesized from coal tar.

Reagents in organic chemistry

Benzoquinone is used in organic chemistry as an oxidizing agent. Stronger quinone oxidising agents exist; for instance: chloranil and 2,3-dichloro-5,6-dicyano-1,4-benzoquinone (also known as DDQ).^[4]

Nomenclature

Quinones are commonly named with a prefix that indicates the parent aromatic hydrocarbon ("benzo-" for benzene, "naphtho-" for naphthalene, "anthra-" for anthracene, etc.) and the "-quinone" suffix. Infix multipliers "-di-", "-tri-", "-tetra-" (etc.) are used when there are 4, 6, 8 (etc.) carbonyls. The position of the carbonyl groups can be indicated before the prefix (as in "1,4,5,8-naphthodiquinone") or after it ("anthra-1,4-quinone").

See also

- Benzoquinone
- Naphthoquinone
- Anthraquinone

External links

- MeSH *Quinones* ^[5]

References

- [1] International Union of Pure and Applied Chemistry (1995). "Quinones (<http://goldbook.iupac.org/Q05015.html>)". *Compendium of Chemical Terminology* Internet edition.
 - [2] Gustaaf Goor, Jürgen Glenneberg, Sylvia Jacobi "Hydrogen Peroxide" in Ullmann's Encyclopedia of Industrial Chemistry 2007, Wiley-VCH, Weinheim. doi: 10.1002/14356007.a13_443.pub2.
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 - [4] March, Jerry (1985), *Advanced Organic Chemistry: Reactions, Mechanisms, and Structure* (3rd ed.), New York: Wiley, ISBN 0-471-85472-7
 - [5] http://www.nlm.nih.gov/cgi/mesh/2009/MB_cgi?mode=&term=Quinones
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