

OXIDATION REACTIONS

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In organic chemistry, oxidation refers to either:

- i. the **gain** of an **oxygen** atom
- ii. the **loss** of a **hydrogen** atom

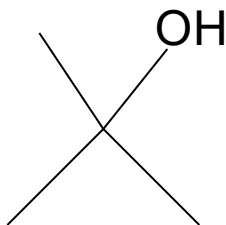
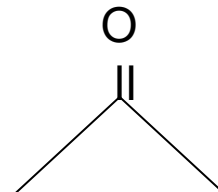
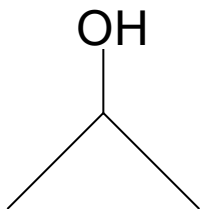
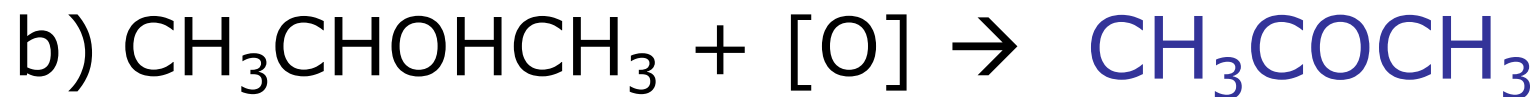
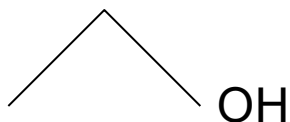
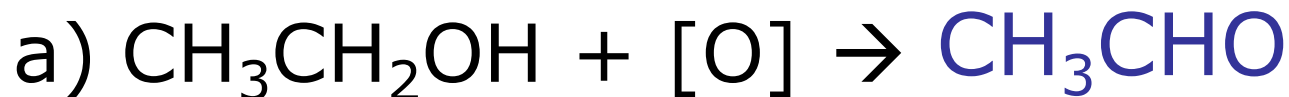
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A multitude of oxidizing agents exist*, but for simplicity will be written as [O] in a chemical reaction.

*common oxidizing agents are potassium permanganate (KMnO_4) or potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$).

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Example #1



No reaction

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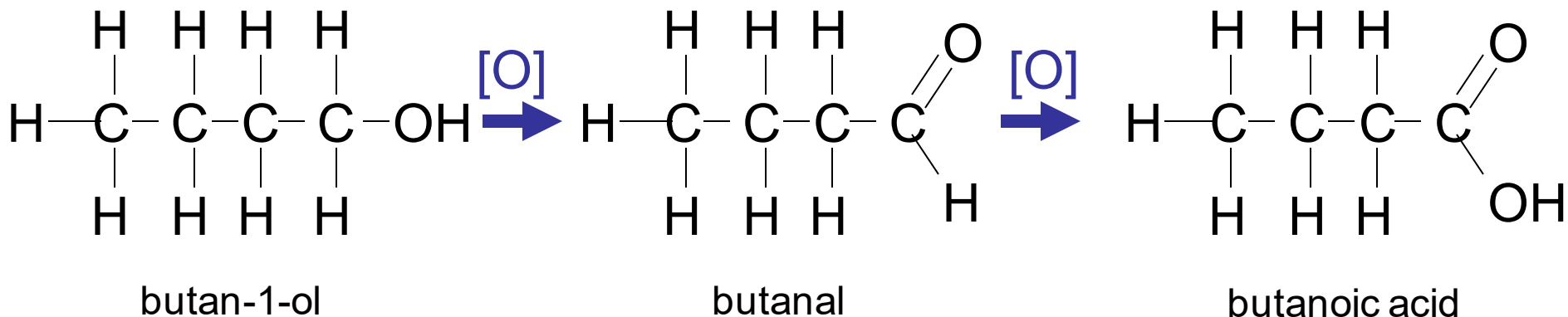
potassium permanganate (KMnO_4) or potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$) can also be used as a qualitative test for the different types of alcohols because there is a distinct colour change.

Reduction of dichromate		Reduction of permanganate	
oxidising agent	<i>gains electrons</i> → reduced species	oxidising agent	<i>gains electrons</i> → reduced species
dichromate ions	<i>gains electrons</i> → chromium(III) ions	permanganate ions	<i>gains electrons</i> → manganese(II) ions
$\text{Cr}_2\text{O}_7^{2-}$	<i>gains electrons</i> → Cr^{3+}	MnO_4^-	<i>gains electrons</i> → Mn^{2+}
orange	<i>gains electrons</i> → green	purple	<i>gains electrons</i> → colourless

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Example #2

Draw structural formulas and write IUPAC names to represent the oxidation of an alcohol to form butanoic acid.



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Oxidation of alcohols may produce

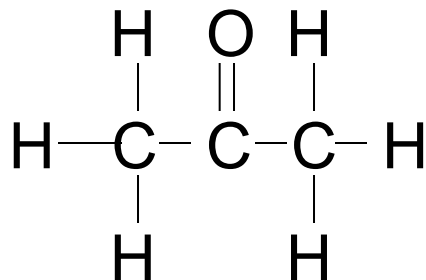
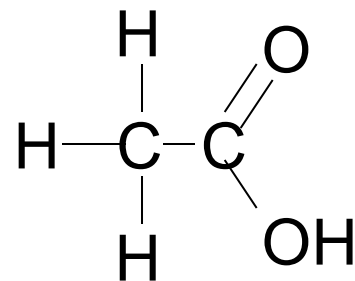
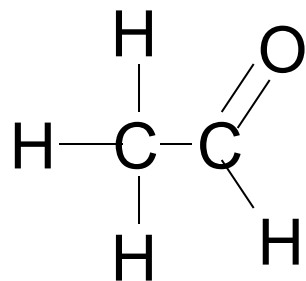
or

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Depending on the strength of the oxidizing agent, some chemicals may undergo further oxidation.

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Example #3

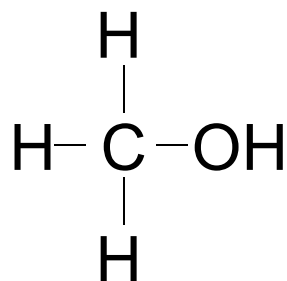


No reaction

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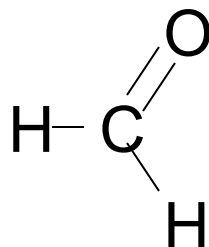
Example #4

Write a series of chemical equations to show the reactions needed to produce methanoic acid from methanol. Name each organic compound using both IUPAC and common systems.



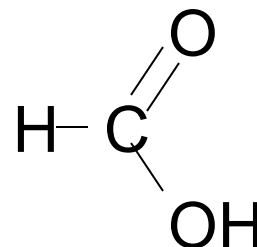
methanol

methyl alcohol



methanal

formaldehyde



methanoic acid

formic acid

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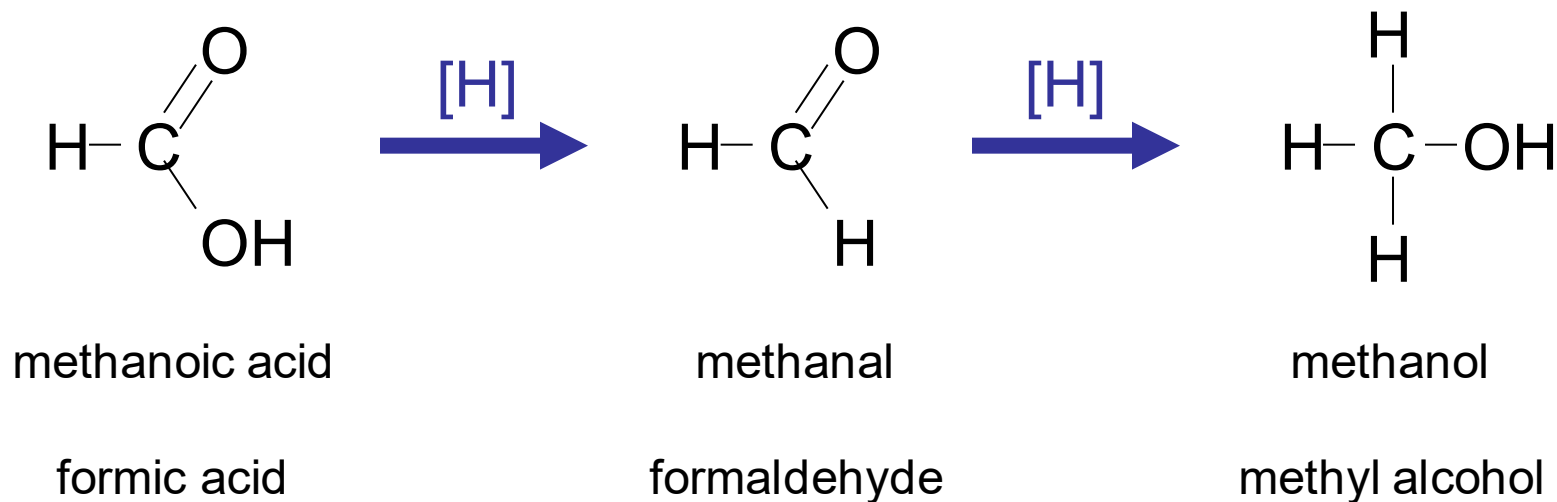
Further oxidation of an aldehyde may produce a

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Example #5

Going backwards...

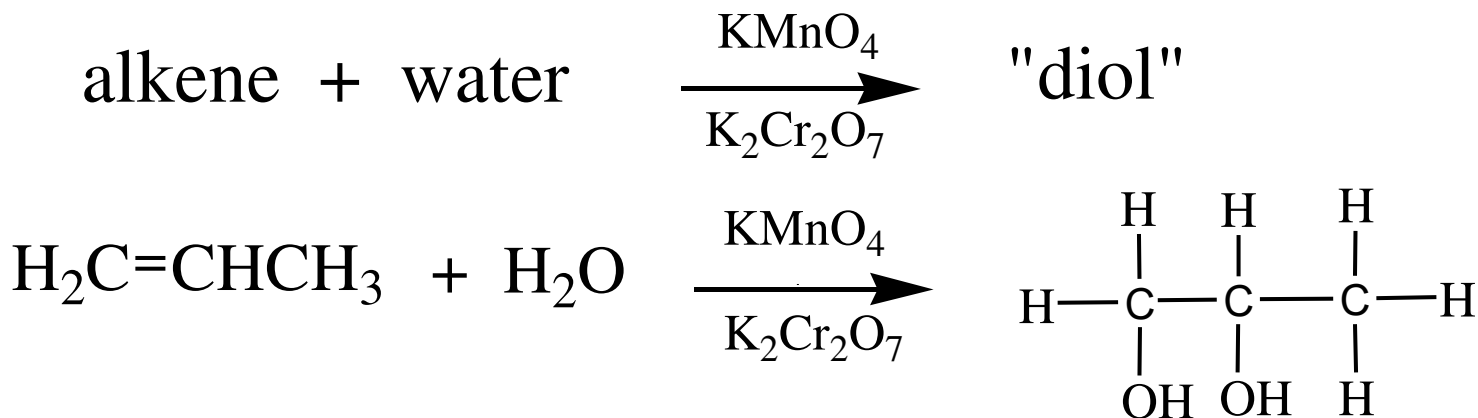
To change a carboxylic acid to an aldehyde, and then an alcohol, a *reducing agent* may be used. The symbol for a reducing agent is [H]. This type of reaction is classified as **reduction**.



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Oxidation of Alkenes

- Not to be confused with hydration of an alkene which also produce alcohols
- This reaction uses an oxidizing agent like KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7$ to produce a “diol”.



HOMEWORK

- o Page 45 # 1 – 3 (oxidation reactions)
- o Page 46 # 2, 3, 4 (oxidation reactions)
- o Page 53 # 1 (oxidation and hydrolysis)