

The content on this sheet is assessed on paper 2 only.

## Topic 9b—Hydrocarbons

\* Indicates that these are some examples only: you could be asked about any substance / reaction.

<p><b>9.10—Formulae and structures of the alkanes</b></p> <p><u>Methane:</u> Formula = CH<sub>4</sub> Structure = <math>\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{H} \\   \\ \text{H} \end{array}</math></p> <p><u>Ethane:</u> Formula = C<sub>2</sub>H<sub>6</sub> Structure = <math>\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}</math></p> <p><u>Propane:</u> Formula = C<sub>3</sub>H<sub>8</sub> Structure = <math>\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{H} \end{array}</math></p> <p><u>Butane:</u> Formula = C<sub>4</sub>H<sub>10</sub> Structure = <math>\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array}</math></p>	<p><b>9.12—Formulae and structures of the alkenes</b></p> <p><u>Ethene:</u> Formula = C<sub>2</sub>H<sub>4</sub> Structure = <math>\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{C}=\text{C} \\   \quad   \\ \text{H} \quad \text{H} \end{array}</math></p> <p><u>Propene:</u> Formula = C<sub>3</sub>H<sub>6</sub> Structure = <math>\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \\ \text{C}=\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}</math></p> <p><u>But-1-ene:</u> Formula = C<sub>4</sub>H<sub>8</sub> Structure = <math>\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \quad   \\ \text{C}=\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{H} \end{array}</math></p> <p><u>But-2-ene:</u> Formula = C<sub>4</sub>H<sub>8</sub> Structure = <math>\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \quad   \\ \text{H}-\text{C}-\text{C}=\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}</math></p>	<p><b>9.14—Testing for unsaturation*</b></p> <p>We test for unsaturation by adding <b>bromine water</b>.</p> <p>In the presence of a double bond, an <b>addition</b> reaction occurs. For ethene, the following molecule forms:</p> $\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{Br} \quad \text{Br} \end{array}$ <p><i>This molecule is called 1,2-dibromoethane.</i></p> <p>Other alkenes will react in a <b>similar</b> way.</p>
<p><b>9.11—Alkanes</b></p> <p>Alkanes are made of carbon atoms which all form <b>single</b> bonds to other carbon atoms: they are described as being <b>saturated</b> for this reason. They consist of <b>carbon</b> and <b>hydrogen</b> atoms only, and so are <b>hydrocarbons</b>.</p>	<p><b>9.13—Alkenes</b></p> <p>Alkenes contain a C=C <b>functional group</b>. This double bond means that they are described as being <b>unsaturated</b>. They consist of <b>carbon</b> and <b>hydrogen</b> atoms only, and so are <b>hydrocarbons</b>.</p>	<p><b>9.15—Bromine water</b></p> <p>As described above, bromine water is used to test for the presence of <b>unsaturation</b>. In the presence of an <b>alkene</b>, bromine water will undergo a colour change from <b>orange</b> to <b>colourless</b>. In the presence of an <b>alkane</b>, the bromine water would remain <b>orange</b>.</p> <p><b>9.16—Combustion of hydrocarbons</b></p> <p>All hydrocarbons can combust (burn in <b>oxygen</b>) to release energy. In complete combustion, the only products of these reactions would be <b>water</b> and <b>carbon dioxide</b>.</p>