

Assessment schedule – 2019

Chemistry: Demonstrate understanding of aspects of carbon chemistry (90932)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	<p>Complete combustion occurs when there is a plentiful supply of oxygen; incomplete combustion occurs when there is limited oxygen.</p> <p>Water is always produced as a combustion product. During complete combustion, carbon dioxide is produced. During incomplete combustion, the following products could be produced: carbon dioxide, carbon monoxide, carbon and water.</p> <p>Blue flame for complete combustion, yellow flame for incomplete combustion which is due to soot particles being heated.</p> <p>Carbon dioxide gas and water vapour both are greenhouse gases, so they contribute to the greenhouse effect, which leads to global warming due to increased trapping of infra-red radiation / heat and this affects the environment with rising sea levels / melting of polar ice (example). CO₂ is absorbed by the ocean / reacts with water in clouds to form (carbonic) acid and this decreases the pH of the ocean, affecting marine ecosystems / causes acid rain which can erode buildings, etc.</p> <p>Carbon particles can produce visual pollution in the environment, e.g. blackening of limestone walls and monuments as carbon particles are deposited on them, or slow down photosynthesis due to carbon particles coating leaves, which prevents entry / exit of gases and water, or carbon particles in waterways affecting fish and plants, etc.</p> <p>Allow for other valid effects.</p>	<ul style="list-style-type: none"> Names products of complete or incomplete combustion. Describes flame of complete or incomplete combustion. One valid effect of a combustion product on the environment. 	<ul style="list-style-type: none"> Explains what causes complete and incomplete combustion. Links yellow flame to soot OR blue flame to no soot. Explains effects of one combustion products on the environment. 	<ul style="list-style-type: none"> Fully compares and contrasts complete and incomplete combustion of butane, and explains effects of two combustion products on the environment.
(b)(i)	<p>pentane + oxygen → carbon dioxide + water</p> $\text{C}_2\text{H}_4 + 3\text{O}_2 \rightarrow 2\text{H}_2\text{O} + 2\text{CO}_2$	<ul style="list-style-type: none"> Word equation completed. 	<ul style="list-style-type: none"> Two correct but unbalanced equations. 	<ul style="list-style-type: none"> One balanced equation correct.
(ii)	$\text{C}_3\text{H}_8 + 4\text{O}_2 \rightarrow 4\text{H}_2\text{O} + \text{CO}_2 + 2\text{CO}$ $2\text{C}_4\text{H}_{10} + 9\text{O}_2 \rightarrow 10\text{H}_2\text{O} + 8\text{CO}$ <p>OR $\text{C}_4\text{H}_{10} + \frac{9}{2}\text{O}_2 \rightarrow 5\text{H}_2\text{O} + 4\text{CO}$</p>			

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	2m	3m	2e with minor error in (a)	2e

Q	Evidence	Achievement	Merit	Excellence
TWO (a)(i)	Cracking. It is necessary to provide alkenes that can be used to make polymers	<ul style="list-style-type: none"> Cracking or produce alkenes. 	<ul style="list-style-type: none"> Links cracking to producing an alkene. One Correct equation. 	<ul style="list-style-type: none"> Both correct balanced equations.
(ii)	$C_7H_{16} \rightarrow C_5H_{12} + C_2H_4$ (accept condensed or expanded)			
(iii)	$C_{15}H_{32} \rightarrow C_8H_{18} + 2C_2H_4 + C_3H_6$			
(b)	<p>Ethene monomers contain double bonds between C atoms.</p> <p>Many monomers / ethene molecules form chains / very large molecules. The double bond between C atoms in the monomers break, and single bonds form between C atoms of monomer units, resulting in a polymer / chain. The polymer contains only single bonds between C atoms.</p> <pre> H H H H H H H H -C -C -C -C -C -C -C -C - H H H H H H H H </pre>	<ul style="list-style-type: none"> One correct point described. Correct polymer structure (may not be 4 repeating units). 	<ul style="list-style-type: none"> Explains process or difference between monomer and polymer in terms of double and single bonds. 	<ul style="list-style-type: none"> Correct explanations referring to structure of ethene and polyethene and 4 correct repeating units.
(c)	<p>For example:</p> <ul style="list-style-type: none"> Plastic (e.g. polyethene) is used for packaging because it helps protect and preserve goods. Plastic (e.g. polypropene) is used to make pipes as it is hard and not reactive. Plastic is used for raincoats, as it is waterproof. 	<ul style="list-style-type: none"> Two uses given. 	<ul style="list-style-type: none"> Two uses linked to relevant properties. 	

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	3m	4m	1e (b)	2e

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)	<p>As the number of carbon atoms increases, the boiling point increases.</p> <p>Referring to the table: for example butane with 4 carbon atoms has a boiling point of 0 °C, pentane with 5 carbon atoms has a boiling point of 36°C, and hexane with 6 carbon atoms has a boiling point of 69 °C, showing that as the number of carbon atoms increases so does the boiling point.</p>	<ul style="list-style-type: none"> • Correct trend. 	<ul style="list-style-type: none"> • Correct trend with reference to two alkanes. 	
(ii)	<p>For both alkanes and alkenes, as the number of carbon atoms increases, the boiling point increases.</p> <p>Alkanes with the same number of carbon atoms always have a higher boiling point than the corresponding alkene.</p>	<ul style="list-style-type: none"> • Either point correct. 	<ul style="list-style-type: none"> • One similarity and one difference linked to table. 	
(b)(i)	$\begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} - \text{H} \\ \\ \text{H} \end{array} \quad \begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} - \text{O} - \text{H} \\ \\ \text{H} \end{array}$ <p>methane methanol</p>	<ul style="list-style-type: none"> • Both structures correct. 	<ul style="list-style-type: none"> • One correct process and condition with one unbalanced equation. 	<ul style="list-style-type: none"> • Full explanation of both processes with conditions and balanced equations.
(ii)	<p>Methane is reacted with steam and a nickel catalyst to produce carbon monoxide and hydrogen.</p> $\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$ <p>The carbon monoxide is reacted with hydrogen gas at a high temperature and a copper and zinc catalyst to produce methanol.</p> $\text{CO} + 2\text{H}_2 \xrightarrow[\text{Cu-Zn}]{250^\circ\text{C}} \text{CH}_3\text{OH}$	<ul style="list-style-type: none"> • One correct process described. 	<ul style="list-style-type: none"> • One correct process and condition with one unbalanced equation. 	<ul style="list-style-type: none"> • Full explanation of both processes with conditions and balanced equations.
(c)	<p>Methanol and ethanol are both alcohols, whereas propene is an alkene.</p> <p>Both methanol and ethanol are soluble in water, as they contain an OH group. The attraction between the alcohol and water is greater than the attraction between the individual molecules, so it dissolves. Propene is insoluble in water, as it contains only C and H atoms.</p> <p>Methanol contains 4 hydrogen atoms, so produces 2 molecules of water, as water has 2 hydrogen atoms. Ethanol and propene both contain 6 hydrogen atoms, so produce 3 molecules of water.</p> <p>Students may use structures and / or equations to support their answer.</p>	<ul style="list-style-type: none"> • One correct description of solubility or number of molecules of water produced. 	<ul style="list-style-type: none"> • Explains solubility with reference to OH group. • Explains number of molecules of water produced for 1 compound 	<ul style="list-style-type: none"> • Full comparison and contrast.

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	1a	2a	3a	4a	2m	3m	1e	2e

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 8	9 – 14	15 – 19	20 – 24