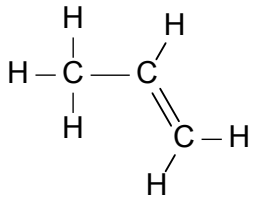
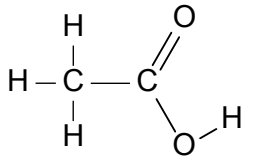
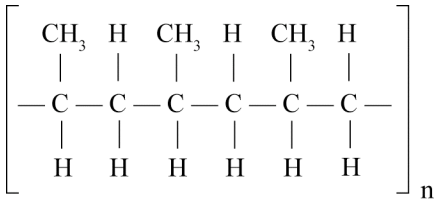
Assessment Schedule – 2007

Chemistry: Describe properties and reactions of carbon and its compounds (90648)

Evidence Statement

Question	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
ONE (a)	**1** Butane **2**  **3** methanol **4** 	THREE names or structures correct. Must have all hydrogens.		
(b)	methanol and ethanoic acid or **3** and **4**	Both correct.		
(c)	$C_4H_{10}(g)+6.5O_2(g)\rightarrow 4CO_2(g)+5\,H_2O(g)$ or $2C_4H_{10}(g)+13O_2(g)\rightarrow 8CO_2(g)+10\,H_2O(g)$	Correct formulae of reactants or products. States not required.	Correct formula of reactants and products States not required.	Correctly balanced equation. States not required.
(d)		All single bonds, only carbons and hydrogens, with at least 6 carbons shown, and without a hydrogen at one end OR puts in methyl groups correctly but misses some H's.	Main chain has methyl side groups. Has drawn 3 repeating units.	

(e)	**Chemical properties:** • Both liquids will undergo combustion reactions. • Ethanol can be oxidized to ethanoic acid. **Physical properties:** • Hexane is immiscible in water, forming 2 layers, whereas ethanol is miscible in water forming a solution. • Hexane is a bigger molecule than ethanol (diagram acceptable), but both have similar boiling points. • Hexane is less dense than ethanol. Distinguish by solubility in water, or by burning droplets on a spatular, or by finding the mass of the same volume of liquid, or by distilling under carefully controlled conditions (hexane bp 68.7 ^{o}C ethanol bp 78.3 ^{o}C).	Compares TWO aspects of the two liquids appropriately (can include smell). OR Distinguishes between the liquids, but method is not completely clear/safe.	Describes a clear method for distinguishing between the liquids safely, using a chemical or a physical property. OR Compares both a chemical and a physical property, with some method of distinguishing them.	Compares a chemical property AND A physical property of both compounds AND Distinguishes between liquids clearly and safely.
TWO (a)(i)	Graphite burns brightly/sparks / smoke formed / soot formed / graphite disappears/heat generated.	ONE correct observation.		
(a)(ii)	As graphite burns, the amount of oxygen decreases as it is a closed system until graphite is burning in a limited supply – incomplete combustion.	Identifies incomplete combustion. OR Limited oxygen	Explains that incomplete combustion is due to limited oxygen.	
(b)(i)	$CO_2(g) + H_2O(\ell) \rightarrow H_2CO_3(aq)$ or $CO_2(g) + 2H_2O(\ell) \rightarrow HCO_3^-(aq) + H_3O^+(aq)$	Correctly balanced equation. States not required.		
(b)(ii)	Solution would turn red because CO_2 in water forms an acidic solution. Acidic solution due to carbonic acid/ H^+ ions/low pH	States colour change of litmus AND acknowledges formation of acid.	Links colour change of litmus to the formation of acid solution AND states carbonic acid/hydrogen carbonate/hydrogen ions/low pH.	
(c)	Oxygen is used to burn sugars for energy and CO_2 is a byproduct of the reaction.	Food/sugars/glucose/carbon compounds "burn" to produce carbon dioxide OR oxygen (aerobic) is taken in and carbon dioxide released OR CO_2 is a waste product of respiration.	Oxygen is required to react with sugar/glucose and produces CO_2 .	

(d)	• Combustion of fuels leads to higher levels of CO_2 in the atmosphere and CO, C, SO_2, NO_x. Further discussion on: • "greenhouse effect". (CO_2 is transparent to light but rather opaque to heat rays.) Therefore, CO_2 in the atmosphere slows down the radiation of heat from the earth back into space — This leads to global warming which is seen in: - increased ocean / land temps - retreat of glaciers - change in migration and breeding of species - new growth and flowering patterns of plants - extreme weather events - decreased agricultural yields - spread of disease via warmer conditions for carriers. • Acid rain • Photochemical smog • Health effects on humans - respiratory problems from C, SO_2, NO_x - CO binding to haemoglobin.	Identifies CO_2 as a combustion product AND states CO_2 is a cause of global warming. OR Identifies a non-metal oxide produced as a result of fuel combustion and an appropriate effect on the global environment.	Explains role of ONE non-metal oxide in affecting the atmosphere. AND Describes TWO valid implications for the global environment.	Explains role of TWO non-metal oxides which produce different effects on the atmosphere AND Describes ONE valid implication for each non-metal oxide on the global environment. OR An in-depth analysis of ONE combustion product and its effects.
THREE (a)	(i) acid (ii) carbonate	Both answers correct.		
(b)(i)	Limewater goes milky.	Correct.		
(b)(ii)	$Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(\ell)$ OR $Ca(OH)_2 + 2CO_2 \rightarrow Ca(HCO_3)_2$	Correct formulae of reactants OR products. States not required.	Correct formulae of reactants AND products. States not required.	
(c)	CO_2 doesn't support combustion so cannot be used by the fire as a fuel/cannot be further oxidised. CO_2 is denser than air so it 'suffocates' the fire by falling on it and displacing air (oxygen), which is then not available for the combustion reaction. CO_2 is easily compressed and a lot of CO_2 can be stored in a small container (fire extinguisher). CO_2 sublimes when pressure is released, so it quickly becomes a gas again. CO_2 is non-toxic so can be used without making fire fighting more hazardous CO_2 is a non-conductor so can be used on electrical fires CO_2 is generally chemically inert so can be used on a wide variety of substances	States TWO relevant properties. OR Links one property to use in a fire extinguisher.	States TWO relevant properties. AND Links one property to use in a fire extinguisher.	Discusses at least THREE relevant properties in relation to the use of CO_2 in a fire extinguisher. Must include a physical AND a chemical property.

Judgement Statement — 2007

Achievement	Achievement with Merit	Achievement with Excellence
EIGHT opportunities answered at Achievement level (or higher). Minimum of $8 \times A$	NINE opportunities answered including at least FOUR at Merit level (or higher) and FIVE at Achievement level (or higher). Minimum $4 \times M + 5 \times A$	ELEVEN opportunities answered including at least TWO at Excellence level plus FOUR at Merit level (or higher) and FIVE at Achievement level (or higher). Minimum $2 \times E + 4 \times M + 5 \times A$