

SL & HL Questions on Alkanes

1. State the balanced equations for the complete combustion (under standard conditions) of 2-methylbutane, C_5H_{12} (boiling point: $28\text{ }^\circ\text{C}$), 3-methylpentane, C_6H_{14} , and octane, C_8H_{18} .
2. If the ratio of air to gasoline (petrol) entering a car engine is reduced then the amount of air pollution caused by oxides of nitrogen emitted in the exhaust gas is lowered. However, the concentration of two other air pollutants is increased. Identify these two pollutants and explain how they arise.
3. The first step in the reaction between methane and chlorine in the presence of ultraviolet light is the homolytic fission of the chlorine to chlorine single bond, $Cl-Cl(g)$, in gaseous chlorine.
 - i. Explain the meaning of the term *homolytic fission*.
 - ii. Explain why homolytic fission occurs with the $Cl-Cl$ bond in chlorine and not the $C-H$ bond in methane.
 - iii. State the name of the product formed when the $Cl-Cl$ bond is broken homolytically and state its electron configuration.
 - iv. Explain why only a few homolytic fission reactions involving chlorine need to be successful in order to bring about the complete reaction between chlorine and methane to form chloromethane and hydrogen chloride.
4. The reaction between bromine and ethane occurs in the presence of ultraviolet light.
 - i. Explain why ultraviolet light is necessary for the reaction to proceed.
 - ii. Describe, using equations, the stepwise mechanism of the reaction between one mol of bromine and one mol of ethane to form one mol of bromoethane and one mol of hydrogen bromide.
 - iv. Describe how you could make pure 1,2-dibromoethane from bromine and ethane.