

Dr Clays A-level Chemistry

UNIT 3 TOPIC 2
ALKANES & HALOGENOALKANES

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Unit 3 Topic 2– Alkanes & Halogenoalkanes

Exercise 1 – Fractional Distillation, Cracking and Combustion

1. Petroleum is separated into its fractions by fractional distillation

   a) What are fractions?

   b) Explain how a fractionating column works in five key points.

   c) Write a list of the fractions, in order of increasing boiling point, and give a use for each.

   d) Why is fractional distillation important?

2. Many of the fractions are then subjected to a process called cracking.

   a) Name the two types of cracking. State the conditions required for each and give one useful product of each process.

   b) Why is cracking economically important?

3. Most of the fractions produced during fractional distillation are used as fuels.

   a) Write an equation for the complete combustion of octane.

   b) Write two equations for the incomplete combustion of octane.

   c) Give two reasons why incomplete combustion is undesirable.

4. a) Identify five pollutants produced during the combustion of alkanes.

   b) Explain why each is harmful.

   c) Explain how two of these pollutants are removed from exhaust fumes. Write an equation to illustrate your answer.

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EXERCISE 2 – CHLORINATION OF ALKANES

1. Alkanes react with halogens in a reaction described as homolytic free radical substitution. Explain what is meant by the terms:

    i) homolytic
    ii) free radical
    iii) substitution

2. a) Using full displayed formulae, show the four steps involved in the reaction of **ethane** with chlorine to give chloroethane. State the type of reaction involved in each step.

    b) Show by mans of additional steps how this mechanism can account for the formation of:

    iv) 1,1-dichloroethane
    v) butane

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EXERCISE 3 – reactions of haloalkanes

1. a) Draw the structure of a chlorofluorocarbon and write an equation to show how it can release chlorine radicals in the presence of ultra-violet light.

   b) Write equations to show how chlorine radicals can catalyse the destruction of ozone.

2. a) Explain why haloalkanes can react with nucleophiles.

   b) Write an equation and give the mechanism for the following reactions:

      i) bromoethane with aqueous sodium hydroxide

      ii) 2-chloropropane with potassium cyanide

      iii) 1-iodobutane with ammonia

3. State two types of reaction that could take place when 1-chlorobutane reacts with potassium hydroxide. Give the mechanism for each reaction and state the role of the hydroxide ion in each case. Suggest conditions which would favour each type of reaction.

4. Suggest, giving reasons, which of chloroethane, bromoethane and iodoethane will react fastest with sodium hydroxide.

5. State the possible products that could be formed when the following haloalkanes undergo elimination. If more than one product is formed, identify them both and explain how each is formed.

   a) 1-bromobutane

   b) 2-bromobutane

   c) 1-bromomethylpropane

   d) 2-bromomethylpropane