**2.1.1 Substitution Reactions of Alkanes**

**1) Write an equation to show the reaction of:**

**a) methane with chlorine**

**b) ethane with chlorine**

**Name the organic product in each case.**

**2) Explain what is meant by a substitution reaction and explain why the reactions in question 1 are substitution reactions.**

**3) Draw and name the possible products of the reaction between:**

**a) propane and bromine**

**b) butane and iodine**

**c) pentane and chlorine**

**d) methylpropane and bromine**

**e) methylbutane and chlorine**

**4) Define the terms:**

**a) free radical**

**b) homolytic fission**

**Use these terms to describe the first stage in the reaction of ethane with chlorine.**

**5) Write two equations to show how ethane can be converted into chloroethane via two simple collisions.**

**6) As a result of the reaction in question 4 and the reactions in question 5, how many different types of free radical are there in the system at any given time? Hence write three different equations to show how free radicals can be removed. Which reaction will be the most common?**

**7) Hence write the four steps in the reaction of ethane with chlorine.**

**8) Explain the meaning of the terms:**

**a) initiation**

**b) propagation**

**c) termination**

**Label the four steps in question 7 as initiation, propagation and termination**

**9) The product of this reaction can also react with chlorine. What other products could be made as a result?**

**10) Could any new products be made as a result of different termination steps?**

**11) Using your answers to questions 9 and 10, comment on the effectiveness of free radical substitution reactions as a way of making halogenoalkanes.**