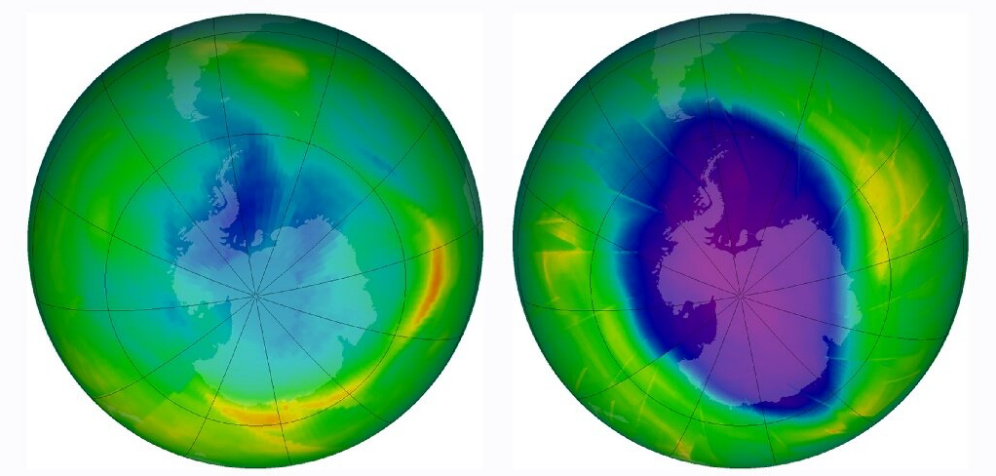
HALOGENOALKANES



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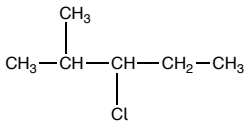
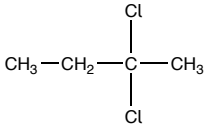
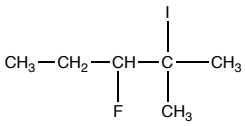
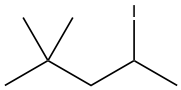
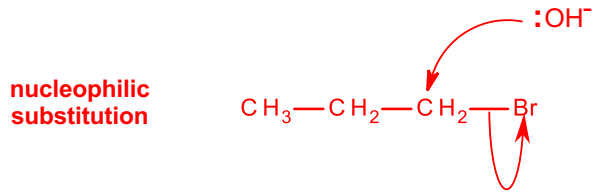
TASK 1 – Drawing and naming halogenoalkanes

structure				
name	**3-chloro-2-methylpentane**	**2,2-dichlorobutane**	**3-fluoro-2-iodo-2-methylpentane**	**2-iodo-3,3-dimethylpentane**

NUCLEOPHILIC SUBSTITUTION REACTIONS

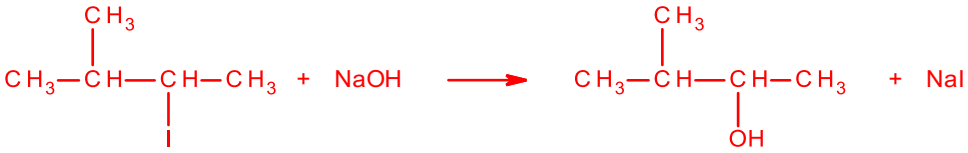
Example 3

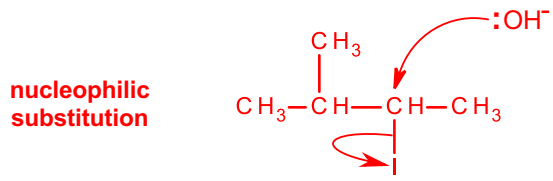
e.g. 1-bromopropane + aqueous NaOH

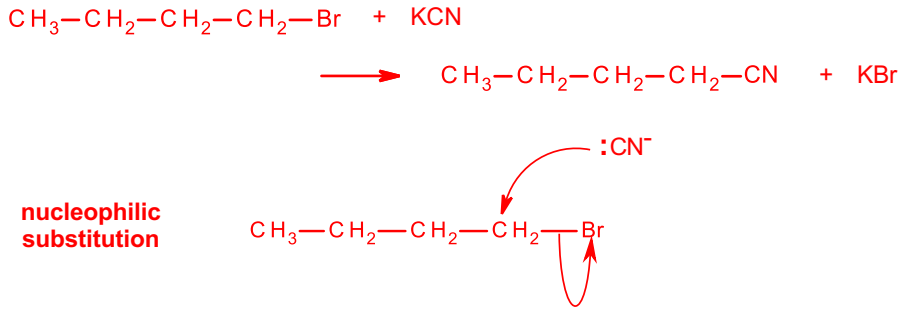
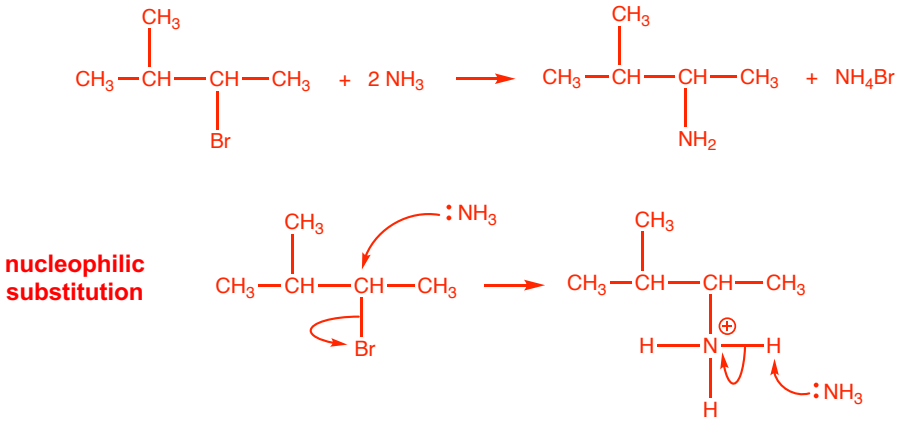


Example 4

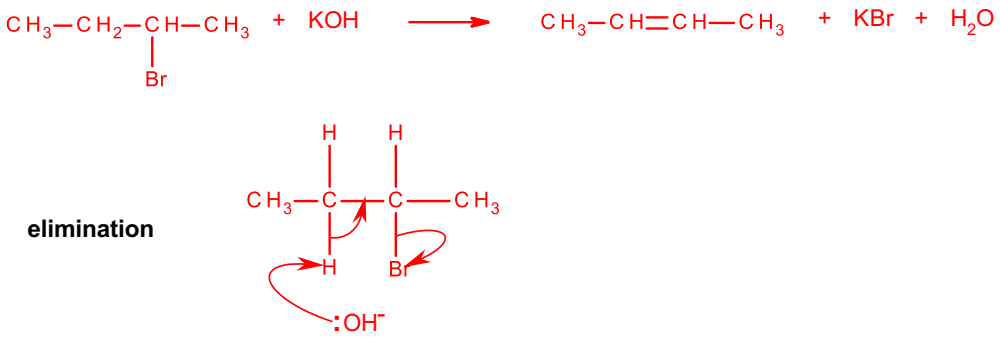
e.g. 2-iodo-3-methylbutane + aqueous NaOH





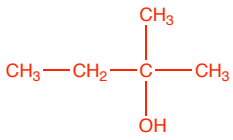
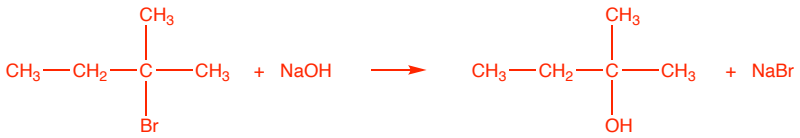
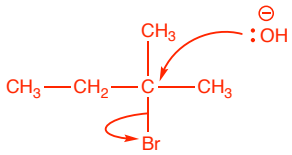
Example 6	e.g. 1-bromobutane + KCN in aqueous ethanol 
Example 8	e.g. 2-bromo-3-methylbutane + excess conc NH_3 

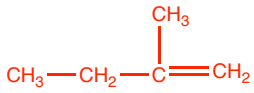
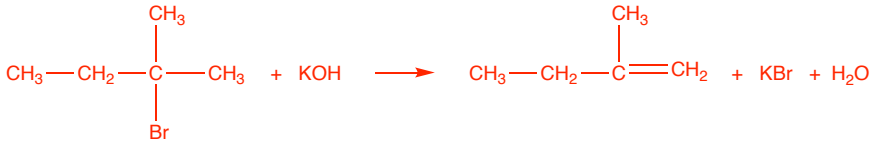
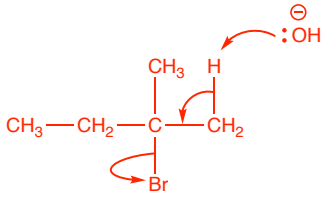
ELIMINATION REACTIONS

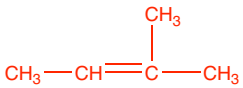
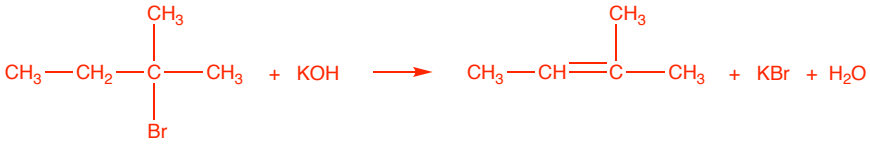
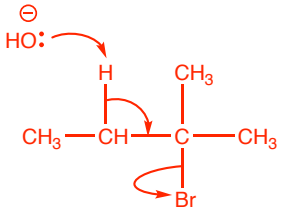
Example 10	e.g. 2-bromobutane + hot, ethanolic KOH (to give but-2-ene) 

TASK 2 – Competing reactions

2-bromo-2-methylbutane reacts with hydroxide ions to form an alcohol and two alkenes.

ALCOHOL	
Structure of alcohol	
Name of alcohol	**2-methylbutan-2-ol**
Balanced equation	
Name of mechanism	**nucleophilic substitution**
Outline of mechanism	
Role of OH^- ion	**nucleophile**
Reagent and conditions to favour this reaction	**warm, aqueous NaOH**

ALKENE 1	
Structure of alkene	
Name of alkene	**2-methylbut-1-ene**
Balanced equation	
Name of mechanism	**elimination**
Outline of mechanism	
Role of OH^- ion	**base**
Reagent and conditions to favour this reaction	**hot, ethanolic KOH**

ALKENE 2	
Structure of alkene	
Name of alkene	**2-methylbut-2-ene**
Balanced equation	
Name of mechanism	**elimination**
Outline of mechanism	
Role of OH^- ion	**base**
Reagent and conditions to favour this reaction	**hot, ethanolic KOH**

TASK 3 – REACTIONS OF HALOGENOALKANES

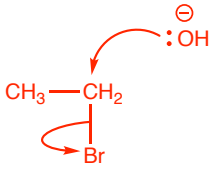
1) bromoethane + aqueous NaOH

balanced equation (showing structural formulae)

name of organic product **ethanol**

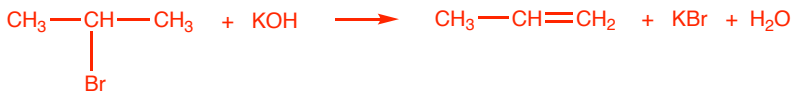
name of mechanism **nucleophilic substitution**

mechanism outline



2) 2-bromopropane + ethanolic KOH

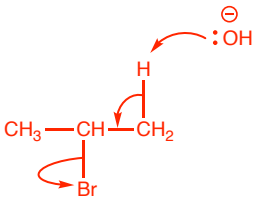
balanced equation (showing structural formulae)



name of organic product **propene**

name of mechanism **elimination**

mechanism outline



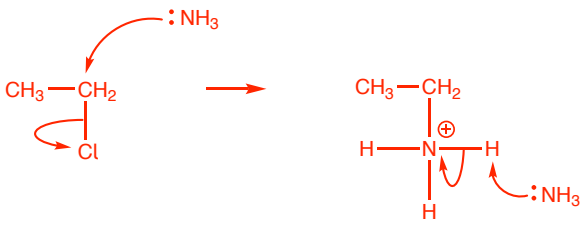
3) chloroethane + NH_3 (excess of NH_3)

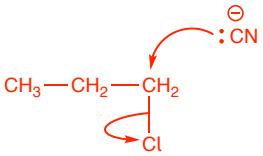
balanced equation (showing structural formulae)

name of organic product **ethylamine / ethanamine**

name of mechanism **nucleophilic substitution**

mechanism outline

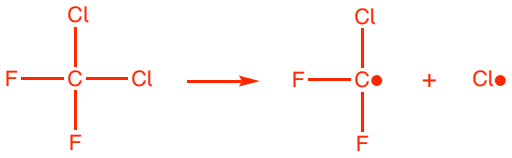


4)	chloromethane + chlorine (with uv light, excess of chloromethane)	
	balanced equation (showing structural formulae)	
	$CH_3Cl + Cl_2 \rightarrow CH_2Cl_2 + HCl$	
	name of organic product	**dichloromethane**
	name of mechanism	**free radical substitution**
	mechanism outline	**Initiation** $Cl_2 \rightarrow 2Cl\bullet$
		Propagation $CH_3Cl + Cl\bullet \rightarrow \bullet CH_2Cl + HCl$
		$\bullet CH_2Cl + Cl_2 \rightarrow CH_2Cl_2 + Cl\bullet$
		Termination $\bullet CH_2Cl + Cl\bullet \rightarrow CH_2Cl_2$ or $2\ \bullet CH_2Cl \rightarrow CH_2Cl\text{-}CH_2Cl$
5)	**1-chloropropane + KCN**	
	balanced equation (showing structural formulae)	
		
	name of organic product	**butanenitrile**
	name of mechanism	**nucleophilic substitution**
	mechanism outline	

CFCs and the OZONE LAYER

TASK 4 – CFCs & OZONE

1 **a** Write an equation to show the formation of ozone destroying free radicals from CFC-11, $CFCl_3$

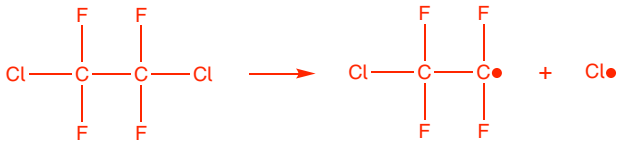


b Write a pair of equations to show how free radicals from part **a** destroy ozone molecules.

$Cl\bullet + O_3 \rightarrow ClO\bullet + O_2$

$ClO\bullet + O_3 \rightarrow Cl\bullet + 2O_2$

2 **a** Write an equation to show the formation of ozone destroying free radicals from CFC-114, CF_2ClCF_2Cl



b Write a pair of equations to show how free radicals from part **a** destroy ozone molecules.

$Cl\bullet + O_3 \rightarrow ClO\bullet + O_2$

$ClO\bullet + O_3 \rightarrow Cl\bullet + 2O_2$

c Explain why one free radical from part **a** can destroy very many ozone molecules.

Cl● acts as a catalyst – the Cl● is regenerated after it destroys O_3 and so can destroy more O_3

Cl● is removed by reaction with another radical but chances of collision with another radical is low as at any moment there are far more molecules present than radicals

3 **a** R-134a (CF_3CH_2F) is commonly used as a refrigerant in place of CFCs. Explain why this compound cannot destroy ozone.

does not contain any Cl atoms