

1. A chemist compares the rates of hydrolysis of 1-chloropropane and 1-bromopropane in ethanol.

Which reagent in aqueous solution should be used?

- A Silver chloride
- B Silver nitrate
- C Potassium chloride
- D Potassium nitrate

white ppt.
cream ppt.
in AgNO_3

Your answer

B

[1]

2. Ethane reacts with chlorine by radical substitution to form chloroethane.

Which radical(s) is/are present in the mechanism?

1 H•

2 Cl•

3 C₂H₅•

- A 1, 2 and 3
B Only 1 and 2
C Only 2 and 3
D Only 1

Your answer



[1]

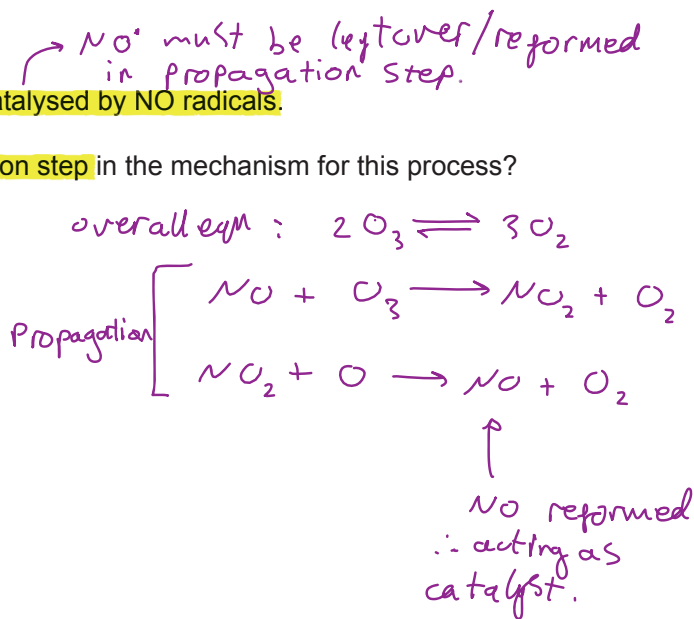
3. The breakdown of ozone is catalysed by NO radicals.

Which equation is a propagation step in the mechanism for this process?

- A $\text{NO} + \text{O}_2 \rightarrow \text{N} + \text{O}_3$
 B $\text{NO} + \text{O}_2 \rightarrow \text{NO}_2 + \text{O}$
 C $\text{N} + \text{O}_3 \rightarrow \text{NO} + \text{O}_2$
 D $\text{NO}_2 + \text{O} \rightarrow \text{NO} + \text{O}_2$

Your answer

D



[1]

4. This question is about the hydrolysis of haloalkanes.

(a) The rate of hydrolysis of a haloalkane depends on the halogen present.

State and explain how the halogen in the haloalkane affects the rate of hydrolysis.

The weaker the bond the faster the rate of hydrolysis. For example, a C-F has the slowest rate of hydrolysis followed by C-Br and C-I has the fastest. [2]

(b) Chlorocyclohexane is hydrolysed with aqueous sodium hydroxide.

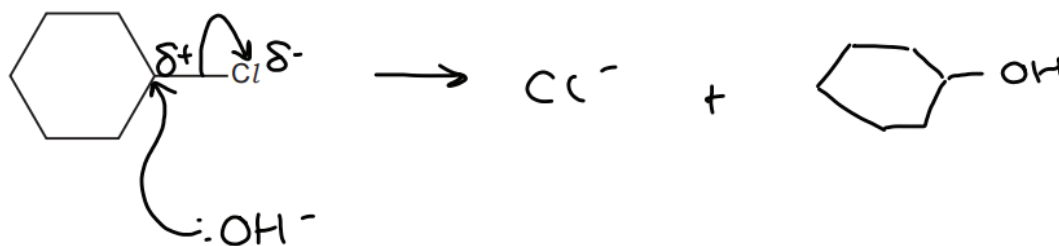
haloalkane

OH⁻

nucleophilic substitution

Outline the mechanism for this reaction.

Show curly arrows, relevant dipoles and the products.



[3]

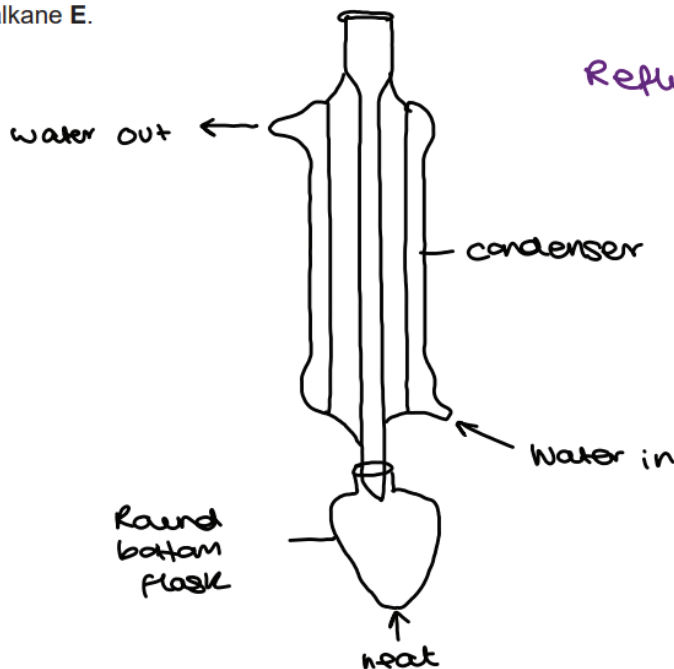
(c) A student hydrolyses a haloalkane, E, using the following method.

- 0.0100 mol of haloalkane E is refluxed with excess NaOH(aq) to form a reaction mixture containing an organic product F.
- The reaction mixture is neutralised with dilute nitric acid.
- Excess $\text{AgNO}_3(\text{aq})$ is added to the reaction mixture. 1.88 g of a precipitate G forms.

nucleophilic substitution

Organic product, F, has a molar mass of 74.0 g mol^{-1} and has a chiral carbon atom.

(i) Draw a labelled diagram to show how the student would carry out the hydrolysis of haloalkane E.



[2]

(ii) Analyse the information to identify E, F and G.

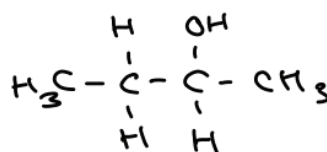
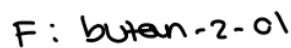
Show your working.



$$\frac{1.88}{0.01} = 188 \text{ g mol}^{-1} = \text{RFM of G}$$

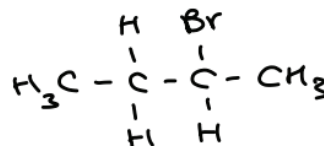
$$188 - 107.9 = 80.1 = \text{Br}^-$$

↑
RFM of Ag



$$(12 \times 4) + 9 + 16 + 1 = 74 \text{ g mol}^{-1}$$

E:

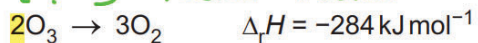


[3]

5. Radical reactions are responsible for the catalysed breakdown of the ozone layer.

The overall equation is shown below.

2 : 3 molar ratio



The molar gas volume in the ozone layer is approximately $2.5 \text{ m}^3 \text{ mol}^{-1}$.

What is the energy released, in kJ, during the breakdown of 1.0 m^3 of ozone in the ozone layer?

- A 56.8
B 113.6
C 355
D 710

Your answer

A

$$\frac{2.5 \text{ m}^3 \text{ mol}^{-1}}{1 \text{ m}^3} = 2.5 \text{ mol}^{-1}$$

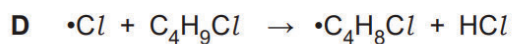
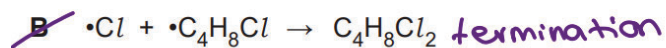
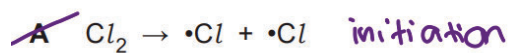
$$\frac{-284 \text{ kJ mol}^{-1}}{2.5 \text{ mol}^{-1}} = 113.6 \text{ kJ}$$

$$\frac{2}{113.6 \text{ kJ}} = 56.8 \text{ kJ} \quad [1]$$

6. Butane reacts with chlorine in the presence of ultraviolet radiation to form a mixture of organic products.

free radical substitution

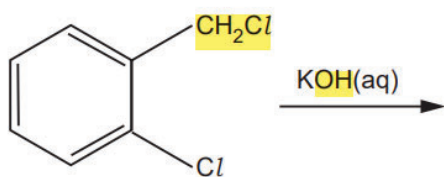
Which equation shows a propagation step in the mechanism for this reaction?



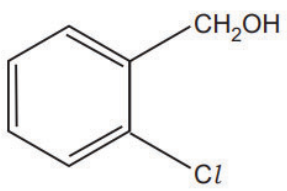
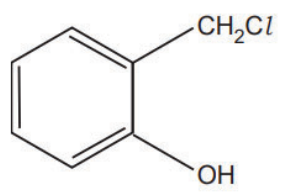
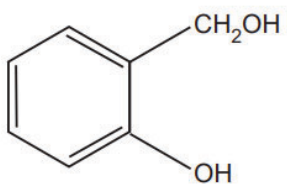
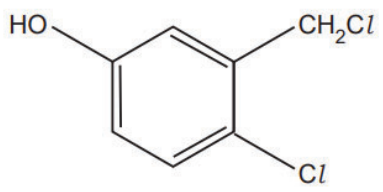
Your answer

[1]

7. What is the organic product of the reaction below?



nucleophilic substitution
 OH^- nucleophile

A	 <p>Structure A: A benzene ring with a CH_2OH group and a Cl atom on adjacent carbons.</p>
B	 <p>Structure B: A benzene ring with a CH_2Cl group and an OH group on adjacent carbons.</p>
C	 <p>Structure C: A benzene ring with a CH_2OH group and an OH group on adjacent carbons.</p>
D	 <p>Structure D: A benzene ring with a CH_2Cl group, a Cl atom, and an OH group on three different carbons.</p>

Your answer

[1]