

20.1 Types of Organic Reactions

Question Paper

Course	DPIB Chemistry
Section	20. Organic Chemistry (HL only)
Topic	20.1 Types of Organic Reactions
Difficulty	Easy

Time allowed: 60
Score: /42
Percentage: /100

Question 1a

a)
Define the term *nucleophile*.

[2]

[2 marks]

Question 1b

b)
Explain why the hydroxide ion, OH^- , is a stronger nucleophile than water.

[2]

[2 marks]

Question 1c

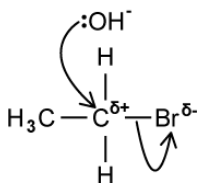
c)
State the two ways a nucleophilic substitution reaction can occur.

[1]

[1 mark]

Question 1d

d)
State the name of the mechanism occurring in the image below which will form ethanol in one step.



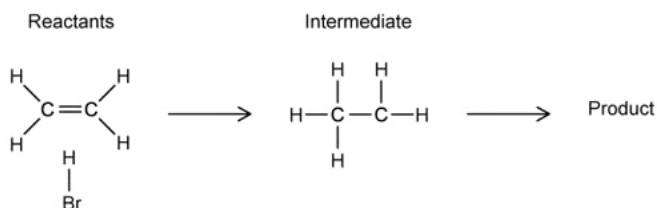
[1]

[1 mark]

Question 2a

a)

The start of the electrophilic addition mechanism for the addition of hydrogen bromide to ethene is shown below:



Complete the mechanism by:

i)

Adding **two** curly arrows and the partial charges, $\delta+$ / $\delta-$, to the reactants.

[3]

ii)

Adding the correct charge to the carbocation intermediate, adding the anion, including its lone pair, and **one** curly arrow to the intermediate step.

[3]

[6 marks]

Question 2b

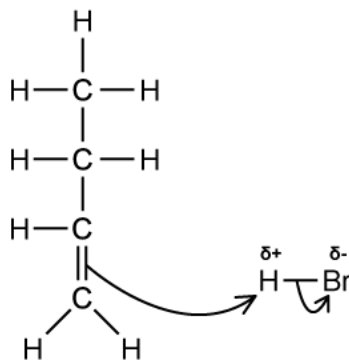
- b)
Draw the product of the reaction in part a).

[1]

[1 mark]

Question 2c

- c)
The electrophilic addition of hydrogen bromide to but-1-ene results in two isomeric products - one is a major product and one is a minor product. The first steps of the electrophilic addition mechanism are shown below:



- i)
Draw the displayed formula of the secondary carbocation intermediate that forms the major product.

[1]

- ii)
Draw the displayed formula of the primary carbocation intermediate that forms the minor product.

[1]

[2 marks]

Question 2d

- d)
Explain why the secondary carbocation is more stable than the primary carbocation.

[1]

[1 mark]

Question 3a

a)

Name the type of mechanism that benzene will undergo in order to form nitrobenzene.

[1]

[1 mark]

Question 3b

b)

State the reagents required to form nitrobenzene from benzene.

[1]

[1 mark]

Question 3c

c)

Phenylamine, $C_6H_5NH_2$, can be formed from nitrobenzene. State the reagents required.

[2]

[2 marks]

Question 3d

d)

Outline the mechanism for the formation of nitrobenzene from benzene.

[3]

[3 marks]

Question 4a

a)

State what is meant by the term *protic, polar solvent*.

[2]

[2 marks]

Question 4b

b)

State what is meant by the term *aprotic, polar solvent*.

[2]

[2 marks]

Question 4c

c)

State which type of solvent is best suited to the following nucleophilic substitution reactions.

i)

S_N1

[1]

ii)

S_N2

[1]

[2 marks]

Question 4d

d)
Identify the type of reaction that converts aldehydes and ketones to their corresponding parent alcohol.

[1]

[1 mark]

Question 4e

e)
Name a reducing agents that can convert aldehydes and ketones into their corresponding alcohols.

[1]

[1 mark]

Question 5a

a)
2-chloro-2-methylpropane is reacted with aqueous sodium hydroxide in ethanol and heated under reflux.

i)
Deduce the class of halogenoalkane that 2-chloro-2-methylpropane belongs to.

[1]

ii)
State the name of the product formed in this reaction.

[1]

iii)
State the type of mechanism that this reaction will favour.

[1]

[3 marks]

Question 5b

b)

Outline the mechanism for the reaction given in part a).

[4 marks]**Question 5c**

c)

State the type of bond breaking that occurs in this mechanism.

[1]

[1 mark]**Question 5d**

d)

A student stated that changing the halogenoalkane for the reaction in part a) to 2-iodo-2-methylpropane, the reaction would be quicker. Is the student correct? Explain your answer.

[3]

[3 marks]