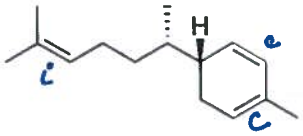
12A. Identify groups of conjugated atoms.

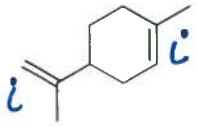
c = conjugated
i = isolated

12A.1 Determine if the alkenes in the following molecules are conjugated or isolated.

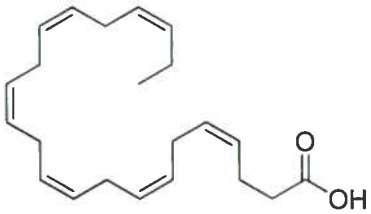
a) zingiberene (in ginger)



b) limonene (in citrus)

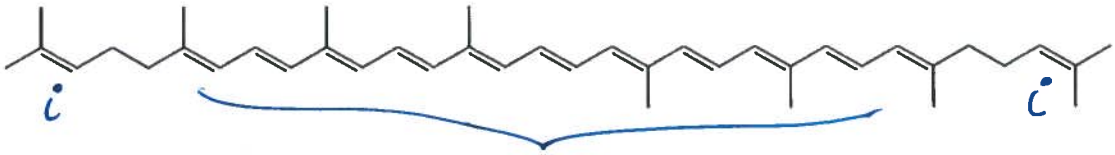


c) docosahexanoicacid (in fish oil)



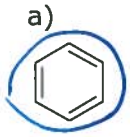
all i

d) lycopene (in tomato)

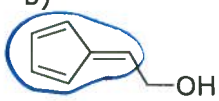


12A.2 For the molecules below circle groups of atoms that are conjugated.

a)

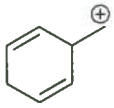


b)



c)

d)

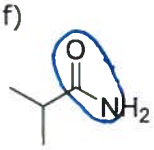


none

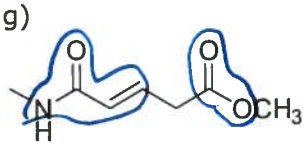
e)

none

f)

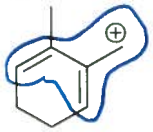


g)

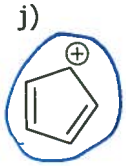


h)

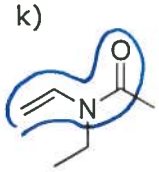
i)



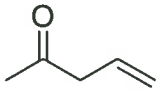
j)



k)



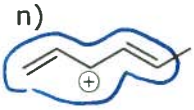
l)



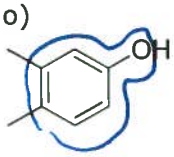
none

m)

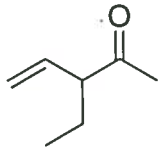
n)



o)



p)



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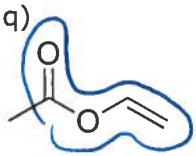
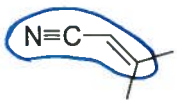
q)

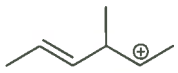


r)



u)

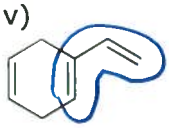
x)



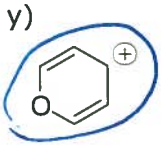
none

s)

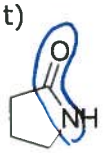
v)



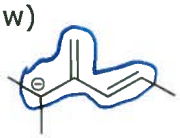
y)



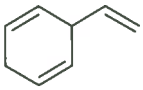
t)



w)



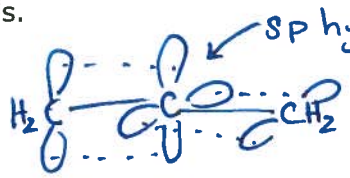
z)



none

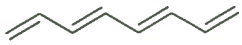
12A.3 Although allenes have three adjacent carbons with p orbitals, they are not conjugated. Draw the p orbital system of the allene below to explain this.

$H_2C{=}C{=}CH_2$

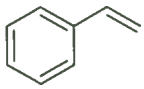


12A.4 Circle the molecule in each set with the largest (most exothermic) heat of hydrogenation.

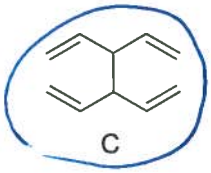
a)



A



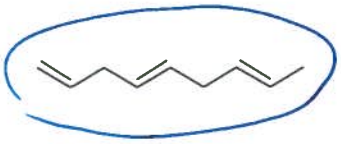
B



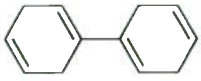
C

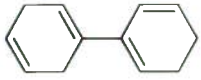
D

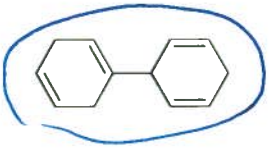
b)



c)



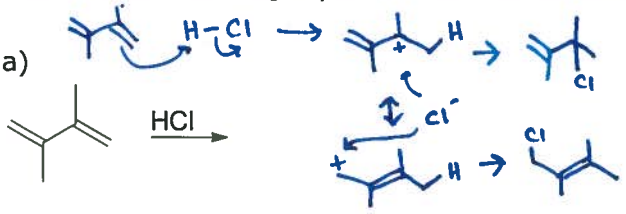




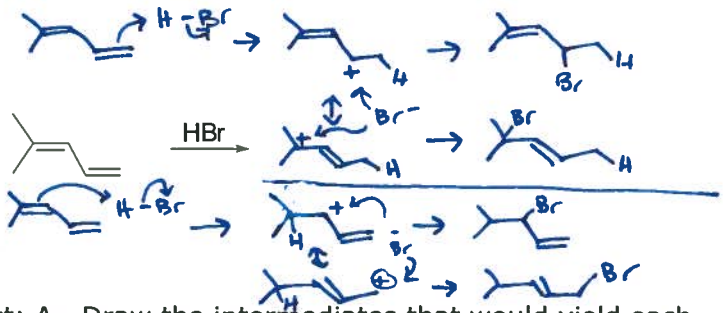
12B. Predict the 1,2 and 1,4 products of addition of HX to symmetric and asymmetric conjugated dienes. Draw the mechanism for their formation.

12B.1 Draw the major products of the following reactions and their mechanism of formation.

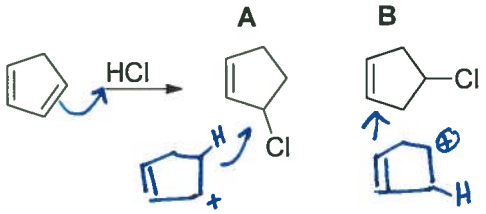
a)



b)



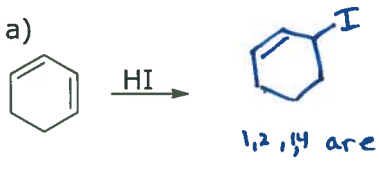
12B.2 The reaction below produced only one product: A. Draw the intermediates that would yield each product and explain why B is not observed.



A's intermediate is resonance stabilized, B's is not, therefore less stable and B is not formed

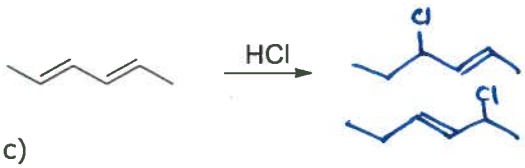
12B.3 Predict all major products of the following reactions.

a)

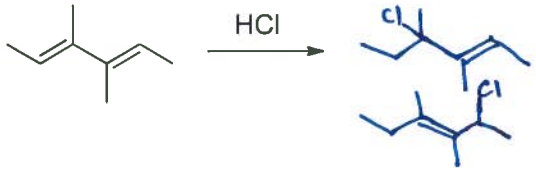


1,2, 1,4 are equiv

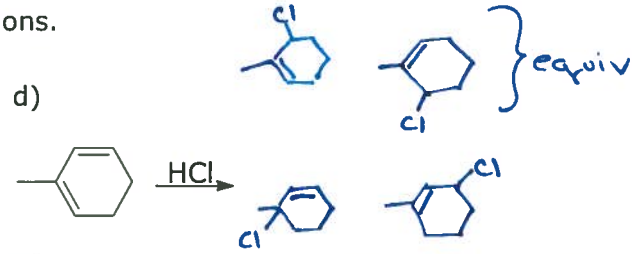
b)



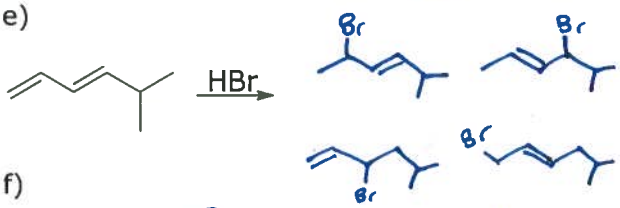
c)



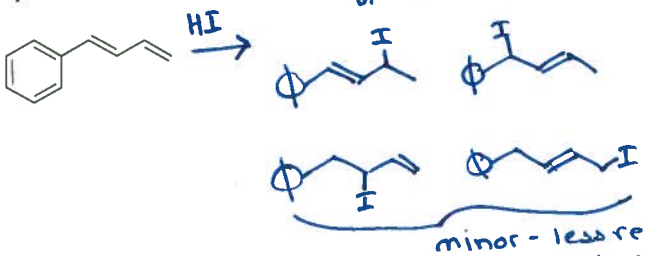
d)



e)



f)



minor - less resonance in intermediate

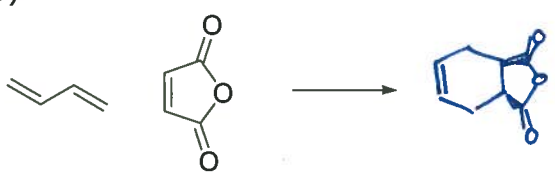
12C. Predict the products of the Diels-Alder reaction including stereochemistry.

12C.1 Predict the major product, if any, indicate stereochemistry where appropriate.

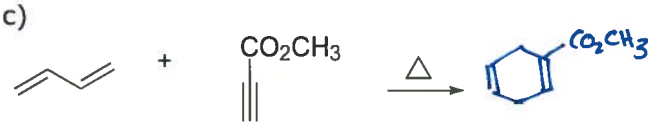
a)

+ enant.

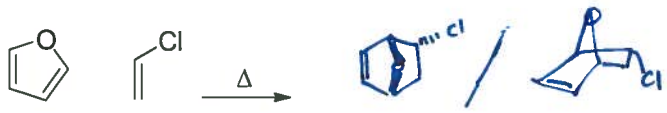
b)



c)



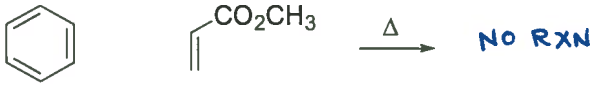
d)



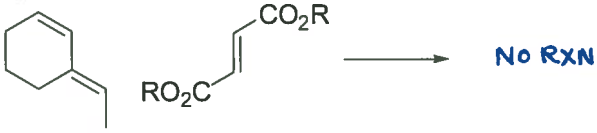
e)

f)

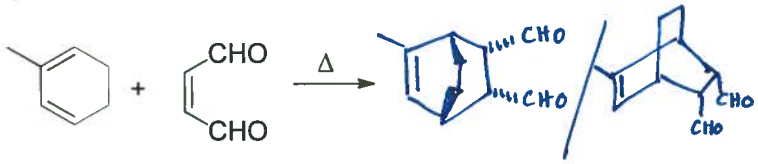
g)



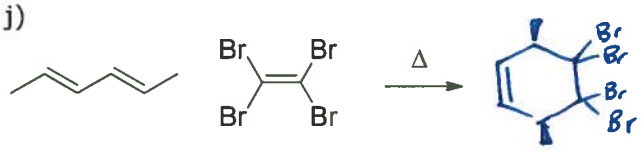
h)



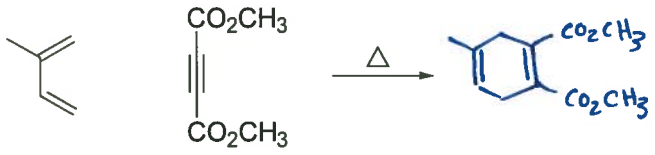
i)



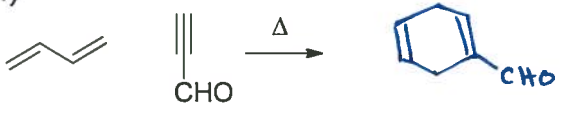
j)



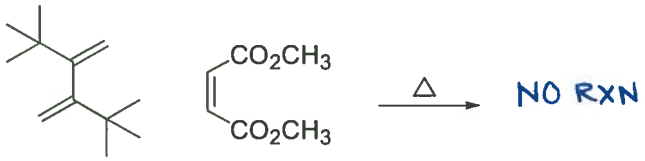
k)



l)



m)



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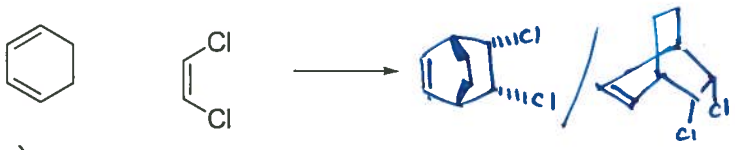
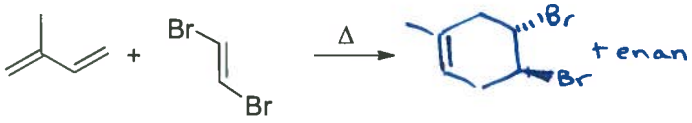
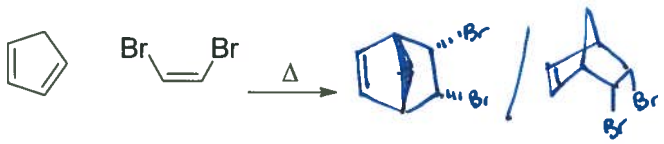


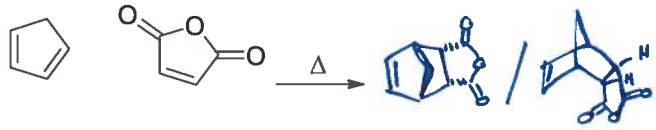
o)



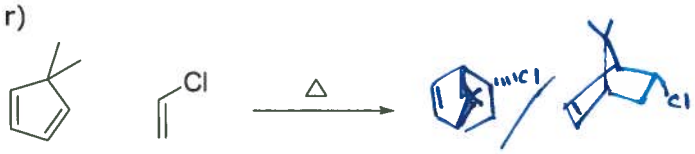
p)



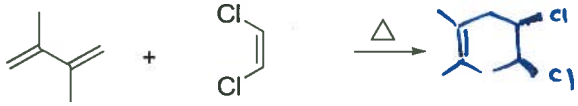
q)



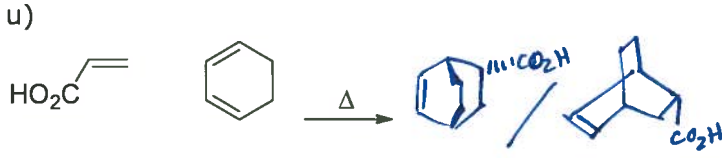
r)



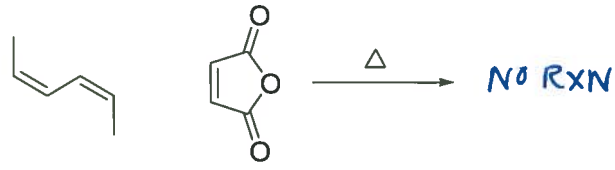
s)



u)

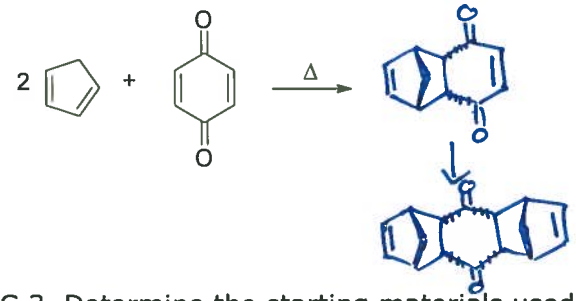


v)

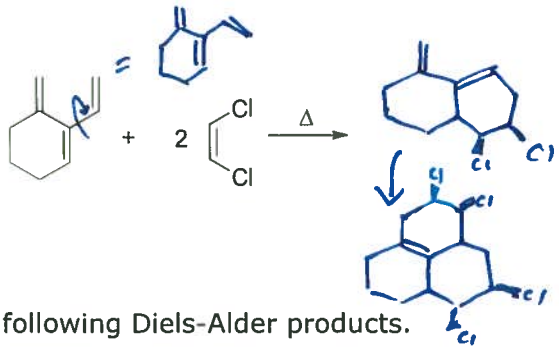


12C.2 The following undergo two sequential Diels-Alder reactions. Draw the product after each addition.

a)

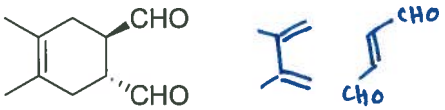


b)



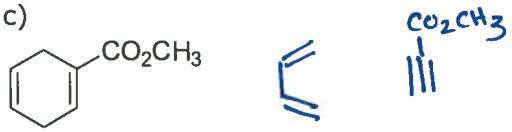
12C.3 Determine the starting materials used to form the following Diels-Alder products.

a)

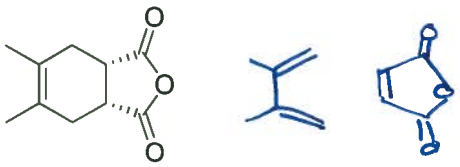


b)

c)



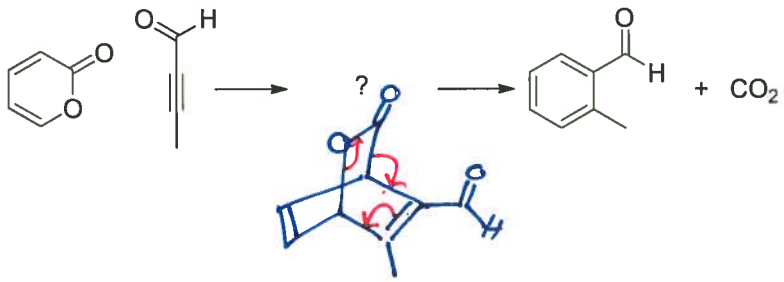
d)



e)

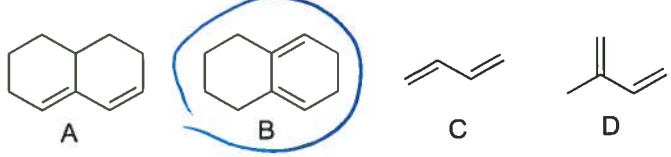
f)

12C.4 The following molecules undergo a Diels-Alder addition followed by a reverse Diels-Alder giving of carbon dioxide gas. Draw the intermediate.



12D. Recognize factors that effect the rate of the Diels-Alder reaction.

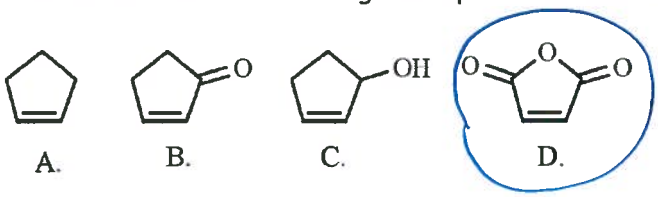
12D.1. Circle the diene that would react fastest under Diels-Alder conditions.



12D.2 Which of the following is a characteristic of the Diels-Alder reaction?

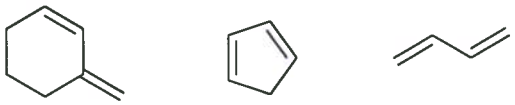
a) It is concerted. b) It involves anions. c) It involves cations. d) It requires multiple steps.

12D.3 Which of the following dienophiles is most reactive in a Diels-Alder reaction?



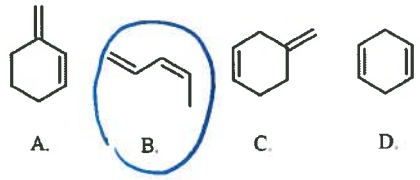
A. B. C. D.

12D.4. Rank the following in order of Diels-Alder reactivity, where 1 reacts fastest and 3 slowest.



3 1 2

12D.5 Which of the following can be an *s-cis* diene?



A. B. C. D.