Bruice, Chapter 7, 40 Multiple Choice Questions Exercise

Q1 Are the double bonds in 2-methyl-1,3-butadiene isolated, conjugated or cumulated?
Hint Review the introduction to Section 7.
a. isolated
b. conjugated
c. cumulated
d. all of the above
e. none of the above

Q2 Are the bonds in propadiene isolated, conjugated or cumulated?
Hint Review Section 7.1
a. isolated
b. conjugated
c. cumulated
d. all of the above
e. none of the above

Q3 Are the bonds in 5-bromo-1,4-cyclohexadiene isolated, conjugated or cumulated?
Hint Review the introduction to Section 7.1
a. isolated
b. conjugated
c. cumulated
d. all of the above
e. none of the above

Q4 What is the IUPAC name of isoprene? Option 1: 2-methyl-1,3-butadiene. Option 2: 2-methylbuta-1,3-diene. Option 3: 3-methylbuta-1,3-diene.

Hint Review Section 7.1

a. option 1 only

b. option 2 only

c. option 3 only

d. options 1 and 2

e. options 2 and 3.

Q5 In deciding the IUPAC name of an unsaturated compound, which one of the following criteria has highest priority?

Hint Review Section 7.1

a. longest carbon chain

b. chain with most double bonds

c. chain with most triple bonds

d. chain with most multiple bonds

e. chain with most hetero atoms

Q6 Which answer shows the correct order of functional group priorities?

Hint Review Section 7.1

a. C=O > OH > NH_2 > C=C = C≡C

b. C=O < OH < NH_2 < C=C = C≡C

c. OH > NH_2 > C=O > C=C = C≡C

d. OH < NH_2 < C=O < C=C = C≡C

e. OH < NH_2 < C=O < C=C < C≡C

Q7	In IUPAC nomenclature, in which direction does one have to number the main chain?
Hint	Review Section 7.1
a.	lowest number to the lowest-priority functional group
b.	lowest number to the highest-priority functional group
c.	highest number to the highest-priority functional group
d.	highest number to the lowest-priority functional group
e.	this option not used

Q8	Which one of the following compounds is named in the correct IUPAC nomenclature?
Hint	Review Section 7.1
a.	3-butyl-1-hexen-4-yne
b.	4-butyl-5-hexen-2-yne
c.	4-vinyl-2-octyne
d.	5-vinyl-6-octyne
e.	4-pentyl-5-hexen-2-yne

Q9	How many configurational isomers can exist for a molecule with three isolated double bonds?
Hint	Review Section 7.2
a.	3
b.	6
c.	8
d.	9
e.	27

Q10 Among the unbranched heptadienes listed, which one is the thermodynamically least stable structural isomer?

Hint Review Section 7.3

a. 1,2-heptadiene

b. 2,3-heptadiene.

c. 1,4-heptadiene

d. 1,5-heptadiene

e. 2,4-heptadiene

Q11 Which relation correctly shows the relative lengths of C-C single bonds between carbons of various hybridizations?

Hint Review Section 7.3

a. (sp-sp) < (sp-sp2) < (sp-sp3) ≈ (sp3-sp3) < (sp2-sp2)

b. (sp2-sp2) < (sp-sp2) < (sp-sp3) ≈ (sp-sp) < (sp3-sp3)

c. (sp3-sp3) < (sp-sp2) < (sp-sp3) ≈ (sp2-sp2) < (sp-sp)

d. (sp-sp) > (sp-sp2) > (sp-sp3) ≈ (sp2-sp2) > (sp3-sp3)

e. (sp-sp) < (sp-sp2) < (sp-sp3) ≈ (sp2-sp2) < (sp3-sp3)

Q12 Which bond length in Angstroems best describes the typical C-C single bond between the double bonds in conjugated dienes?

Hint Review Section 7.3

a. 1.34

b. 1.37

c. 1.47

d. 1.50

e. 1.54

Q13 How many nodes are there in the HOMO (highest occupied molecular orbital) of 1,3-butadiene?

Hint Review Section 7.3

a. 0

b. 1

c. 2

d. 3

e. 4

Q14 What is the relation between the pi-planes of the two double bonds in allenes and in 1,3-dienes?

Hint Review Section 7.3

a. same plane in both cases

b. perpendicular in both cases

c. perpendicular planes for allene, same plane for 1,3-diene

d. perpendicular planes for 1,3-diene, same plane for allene

e. staggered in both cases

Q15 Which reaction type is the one most frequently encountered in the reactions of dienes?

Hint Review Section 7.4

a. nucleophilic substitution reactions

b. electrophilic substitution reactions

c. nucleophilic addition reactions

d. electrophilic addition reactions

e. this option no used

Q16 Which one of the following compounds is the major product in the addition of 2 HBr to 1,4-pentadiene?

Hint Review Section 7.5

a. 1,5-dibromopentane

b. 2,4-dibromopentane

c. 1,4-dibromopentane

d. 1,2-dibromopentane

e. 1,1-dibromopentane

Q17 Which one of the following compounds is the major product in the addition of 1 HBr to 2-methyl-1,4-pentadiene?

Hint Review Section 7.5

a. 5-bromo-2-methyl-1-pentene

b. 4-bromo-2-methyl-1-pentene

c. 4-bromo-4-methyl-1-pentene

d. 5-bromo-4-methyl-1-pentene

e. 2-bromomethyl-1,4-pentadiene

Q18 In the addition of HBr to 1,3-butadiene, which is the correct first mechanistic step?

Hint Review Section 7.6

a. H^+ addition to terminal C-atom and formation of allyl cation

b. H^+ addition to non-terminal C-atom and formation of allyl cation

c. Br^- addition to terminal C-atom and formation of allyl anion

d. Br^- addition to -terminal C-atom and formation of allyl anion

e. concerted addition of H^+ and Br^-

Q19 In the addition of HBr to 1,4-hexadiene, which is the most likely product?

a. 4-bromo-2-hexene

b. 1-bromo-2-hexene

c. 2-bromo-3-hexene

d. 3-bromo-1-hexene

e. this option not used

Q20 What is the reason for the preferential formation of the 1,4-addition products in HBr additions to conjugated dienes?

Hint Review Section 7.7

a. kinetic and thermodynamic product

b. kinetic product

c. thermodynamic product

d. photonic product

e. electronic product

Q21 For a reaction where the thermodynamic and the kinetic products differ, which one of the following statements is true?

Hint Review Section 7.7

a. mild conditions leads to thermodynamic product

b. mild conditions lead to kinetic product

c. mild conditions lead to kinetic and thermodynamic products

d. vigorous conditions lead to a mixture of kinetic and thermodynamic product

e. vigorous conditions lead to kinetic product

Q22 For a reaction where the thermodynamic and the kinetic products differ, which one of the following statements best describes the second step in the reaction coordinate diagram?

Hint Review Section 7.7

a. the less stable product requires the lower activation barrier

b. the more stable product requires the lower activation barrier

c. the activation barriers for the formation of both products are exactly the same

d. this option is not used

e. this option is not used

Q23 In a reaction in which the kinetic and the thermodynamic products differ, which of the following statements is true?

Hint Review Section 7.7

a. the thermodynamic product predominates when the reaction is irreversible

b. the thermodynamic product predominates when the reaction is reversible

c. the kinetic product predominates when the reaction is reversible

d. both products are formed in equal amounts when the reaction is reversible

e. both products are formed in equal amounts when the reaction is irreversible

Q24 In electrophilic additions to 1,3-butadienes, which of the following statements concerning the competition between 1,2- and 1,4-addition is true?

Hint Review Section 7.7

a. 1,2-addition is ALWAYS the kinetic product

b. 1,4-addition is ALWAYS the kinetic product

c. 1,2-addition or 1,4-addition may be the kinetic product

d. this option is not used

e. this option is not used

Q25 In the electrophilic addition of HBr to 4-methyl-1,3-pentadiene, which one of the four structures shown is the thermodynamic product?

Hint Review Section 7.7

a. 1-bromo-4-methyl-2-pentene

b. 3-bromo-4-methyl-1-pentene

c. 4-bromo-4-methyl-2-pentene

d. 4-bromo-2-methyl-2-pentene

e. this option is not used

Q26 What reagents are combined in a Diels-Alder reaction?

Hint Review Section 7.8

a. a conjugated diene and a dienophile

b. a cumulated diene and a dienophile

c. an isolated diene and a dienophile

d. two conjugated dienes and a dienophile

e. a conjugated diene and a dienophobe

Q27 Which one of the following compounds is NOT a dienophile?

Hint Review Section 7.8

a. CH_2=CH-CH=O

b. CH_2=CH-C≡N

c. CH_2=CH-O-COR

d. CH_2=CH-CH=CH_2

e. CH_2=CH-CH_3

Q28 What is the product of a typical Diels Alder reaction?

Hint Review Section 7.8

a. cyclohexane

b. cyclohexene

c. cyclohexa-1,3-diene

d. cyclohexa-1,4-diene

e. 1,3-hexadiene

Q29 Most of the following Diels Alder reactions occur below 30 degree Celcius. Identify the one reaction that requires a much higher reaction energy.

Hint Review Section 7.8

a. 1,3-butadiene and *para*-benzoquinone

b. 1,3-butadiene and propenoic acid methyl ester

c. 1,3-butadiene and maleic anhydride

d. 1,3-butadiene and acrolein

e. 1,3-butadiene and ethene

Q30 What type of cycloaddition is represented by the Diels-Alder reaction?

Hint Review Section 7.8

a. [2 + 2]

b. [4 + 2]

c. [6 + 2]

d. [6 + 4]

e. [4 + 4]

Q31 What is the stereochemistry of the product is formed in the stereospecific reaction of 1,3-butadiene and *cis*-2-butene?

Hint Review Section 7.8

a. *cis* product

b. *trans* product with (*S,S*) configurations

c. *trans* product with (*R,R*) configurations

d. *trans* product with (*S,S*) and (*R,R*) configurations

e. *trans* product without chiral centers

Q32 Identify the major product of the Diels-Alder reaction between 1-methoxy-1,3-butadiene and the dienophile acrolein (CH_2=CH-CH=O)?

Hint Review Section 7.8

a. 5-methoxy-4-cyclohexene-carbaldehyde

b. 4-methoxy-3-cyclohexene-carbaldehyde

c. 5-methoxy-3-cyclohexene-carbaldehyde

d. 2-methoxy-3-cyclohexene-carbaldehyde

e. 4-methoxy-4-cyclohexene-carbaldehyde

Q33 What determines the regiochemistry in the Diels-Alder reaction between a X-CH=CH-CH=CH_2 and Y-CH=CH_2? The X-group is electron-donating and the Y-group is electron-withdrawing.

Hint Review Section 7.8

a. X and Y should be as far away from each other as possible.

b. complementarity of charge distributions at the bond-forming pairs of C-atoms

c. similarity of the charge distributions at the bond-forming pairs of C-atoms

d. charge distribution in the diene only

e. charge distribution in the dienophile only

Q34 Which one of the following compounds always has the s-*cis* conformation and therefore reacts fast in Diels-Alder reactions?

Hint Review Section 7.8

a. 3-methylene-cyclohexene

b. 1,3-butadiene

c. 1-methoxy-1,3-butadiene

d. 2-methoxy-1,3-butadiene

e. 1,3-cyclopentadiene

Q35 What type of bicyclic system is represented by the compound bicyclo[4.4.0]decane?

Hint Review Section 7.9

a. spirocyclic

b. fused

c. bridged

d. gyrocyclic

e. omega-cyclic

Q36 What type of bicyclic system is represented by the compound bicyclo[2.2.1]hept-2-ene?

Hint Review Section 7.9

a. spirocyclic

b. fused

c. bridged

d. spiro and bridged

e. fused and bridged

Q37 What is the name of the spirocyclic compound that is formed when a cyclopentane and cyclohexane share a carbon atom?

Hint Review Section 7.9

a. spiro[4.5]decane

b. spiro[5.4]decane

c. spiro[5.6]decane

d. spiro[6.5]decane

e. spiro[5.5]decane

Q38 What is the name of the fused bicyclic compound that is formed when cyclopentane and cycloheptane share one bond?

Hint Review Section 7.9

a. bicyclo[2.5.7]decane

b. bicyclo[0.5.7]decane

c. bicyclo[0.3.5]decane

d. bicyclo[7.5.0]decane

e. bicyclo[5.3.0]decane

Q39 Which of the following solvents CANNOT be used to recrystallize maleic anhydride?

Hint Compare Problem 29 in Bruice 2/e.

a. cyclopentene

b. bicyclo[3.3.0]octane

c. pentane

d. cyclopentadiene

e. cyclopentane

Q40 Which of the following reactions will afford 5-methyl-bicyclo[2.2.1]hept-2-ene in a Diels-Alder reaction?

Hint Compare Problem 34 in Bruice 2/e.

a. cyclopentadiene and propane

b. cyclopentene and propene

c. cyclopentene and propane

d. cyclopentadiene and propene

e. cyclopentane and propene