11-1 Answer in the back of the textbook is adequate.

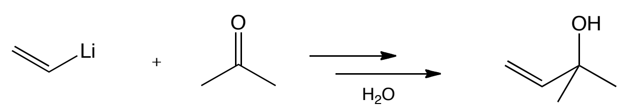
11-2 Answer in the back of the textbook is adequate.

11-3 Answer in the back of the textbook is adequate.

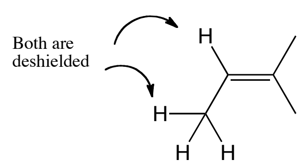
11-4 Answer in the back of the textbook is adequate.

11-5 Answer in the back of the textbook is adequate.

11-6 Recall that the properties of basicity and nucleophilicity go hand-in-hand---all bases are nucleophiles and all nucleophiles are bases. Here we have a variant on the addition of an organometallic reagent to a ketone, the product of which is an alcohol.

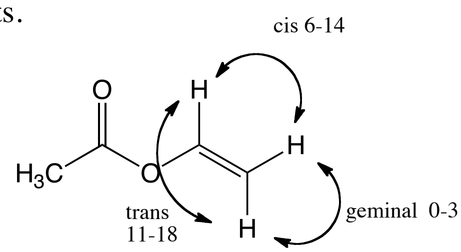


11-7 The induced magnetic field that strongly deshields hydrogens attached to sp^2-hybridized carbon atoms also extends outward to hydrogens attached to a carbon that is attached to an sp^2-hybridized carbon, but the effect is significantly less as these hydrogens are further removed from the π electrons.

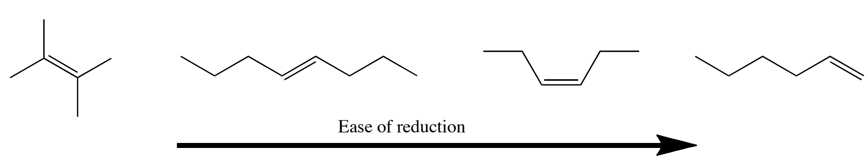


11-8 This exercise is worked out on page 457 as "Working with Concepts".

11-9 Here we can make assignments based upon coupling constants. The two geminal hydrogens will have a small and a large coupling constant whereas the remaining vinyl hydrogen with have two relatively large coupling constants.



11-10 The more substituted are the sp^2-hybridized carbon atoms of an alkene, the more stable it is. When the degree of substitution is the same, a trans alkene will be more stable than is a cis alkene.

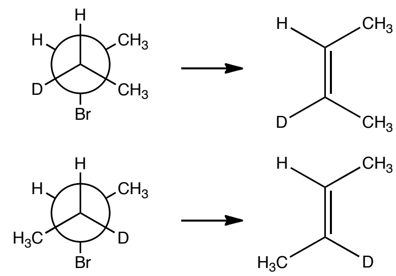


11-11 Bond angle distortion is much greater in the alkene than in the alkane product. The sp^2-hybrized carbon atoms of the alkene are constrained to 90˚ rather than 120˚.

11-12 This exercise is worked out on page 464 as "Working with Concepts".

11-13 The more bulky is the base, the more the reaction is driven to removal of a hydrogen from a less-substituted carbon atom.

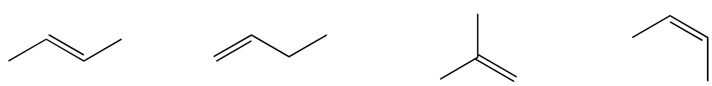
11-14 The key here is that we must orient the hydrogen anti to the leaving group as both products requested retain the deuterium.



11-15 Answer in the back of the textbook is adequate.

11-16 Answer in the back of the textbook is adequate.

11-17 There are four alkenes with the formula C_4H_8:



A B C

The assignments are straight forward. Only a terminal, monosubstituted alkene has two absorptions. As well, the C-H bending is unique to the trans disubstituted alkene. Finally, the absorption at 890 cm^{-1} is characteristic of a 1,1-disubstituted alkene.

11-18 There are books with tables that list all of the possible combinations of elements that result in a given mass. But this can be a fun exercise to work through logically. For a mass of 46, we know we can have no more than 3 carbon atoms which would total 36. But with three carbon atom we can not have an oxygen and, as well, with only three carbon atoms and no oxygen, we would need 10 hydrogen atoms, too many for three carbon atoms. So we back off to two carbon atoms and here we must have an oxygen as otherwise again we would need too many hydrogen atoms. Two carbons and one oxygen give a total of 40, requiring that we finish the formula with six hydrogens: C_2H_6O. We are not done as we must also consider the possibility of one carbon which requires two oxygens which total 44, leaving mass for two hydrogen atoms. You should work the others out for yourself.

11-19

11-20 Just grab your calculator and crunch the numbers using the values in Table 11-5.

11-21 Bromine as two isotopes present in nearly equal amounts at natural abundance. So there are four possible combinations (with a contribution of 14 from the carbon and two hydrogens):
14 + 79 + 79 = 172
14 + 79 + 81 = 174
14 + 81 + 79 = 174
14 + 81 + 81 = 176.
Note that as there are two ways to arrive at 174, the intensity of this peak will be twice that of the other two.

11-22 Here we have the combination of two factors: atomic weight and number of bonds when the element is valence satisfied.

Element	Atomic weight	# of bonds
Hydrogen	odd	odd
Carbon	even	even
Oxygen	even	even
Nitrogen	even	odd

The effect on the molecular weight, even or odd, of each element is the sum of the two properties in the table. Recall that two odds make and even, two evens make and even, and only and even plus an odd makes an odd. So C, H, and O also provide an even molecular weight whereas the addition of one nitrogen results in an odd. But add two nitrogens, and two odds make an even.

11-23 The answer at the back of the textbook is adequate.

11-24 The simple procedure is to replace each halogen by a hydrogen atom, each nitrogen atom by a CH, and simply ignore any oxygens present. We then us the formula: C_nH_{2n+2} to find the number of hydrogen atoms that would be present absent any rings or double bonds. Each pair of hydrogens that are missing indicates the presence of one ring or one multiple bond.

a) C_5H_{10} is missing two hydrogens, or one pair;
b) $C_9H_{12}O$ translates to C_9H_{12} which is missing 4 pairs;
c) C_8H_7ClO translates to C_8H_8 which is missing 5 pairs;
d) $C_8H_{15}N$ translates to C_9H_{16} which is missing 2 pairs;
e) C_4H_8Br2 translates to C_4H_{10} which is missing no pairs.

11-25 This exercise is worked out on page 483 as "Working with Concepts".

11-26 We have a formula that corresponds to two rings, one ring and one double bond, or two double bonds. But we can conclude from the lack of absorptions in the infrared characteristic of double bonds that we have a bicyclic structure. Only two are possible.