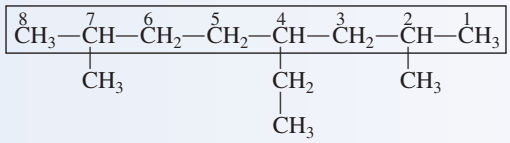
Selection of the numbering system to be used cannot be made based on the "first-encountered-alkyl-group rule" because an alkyl group is equidistant from each end of the chain. Thus the second-encountered alkyl group is used as the "tie-breaker." It is closer to the right end of the parent chain (carbon 4) than to the left end (carbon 5). Thus we use the right-to-left numbering system.

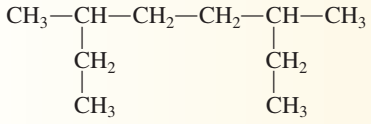
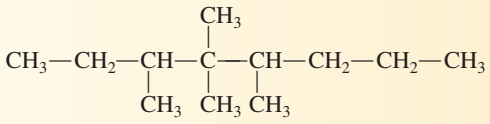


Two different kinds of alkyl groups are present: ethyl and methyl. Ethyl has alphabetical priority over methyl and precedes methyl in the IUPAC name. The IUPAC name is 4-ethyl-2,7-dimethyloctane.

Always compare the total number of carbon atoms in the name with the number of carbon atoms in the structure to make sure they match. The name 4-ethyl-2,7-dimethyloctane indicates the presence of 2 + 2(1) + 8 = 12 carbon atoms. The structure does have 12 carbon atoms.

Practice Exercise 12.2

Give the IUPAC name for each of the following alkanes.

a.  **b.** 

Answers: **a.** 3,6-Dimethyloctane; **b.** 3,4,4,5-Tetramethyloctane

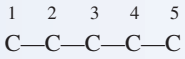
After you learn the rules for naming alkanes, it is relatively easy to reverse the procedure and translate the name of an alkane into a structural formula. Example 12.3 shows how this is done.

EXAMPLE 12.3
Generating the Structural Formula of an Alkane from Its IUPAC Name

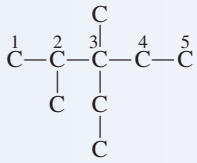
Draw the condensed structural formula for 3-ethyl-2,3-dimethylpentane.

Solution

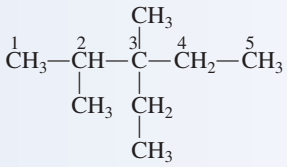
Step 1: The name of this compound ends in *pentane,* so the longest continuous chain has five carbon atoms. Draw this chain of five carbon atoms and number it.



Step 2: Complete the carbon skeleton by attaching alkyl groups as they are specified in the name. An ethyl group goes on carbon 3, and methyl groups are attached to carbons 2 and 3.

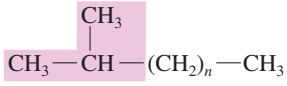


Step 3: Add hydrogen atoms to the carbon skeleton so that each carbon atom has four bonds.

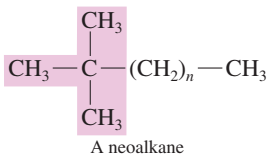


(continued)

A few smaller branched alkanes have common names—that is, non-IUPAC names—that still have widespread use. They make use of the prefixes *iso* and *neo,* as in isobutane, isopentane, and neohexane. These prefixes denote particular end-of-chain carbon atom arrangements.



An isoalkane
(e.g., $n = 1$, Isopentane)



A neoalkane
(e.g., $n = 1$, Neohexane)