

## 16.1: Classifying Amines

### Learning Objectives

- Determine the structural feature that classifies amines as primary, secondary, or tertiary.

Amines are classified according to the number of carbon atoms bonded directly to the nitrogen atom. A primary ( $1^\circ$ ) amine has one alkyl (or aryl) group on the nitrogen atom, a secondary ( $2^\circ$ ) amine has two, and a tertiary ( $3^\circ$ ) amine has three (Figure 16.1.1).

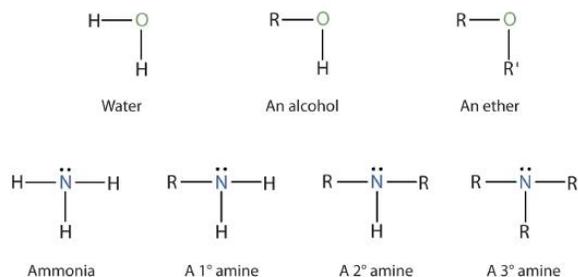
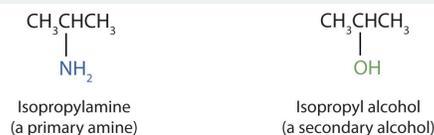


Figure 16.1.1: The Structure of Amines Compared to Water, an Alcohol, and an Ether

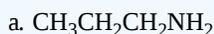
To classify alcohols, we look at the number of carbon atoms bonded to the *carbon atom* bearing the OH group, not the oxygen atom itself. Thus, although isopropylamine looks similar to isopropyl alcohol, the former is a *primary* amine, while the latter is a *secondary* alcohol.



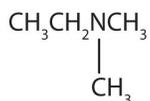
The common names for simple aliphatic amines consist of an alphabetic list of alkyl groups attached to the nitrogen atom, followed by the suffix *-amine*. (Systematic names are often used by some chemists.) The amino group ( $\text{NH}_2$ ) is named as a substituent in more complicated amines, such as those that incorporate other functional groups or in which the alkyl groups cannot be simply named.

### Example 16.1.1

Name and classify each compound.



b.



- $\text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_3$
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{NHCH}_3$

### Solution

- There is only one alkyl group attached to the nitrogen atom, so the amine is primary. A group of three carbon atoms (a propyl group) is attached to the  $\text{NH}_2$  group through an end carbon atom, so the name is propylamine.
- There are two methyl groups and one ethyl group on the nitrogen atom. The compound is ethyldimethylamine, a tertiary amine.
- There are two ethyl groups attached to the nitrogen atom; the amine is secondary, so the compound is diethylamine.
- The nitrogen atom has a methyl group and a propyl group, so the compound is methylpropylamine, a secondary amine.

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