

## 4.7: Amides

### Learning Objectives

- Identify the general structure for an amide.
- Identify the functional group for an amide.
- Name amides with common names.
- Name amides according to the IUPAC system.

**Amides** are carboxylic acid derivatives that contain a functional group has an nitrogen atom attached to a carbonyl carbon atom. If the two remaining bonds on the nitrogen atom are attached to hydrogen atoms, the compound is a *simple amide*. If one or both of the two remaining bonds on the atom are attached to alkyl or aryl groups, the compound is a *substituted amide*.

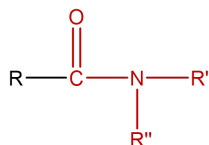


Figure 4.7.1: General structure of an amide. If R' and R'' are both hydrogen atoms, the compound is a simple amide. If not, it is a substituted amide.

The carbonyl carbon-nitrogen bond is called an **amide linkage**. This bond is quite stable and is found in the repeating units of protein molecules, where it is called a *peptide linkage*.

### Naming Amides

Simple amides are named as derivatives of carboxylic acids. The *-ic acid* ending of the common name or the *-oic acid* ending of the International Union of Pure and Applied Chemistry (IUPAC) name of the carboxylic acid is replaced with the suffix *-amide*.



Figure 4.7.2: Structures of a carboxylic acid (left) and amide (right) along with common (top) and IUPAC (bottom) names.

The names of substituted amides, include the identity of the R' or R'' (of N-R) substituents. Instead of locator numbers, N- is used to indicate the location of these groups (Figure 4.7.3).

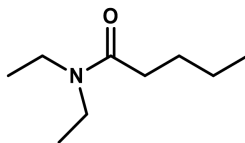
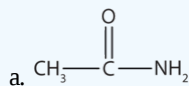
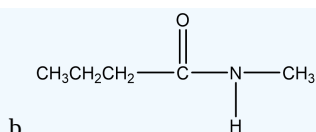


Figure 4.7.3: Skeletal structure of N,N-diethylpentanamide.

### ✓ Example 4.7.1

Name each compound with the common name, the IUPAC name, or both.



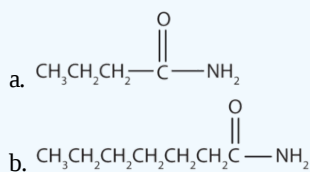


### Solution

- This amide has two carbon atoms and is thus derived from acetic acid. The OH of acetic acid is replaced by an  $\text{NH}_2$  group. The *-ic acid* from *acetic acid* (or *-oic acid* from ethanoic acid) is dropped, and *-amide* is added to give *acetamide* (or ethanamide in the IUPAC system).
- This is a substituted amide since there is a methyl group bonded to the nitrogen. The parent portion of the molecule is derived from butanoic acid. The *-oic acid* is dropped, and *-amide* is added to give butanamide. The methyl group is attached to the nitrogen (N) of the functional group, so the location is indicated as N-methyl. Therefore the name of the molecule is N-methylbutanamide.

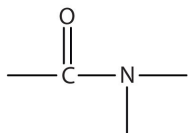
### ? Exercise 4.7.1

Name each compound with the common name, the IUPAC name, or both.



### Key Takeaways

- Amides have a general structure in which a nitrogen atom is bonded to a carbonyl carbon atom.
- The functional group for an amide is as follows:



- In names for amides, the *-ic acid* of the common name or the *-oic acid* ending of the IUPAC for the corresponding carboxylic acid is replaced by *-amide*.

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