

1.11: Amines and Amides

Learning Objective

- How to name amines and amides.

An **amino group** consists of a nitrogen atom bonded to two hydrogen atoms, written as -NH_2 . If the hydrogens are replaced by R groups, the group is referred to as a **substituted amino group**. **Amines** and **amides** are two compounds which contain **amino or substituted amino groups**.

Amines are designated as **primary, secondary, or tertiary amines** based upon the degree of substitution of the amino group. For example, an amine in which all three of the potential nitrogen bonds are with R groups instead of hydrogens is called a tertiary amine (see the right-most molecule below).

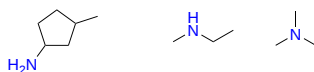


Figure 1.11.1: primary, secondary, and tertiary amines

Despite the complexity of the below molecule, because the nitrogen is directly bound to two hydrogens and only one R group, it is a primary amine.

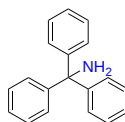


Figure 1.11.2: an enormous primary amine

There are multiple substitutive nomenclatures for naming amines, with the two most common being IUPAC and Chemical Abstract Service. Both will be described below.

This molecule is named 2-pentanamine (CAS) or 2-aminopentane (IUPAC).

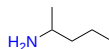


Figure 1.11.3: 2-pentanamine (CAS) / 2-aminopentane (IUPAC)

Practice Questions

1. What are the names of Molecule A?

Molecule A

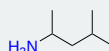


Figure 1.11.4.

2. This molecule is named 1,6-hexanediamine (CAS) or 1,6-diaminohexane (IUPAC).

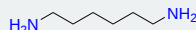


Figure 1.11.5: 1,6-hexanediamine (CAS) / 1,6-diaminohexane (IUPAC)

What are the names of Molecule B?

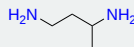


Figure 1.11.6: Molecule B

3. This molecule is named N,N-dimethylethanamine (CAS) or dimethylaminoethane (IUPAC).

N,N-dimethylethanamine (CAS) / dimethylaminoethane (IUPAC)



Figure 1.11.7.

What are the names of Molecule C?

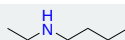


Figure 1.11.8: Molecule C

4. This molecule is named 4-amino-2-pentanone (CAS) or 4-aminopentan-2-one (IUPAC). Number the carbons.



Figure 1.11.9: 4-amino-2-pentanone (CAS) / 4-aminopentane-2-one (IUPAC)

5. Number the carbons. What are the names of Molecule D?



Figure 1.11.10: Molecule D

6. This molecule is named 2-(N-methylamino)ethanol (CAS) or 2-methylaminoethanol (IUPAC). Number the carbons.

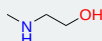


Figure 1.11.11: 2-(N-methylamino)ethanol (CAS) / 2-methylaminoethanol (IUPAC)

7. Number the carbons. What are the names of Molecule E?

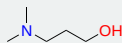


Figure 1.11.12: Molecule E

An **amide** is a **carboxylic acid derivative** in which the **carboxyl -OH** has been replaced with an **amino or substituted amino group**. Amides are also described as primary, secondary, or tertiary depending on the number of R groups bound directly to the nitrogen.

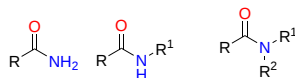


Figure 1.11.13: primary, secondary, and tertiary amides

The naming of simple amides is based on the carboxylic acid nomenclature, and keeps the same name in the CAS and IUPAC systems.

The name of this molecule is 3-methylbutanamide.

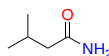


Figure 1.11.14: 3-methylbutanamide

Practice Questions

1. What is the name of Molecule F?

Molecule F

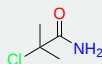


Figure 1.11.15.

2. The name of this molecule is N-methylbenzamide.

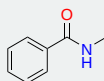


Figure 1.11.16: N-methylbenzamide

What is the name of Molecule G?

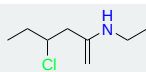


Figure 1.11.17: Molecule G

3. What additions do we make to our existing naming rules to name amines and amides, in the substitutive naming system that you use?
4. Write the steps that you use to name an amine in order, as instructions for a student who doesn't know how to do it.
5. Draw any amine and go through the steps in naming your molecule.
6. Write the steps that you use to name an amide in order, as instructions for a student who doesn't know how to do it.
7. Draw any amide and go through the steps in naming your molecule.

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