3.15 AMINES AND AMIDES

SECTION 3.15 QUESTIONS

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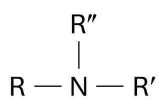
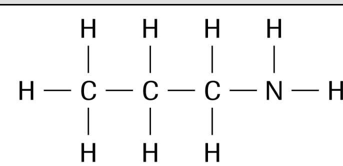
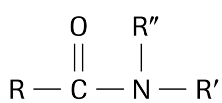
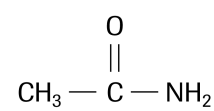
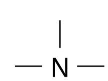
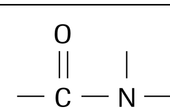
Understanding Concepts

1. An –OH group is removed from the carboxylic acid and an –H is removed from the amide to produce a water molecule.
2. Amines contain –NH groups, which are less polar than –OH groups in alcohols, and are less capable of hydrogen bonding than are –OH groups, which accounts for the lower boiling points of amines.
3. (a) amine
   (b) amide
4. (a) alcohol, amine; The –OH group in alcohols is more polar than the –NH group in amines, making alcohols less soluble in nonpolar solvents than amines.
   (b) hydrocarbon, amine; Bonds between N and C are more polar than bonds between H and C. Therefore, amines are slightly more polar than hydrocarbons, making them less soluble in nonpolar solvents. However, if the nonpolar groups are large, the increased attraction between nonpolar groups may make amines more soluble in nonpolar solvents.
5. Length of nonpolar hydrocarbon component: $CH_3CH_2CH_2CH_2CH_3$
   Presence of double or triple bonds: $CH_2{=}CH_2$, $CH_3C{\equiv}CCH_3$
   –OH groups: CH_3CH_2OH
   –NH groups: H_2NCH_3
   C=O bonds: CH_3CHO, CH_3COOH
6. Student examples will vary.

Front:

Family name and general formula	Examples		
	IUPAC name	Common name	Structural formula
Amines 	1-aminopropane	(none)	
Amides 	ethanamide	(none)	

Back:

Family	Characteristic properties	Characteristic functional groups	Intermolecular forces
Amines	often have unpleasant odours; react with carboxylic acids to form amides; have higher boiling points and melting points than similar-sized hydrocarbons, lower boiling points and melting points than similar-sized alcohols; smaller amines are readily soluble in water		Hydrogen bonds due to any –NH groups; van der Waals forces due to polar C–N bonds
Amides	generally insoluble in water		Hydrogen bonding due to –NH groups

7. (a) Each small unit must contain an amino group and a carboxyl group, so that an amide bond can form between small units.
   (b) Because they have both amino groups and carboxyl groups, amino acids are likely fairly soluble in water and are capable of forming strong amide bonds.

Making Connections

8. The carboxylic acids, such as citric acid in lemons and acetic acid in vinegar, react with the amines responsible for the fishy taste in fish to produce amides, thereby reducing the smell. For example,

$$CH_3COOH + H\underset{\displaystyle CH_3}{\underset{|}{N}}CH_3 \rightarrow CH_3CO\underset{\displaystyle CH_3}{\underset{|}{N}}CH_3 + H_2O$$

ethanoic acid + dimethylamine $\rightarrow$ *N, N*-dimethyl ethanamide + water

3.16 EXPLORE AN ISSUE: REGULAR OR DIET?

Understanding the Issue

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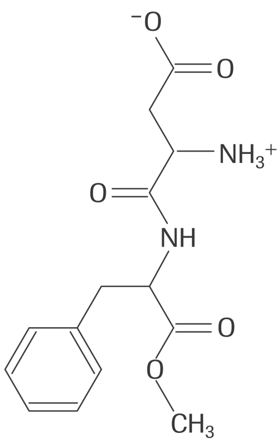
1. cyclamates, saccharin, aspartame
2. (a) People who are trying to reduce their food energy intake, or who are living with diabetes, can still enjoy sweetened drinks and foods. Also, artificially sweetened products do not contribute to tooth decay.
   (b) People who use artificial sweeteners are not avoiding highly sweetened foods and drinks, so are likely to continue to consume them, whether sweetened naturally or artificially. Consuming sweetened foods may lead to continued weight gain and tooth decay. Furthermore, studies indicate that artificial sweeteners may be bad for your health.
3. (a)



aspartame

$M_{\text{aspartame}} = 294.34$ g/mol

   (b) $M_{\text{aspartame}} = 294.34$ g/mol

The portion in the aspartame molecule attributable to methanol is CH_3O.

$m_{CH_3O} = 31.04$ g

$$\%CH_3O = \frac{31.04\text{ g}}{294.34\text{ g/mol}} \times 100\%$$

$\%CH_3O = 10.55\%$

   (c)
$$m_{CH_3OH} = 200\text{ mg} \times \frac{M_{CH_3OH}}{M_{aspartame}}$$
$$= 200\text{ mg} \times \frac{32.05\text{ g/mol}}{294.34\text{ g/mol}}$$

$m_{CH_3OH} = 21.8$ mg