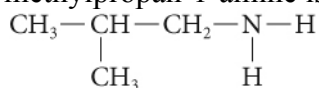


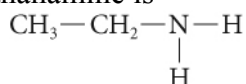
Section 1.7: Amines and Amides

Tutorial 1 Practice, page 58

1. (a) The longest carbon chain is a butyl group with its second carbon atom (using the lowest possible number) bonded to the nitrogen atom. This is the only alkyl group attached to the nitrogen atom, so the compound is a primary amine and its name is butan-2-amine.
- (b) This compound is a tertiary amine whose longest carbon chain has 4 carbon atoms. The compound is a butanamine. The two substituents are two ethyl groups. The name of the compound is *N,N*-diethylbutan-1-amine.
- (c) This compound is a tertiary amine whose longest carbon chain has 3 carbon atoms. The compound is a propanamine. The two substituents are a methyl group and a propyl group. The name of the compound is *N*-methyl-*N*-propylpropan-1-amine.
- (d) The longest carbon chain is an octyl group with its third carbon atom (using the lowest possible number) bonded to the nitrogen atom. This is the only alkyl group attached to the nitrogen atom, so the compound is a primary amine, and its name is octan-3-amine.
- (e) This is a secondary amine whose longest carbon chain has 4 carbon atoms. The compound is a butanamine. The second carbon atom (using the lowest possible number) is attached to the nitrogen atom. The substituent is an ethyl group. The name of the compound is *N*-ethylbutan-2-amine.
2. (a) 2-methylpropan-1-amine is a primary amine. The propyl group attached to the nitrogen atom has a methyl group at its second carbon atom. The structure of 2-methylpropan-1-amine is

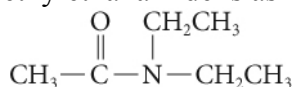


- (b) Ethanamine is a primary amine with a 2-carbon ethyl group. The structure of ethanamine is

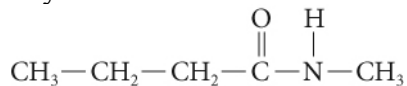


Tutorial 2 Practice, page 60

1. (a) The carboxylic acid part has a chain with 4 carbon atoms: butanoic acid. The amine part is ammonia. So, the name of the amide is butanamide.
- (b) The carboxylic acid part has a chain with 2 carbon atoms: ethanoic acid. The amine part is a primary amine with 3 carbon atoms: propanamine. So, the name of the amide is *N*-propylethanamide.
- (c) The carboxylic acid part has a chain with 4 carbon atoms: butanoic acid. The amine part is a secondary amine with two methyl groups: *N,N*-dimethanamine. So, the name of the amide is *N,N*-dimethylbutanamide.
2. (a) Two ethyl groups are bonded to the nitrogen atom (from the amine). The carbonyl group from the carboxylic acid is attached to a 2 carbon chain. The structure of *N,N*-diethylethanamide is as follows:



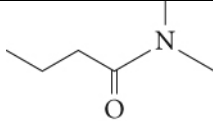
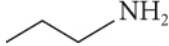
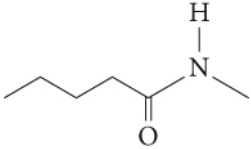
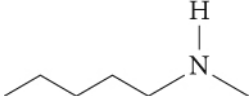
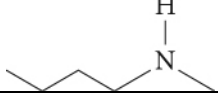
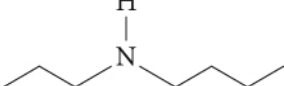
(b) One methyl group is bonded to the nitrogen atom (from the amine). The carbonyl group from the carboxylic acid is attached to a 4 carbon chain. The structure of *N*-methylbutanamide is:



Section 1.7 Questions, page 62

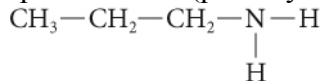
1. (a) The name of the compound is propanamide.
- (b) The name of the compound is *N,N*-dimethylpropan-1-amine.
- (c) The name of the compound is *N,N*-diethylpropanamide.
- (d) The name of the compound is 2-chloroheptan-4-amine.
- (e) The name of the compound is hept-6-ene-2,4-diamine.

2. Table 2

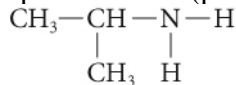
Name	Condensed structure	Line diagram or structural formula	Type of compound
<i>N,N</i> -dimethylbutanamide	CH ₃ CH ₂ CH ₂ CON(CH ₃) ₂		amide
propan-1-amine	CH ₃ CH ₂ CH ₂ NH ₂		amine
<i>N</i> -ethylpentanamide	CH ₃ CH ₂ CH ₂ CH ₂ CONHCH ₂ CH ₃		amide
<i>N</i> -methylpentan-1-amine	CH ₃ CH ₂ CH ₂ CH ₂ CH ₂ NHCH ₃		amine
<i>N</i> -methylbutan-1-amine	CH ₃ CH ₂ CH ₂ CH ₂ NHCH ₃		amine
<i>N</i> -propylbutan-1-amine	CH ₃ CH ₂ CH ₂ CH ₂ NHCH ₂ CH ₂ CH ₃		amine

3. The four structural isomers of C₃H₉N are as follows:

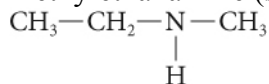
propan-1-amine (primary amine)



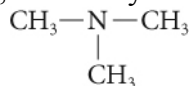
propan-2-amine (primary amine)



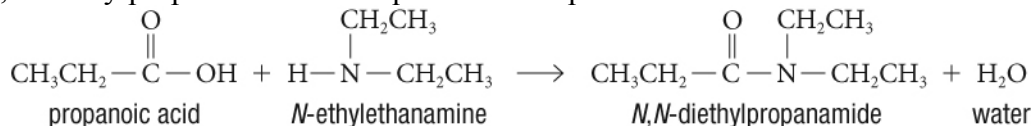
N-methylethanamine (secondary amine)



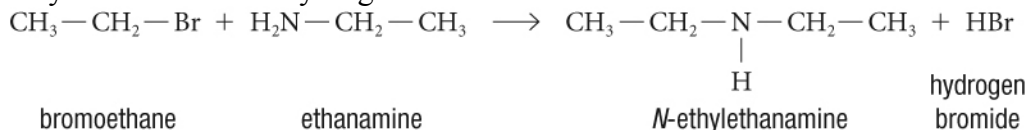
N,N-dimethylmethanamine (tertiary amine)



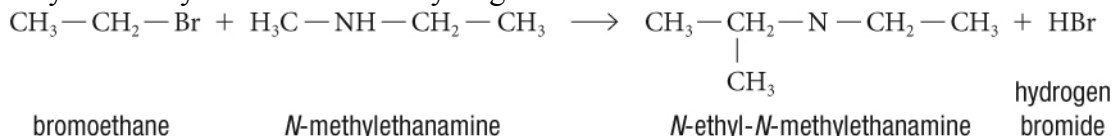
4. The reaction of *N*-ethylethanamine and propanoic acid will produce *N,N*-diethylpropanamide. The equation that represents the formation reaction is



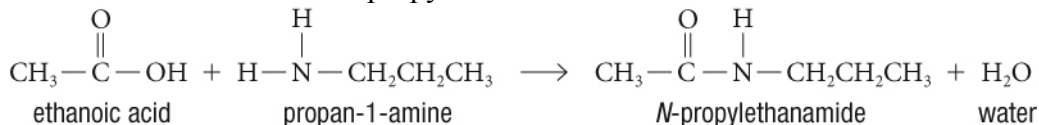
5. (a) The reaction is a substitution reaction. The products of the reaction are *N*-ethylethanamine and hydrogen bromide.



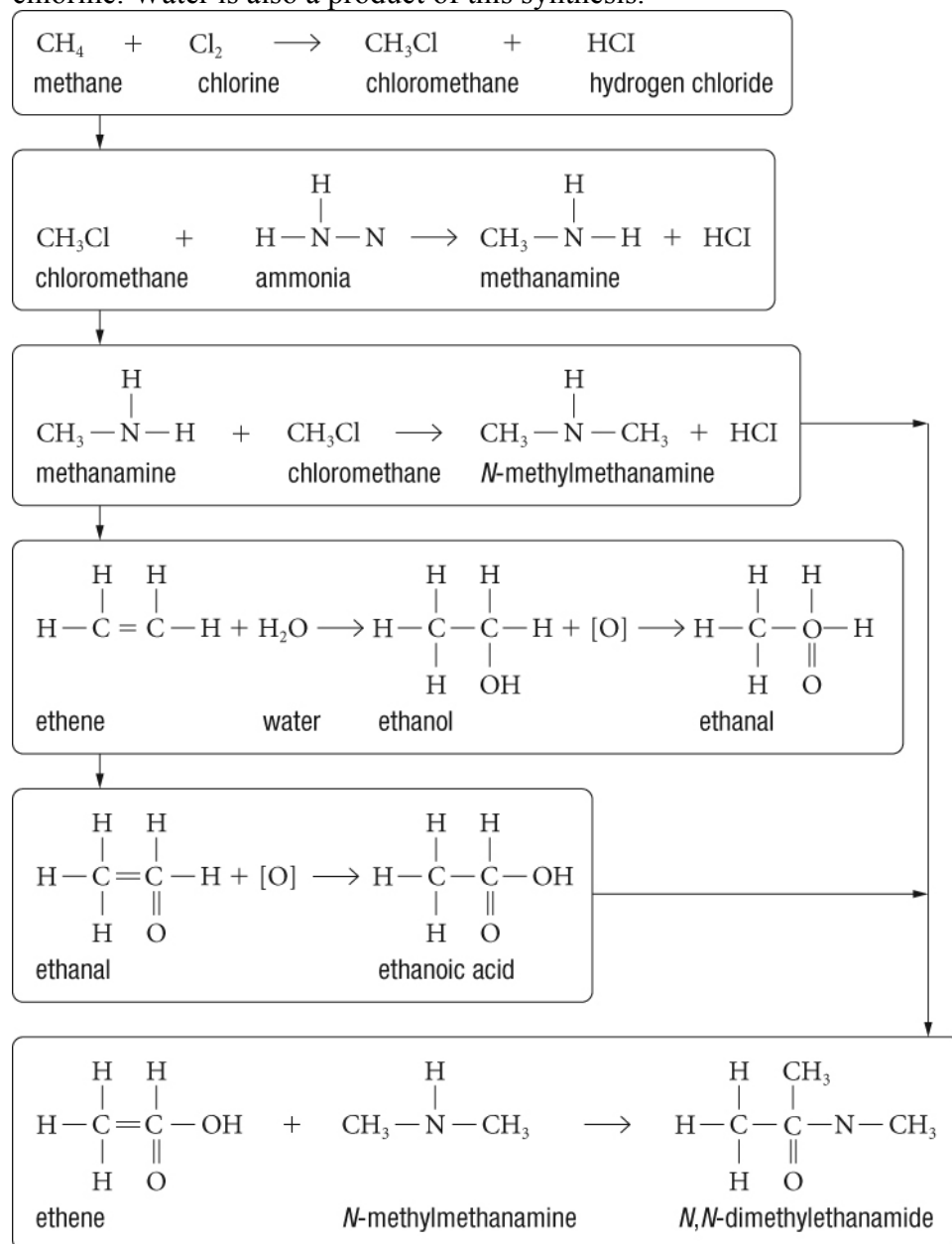
(b) The reaction is a substitution reaction. The products of the reaction are *N*-ethyl-*N*-methylethanamine and hydrogen bromide.



(c) The reaction of ethanoic acid and propan-1-amine is a condensation reaction. The products of the reaction are *N*-propylethanamide and water.



6. Answers may vary. Sample answer: The following flow chart shows how to synthesize *N,N*-dimethylethanamide from an alkane, an alkene, a halogen, and ammonia. For the alkane, I will use methane. For the alkene, I will use ethane. For the halogen, I will use chlorine. Water is also a product of this synthesis.



7. Answers may vary. Students' diagrams should include the natural gas processing and the use of the several amines such as monoethanolamine, diethanolamine, methyldiethanolamine, and diethylene glycolamine, or 2-(2-aminoethoxy)ethanol; and how pollutant gases such as hydrogen sulfide and carbon dioxide are removed.