ACTIVITY 1.9.1 BUILDING MOLECULAR MODELS TO ILLUSTRATE REACTIONS

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(b) (Answers will vary, depending on the structures created. Reaction #10 would be aromatic; others may be any of the three types, but most likely aliphatic.)

(c) ethene + $H_2O \xrightarrow{H_2SO_4}$ ethanol
ethanol + (O) $\rightarrow$ ethanal
ethanal + (O) $\rightarrow$ ethanoic acid

ACTIVITY 1.9.2 PREPARATION OF AN ESTER—ASPIRIN

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(a) (Answer will depend on actual measurements.)
Calculate theoretical yield of ASA using mass of reactants used.
$2\ HOC_6H_4COOH + (CH_3CO)_2O \rightarrow 2\ CH_3COOC_6H_4COOH + H_2O$

salicylic acid + acetic anhydride $\rightarrow$ acetylsalicylic acid + water
actual yield = mass of ASA obtained
percentage yield = (actual yield/theoretical yield) $\times$ 100%

(b) The carboxyl group in ASA imparts acidic properties to the compound; one of the properties of an acid is a sour taste.

(c) The purity of the ASA can be tested by titrating a sample of the ASA with a base (e.g., NaOH, using phenolphthalein as indicator).
$CH_3COOC_6H_4COOH + NaOH \rightarrow CH_3COOC_6H_4COONa + H_2O$

Procedure

1. Dissolve a known mass of ASA in methanol in an Erlenmeyer flask.
2. Add a few drops of phenolphthalein.
3. Titrate with a standard solution of $NaOH_{(aq)}$ delivered from a buret, until the solution just turns pink.
4. Repeat steps 1 to 3 three more times.

Calculations

$n_{NaOH} = cV$
$n_{ASA} = n_{NaOH}$
$m_{ASA} = nM$
purity of ASA = (m_{ASA}/mass of sample) $\times$ 100%

Safety Precautions:
Sodium hydroxide is corrosive. Wear a lab apron and eye protection. If the base comes into contact with skin, wash well with cool water.

Methanol is flammable; keep away from open flames.

CHAPTER 1 SUMMARY

MAKE A SUMMARY

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(Answers will vary.)

CHAPTER 1 SELF-QUIZ

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1. False: An ester is formed when the hydrogen atom from the hydroxyl group of an alcohol and the hydroxyl group of the carboxyl group of an acid are eliminated, and water is condensed.
2. True

3. True
4. False: In an amide, the nitrogen atom is connected to at least one carbon atom, while in an amine, the nitrogen atom may be connected to 1, 2, or 3 hydrogen atoms.
5. False: When 1-pentanol and 3-pentanol are each oxidized in a controlled way, they produce pentanal and 3-pentanone, respectively.
6. (b)
7. (b)
8. (a)
9. (e)
10. (b)
11. (c)
12. (e)
13. (c)
14. (e)
15. (c)

CHAPTER 1 REVIEW

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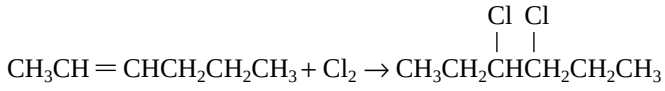
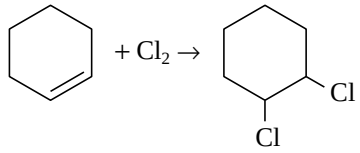
Understanding Concepts

1. (a)

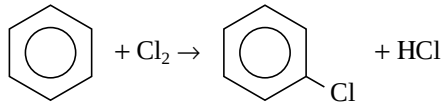


$$CH_3CH{=}CHCH_2CH_2CH_3 + Cl_2 \rightarrow CH_3CH_2\underset{\displaystyle Cl}{\overset{\displaystyle Cl}{\underset{|}{\overset{|}{C}}}}HCH_2CH_2CH_3$$

(b)

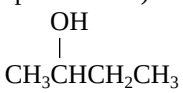


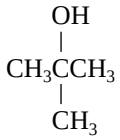
(c)



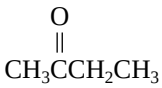
Reactions in (a) and (b) are addition reactions, and the reaction in (c) is a substitution reaction.

2. C, B, D, A. The reason for this is that more polar compounds have higher boiling points as a result of increased intermolecular forces of attraction. C is an alkane and is nonpolar; B is more polar than C because of its carbonyl group; D is more polar than B because of its OH group, which is capable of hydrogen bonding; A is more polar than D because it has an OH group and a carbonyl group.
3. (Sample answers)

(a)


(b)


(c) $CH_3OCH_2CH_2CH_3$

(d)


(e)