Functional Groups

List the functional groups found in each of the following molecules.

Aspirin  Cipro  Morphine

Naming

If the name is provided, draw the structure. If the structure is provided, give the IUPAC name:

4-sec-butyloctane  Trans-1,2-dibromocyclopentane

2-chloro-3-ethyl-3-methylhexane  (S)-2-fluoropentane
Conformations

1) Using Newman projections, draw the most stable conformation of 1,2-dichloroethane.

2) Draw the most stable chair conformation of trans-1-bromo-3-methylcyclohexane.

Constitutional Isomers

Draw and name as many constitutional isomers of C₅H₁₁Cl as you can!
Stereoisomers

For the compound shown below, assign R/S configuration. Draw its enantiomer and one diastereomer and give the R/S configuration of each.

![Stereoisomers diagram]

2R, 3S

2S, 3R

2R, 3R

Reactions

1) Propane is used as a heat source for grills. Write the chemical reaction for the combustion of propane.

2) Write the Bronsted-Lowry acid-base reaction for the reaction between ammonia and the hydronium ion. Label the acid, base, conjugate acid, and conjugate base. Which side of the reaction is favored? Explain.

1) \( \text{C}_3\text{H}_8 + 5 \text{O}_2 \rightarrow 3 \text{CO}_2 + 4 \text{H}_2\text{O} \)

2) \( \text{NH}_3(\text{aq}) + \text{H}_3\text{O}^+ (\text{aq}) \rightarrow \text{NH}_4^+ (\text{aq}) + \text{H}_2\text{O}(\ell) \)

Reaction is product favored because the products are weaker acids and bases.
**Bonding**

1) For the following molecule: \( \text{H} \equiv \text{C} \equiv \text{N} \)

- What is the hybridization of the carbon atom? \( \text{sp} \)
- What are the associated bond angles? \( 180^\circ \)
- How many sigma bonds? \( \text{Pi bonds?} \) 2 sigma, 2 pi

**Properties**

1) Rank the following compounds in order of increasing boiling point. Justify your reasoning.

\[
\begin{align*}
1 & \quad \text{Ethane} \\
2 & \quad \text{Ethanol} \\
3 & \quad \text{Cyclopentane}
\end{align*}
\]

3 < 1 < 2,

2 exhibits hydrogen bonding, 3 is a cycloalkane which will have a lower boiling than the straight chain alkane.

2) Rank the following compounds in order of increasing pKₘₐₙ. Justify your reasoning.

\[
\begin{align*}
1 & \quad \text{Cyclohexanol} \\
2 & \quad \text{Cyclohexanoic acid} \\
3 & \quad \text{HCl}
\end{align*}
\]

3 < 2 < 1,

3 is a strong acid, 2 is a weak acid, and 1 is an alcohol.