1.

- \( \text{C}_5\text{H}_5 \), no functional groups
- \( \text{C}_6\text{H}_6 \), aromatic
- \( \text{C}_5\text{H}_{13}\text{N} \), amine
- \( \text{C}_6\text{H}_{13}\text{Cl} \), alkyl halide
- \( \text{C}_7\text{H}_{10}\text{O} \), alkyne and aldehyde
- \( \text{C}_{10}\text{H}_{16}\text{O}_2 \), alkene and carboxylic acid
- \( \text{C}_9\text{H}_8\text{O}_4 \), carboxylic acid, ester and aromatic

2. 

- Molecular Formula: \( \text{C}_{14}\text{H}_{19}\text{N}_2\text{O}_5 \)
- Functional Groups:
  1. ester
  2. amide
  3. amine
  4. carboxylic acid

3. 

(a) 3-chloro-2,3-dimethyl-1-butene
(b) 3-ethyl-3-hexene

(c) (Z)-2-butene

(d) (E)-2-butene

(e) (Z)-2-methyl-3-hexene

4.

(a) \[ \text{HI} \rightarrow \text{I} \]

(b) \[ \text{HI} \rightarrow \text{I} \]

(c) \[ \text{H}_2, \text{Pd/C} \rightarrow \text{OH} \]

(d) \[ \text{dilute} \quad \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{OH} \]

5.

(a) \[ \text{Br}_2 \rightarrow \text{Br} \]
6. N, O and F are much more electronegative than their heavier analogues, P, S and Cl respectively. The N-H, O-H and F-H bonds are therefore much more polar leading to stronger H-bonding.

The F atom in HF can potentially act as an acceptor of three hydrogen bonds (corresponding to its three lone pairs). However, the HF molecule has only one point of donation (corresponding to its single H atom). On average there are a total of two hydrogen bonds associated with each HF molecule (one donated, one accepted).

Ammonia has three points of donation (3H) but can accept only once (1 lone pair).

Water, however can participate in up to four hydrogen bonds (two donated and two accepted) giving greater intermolecular forces overall.