CHE 1000: INTRODUCTORY CHEMISTRY
2019/2020

REPRESENTATION OF ORGANIC MOLECULES: 1

1. Empirical formula

The simplest ***whole number ratio*** of each element present in a compound

2. Molecular formula

This represents the actual number of each element present in a compound

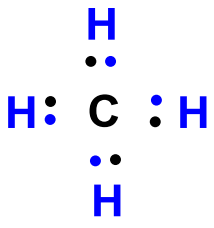
Examples

	butane	pentane
Empirical:	C_2H_5	C_5H_{12}
Molecular:	C_4H_{10}	C_5H_{12}

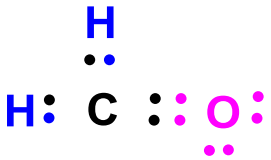
3. Lewis structures

- Valence electrons are represented as dots
- **1** or **2** or **3** lone pairs between atoms represents a **single** or **double** or **triple** bond(s)
- Lone pairs and charges must be shown

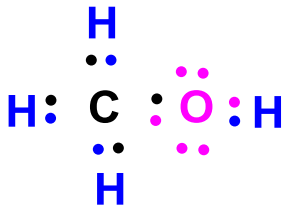
Electron-dot structures (Lewis structures)



methane



methanal



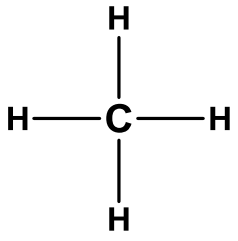
methanol

hydrogen cyanide

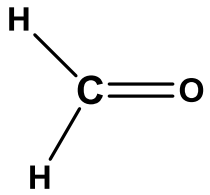
4. Kekulé structure

- The bonding electron pair represented as a line
- The lone pairs are usually left out (unless they need to draw attention to something)

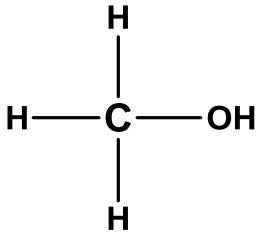
Line-bond structures (Kekulé structures)



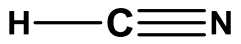
methane



methanal



methanol



hydrogen cyanide

Take home problems:

1. Write the Lewis and Kekulé structure for ethene, C_2H_4

2. Write the Lewis and Kekulé structure for ethyene, C_2H_2

5. Skeletal structures (Line and 3-D structures)

This the quickest way to draw organic compounds, and the mostly widely accepted representation of organic compounds

The rules for drawing skeletal structures are as follows;

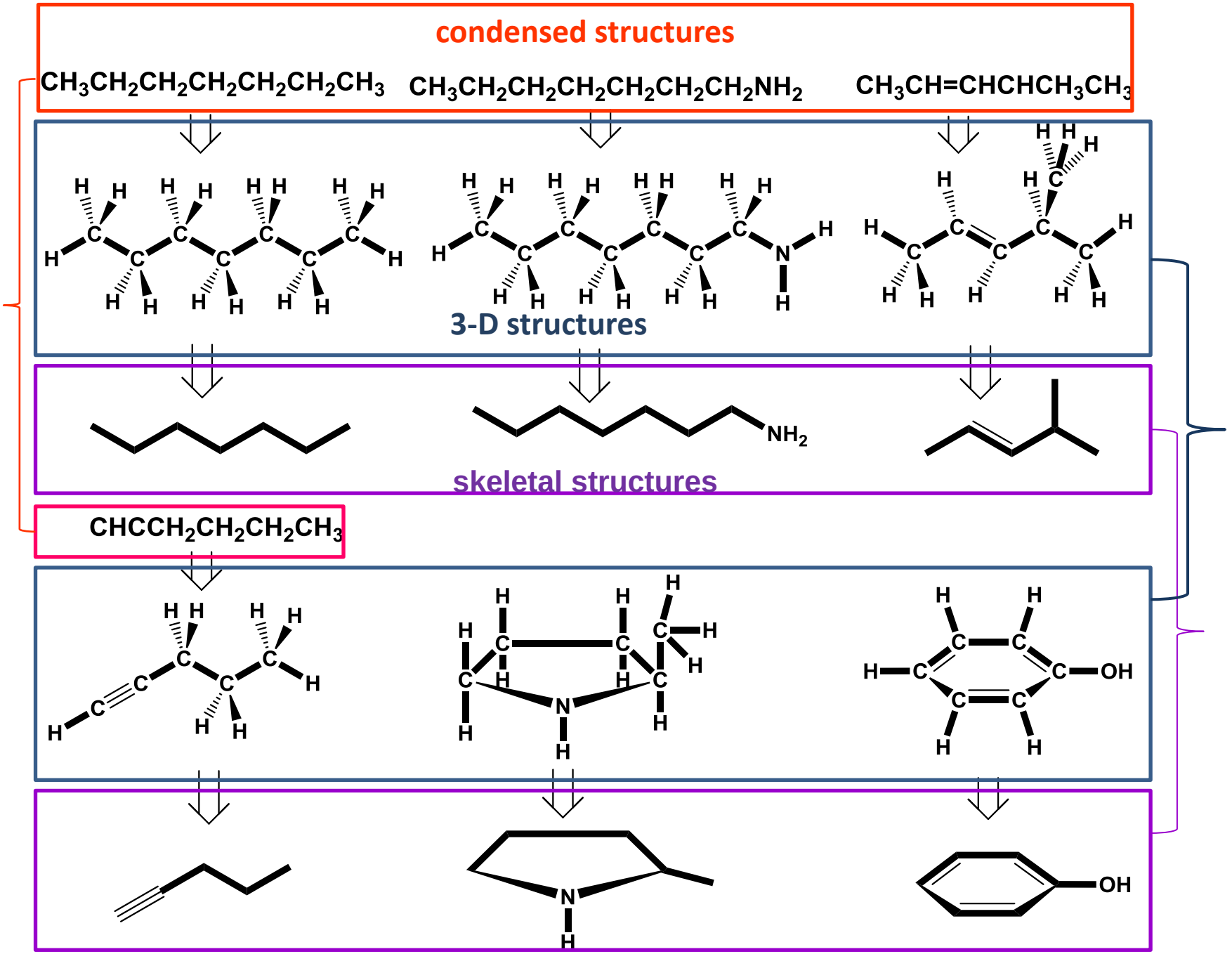
Rule 1: Carbon atoms are not shown (leave out the 'C' for carbon)

Rule 2: Carbon atom is assumed to be at the intersection of two lines or at the end of the line

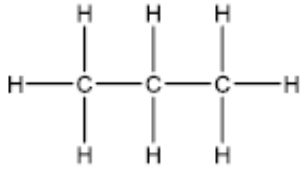
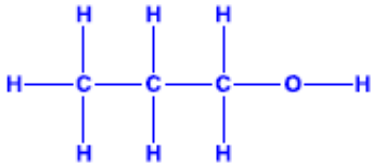
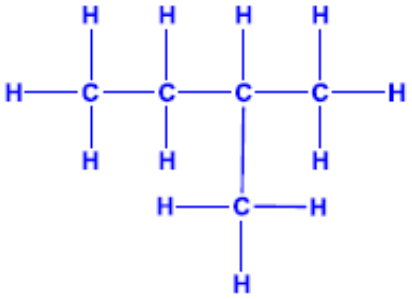
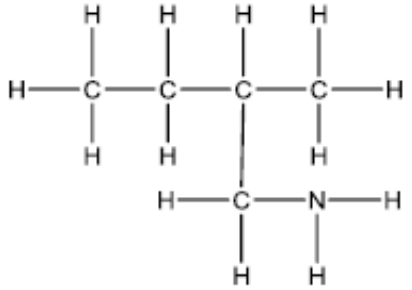
Rule 3: Hydrogen atoms are only shown when they are bond to a heteroatom. *Since carbon has the valence of four (i.e carbon normally forms bonds to other atoms) the correct number of hydrogens can be calculated*

Rule 4: All heteroatoms (O, N, Br, *etc.)* are shown

Rule 5: The double or triple bonds between two carbon atoms or between a carbon atom and heteroatom or between two heteroatoms must be shown


condensed structures
CH3CH2CH2CH2CH2CH2CH3
CH3CH2CH2CH2CH2CH2CH2NH2
CH3CH=CHCHCH3CH3
3-D structures
NH2
skeletal structures
CHCCH2CH2CH2CH3
OH

Take home problems:

Constitutional formula	Condensed formula	Skeletal structure
		
		
		
		

Take home problems:

How many hydrogens are bonded to each carbon in the following compound? Give its molecular formula.