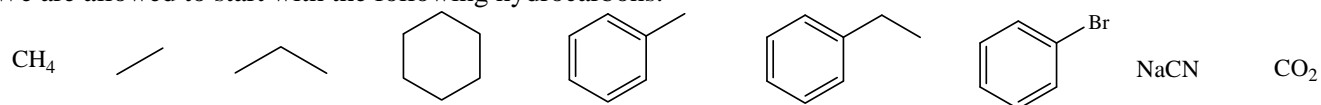


We are allowed to start with the following hydrocarbons.



If we have to construct a larger carbon skeleton ($\text{C}_4 - \text{C}_6$ for us) we will have to make some carbon/carbon bonds. In our course this will always utilize a carbon nucleophile and a carbon electrophile. We have a limited number of possibilities of each of those classes of molecules. We will be able to combine our 1-3 carbon starting structures in various possible ways to total 4C, 5C or 6C target molecules (TM-#). Number combinations are shown below.

Target Molecule	Possible combinations
1C	1C
2C	2C, (1C + 1C)
3C	3C, (2C + 1C), (1C + 1C + 1C)
4C	(3C + 1C), (2C + 2C), (2C + 1C + 1C), (1C + 1C + 1C + 1C)
5C	(3C + 2C), (2C + 2C + 1C), (2C + 1C + 1C + 1C), (1C + 1C + 1C + 1C + 1C)
6C	(3C + 3C), (3C + 2C + 1C), (2C + 2C + 2C), (3C + 1C + 1C + 1C), (2C + 2C + 1C + 1C), (2C + 1C + 1C + 1C + 1C), (1C + 1C + 1C + 1C + 1C + 1C)

1 1. Mg 2. $\text{O}=\text{C}-\text{H}$ RBr 3. workup	9a $\text{R}-\text{O}^-$ RBr $\xrightarrow{\text{S}_\text{N}2}$	18 $\text{N}\equiv\text{C}-\text{CH}_2^-$ RBr $\xrightarrow{\text{S}_\text{N}2}$	28 Br O^- $\xrightarrow{\text{O}^-}$	36 $\text{R}'-\text{Cu}^\ominus$ $\text{R}'-\text{C}(=\text{O})-\text{Cl}$ $\xrightarrow{\text{R}'-\text{Cu}^\ominus}$ $\text{R}'-\text{C}(=\text{O})-\text{R}'$	46 $\text{R}'-\text{N}-\text{H}$ $\text{R}'-\text{C}(=\text{O})-\text{H}$ pH = 5 (-H ₂ O) $\xrightarrow{\text{R}'-\text{N}-\text{H}}$ imine
2 1. Mg 2. $\text{O}=\text{C}-\text{R}$ RBr 3. workup	9b $\text{R}-\text{OH}$ RBr $\xrightarrow{\text{S}_\text{N}1}$	19 $\text{H}-\text{C}(\text{OH})-\text{H}$ CrO_3 pyridine PCC	29 $\text{H}-\text{C}(\text{OH})-\text{H}$ H_2SO_4 Δ	37 $\text{H}-\text{C}(=\text{O})-\text{H}$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{H}-\text{C}(\text{H})-\text{H}$	$\text{R}'-\text{N}(\text{H})-\text{R}'$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{R}'-\text{N}(\text{H})-\text{R}'$ 2° amines
3 1. Mg 2. $\text{O}=\text{C}-\text{R}$ RBr 3. workup	10a $\text{R}-\text{C}(=\text{O})^-$ RBr $\xrightarrow{\text{S}_\text{N}2}$	20 $\text{H}-\text{C}(\text{OH})-\text{H}$ CrO_3 pyridine PCC	30 Br Br 1. 3 eqs. $\text{R}_2\text{N Na}$ 2. workup	38 $\text{R}'-\text{C}(=\text{O})-\text{H}$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{R}'-\text{C}(\text{H})-\text{H}$	$\text{R}'-\text{N}(\text{H})-\text{R}'$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{R}'-\text{N}(\text{H})-\text{R}'$ 3° amines
4 1. Mg 2. $\text{O}=\text{C}-\text{O}-\text{R}$ RBr 3. workup	10b $\text{R}-\text{C}(=\text{O})-\text{OR}$ RBr $\xrightarrow{\text{S}_\text{N}1}$	21 $\text{H}-\text{C}(\text{OH})-\text{R}$ CrO_3 pyridine PCC	31 $\text{R}-\text{C}\equiv\text{C}-\text{H}$ 1. 1 eq. $\text{R}_2\text{N Na}$ $\text{H}-\text{C}(=\text{O})-\text{H}$ 3. workup	39 $\text{R}'-\text{C}(=\text{O})-\text{R}$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{R}'-\text{C}(\text{H})-\text{R}$	$\text{R}'-\text{N}(\text{H})-\text{R}'$ $\text{R}'-\text{C}(=\text{O})-\text{H}$ pH = 5 (-H ₂ O) $\xrightarrow{\text{R}'-\text{N}(\text{H})-\text{R}'}$ iminium ion
5 1. Mg 2. $\text{O}=\text{C}=\text{O}$ RBr 3. workup	11 NaSH RBr $\xrightarrow{\text{S}_\text{N}2}$	22 $\text{H}-\text{C}(\text{OH})-\text{H}$ CrO_3 H_2O Jones	32 $\text{R}-\text{C}\equiv\text{C}-\text{H}$ 1. 1 eq. $\text{R}_2\text{N Na}$ $\text{R}'-\text{C}(=\text{O})-\text{H}$ 3. workup	40 $\text{R}'-\text{C}(=\text{O})-\text{OR}$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{R}'-\text{C}(\text{H})-\text{OR}$	$\text{R}'-\text{N}(\text{H})-\text{R}'$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{R}'-\text{N}(\text{H})-\text{R}'$ 3° amines
6 1. Mg 2. $\text{O}=\text{C}-\text{O}-\text{R}$ RBr 3. workup	12 NaSR RBr $\xrightarrow{\text{S}_\text{N}2}$	23 $\text{R}'-\text{C}(=\text{O})-\text{OH}$ PCl_3	33 $\text{R}-\text{C}\equiv\text{C}-\text{H}$ 1. 1 eq. $\text{R}_2\text{N Na}$ $\text{R}'-\text{C}(=\text{O})-\text{R}$ 2. workup	41 $\text{R}'-\text{C}(=\text{O})-\text{OH}$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{R}'-\text{C}(\text{H})-\text{OH}$	$\text{Ph}-\text{S}(\text{Ph})-\text{Ph}$ $\text{H}_3\text{C}-\text{Br}$ (RBr) $\xrightarrow{\text{H}_3\text{C}-\text{Br}}$ $\text{Ph}-\text{S}(\text{Ph})-\text{CH}_3$ sulfur salt
7 1. Mg 2. $\text{O}=\text{C}-\text{O}-\text{R}$ RBr 3. workup	13 1. NaN ₃ 2. LiAlH ₄ RBr 3. workup $\xrightarrow{\text{S}_\text{N}2}$	24 $\text{R}'-\text{C}(=\text{O})-\text{Cl}$ ROH	34 $\text{R}-\text{C}\equiv\text{C}-\text{H}$ 1. 1 eq. $\text{R}_2\text{N Na}$ O 2. workup	42 O 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{D}-\text{CH}_2-\text{CH}_2-\text{OH}$	$\text{Ph}-\text{S}(\text{Ph})-\text{CH}_3$ Br^- 1. n-BuLi $\xrightarrow{\text{n-BuLi}}$ $\text{Ph}-\text{S}(\text{Ph})-\text{CH}_2^-$ sulfur ylid
8 1. Mg 2. $\text{R}'-\text{C}\equiv\text{N}$ RBr 3. workup	14 NaCN RBr $\xrightarrow{\text{S}_\text{N}2}$	25 $\text{R}'-\text{C}(=\text{O})-\text{Cl}$ RSH	35 $\text{R}'-\text{Cu}^\ominus$ $\text{R}'-\text{Br}$ $\xrightarrow{\text{R}'-\text{Cu}^\ominus}$	43 O 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{D}-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_3$	$\text{Ph}-\text{S}(\text{Ph})-\text{CH}_2^-$ Br^- 2. $\text{O}=\text{C}-\text{H}$ $\xrightarrow{\text{O}=\text{C}-\text{H}}$ $\text{Ph}-\text{S}(\text{Ph})-\text{CH}_2-\text{O}-\text{C}(=\text{O})-\text{H}$ epoxides
	15 1. $\text{R}'-\text{C}\equiv\text{C}^-$ RBr 2. workup	26 $\text{R}'-\text{C}(=\text{O})-\text{Cl}$ R_2NH		44 $\text{R}'-\text{C}\equiv\text{N}$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{D}-\text{C}(\text{H})-\text{NH}_2$	
	16 $\text{R}'-\text{C}(=\text{O})-\text{CH}_2^-$ RBr $\xrightarrow{\text{S}_\text{N}2}$	27 $\text{R}'-\text{C}(=\text{O})-\text{Cl}$ $\text{R}'-\text{C}(=\text{O})-\text{OH}$		45 $\text{R}-\text{Br}$ 1. LiAlH ₄ 2. workup $\xrightarrow{\text{LiAlH}_4}$ $\text{R}-\text{D}$	
	17 $\text{RO}-\text{C}(=\text{O})-\text{C}^-$ RBr $\xrightarrow{\text{S}_\text{N}2}$				