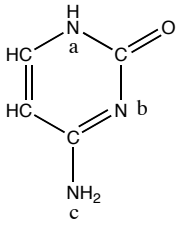
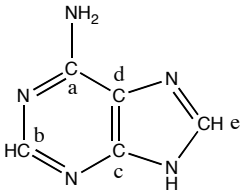
# LECTURE 14

1. For the DNA bases below, assign the **hybridization** and **geometry** to
   (a) the nitrogen atoms in cytosine, and
   (b) the carbon atoms in adenine. (Note that the lone pairs are not pictured.)




cytosine



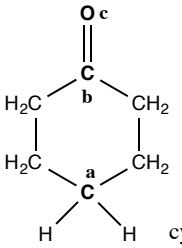

adenine

**(a) $N_a$: $sp^3$, trigonal pyramidal, $N_b$: $sp^2$, bent, $N_c$ :$sp^3$, trigonal pyramidal**
**(b) All of the carbon atoms are $sp^2$, trigonal planar.**

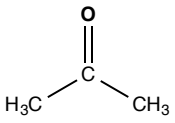
2. Identify the hybridization of the underlined atom in each of the following molecules:
   (a) $H_2C\underline{C}CH_2$ (b) $H_3C\underline{C}H_3$ (c) $CH_3N\underline{N}N$ (d) $CH_3C\underline{O}OH$.

**(a)** $H_2C\underline{C}CH_2$ : ***sp*** **(b)** $H_3C\underline{C}H_3$: ***$sp^3$*** **(c)** $CH_3N\underline{N}N$: ***sp*** **(d)** $CH_3C\underline{O}OH$: ***$sp^2$***

3. In her video, Stefanie Sydlik describes her MIT graduate work on designing sensors for undetonated landmines and other explosives. Her sensors detect cyclohexanone and acetone, molecules used in the purification of explosives. Note that lone pairs are not pictured in the structures below.




cyclohexanone




acetone

(a) For cyclohexanone, write the hybridization of $C_a$, $C_b$, and $O_c$.
(b) For each bond in acetone, indicate whether it is a σ or π bond, and identify the orbitals that contribute to the bond. For example, there are six σ(C2sp$^3$, H1s) bonds.

(a) **$C_a$ is $sp^3$; $C_b$ is $sp^2$; $O_c$ is $sp^2$**
(b) In addition to the six σ(C2sp$^3$, H1s) bonds, there are **two σ(C2sp$^3$, C2sp$^2$)** bonds and a C=O double consisting of a **σ(C2sp$^2$, O2sp$^2$)** and a **π(C2$p_x$, O2$p_x$)** [or π(C2$p_x$, O2$p_x$)] bond.

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