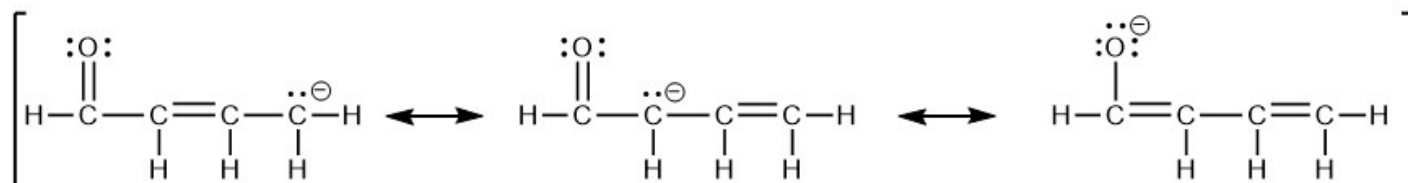
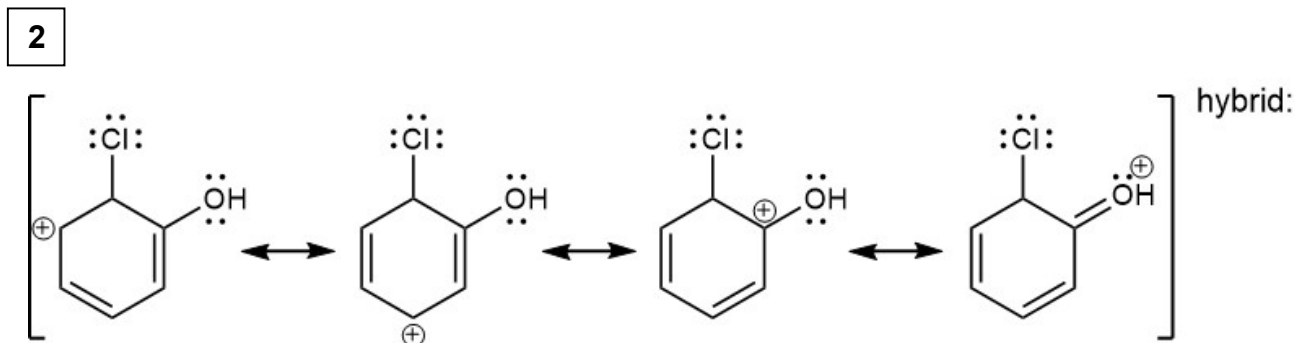




- 1 **Group work:** provide **curved arrows** to convert one resonance structure to the next, **rank** the given resonance forms (e.g., most important, least important, equal contributors, etc.), briefly **explain** the ranking, and draw the **resonance hybrid**.

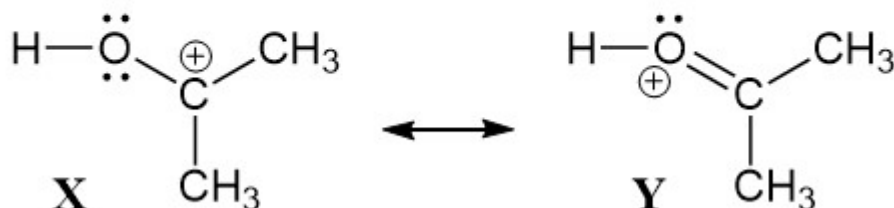


hybrid:

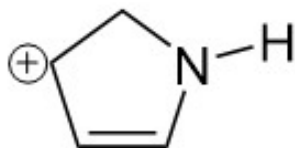


Try SkillBuilders 2.5, 2.6

- 3 Which resonance structure contributes more to the resonance hybrid? Explain briefly.



4 Draw resonance structures for the following cation.

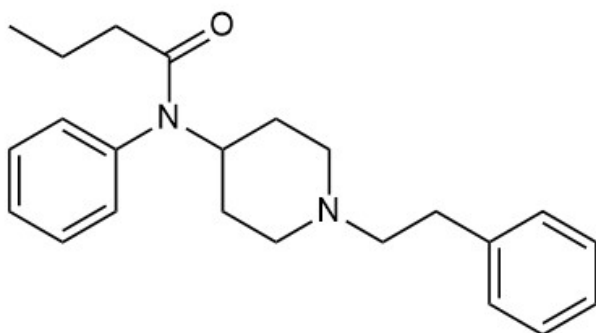


**Hybridization and Resonance: Localized and Delocalized Lone Pairs (Klein 2.13)**

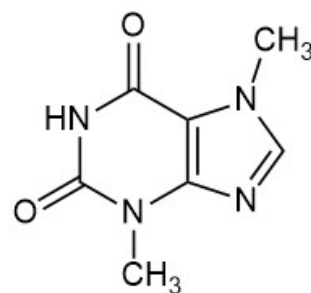
A lone pair that is involved in resonance is described as being \_\_\_\_\_ because it is spread out over multiple atoms.

A \_\_\_\_\_ lone pair is at a single location (not involved in resonance).

**Group work:** Add all missing lone pairs, and identify each as *localized (L)* or *delocalized (D)*.



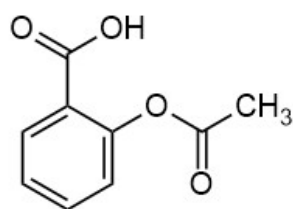
**Fentanyl** - an addictive painkiller. This synthetic opioid is a leading cause of overdose deaths in U.S.



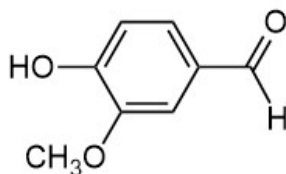
**Theobromine** - makes chocolate toxic to dogs

**Group work:** Use page 2-7 to identify the Functional Groups in fentanyl, aspirin, vanillin & carvone.

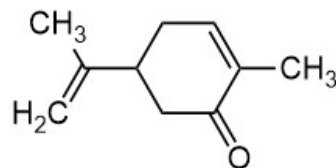
7



**Aspirin** - pain-reliever and fever reducer, a nonsteroidal anti-inflammatory drug (NSAID) that has been on the market since 1899



**Vanillin** - primary component of extracts of vanilla bean, used as artificial flavoring



**Carvone** - smells and tastes like either spearmint or caraway!

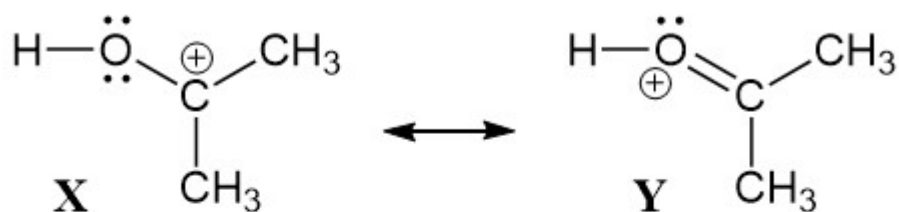
### Try SkillBuilder 2.9

Note: "R" represents any carbon group.

	Functional Group	Example	Abbreviation	Name
CHM 3140	alkane	CH <sub>4</sub>	RH	methane
	alkyl halide	CH <sub>3</sub> Cl	RX or RCl	chloromethane (methyl chloride)
	alkene	H <sub>2</sub> C=CH <sub>2</sub>	R <sub>2</sub> CCR <sub>2</sub>	ethene (ethylene)
	alkyne	HC≡CH	RCCR	ethyne (acetylene)
CHM 3150	alcohol	CH <sub>3</sub> OH	ROH	methanol (methyl alcohol)
	ether	CH <sub>3</sub> OCH <sub>3</sub>	ROR or R <sub>2</sub> O	methoxymethane (dimethyl ether)
	amine	CH <sub>3</sub> NH <sub>2</sub>	R <sub>3</sub> N	methanamine (methyl amine)
	aldehyde	CH <sub>3</sub> - $\overset{\text{O}}{\parallel}$ -C-H	RCHO	ethanal (acetaldehyde)
	ketone	CH <sub>3</sub> - $\overset{\text{O}}{\parallel}$ -C-CH <sub>3</sub>	RCOR or R <sub>2</sub> CO	2-propanone (acetone)
	carboxylic acid	CH <sub>3</sub> - $\overset{\text{O}}{\parallel}$ -C-OH	RCO <sub>2</sub> H	ethanoic acid (acetic acid)
	acid chloride (acyl halide)	CH <sub>3</sub> - $\overset{\text{O}}{\parallel}$ -C-Cl	RCOCl	ethanoyl chloride (acetyl chloride)
	ester	CH <sub>3</sub> - $\overset{\text{O}}{\parallel}$ -C-OCH <sub>3</sub>	RCO <sub>2</sub> R	methyl ethanoate (methyl acetate)
	amide	CH <sub>3</sub> - $\overset{\text{O}}{\parallel}$ -C-NH <sub>2</sub>	RCONR <sub>2</sub>	ethanamide (acetamide)
	anhydride	CH <sub>3</sub> - $\overset{\text{O}}{\parallel}$ -C-O-C(=O)-CH <sub>3</sub>	RCO <sub>2</sub> COR or (RCO) <sub>2</sub> O	ethanoic anhydride (acetic anhydride)
	nitrile	CH <sub>3</sub> CN	RCN	ethanenitrile (acetonitrile)
	aromatic		ArH	benzene

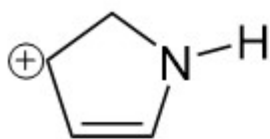
3

Which resonance structure contributes more to the resonance hybrid? Explain briefly.

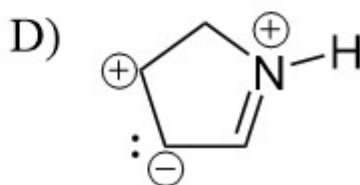
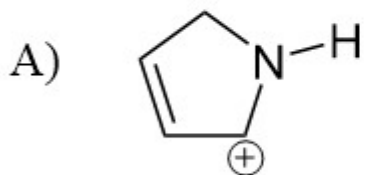


- A) **X** because carbon better handles positive charge (C less electronegative)
- B) **Y** because oxygen better handles positive charge (O more electronegative)
- C) **Y** because oxygen better handles positive charge (O is larger).
- D) **X** because **Y** is missing an octet.
- E) **Y** because **X** is missing an octet.

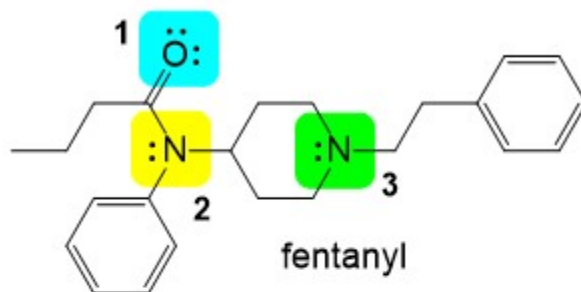
4



Which of the following is NOT a resonance form of the compound given above?



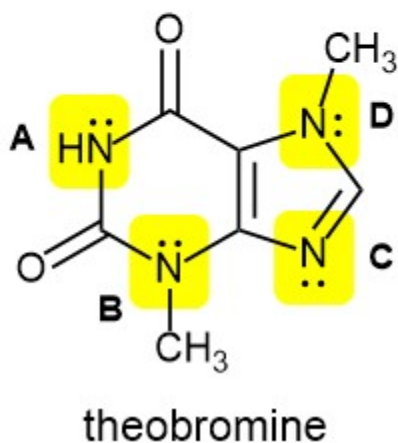
Identify each of the lone pairs in fentanyl as localized or delocalized.



1	2	3
A) localized	delocalized	localized
B) delocalized	localized	localized
C) localized	delocalized	delocalized
D) delocalized	delocalized	localized
E) delocalized	delocalized	delocalized

Theobromine is found in cocoa beans, and it is the compound responsible for making chocolate toxic to dogs.

Consider the nitrogen atom lone pairs in theobromine. Which (if any) of these lone pairs is LOCALIZED?



- A) Lone pair A  
 B) Lone pair B  
 C) Lone pair C  
 D) Lone pair D  
 E) None of the above. These lone pairs are all *delocalized*.