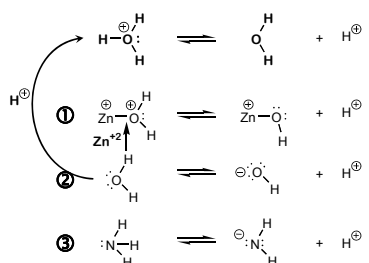


Choose the order that has the following acids correctly arranged with respect to increasing acidity.

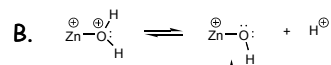
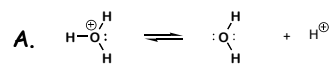


1

Using the electronegativity elements, predict which of the following acids would be more acidic.

element	electronegativity
Zn	1.7
H	2.1

$$pK_a = -1.74$$



$$pK_a = 7.3$$



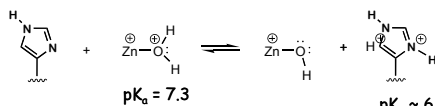
2

Would this equilibrium favor the products or reactants?

- A. Reactants  
B. Products

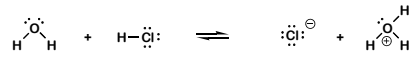


Carbonic anhydrase



$$pK_a = 7.3$$

$$pK_a \sim 6$$



$$pK_a = -7$$

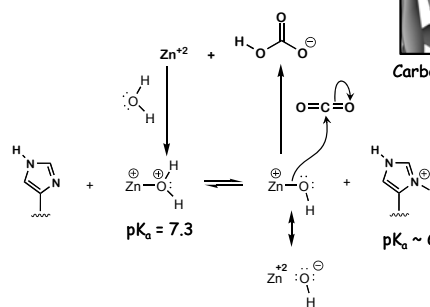
$$pK_a = -1.74$$

4

What role does zinc play in the enzyme carbonic anhydrase?



Carbonic anhydrase

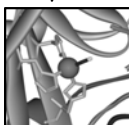


$$pK_a = 7.3$$

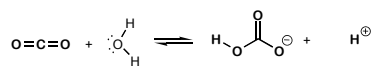
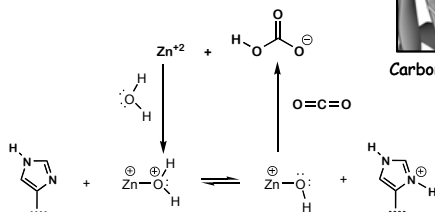
$$pK_a \sim 6$$

5

What role does zinc play in the enzyme carbonic anhydrase?



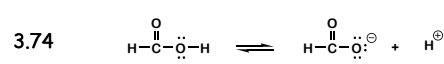
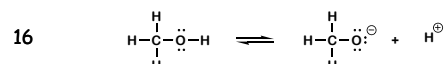
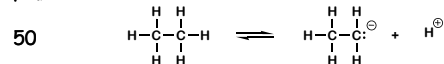
Carbonic anhydrase



6

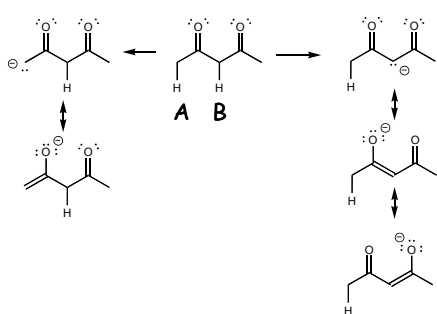
Review: What are some factors that affect acidity?

$$pK_a$$



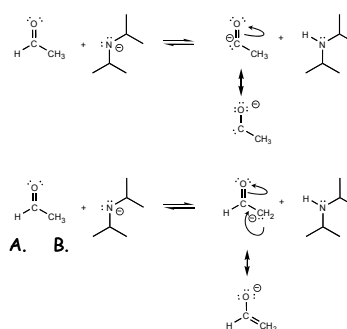
7

Which of the following hydrogens is more acidic?



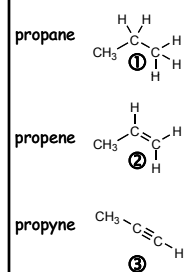
8

Which C-H bond is the most acidic in the following reaction?



9

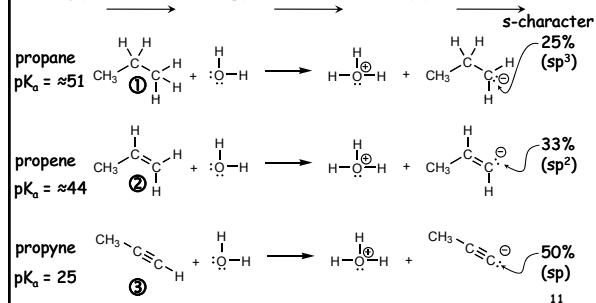
Which hydrocarbon is the most acidic?



10

Choose the answer that has the following acids correctly arranged with respect to *increasing* acidity.

- A. ① ② ③    B. ① ③ ②    C. ② ① ③  
D. ② ③ ①    E. ③ ② ①    F. ③ ① ②

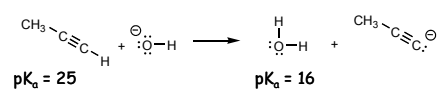
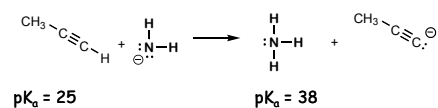


11

Can hydroxide ion convert an acetylene into the conjugated base? A. yes B. no

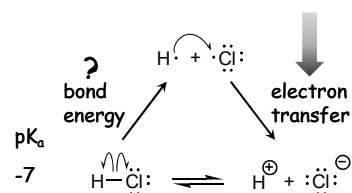
Can amide ion convert an acetylene into the conjugated base?

What information is needed?



12

What factors contribute to the ionization of an acid?



14

What factors affect the  $pK_a$  value of an acid?

$$\text{H}-\ddot{\text{C}}\text{:} \xrightarrow{\text{bond energy}} \text{H}\cdot + \cdot\ddot{\text{C}}\text{:} \xrightarrow{\text{electron transfer}} \text{H}^{\oplus} + \text{:}\ddot{\text{C}}\text{:}^{\ominus}$$

electron transfer

Acidity increases within a given row (electronegativity effect)

hydride $pK_a$	C ( $\text{H}_2\text{C}-\text{H}$ ) 48	N ( $\text{H}_2\text{N}-\text{H}$ ) 38	O ( $\text{HO}-\text{H}$ ) 15.7	F ( $\text{F}-\text{H}$ ) 3.2
			S ( $\text{HS}-\text{H}$ ) 7.0	Cl ( $\text{Cl}-\text{H}$ ) -7
			Se ( $\text{HSe}-\text{H}$ ) 3.9	Br ( $\text{Br}-\text{H}$ ) -9
				I ( $\text{I}-\text{H}$ ) -10

bond energy

Acidity increases within a given column (bond strength effect)

15

Choose a possible explanation for the observation that ethane thiol is more acidic than ethanol?

periodic table

A. Sulfur is less electronegative than oxygen. C N O F  
S Cl  
Se Br  
I

B. The S-H bond is weaker than the O-H bond.

C. Water is a weaker acid than ethane thiol.

D. The hydronium ion is a stronger acid than ethane thiol.

ethane thiol  $pK_a = 10.6$

$$\text{CH}_3-\text{C}(\text{H})_2-\text{S}-\text{H} + \text{H}-\text{O}-\text{H} \xrightarrow{365 \text{ kJ/mol}} \text{H}-\text{O}^{\oplus}-\text{H} + \text{CH}_3-\text{C}(\text{H})_2-\text{S}^{\ominus}$$

ethanol  $pK_a = 15.9$

$$\text{CH}_3-\text{C}(\text{H})_2-\text{O}-\text{H} + \text{H}-\text{O}-\text{H} \xrightarrow{459 \text{ kJ/mol}} \text{H}-\text{O}^{\oplus}-\text{H} + \text{CH}_3-\text{C}(\text{H})_2-\text{O}^{\ominus}$$

16

Atom electronegativity and bond energies are two factors that can affect acidity.

ethane thiol  $pK_a = 10.6$

$$\text{CH}_3-\text{C}(\text{H})_2-\text{S}-\text{H} \xrightarrow{365 \text{ kJ/mol}} \text{CH}_3-\text{C}(\text{H})_2-\text{S}^{\ominus} + \text{H}^{\oplus}$$

ethanol  $pK_a = 15.9$

$$\text{CH}_3-\text{C}(\text{H})_2-\text{O}-\text{H} \xrightarrow{459 \text{ kJ/mol}} \text{CH}_3-\text{C}(\text{H})_2-\text{O}^{\ominus} + \text{H}^{\oplus}$$

ethylamine  $pK_a \sim 36$

$$\text{CH}_3-\text{C}(\text{H})_2-\text{N}-\text{H} \xrightarrow{3.5 \text{ electronegativity}} \text{CH}_3-\text{C}(\text{H})_2-\text{N}^{\ominus} + \text{H}^{\oplus}$$

3.0 electronegativity

Acidity increases within a given row (electronegativity effect)

hydride $pK_a$	C ( $\text{H}_2\text{C}-\text{H}$ ) 48	N ( $\text{H}_2\text{N}-\text{H}$ ) 38	O ( $\text{HO}-\text{H}$ ) 15.7	F ( $\text{F}-\text{H}$ ) 3.2
			S ( $\text{HS}-\text{H}$ ) 7.0	Cl ( $\text{Cl}-\text{H}$ ) -7
			Se ( $\text{HSe}-\text{H}$ ) 3.9	Br ( $\text{Br}-\text{H}$ ) -9
				I ( $\text{I}-\text{H}$ ) -10

Acidity increases within a given column (bond strength effect)

17

text