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Chapters 21 Worksheet – alpha-Carbon Chemistry

21A. Alpha-Halogenation Products

Draw the major product of each harrowing halogenation reaction: starting material + reagent \rightarrow Product.

Starting Material		Reagents & <i>translation</i> *know this mechanism	Draw the Major Product Pav attention to the amount of reagent added!
1	, о Н	* (a) Br ₂ , HAc Molecular bromine (1 mol) in acetic acid	
2		* (a) Br ₂ , HAc Molecular bromine (1 mol) in acetic acid	
3	ОН	 * (b) 1. Br₂, PBr₃; 2. NaOH; 3. H₃O⁺ 1. Molecular bromine and phosphorous tribromide; 2. sodium hydroxide; 3. Aqueous acid 	
4	ОН	 * (b) 1. Br₂, PBr₃; 2. NaOH; 3. H₃O⁺ 1. Molecular bromine and phosphorous tribromide; 2. sodium hydroxide; 3. Aqueous acid 	
5		 * (c) 1. xs Br₂, xs NaOH 2. H₃O⁺ Molecular bromine and sodium hydroxide (base) followed by aqueous acid 	
6	C C	 * (c) 1. xs Br₂, xs NaOH 2. H₃O⁺ Molecular bromine and sodium hydroxide (base) followed by aqueous acid 	

21A. alpha-Halogenation Mechanisms

- Draw the **product** and full arrow-pushing **mechanism** for the following fantastic reactions, including all **charged intermediates**.

(a) Keto-enol tautomerization – this happens *in the beginning of* any acidic alpha-halogenation reaction. The product is the enol form.

(b) Enolate Formation – this happens *in the beginning of* any basic alpha-halogenation or aldol reaction. The product is an enolate ion. No reaction intermediate required – this is a one-step mechanism.



(c) Acidic bromination – show the mechanism for enol formation then bromination.



(d) Basic bromination - use 1 mole each of NaOH and bromine to add one Br to the alpha-carbon.



(e) Acid bromide hydrolysis – this is the last step of the HVZ reaction and utilizes the NAS mechanism.



21B. Aldol Reactions

- Draw the major product of each amazing aldol reaction: starting material + reagent → Product.

Starting Material		Reagents & <i>translation</i> *know this mechanism	Draw the Major Product Pay attention to the amount of reagent added!
1	, С Н	* (d) NaOH, H ₂ O Sodium hydroxide in water	
2		* (d) NaOH, H₂O Sodium hydroxide in water	
3	- X	(e) NaOH, H₂O, ∆ Sodium hydroxide in water with heat	
4		(e) NaOH, H₂O, ∆ Sodium hydroxide in water with heat	

21B. Aldol Reaction Mechanisms

- Draw the **product** and full arrow-pushing **mechanism** for the following awesome aldol reactions, including all **charged intermediates**.

(a) Aldol Addition Reaction



(b) Aldol Condensation Reaction



1 equiv. NaOH

EtOH, Δ