in 1923, Johannes _	and Thomas de	eveloped a new definition for acids and bases.	
□ Bronsted-Lo	wry Acid: a proton (H+)		
- acid	donates H+ to water producing H <sub>3</sub> O+ ion (hyd	dronium)	
	HBr (aq) + $H_2O$ (I) $\longrightarrow$	(aq) + Br <sup>-</sup> (aq)	
	acid H <sup>+</sup>		
□ Bronsted-Lc	wry Base: a proton (H+)		
	$NH_3$ (aq) + $H_2O$ (I) $\longrightarrow$ I	NH <sub>4</sub> + (aq) + (aq)	
	base		
<b>EXAMPLE:</b> Identify $\epsilon$	each compound as either Bronsted-Lowry ac	d or base.	
a) NH <sub>4</sub> +	c) CH <sub>3</sub> NH <sub>2</sub>		
b) LiH	d) H <sub>2</sub> Te		
Are ALL Arrhenius a	cids and bases considered Bronsted-Lowry a		
Are ALL Arrhenius a	HBr (aq) + H <sub>2</sub> O (I) donates H <sup>+</sup> produces H	(aq) + Br <sup>-</sup> (aq)   <sup>+</sup> = H <sub>3</sub> O <sup>+</sup>	
Are ALL Arrhenius a	HBr (aq) + $H_2O$ (I) $\longrightarrow$	(aq) + Br <sup>-</sup> (aq)   <sup>+</sup> = H <sub>3</sub> O <sup>+</sup>	
	HBr (aq) + H <sub>2</sub> O (I) $\longrightarrow$ donates H <sup>+</sup> produces H  Na(OH) (aq) + H <sub>2</sub> O (I) $\longrightarrow$ Na <sup>+</sup>	(aq) + Br - (aq) 	
Are ALL Bronsted-Lo	HBr (aq) + H <sub>2</sub> O (I) $\longrightarrow$ donates H <sup>+</sup> produces H  Na(OH) (aq) + H <sub>2</sub> O (I) $\longrightarrow$ Na <sup>+</sup> accepts H <sup>+</sup>	(aq) + Br - (aq)   + = H <sub>3</sub> O+ - (aq) + H <sub>2</sub> O (I) +(aq) produces OH-	Lowry
Are ALL Bronsted-Lo	HBr (aq) + H <sub>2</sub> O (I) →	(aq) + Br - (aq)    + = H <sub>3</sub> O+   - (aq) + H <sub>2</sub> O (I) + (aq)   produces OH-  us bases.  Bronsted-	
o Are ALL Bronsted-Lo □ Bases that o	HBr (aq) + H <sub>2</sub> O (I) $\longrightarrow$ produces H  Na(OH) (aq) + H <sub>2</sub> O (I) $\longrightarrow$ Na <sup>+</sup> accepts H <sup>+</sup> Dwry bases considered Arrhenius bases?  NH <sub>3</sub> (aq) + H <sub>2</sub> O (I) $\longrightarrow$ N  does not		
o Are ALL Bronsted-Lo □ Bases that o	HBr (aq) + H <sub>2</sub> O (I) produces H  Na(OH) (aq) + H <sub>2</sub> O (I) Na <sup>+</sup> accepts H <sup>+</sup> Dwry bases considered Arrhenius bases?  do not contain ion are NOT Arrheniu  NH <sub>3</sub> (aq) + H <sub>2</sub> O (I) N  does not donate OH <sup>-</sup>		
Are ALL Bronsted-Lo □ Bases that o  Are ALL Bronsted-Lo	HBr (aq) + H <sub>2</sub> O (I) produces H  Na(OH) (aq) + H <sub>2</sub> O (I) Na <sup>+</sup> accepts H <sup>+</sup> Dwry bases considered Arrhenius bases?  do not contain ion are NOT Arrheniu  NH <sub>3</sub> (aq) + H <sub>2</sub> O (I) N  does not donate OH <sup>-</sup>	(aq) + Br - (aq)    + = H <sub>3</sub> O+   (aq) + H <sub>2</sub> O (I) + (aq)   produces OH-    us bases.    H <sub>4</sub> + (aq) + (aq)   produces OH-	
Are ALL Bronsted-Lo	HBr (aq) + H <sub>2</sub> O (I)	(aq) + Br - (aq)  t = H <sub>3</sub> O+  (aq) + H <sub>2</sub> O (I) + (aq)  produces OH-  Us bases.  Bronsted- Arrhe  Arrhe  id/base, Arrhenius acid/base or both.	
Are ALL Bronsted-Lo	HBr (aq) + H <sub>2</sub> O (I)	(aq) + Br - (aq)    + = H <sub>3</sub> O+   (aq) + H <sub>2</sub> O (I) + (aq)   produces OH-    us bases.    H <sub>4</sub> + (aq) + (aq)   produces OH-    id/base, Arrhenius acid/base or both.    OH) <sub>2</sub>	

## **CONCEPT: BRONSTED-LOWRY ACIDS AND BASES**

## **Conjugate Acid-Base Pairs**

- Bronsted-Lowry acids and bases occur in \_\_\_\_\_ pairs.
  - □ When base accepts a proton, it transforms into a conjugate \_\_\_\_\_.

$$CH_3NH_2$$
 (aq)  $\xrightarrow{add H^+}$  \_\_\_\_\_(aq)

□ When acid donates a proton, it transforms into conjugate \_\_\_\_\_.

**EXAMPLE:** Provide formulas of the conjugates for each of the following compounds.

- a) NH<sub>2</sub>NH<sub>2</sub>
- b) HCHO<sub>2</sub>
- c) HSO<sub>4</sub>- (base)
- d) HClO<sub>2</sub>

PRACTICE: Identify conjugate acid and conjugate base in the following reaction.

$$H_2PO_4^-$$
 (aq) +  $H_2O$  (I)  $\longrightarrow$   $HPO_4^{2-}$  (aq) +  $H_3O^+$  (aq)

- a) HPO<sub>4</sub><sup>2-</sup> (conjugate acid), H<sub>3</sub>O<sup>+</sup> (conjugate base)
- b) HPO<sub>4</sub><sup>2-</sup> (conjugate base), H<sub>3</sub>O<sup>+</sup> (conjugate acid)
- c) H<sub>2</sub>PO<sub>4</sub>- (conjugate acid), H<sub>2</sub>O (conjugate base)
- d) H<sub>2</sub>PO<sub>4</sub>- (conjugate base), H<sub>2</sub>O (conjugate acid)

**PRACTICE:** In the following reaction, label Bronsted-Lowry acid and base, along with conjugate acid and base.

$$H_2C_6H_6O_6 \text{ (aq)} + H_2O \text{ (I)} \longrightarrow HC_6H_6O_6^- \text{ (aq)} + H_3O \text{ (aq)}$$

## **CONCEPT:** BRONSTED-LOWRY ACIDS AND BASES

## **Strength of Conjugate Acids & Bases**

• There is an	relat	ionship between str	ength of acids	& bases and the	eir			
□ A strong acid will have a relatively conjugate base.								
- S	tronger the acid	= the cor	ijugate base	- weak conjuga	ate base has	affinity for proton		
	HCI (aq) H	+ H <sub>2</sub> O (liq) ——	<b></b>	_ 、 ,,	_ (aq) conjugate ba	se		
□ A weak a	acid will have a re	elatively	conjugat	e base.				
- W	eaker the acid =	stronger the conjug	gate base -	stronger conjuga	ate base has	affinity for proton		
	HCN (aq) H	- H <sub>2</sub> O (liq)	<b>→</b> –		(aq) conjugate	e base		
_		conjugate ad				readily donates proton _ donates proton		
<b>EXAMPLE:</b> Which of the following acids have relatively strong conjugate bases?								
a. HBrO <sub>4</sub>	b	. HCN	c. HNO <sub>3</sub>	d	. HClO <sub>4</sub>			

**PRACTICE:** Which of the following is the strongest base?

a.  $NO_{3}^{-}$ 

b. F-

c. Cl-

d. ClO<sub>4</sub>-

e. H<sub>2</sub>O

**PRACTICE:** Which of the following bases will have the weakest conjugate acid?

a. CH₃COOH

b. HCl

c. CH<sub>3</sub>NH<sub>2</sub>

d. (CH<sub>3</sub>)<sub>2</sub>NH

e. LiOH