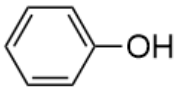
1 Arrange the following compounds in order of INCREASING acid strength (from least acidic to most acidic).



I

HCl

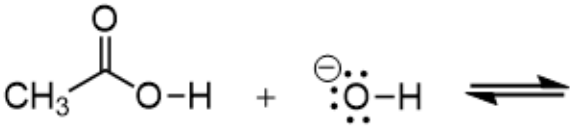
II

CH_3OH

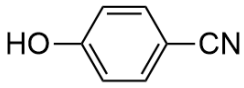
III

Chapter 3 Acid-Base Reactions (Proton Transfer), Part 2 – Practice Problems

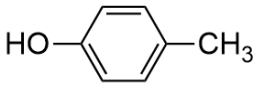
2 Is hydroxide a strong enough base to deprotonate acetic acid (CH_3CO_2H)? Explain.



3 Which is the stronger acid? Explain briefly.



A

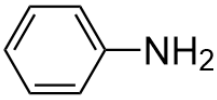


B

4 Which is the stronger base? Explain briefly.

NH_3

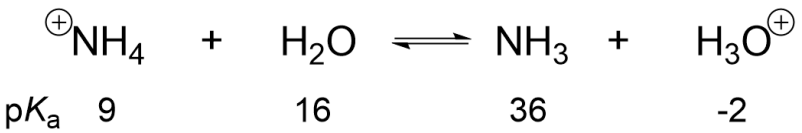
ammonia



aniline

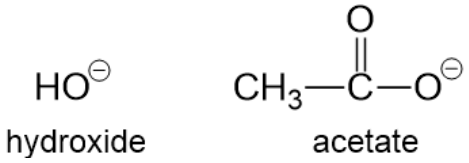
5

Given the pK_a values shown, in which direction does the equilibrium lie? Explain briefly. (next, try it without pK_a!)

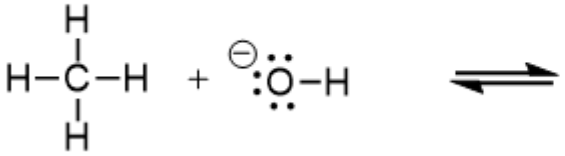


6

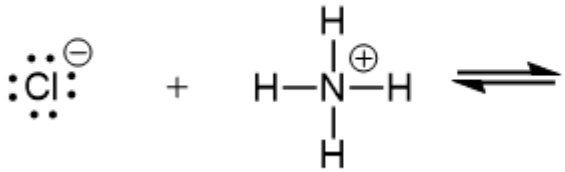
Which is the stronger base? Explain briefly.



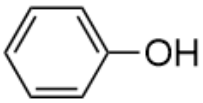
7 Is hydroxide a strong enough base to deprotonate methane (CH_4)? Explain.



8 Is chloride a strong enough base to deprotonate ammonium (NH_4^+)? **A** = Yes; **B** = No



1 Arrange the following compounds in order of INCREASING acid strength (from least acidic to most acidic).



I

HCl

II

CH_3OH

III

A) III < II < I

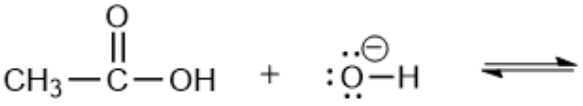
B) III < I < II

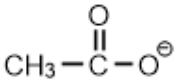
C) I < III < II

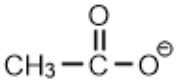
D) II < III < I

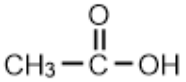
E) I < II < III

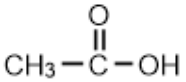
2 Is hydroxide a strong enough base to deprotonate acetic acid (CH_3CO_2H)? Explain.



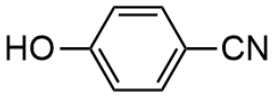
A) Because hydroxide is less stable than this:  hydroxide is a suitable base to deprotonate acetic acid.

B) Because hydroxide is less stable than this:  hydroxide is NOT a suitable base to deprotonate acetic acid.

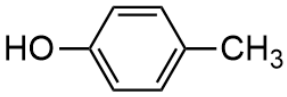
C) Because hydroxide is less stable than this:  hydroxide is a suitable base to deprotonate acetic acid.

D) Because hydroxide is less stable than this:  hydroxide is NOT a suitable base to deprotonate acetic acid.

3 Which is the stronger acid? Explain briefly.



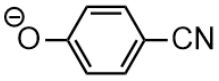
A



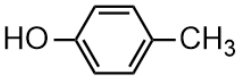
B

A) **A** is the stronger acid because is **more** stable.

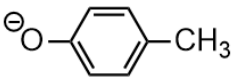
B) **A** is the stronger acid because is **more** stable.



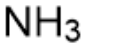
C) **B** is the stronger acid because is **more** stable.



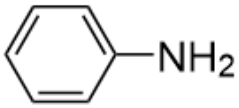
D) **B** is the stronger acid because is **more** stable.



4 Which is the stronger base? Explain briefly.

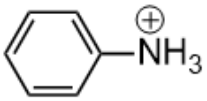


ammonia

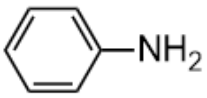


aniline

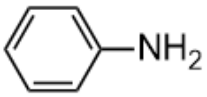
A) Because this is more stable: **aniline** is the **stronger** base.



B) Because this is more stable: **aniline** is the **stronger** base.

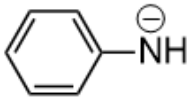


C) Because this is more stable: **ammonia** is the **stronger** base.



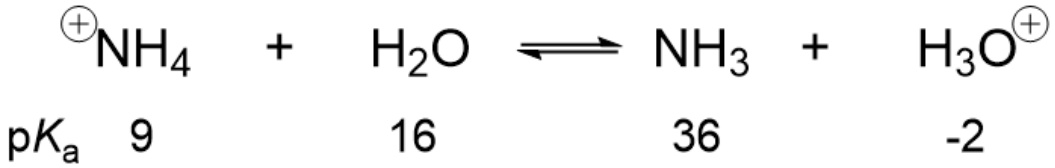
D) Because this is more stable: **ammonia** is the **stronger** base.

E) Because this is more stable: **aniline** is the **stronger** base.



5

Given the pK_a values shown, in which direction does the equilibrium lie? Explain briefly. (next, try it without pK_a!)



A) Forward, because the combined pK_a 25 is lower than 34.

B) Reverse, because the combined pK_a 25 is lower than 34.

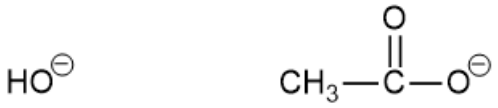
C) Forward, because -2 is lower than 9.

D) Reverse, because -2 is lower than 9.

E) Neither, because the charges are balanced.

6

Which is the stronger base? Explain briefly.



hydroxide acetate

A) Because this is more stable: H–O–H
hydroxide is the **stronger** base.

B) Because this is more stable: H–O⊖
hydroxide is the **weaker** base.

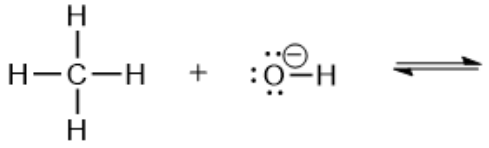
C) Because this is more stable: CH3–C(=O)–OH
acetate is the **stronger** base.

D) Because this is more stable: CH3–C(=O)–O⊖
acetate is the **weaker** base.

E) It's impossible to predict base strength without pK_b data.

7

Is hydroxide a strong enough base to deprotonate methane (CH_4)? Explain.



A) Because hydroxide is more stable than $H_3C^{\ominus}$, hydroxide is a suitable base to deprotonate methane.

B) Because hydroxide is less stable than $H_3C^{\ominus}$, hydroxide is a suitable base to deprotonate methane.

C) Because hydroxide is more stable than $H_3C^{\ominus}$, hydroxide is NOT a suitable base to deprotonate methane.

D) Because hydroxide is less stable than $H_3C^{\ominus}$, hydroxide is NOT a suitable base to deprotonate methane.

E) It's impossible to predict the direction of the equilibrium without pK_a data.

8

Group work: Is chloride a strong enough base to deprotonate ammonium (NH_4^+)? Explain.