

**Acids and Bases I**  
**Worksheet**

- 1) Label the acid, base, conjugate acid, and conjugate base in the following reactions.
- $\text{HNO}_3(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{NO}_3^-(aq)$
  - $\text{HCO}_3^-(aq) + \text{OH}^-(aq) \rightleftharpoons \text{CO}_3^{2-}(aq) + \text{H}_2\text{O}(l)$
  - $\text{H}_2\text{PO}_4^-(aq) + \text{H}_2\text{S}(aq) \rightleftharpoons \text{H}_3\text{PO}_4(aq) + \text{HS}^-(aq)$
  - $\text{HF}(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{F}^-(aq)$
  - $\text{CN}^-(aq) + \text{NH}_4^+(aq) \rightleftharpoons \text{HCN}(aq) + \text{NH}_3(aq)$
  - $\text{HCN}(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{CN}^-(aq)$
  - $2 \text{H}_2\text{O}(l) \rightleftharpoons \text{OH}^-(aq) + \text{H}_3\text{O}^+(aq)$
  - $2 \text{NH}_3(aq) \rightleftharpoons \text{NH}_4^+(aq) + \text{NH}_2^-(aq)$
- 2) The process below is an acid base reaction.
- $$\text{SnCl}_4(s) + 2 \text{Cl}^-(aq) \rightarrow \text{SnCl}_6^{2-}(aq)$$
- Which of the three definitions for acid/base reactions can be applied to this reaction? Justify your answer using Lewis dot diagrams.
  - Identify the acid and the base in the reaction.
- 3) Which of the following chemical equations represents the reaction of an Arrhenius Acid?
- $\text{HNO}_3(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{NO}_3^-(aq)$
  - $\text{HNO}_3(aq) \rightleftharpoons \text{H}^+(aq) + \text{NO}_3^-(aq)$
- 4) Which of the following processes represents the reaction of an Arrhenius Base?
- $\text{KOH}(aq) \rightarrow \text{K}^+(aq) + \text{OH}^-(aq)$
  - $\text{NH}_4^+(aq) \rightleftharpoons \text{H}^+(aq) + \text{NH}_3(aq)$
- 5) Which of the three acid/base definitions covers all types of acid and base reactions?
- 6) Identify the strongest base in each the following reactions. Justify your answer.
- $\text{HClO}_4(aq) + \text{H}_2\text{O}(l) \rightarrow \text{ClO}_4^-(aq) + \text{H}_3\text{O}^+(aq)$
  - $\text{HNO}_3(aq) + \text{H}_2\text{O}(l) \rightarrow \text{NO}_3^-(aq) + \text{H}_3\text{O}^+(aq)$
  - $2 \text{H}_2\text{O}(l) \rightleftharpoons \text{OH}^-(aq) + \text{H}_3\text{O}^+(aq)$
  - $\text{HF}(aq) + \text{H}_2\text{O}(l) \rightleftharpoons \text{H}_3\text{O}^+(aq) + \text{F}^-(aq)$

- 7) What is the strongest acid in each of the following reactions?
- $\text{HI}(aq) + \text{H}_2\text{O}(l) \rightarrow \text{I}^-(aq) + \text{H}_3\text{O}^+(aq)$
  - $\text{H}_2\text{SO}_4(aq) + \text{H}_2\text{O}(l) \rightarrow \text{HSO}_4^-(aq) + \text{H}_3\text{O}^+(aq)$
  - $\text{HNO}_3(aq) + \text{H}_2\text{O}(l) \rightarrow \text{NO}_3^-(aq) + \text{H}_3\text{O}^+(aq)$
- 8) Identify the strongest acid in each of the following sets. Justify your answers.
- HF or HBr
  - HCl or HI
  - HF or HI
- 9) Identify the strongest base in each of the following sets. Explain.
- $\text{F}^-$  or  $\text{Cl}^-$
  - $\text{I}^-$  or  $\text{Br}^-$
  - $\text{I}^-$  or  $\text{F}^-$
- 10) Identify the strongest acid in each of the following sets. Explain.
- HOI or HOBr
  - HOCl or HOBr
  - HOCl or HOI
- 11) Identify the strongest acid in each of the following sets. Explain.
- $\text{HClO}_4$  or HOCl
  - $\text{HIO}_3$  or  $\text{HIO}_2$
  - HOBr or  $\text{HBrO}_3$
  - HOBr or  $\text{HClO}_3$
  - $\text{HBrO}_3$  or  $\text{HClO}_3$
- 12) Identify the strongest acid in each of the following sets. Explain.
- $\text{CH}_3\text{COOH}$  or  $\text{CCl}_3\text{COOH}$
  - $\text{CH}_2\text{ClCOOH}$  or  $\text{CHCl}_2\text{COOH}$
  - $\text{I}(\text{CH}_2)_2\text{COOH}$  or  $\text{Cl}(\text{CH}_2)_2\text{COOH}$
  - $\text{CH}_3\text{CHCl}_2\text{COOH}$  or  $\text{CH}_3\text{CH}_2\text{ClCOOH}$
  - $\text{I}(\text{CH}_2)_2\text{COOH}$  or  $\text{Br}(\text{CH}_2)_2\text{COOH}$