

1. Write the formula for a **proton**.



2. Write the formula for a **hydrated proton**. ( $\text{H}_2\text{O} + \text{H}^+$ )



3. Write the formula for a **hydronium** ion.



4. Give the **Arrhenius** definition of an **acid**.

Any substance that releases  $\text{H}^+$  ions in water

5. Give the **Arrhenius** definition of a **base**.

Any substance that releases  $\text{OH}^-$  ions in water

6. Give the **Bronsted-Lowry** definition of an **acid**.

A species that donates protons ( $\text{H}^+$ ) to another species

7. Give the **Bronsted-Lowry** definition of a **base**.

A species that accepts protons ( $\text{H}^+$ ) from another species

8. Given the equation:  $\text{HCO}_3^- + \text{H}_2\text{S} \rightleftharpoons \text{H}_2\text{CO}_3 + \text{HS}^-$

- a) The **acid** on the left side is



- b) The **base** on the left side is



- c) The **acid** on the right side is



- d) The **base** on the right side is



9. Find the **conjugate acids** of each of the following:

- a)  $\text{HPO}_4^{2-}$



- b)  $\text{PO}_4^{3-}$



- c)  $\text{HSO}_4^-$



- d)  $\text{NH}_3$



- e)  $\text{H}_2\text{PO}_4^-$



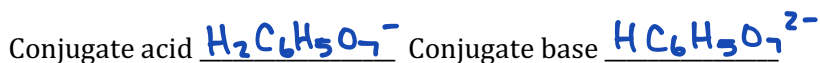
10. Find the **conjugate bases** of each of the following:



11. Give the formulas of a conjugate acid/base pair in which the **dihydrogen citrate ion is the conjugate base**.



12. Give the formulas of a conjugate acid/base pair in which the **dihydrogen citrate ion is the conjugate acid**.



13. Is the dihydrogen citrate ion **amphiprotic**? Explain your answer.

Yes because it can act as an acid (donates  $\text{H}^+$ ) or as a base (accepts  $\text{H}^+$ )

14. Give the correct formulas and names of 4 **amphiprotic anions**. (Don't forget that anions have a negative charge!)

