Name_____
Period __ Date ___/___/___

# 4 • Classifying Chemicals

READING NOTES 4.1

**19-9 Brønsted-Lowry Acids and Bases**

*The Point:*

*Scientists use two kinds of definitions. We will use the same two to define acids & bases. Our operational definition is based on a labette. Some of the conceptual definition you will understand now, some will show up later (electron-dot symbols).*

1. An **operational definition** is based on _____ _____.
   In other words, some sort of **test**.
2. For example, the operational definition of an _____ is a solution that will conduct electricity.
3. From class, the operational definition of an **acid** is: _____
4. From class, the operational definition of a **base** is: _____
5. The operational definition of a **neutral** substance is: _____
6. A **conceptual definition** is based on _____ _____.
   In other words, the theory of **why** something acts the way it does.
7. Acids can be defined conceptually as _____ _____ _____.
   [This is the Arrhenius definition of acids.]
8. Write the symbol for a hydrogen ion: _____
   Here is a water molecule, $H_2O$: 
   Draw the + and – end on the water.
   The $H^+$ ion will be attracted to $H_2O$.
   Draw how it will look:

   This is $H_3O^+$, called _____ ion and referred to in the text as a "hydrated hydrogen ion."
9. According to Brønsted & Lowry, an **acid** is a substance, either _____ or _____, that can _____ a proton (_____ _____) to another substance.
10. A base is any substance that can _____ a proton from another substance.
11. A proton is the same as which ion? _____
12. Study Figure 19-16 on page 561.
    Which molecule is donating a proton? _____
    Which molecule is accepting the proton? _____
    The acid is _____ and the base is _____
    (according to Brønsted & Lowry.)
13. $HCl(g) + H_2O(l) \rightarrow H_3O^+(aq) + Cl^-(aq)$ (Eq. 14)
    _____ _____
    Label the reactants as "acid" and "base."
14. $NH_3(g) + H_2O(l) \rightarrow NH_4^+(aq) + OH^-(aq)$ (Eq. 15)
    _____ _____
    Label the reactants as "acid" and "base."
15. To summarize:

| | Acid | Base |
|---|---|---|
| **Operational definition** | turns cabbage juice _____ | turns cabbage juice _____ |
| **Arrhenius Conceptual Definition** | increases the [___] in aqueous solution | increases the [___] in aqueous solution |
| **Brønsted-Lowry Conceptual Definition** | proton _____ | proton _____ |

**19-6 Properties of Acids**

*The Point:*

*There are standard properties of acids that everyone should know. Here they are.*

16. *1. Acids are _____ _____ that ionize when added to _____.* This means that acids are not ionic compounds; they only form ions when they are dissolved in water.
    *2. Acids react with active _____ to produce _____ gas.* Examples of active metals are ____, ____, ____, ____ (write their symbols). Examples of non-active metals are ____, ____, ____, and ____. Copy (Eq. 9) here as an example.

3. *Acids affect the colors of acid-base* _____. An example we used in our recent labette is _____ _____. In the baggie lab (with $CaCl_2$ and $NaHCO_3$) we used _____ _____ solution.
4. *Acids* _____ *bases.*
5. *Dilute acids have a* _____ *taste.* Three foods that contain acids are _____ _____, _____, and _____ _____.

**19-7 Arrhenius Bases and Their Properties**

*The Point:*

*Bases also have well-known properties. Some of the properties are a little different than those of acids. Here they are.*

17. 1. *Bases are* _____.
2. *Bases cause indicators to turn a characteristic color.* Cabbage juice turns _____. In the baggie lab, the phenol red solution was slightly basic. It's basic color is _____.
3. *Bases* _____ *acids.* Copy (Eq. 13)

This is a _____ _____ reaction. The "driving force" is the formation of _____ a very weak electrolyte.

4. *Water solutions of bases taste* _____ *and feel* _____. It is a _____ (good/bad) idea to **taste test** laboratory chemicals to see whether they are acids or bases.

18. List the five common bases in Figure 19-12:

| Name | Formula | Common name |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

19. Acids act like acids because they have $H^+$ ions. Bases act like bases because they have $OH^-$ ions. During neutralization, $H^+ + OH^- \rightarrow$ _____.

20. Write balanced neutralization reactions for the following acid-base combinations. Afterwards, check your answers in Figure 19-13 (page 558.)

$H_2SO_4 + NaOH \rightarrow$

$HC_2H_3O_2 + NaOH \rightarrow$

$HNO_3 + KOH \rightarrow$

$HCl + KOH \rightarrow$

21. Many bases contain $OH^-$ ions. $NH_3$ is a very common example that does not, however it can still increase the $[OH^-]$ because it accepts a proton from water. Copy (Eq. 12) on page 559.

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