

Acid, Base, or Salt?

The properties of acids and bases are caused by the ions they form in water. Due to the presence of ions, aqueous solutions of both acids and bases are electrolytes. Acids and bases react with each other to form a salt and water. The reaction is a double replacement reaction known as neutralization. (Example: $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$) Since acid characteristics are caused by hydronium ions and base characteristics are caused by hydroxide ions, there are some differences as well.

Acids increase the hydronium ion concentration of water. Hydronium ion concentration is measured on the pH (**P**ower of **H**ydronium) scale. Acids have a pH below 7. They also taste sour, the taste of hydronium. Since acids are polar molecules with metallic hydrogen, they react with active metals to release hydrogen. This single replacement reaction is responsible for the fact that acids corrode metals. Acids can be used to clean metals.

Bases, on the other hand, increase the hydroxide ion concentration of water and reduce the hydronium ion concentration in water. As a result, they have a pH above 7. Hydroxide ions taste bitter. Bases don't react with metals, but they are not so kind to skin. Bases feel slippery because they dissolve skin. (Dissolved skin makes a great lubricant.) Substances that dissolve skin are called caustic. Bases can be used to unclog drains or to make soap.

Aqueous solutions of acids and bases look identical. Indicators, substances that react with acids or bases to show a definite color change, are used to distinguish between them. See the table to the right.

Salts are ionic compounds formed during the neutralization reaction between acids and bases. Salts tend not to have the characteristics of either acids or bases, because they are generally neutral like water. Salts do dissolve in water, however, to form electrolyte solutions.



Enmity between hydronium and hydroxide ions

Indicator	Color in	
	Acid	Base
litmus	red	blue
phenolphthalein	colorless	pink
bromthymol blue	yellow	blue
methyl orange	red	yellow

Fill in the table below based on your reading above and on your knowledge of chemistry.

Characteristic	Acids	Bases
Conductivity		
pH		
Taste		
Indicators		
Corrosive / Caustic		
Neutralization		

Write the appropriate number on the answer space next to each statement to indicate whether it describes (1) AN ACID, (2) A BASE, (3) A SALT, or (4) NONE OF THESE. If more than one choice is described by a statement, write more than one number on the answer space.

- _____ 1. Has a pH less than 7.
- _____ 2. Formed during a neutralization reaction.
- _____ 3. Ionic compound.
- _____ 4. Polar covalent compound.
- _____ 5. Feels slippery to the touch.
- _____ 6. Tastes bitter.
- _____ 7. Water.
- _____ 8. Increases the hydronium ion concentration of water.
- _____ 9. Contains hydroxide ions.
- _____ 10. Ionizes in water.
- _____ 11. Reacts with active metals to release hydrogen gas.
- _____ 12. C_2H_5OH [*HINT*: What kind of bonds are in this compound?]
- _____ 13. CH_3COOH [*HINT*: Which element is the most metallic in this compound?]
- _____ 14. Conducts electricity in water solution.
- _____ 15. Turns litmus red.
- _____ 16. Turns phenolphthalein red.
- _____ 17. Used in the production of soap.
- _____ 18. Found in vinegar.
- _____ 19. Water solution of carbon dioxide [$H_2O(l) + CO_2(g) \rightarrow H_2CO_3(aq)$].
- _____ 20. Can be neutralized to form a salt and water.
- _____ 21. Water solution of ammonia [$H_2O(l) + NH_3(g) \rightarrow NH_4OH(aq)$]