

What you need to know about pH

Know this slide! Important for Exam 2

What does pH mean?

All acid-base reactions produce

1. Water *
2. Salt

[...] square brackets mean “the concentration of”
Solute is put inside of the square brackets

$$\text{pH} = -\log [\text{H}^+]$$

when it is pure water, $[\text{H}^+] = 1 \times 10^{-7} \text{ mol/L}$

pH of pure water is then $-\log$ of 1×10^{-7}
 $= 7$

M is molarity (moles/liter) = moles of solute per liter of solution

Don't get confused...

M = molarity

m = meters

mol = moles

m = molality

The pH scale mathematically

Example: Logarithm of 100

$$100 = 10^2$$

$$\text{So } \log(100) = \log(10^2) = 2$$

*When working with logarithms – count sig figs after the decimal point

* If taking the logarithm gives you a negative number, it is because you are taking the log of a small number

$$45.6 = 4.56 \times 10^1 = 10^{1.659}$$

45.6 is between 10^1 and 10^2 , so its logarithm will be between 1 and 2 = $10^{1.659}$

$$[\text{H}^+] = 0.00010 \text{ M, therefore } \text{pH} = -\log(0.00010) = 4.00$$

*two sig figs in original, so there should be two sig figs after the decimal of the logarithm

$$[\text{H}^+] = 0.00000050 \text{ M, therefore } \text{pH} = -\log(0.00000050) = 6.30$$

*the “6” in this case is a place holder – there are 6 zeroes after the decimal, before the number

$[H^+] = 0.0025 \text{ M}$, therefore $\text{pH} = 2.60$

$\log = -2.60$

pH is the negative $\log = 2.60$

What are oxidation numbers?

*Solving oxidation numbers = algebra

*Oxidation # is like a charge, and sometimes is a charge

*In a compound, all elements of the same kind have the same oxidation number

*Most of the time oxidation # = integer

*Oxidation numbers are a model of electron density

*Redox – Electrons moving from one atom to another

*Oxidation and reduction happen at the same time

How to assign Oxidation numbers

*The sum of all the oxidation numbers has to equal the charge

*If it is a neutral compound, Neutral charge is 0

Cl_2

$x + x = 0$

$x = 0$

CH_3COOH

$2(\text{carbons}) + 2(\text{oxygens}) + 4(\text{hydrogens}) = 0$

Carbon is the unknown

$2x + 2(-2) + 4(+1) = 0$

$2x = 0$

$x = 0$

ClO_3^-

$3(\text{oxygens}) + 1(\text{chlorine}) = -1$

Chlorine is the unknown

$3(-2) + x = -1$

$6 + x = -1$

$x = 5$

NH_4Cl

$1(\text{nitrogen}) + 4(\text{hydrogens}) + 1(\text{chlorine}) = 0$

Nitrogen is the unknown [you know that Cl has oxidation number -1 because in this compound it is the chlorine anion whose charge is -1]

$x + 4(+1) + 1(-1) = 0$

$$x + 3 = 0$$

$$x = -3$$



$$3(\text{carbons}) + 6(\text{hydrogens}) = 0$$

Carbon is the unknown

$$3x + 6(+1) = 0$$

$$3x + 6 = 0$$

$$3x = -6$$

$$x = -2$$



$$2(\text{nitrogens}) + 4(\text{oxygens}) = 0$$

Nitrogen is the unknown

$$2x + 4(-2) = 0$$

$$2x - 8 = 0$$

$$2x = 8$$

$$x = 4$$