CLIL - pH

pH

pH is a measure of the concentration of hydrogen ions (H^+) in a solution and, therefore, its acidity or alkalinity. In aqueous systems, the hydrogen ion concentration is dictated by the dissociation constant of water (**$K_w = 1.011 \cdot 10^{-14}$ at 25°C**) and interactions with other ions in solution. Due to this dissociation constant a neutral solution (hydrogen ion activity equals hydroxide ion activity) has a pH of approximately 7. Aqueous solutions with pH values lower than 7 are considered acidic, while pH values higher than 7 are considered alkaline.

Measuring

pH can be measured:
• by addition of a pH indicator into the studying solution. The indicator color varies depending on the pH of the solution. Using indicators, qualitative determinations can be made with universal indicators that have broad color variablity over a wide pH range and quantitative determinations can be made using indicators that have strong color variablitiy over a small pH range. Precise measurements can be made over a wide pH range using indicators that have multiple equilibriums. Used in conjunction with spectrophotometric methods to determine the relative abundance of each indicator species, extremely precise determinations can be made;
• by using a pH meter together with pH-selective electrodes (pH glass electrode, hydrogen electrode, quinhydrone electrode, ion sensitive field effect transistor and other).

Svante Arrhenius' biography

Svante August Arrhenius (February 19, 1859 – October 2, 1927) was a Swedish chemist and one of the founders of the science of physical chemistry.
Arrhenius was born at Vik (also spelled Wik or Wijk), near Uppsala, Sweden.
At the age of three, Arrhenius taught himself to read, despite his parents' wishes, and by watching his father's addition of numbers in his account books, became an arithmetical prodigy.
In later life, Arrhenius enjoyed using masses of data to discover mathematical relationships and laws. At age 8, he entered the local cathedral school, starting in the fifth grade, distinguishing himself in physics and mathematics, and graduating as the youngest and ablest student in 1876.
At the University of Uppsala, he was unsatisfied with the chief instructor of physics, so he left to study at the Physical Institute of the Swedish Academy of Sciences in Stockholm under the physicist Erik Edlund in 1881.
His work specialized on the conductivities of electrolytes. In 1884, based on this work, he submitted a 150-page dissertation on electrolytic conductivity to Uppsala for the doctorate. It did not impress the professors, and he received the lowest possible passing grade. Arrhenius' explanation was that in forming a solution, the salt dissociates into charged particles (which Michael Faraday had given the name ions many years earlier).
Faraday's belief had been that ions were produced in the process of electrolysis; Arrhenius proposed that, even in the absence of an electric current, solutions of salts contained ions.
He thus proposed that chemical reactions in solution were reactions between ions.
In 1901 Arrhenius was elected to the Swedish Academy of Sciences, against strong opposition.
In 1903 he became the first Swede to be awarded the Nobel Prize in chemistry.
In 1905, upon the founding of the Nobel Institute for Physical Research at Stockholm, he was appointed rector of the institute, the position where he remained until retirement in 1927. He died on October 2 of the same year, and was buried in Uppsala.

Some common pH values

Substance	pH
Concentrated strong acid	-3.60 – 1.00
Battery acid	-0.50
Gastric acid	2.00
Lemon juice	2.40
Cola	2.50
Vinegar	2.90
Orange or apple juice	3.50
Beer	4.50
Acid Rain	<5.00
Coffee	5.00
Tea	5.50
Milk	6.50
Pure water	7.00
Healthy human saliva	6.50 – 7.40
Blood	7.34 – 7.45
Sea water	8.00
Hand soap	9.00-10.00
Household ammonia	11.50
Bleach	12.50
Household lye	13.50

Glossary

Acidic	**Acido**	Glass	**Vetro**
Dissociation	**Dissociazione**	Field	**Campo**
Electrolyte	**Elettrolita**	Swedish	**Svedese**
Alkaline	**Alcalino**	Born	**Nato**
Dictated	**Dettato**	Age	**Età**
Due	**A causa**	Parent	**Genitore**
Approximately	**Approssimativamente**	Wish	**Desiderio**
Measured	**Misurato**	Relationship	**Relazione**
Varies	**Varia**	Young	**Giovane**
Broad	**Ampio**	Work	**Lavoro**
Wide	**Ampio**	Low	**Basso**
Range	**Intervallo**	Charged	**Carico**
Strong	**Forte**	Salt	**Sale**
Small	**Piccolo**	Against	**Contro**
Made	**Fatto**	Awarded	**Premiato**

Practise

Match the words in table A with the English equivalent in table B. Use a dictionary if needed.

Table A

A	Solvente
B	Soluzione acquosa
C	Dipolo
D	Polare
E	Idrossido di ammonio
F	Elettrolita
G	Logaritmo
H	Equilibrio mobile
I	Elettrolita forte
J	Elettrolita debole
K	Concentrazione molare
L	Acido
M	Base
N	Titolazione
O	Idrolisi
P	Soluzione tampone
Q	Prodotto di solubilità
R	Complesso
S	Legame covalente
T	Legame ionico

Table B

1	Solubility product
2	Logarithm
3	Base
4	Dipole
5	Mobile equilibrium
6	Weak electrolyte
7	Complex
8	Ionic bond
9	Tritration
10	Polar
11	Acid
12	Aqueous solution
13	Buffer solution
14	Elecyrolyte
15	Molar concentration
16	Solvent
17	Covalent bond
18	Strong electrolyte
19	Hydrolysis
20	Ammonium hydroxide

Keys

Match the words in table A with the English equivalent in table B. Use a dictionary if needed.

Table A	Table B
A	16
B	12
C	4
D	10
E	20
F	14
G	2
H	5
I	18
J	6
K	15
L	11
M	3
N	9
O	19
P	13
Q	1
R	7
S	17
T	8