**PH and its Measurements**

1. **pH**

* pH is measured on a scale where 7 is neutral, below 7 is acidic, above is basic
* for every 1 pH unit increase, the concentration of hydrogen ions/hydronium ions decreases by a factor of 10 and the concentration of hydroxide ions increases by a factor of 10

each step (n) = x10

= 10n

**pOH**

14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

basic neutral acidic

**pH**

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

acidic neutral basic

* water has a pH of 7 because it can self-ionize to become hydronium and hydroxide
* H3O+ and H+ are used interchangeably to denote acids

pH = - log10 [H3O+(aq)]

pOH = -log10[OH-(aq)]

pH + pOH = 14

[H+] = 10 –pH

[OH-] = 10 –pOH

1. **Measurements**

**Indicators**

* Organic dyes that change colour due to pH
* Litmus only tells whether pH is less than 7 (red) or greater than 7 (blue)
* Universal indicators are much better, they show different colours that we compare to known values

1. **Write a dissociation or ionization equation for each of the following chemical compounds dissolving in water. State whether the equation represents dissociation or an ionization reaction.**
2. lithium chloride
3. potassium hydroxide
4. hydrogen iodide
5. sodium iodide
6. hydrogen sulphate
7. **The following strong acids and strong bases are dissolved in water. Determine the [H+] or [OH-] as appropriate.**
8. 2.0 M HBr(aq)
9. 1.0 mol/L LiOH(aq)
10. 2.5 M HCl(aq)
11. 0.5 mol/L KOH(aq)
12. 10 mol/L NaOH(aq)
13. **What is the pH of each of the following solutions?**

a. vinegar with [H+] = 10 –2 mol/L

b. household ammonia with [H+] = 10 –12 mol/L

c. grapefruit juice with [H+] = 10 –3 mol/L

d. rainwater with [H+] = 10 –5 mol/L

1. **Calculate the [H+] for each of the following solutions:**
2. asparagus soup broth with pH = 8
3. olive oil with pH = 3
4. oven cleaner with pH = 12
5. 0.1 mol/L solution of acetic acid with pH = 4
6. Rainwater with pH =5

**Acid Rain**

**Acid Forming Pollutants**

Normal acid rain is slightly acidic, pH 5.6

**Acid Precipitation** is any form of natural precipitation that has an unusually high acidity (lower than pH 5.6)

**Acid Deposition** is acid forming pollutants that fall to Earth as wet deposition (precipitation) and a dry deposition (dust)

**Three types of Acid Forming Pollutants**

1. **CO2** produced by burning and through respiration, mixes with water to form

carbonic acid (weak)

CO2(g) + H2O(l) -> H2CO3(aq)

1. **NOx** nitrogen oxides, produced by lightning and plant decay, mixes with water

to form nitric acid (strong) and nitrous acid (weak)

2NO2(g) + H2O(l) -> HNO3(aq) + HNO2(aq)

1. **SOx** sulfur oxides, produced by combustion of coal and oil, sulfur dioxide

combines with water to produce sulphurous acid (weak) and sulfur trioxide

reacts with water to form sulfuric acid (strong)

SO2(g) + H2O(l) -> H2SO3(aq)

SO3(g) + H2O(l) -> H2SO4(aq)

**Neutralizing Acid Precipitation**

* Acid precipitation can be neutralized by limestone (CaCO3) in bedrock and through dilution
* Great Lakes have a huge limestone deposit
* When the environment cannot neutralize acid deposition, damage to ecosystems can occur
* Lakes become acidified by acid rain and cannot support life
* Liming is a technique used to neutralize acid deposition where limestone and calcium carbonate is sprinkled over the affected area

**Solutions to the Problem of Acid Rain**

* Reduce automobile use
* Drive fuel-efficient vehicles or hybrid vehicles
* Retrofit older homes to eliminate air leaks
* Plant trees