<u>Amphiprotic Species (ions or molecules)</u>

- are found on **both** sides of the table e.g.) HSO_4^-
- can act as acids (donate H^+'s) or as bases (accept H^+'s)
- to look at an amphiprotic species as an **<u>acid</u>**, you must find it on the **<u>left</u>** side:

Acid Strength Increases

e.g.)

$$\begin{array}{ll} C_6H_5OH & \leftrightarrows \\ HCO_3^- & \leftrightarrows \\ H_2O_2 & \leftrightarrows \end{array}$$

HCO_3^- is a __________er acid than C_6H_5OH
HCO_3^- is a __________er acid than H_2O_2

- to look at an amphiprotic species as a **<u>base</u>**, you must find it on the **<u>right</u>** side:

for HCO_3^- as a **base**:

e.g.)

$$\begin{array}{ll} \leftrightarrows & H^+ + Al(H_2O)_5(OH)^{2+} \\ \leftrightarrows & H^+ + HCO_3^- \\ \leftrightarrows & H^+ + C_6H_5O_7^{3-} \end{array}$$

Base Strength Increases

HCO_3^- is a __________er base than $C_6H_5O_7^{3-}$
HCO_3^- is a __________er base than $Al(H_2O)_5(OH)^{2+}$

HSO_4^- in shaded region on top right will **<u>not</u>** act as a base in water (Too weak of a base)

- However, it is **<u>not</u>** a spectator! (like NO_3^- is) Why not?

(HSO_4^- is also found on the left side quite a way up, it is a relatively "strong" weak *acid*.)

<u>The Leveling Effect for Acids</u>

What is $[H_3O^+]$ in 1.0 M H_3O^+ ? ______

What is $[H_3O^+]$ in 1.0 M HNO_3? ______

What is $[H_3O^+]$ in 1.0 M HCl ? ______

Acids from $HClO_4$ to H_2SO_4 are 100% ionized in <u>water</u>

only solvent used in Chem 12 (and most Chemistry)

- so even though $HClO_4$ is above HCl on the chart, it is no more acidic in a water solution. Therefore the top six strong acids have been levelled.

H_3O^+ is the <u>strongest acid</u> that can exist in an undissociated form in water solution.
all stronger acids <u>ionize</u> to form H_3O^+

(NOTE: although H_2SO_4 is diprotic, the H_3O^+ produced from the second ionization is very little compared to that from the first)

1st ionization: $H_2SO_4 + H_2O \rightarrow H_3O^+ + HSO_4^-$

$\uparrow$ 1M(SA) $\qquad$ $\uparrow$ 1M

2nd ionization: $HSO_4^- + H_2O \leftrightarrows H_3O^+ + SO_4^{2-}$

~1M (WA)

<u>Leveling Affects of Bases</u>

The strongest base which can exist in high concentrations in water solution is OH⁻
The two stronger bases below it will react with water completely to form OH⁻.

Eg) $O^{2-} + H_2O \rightarrow OH^- + OH^-$ Single Arrow

SB

Or

$O^{2-} + H_2O \rightarrow 2OH^-$

What is the final $[O^{2-}]$ in 1.0 M Na_2O ? Answer: 0 M

- **<u>All</u>** the O^{2-} will react with water to form OH^-

1.0M $\xrightarrow{2/1}$ 2.0 M

$O^{2-} + H_2O \rightarrow 2OH^-$ so $[OH^-] = 2.0$ M

Write an equation for NH_2^- reacting with H_2O.

Answer: ____

Write out the definition of the levelling effect from page 125

- Do Ex. 26-27 Pg.126