Warm-up 4/18

1. Define the terms *acid* and *base* according to the Brønsted-Lowry theory. Distinguish between a weak base and a strong base. State **one** example of a weak base.**(3)**

2. Weak acids in the environment may cause damage. Identify a weak acid in the environment **and** outline **one** of its effects. **(2)**

Acids on the Environment

- (ii) sulfurous acid/H_2SO_3;
  corrodes marble/limestone buildings/statues / leaching in soils / harms/kills plants;

  OR

  nitrous acid/HNO_2;

corrodes marble/limestone buildings/statues / leaching in soils / harms/kills plants;

- **OR**
- carbonic acid/H_2CO_3;
  corrodes marble/limestone buildings/statues / acidification of lakes;2
- *Do not allow oxides (e.g. CO_2 etc.).*
  Do not accept just corrodes or damages.

Additional Practice Problem

- Explain, using an equation, whether a solution of 0.10 mol dm^{-3} $FeCl_3(aq)$ would be acidic, alkaline or neutral.

- acidic;
  $[Fe(H_2O)_6]^{3+}$ $[Fe(H_2O)_5(OH)]^{2+} + H^+$ /
  $[Fe(H_2O)_6]^{3+} + H_2O$ $[Fe(H_2O)_5(OH)]^{2+} + H_3O^+$; 2
  Accept equations indicating the formation of
  $[Fe(H_2O)_4(OH)_2]^+$
  $[Fe(H_2O)_3(OH)_3]$
  $[Fe(H_2O)_2(OH)_4]^-$
  Do not penalize $\rightarrow$.

18.1 CALCULATIONS INVOLVING ACIDS AND BASES

Write the equilibrium equation for the dissociation of water:

$H_2O_{(l)} \longleftrightarrow H^+_{(aq)} + OH^-_{(aq)}$ $\Delta H = +\ 57$ kJ/mol

$K_c = ?$

K_w = dissociation constant of this equation

At STP: [OH-] = [H+] = 1.00×10^{-7} units?

$K_w = (1.00 \times 10^{-7}) \times (1.00 \times 10^{-7})$ = $\mathbf{1.00 \times 10^{-14}}$

What happens as temperature increases?

- Higher temperature = shifts to right
- More H+
- Lower pH

Ex: 50^{o}C [H+] = [OH-] = 3.05 x 10^{-7}

Decrease in temperature?

$H_2O_{(l)} \leftrightarrow H^+_{(aq)} + OH^-_{(aq)}$ $\Delta H = +57$ kJ/mol

Pause for…Some key relationships

- $pH = -\log [H+]$ $[H+] = 10^{-pH}$
- $pOH = -\log [OH-]$ $[OH-] = 10^{-pOH}$
- $pK_w = -\log K_w$ $K_w = 10^{-Kw}$
- $pK_a = -\log K_a$ $K_a = 10^{-Ka}$
- $pK_b = -\log K_b$ $K_b = 10^{-Kb}$
- **@ STP:** $[H+] \times [OH-] = 10^{-14}$
  $pH + pOH = pK_w = 14$

Pure water at 50^oc

pH of 7 is neutral for a pure water solution only at 25^oC!

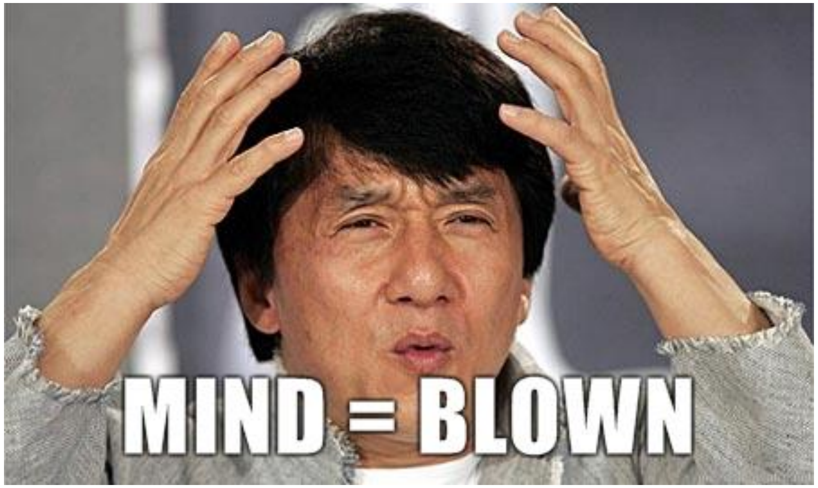
- 50^oC [H+] = [OH-] = 3.05×10^{-7}

- pH = ?
- 6.5

- But this is pure water….What is this telling us about acidity basicity?

Neutral solutions?

- [H+] = [OH-]
- Acidic: [H+] > [OH-]
- Basic: [H+] < [OH-]



Sample Problem #1

- $K_w = 5.48 \times 10^{-14}\ M^2$ @ 50^oC

Find:

[H+]

[OH-]

pH

pOH

Sample Problem #2

- At STP: $[H^+] = 0.001M$

Find:

- pH
- pOH
- $[OH^-]$

Homework – Grey Textbook!

- Pg. 711

16.30, 16.33, 16.39, 16.41