Announcements – Lecture XVIII – Wednesday, Nov 12th

1. **Fifth Lab – Saturday, November 15th … 1-4pm … ISB 155/160 (A-E)**

   a) *Print lab prior to coming to lab -- use the 'Print Friendly Version' located on the top left hand side of the page – this is the version that contains the 'Data Sheet' that you will hand in upon completing the lab.*

   b) *Final set of Lab Owls will appear in Owl after this lab. There are a total of 4 sets of Lab Owls and they are worth 25% of the Lab Grade.*

2. 

iClicker:
Choose any letter: A-E

8.7 Acid Base Properties of Pure Water

Curiosity!

With the $[H_3O^+]$ increasing with increasing temperature this must mean that as the temperature of water increases the water –

a) becomes acidic
b) becomes basic
c) remain neutral

shift →

$$H_2O(l) + H_2O(l) + heat \rightleftharpoons H_3O^+ + OH^-$$

↑ Increase T

but

$[H_3O^+]$ still equals the $[OH^-]$

8.7 Acid Base Properties of Pure Water

Example I

An aqueous solution has a hydronium ion, H_3O^+, concentration of 1×10^{-11} M @ 25°C. This solution is –

a) acidic b) basic c) neutral

$K_W = 1 \times 10^{-14}$ @ 25°C

$K_W = [H_3O^+][OH^-]$

$[H_3O^+][OH^-] = 1 \times 10^{-14}$

$(1 \times 10^{-11})[OH^-] = 1 \times 10^{-14}$

$$[OH^-] = \frac{1 \times 10^{-14}}{1 \times 10^{-11}} = 1 \times 10^{-3}$$

$[OH^-] > [H_3O^+]$

8.8 What are pH and pOH?

$$pH = -\log_{10}[H_3O^+] \qquad pOH = -\log_{10}[OH^-]$$

@ 25°C $\quad [H_3O^+][OH^-] = 1 \times 10^{-14}$

$\log_{10}$ of both sides: $\quad \log_{10}\{[H_3O^+][OH^-]\} = \log_{10}(1 \times 10^{-14})$

tidy this up: $\quad \log_{10}[H_3O^+] + \log_{10}[OH^-] = -14$

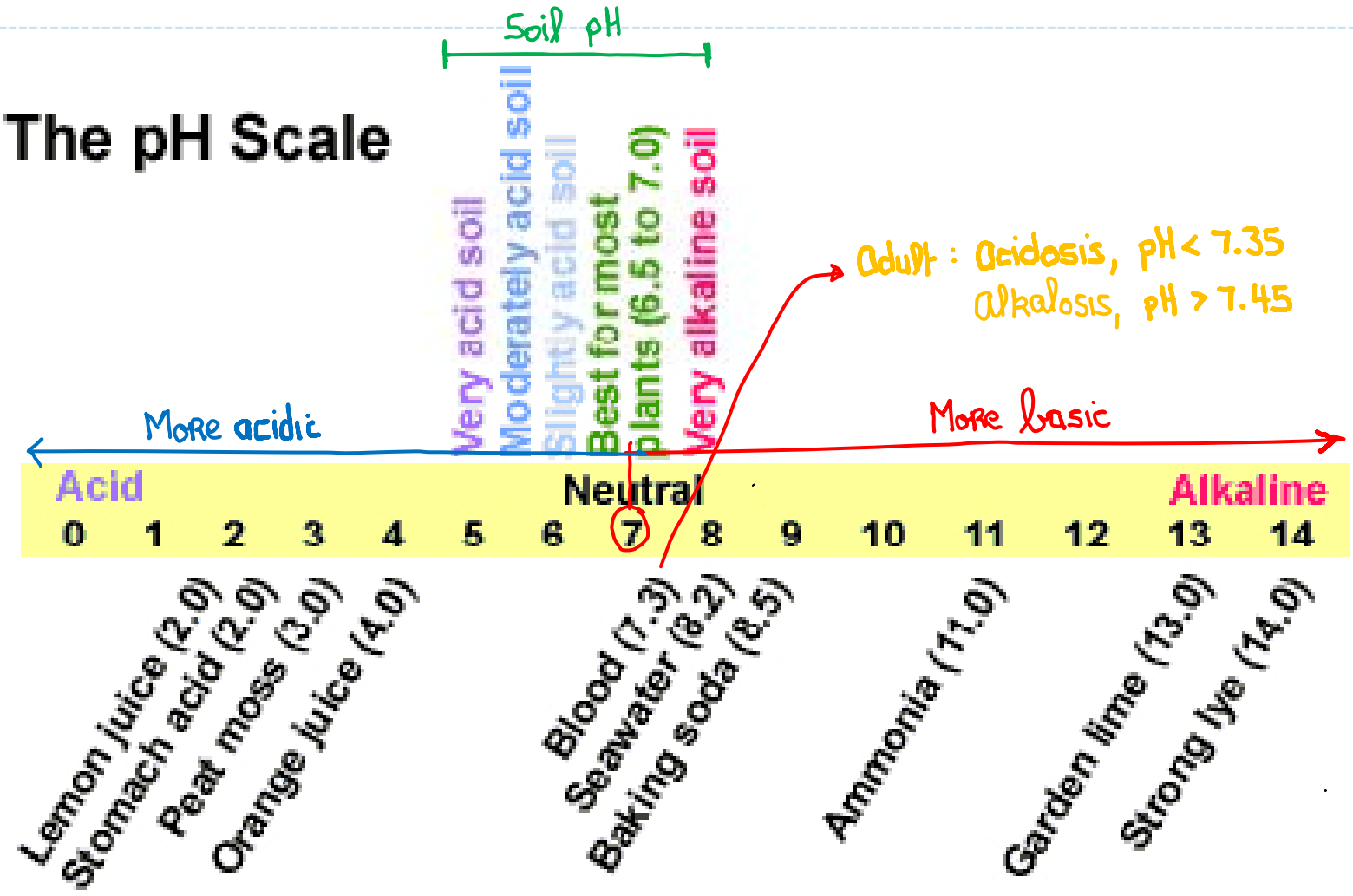
multiply both sides by (-1): $\quad -\log_{10}[H_3O^+] - \log_{10}[OH^-] = 14$

$-\log_{10}[H_3O^+]$ = pH $\qquad -\log_{10}[OH^-]$ = pOH

$$pH + pOH = 14 \quad @ \ 25°C$$

8.8 What are pH and pOH?

pH – Acidity and Basicity



9.8 What are pH and pOH?

pH – Acidity and Basicity

Plant Preferences for pH

Very acid 5.0 - 5.8	Moderately acid 5.5 - 6.8	Slightly acid 6.0 - 6.8	Very alkaline 7.0 - 8.0
azalea	bean	asparagus	acacia
blueberry	begonia	beet	bottlebrush
celeriac	Brussels sprouts	bok choy	cabbage
chickory	calla	broccoli	cauliflower
crabapple	camellia	gooseberry	celery
cranberry	carrot	grape	Chinese cabbage
eggplant	collard greens	kale	cucumber
endive	corn	kohlrabi	date palms
heathers	fuchsia	lettuce	dusty miller
huckleberry	garlic	mustard	eucalyptus
hydrangea	lima bean	muskmelon	geranium
Irish potato	parsley	oats	oleander
lily	pea	okra	olive
lupine	peppers	onion	periwinkle
oak	pumpkin	pansy	pinks
raspberry	radish	peach	pomegranate
rhododendron	rutabaga	peanut	salt cedar
rhubarb	soybean	pear	tamarisk
shallot	squash	peony	thyme
sorrel	sunflower	rice	
spinach beet	tomato	spinach	
spruce	turnip	Swiss chard	
wild strawberry	viola		
sweet potato			
watermelon			
white birch			

8.8 What are pH and pOH?

pH – Acidity and Basicity – Example I

An aqueous solution has an $[OH^-] = 1 \times 10^{-5}$ – the pH of this solution is:

$$pOH = -\log_{10}(1 \times 10^{-5}) = 5$$

$$pH + pOH = 14$$

$$pH = 9$$

8.8 What are pH and pOH

pH – Acidity and Basicity – Example II

a) A 0.15M aqueous solution of an acid HA has a measured pH equal to 0.82
b) A 0.45M aqueous solution of an acid HB has a measured pH equal to 0.69
c) Tom, I have no idea.

Which solution is more acidic? 

The more acidic solution — one with the smallest pH

8.8 What are pH and pOH

pH – Acidity and Basicity – Example III

a) A 0.15M aqueous solution of an acid HA has a measured pH equal to 0.82
b) A 0.45M aqueous solution of an acid HB has a measured pH equal to 0.69
c) Tom, I have no idea.

Which is the stronger acid?

a) $pH = -\log_{10}[H_3O^+]$

$= -\log_{10}(0.15) = 0.82$ ... expected pH if HA is a strong acid ... 100%

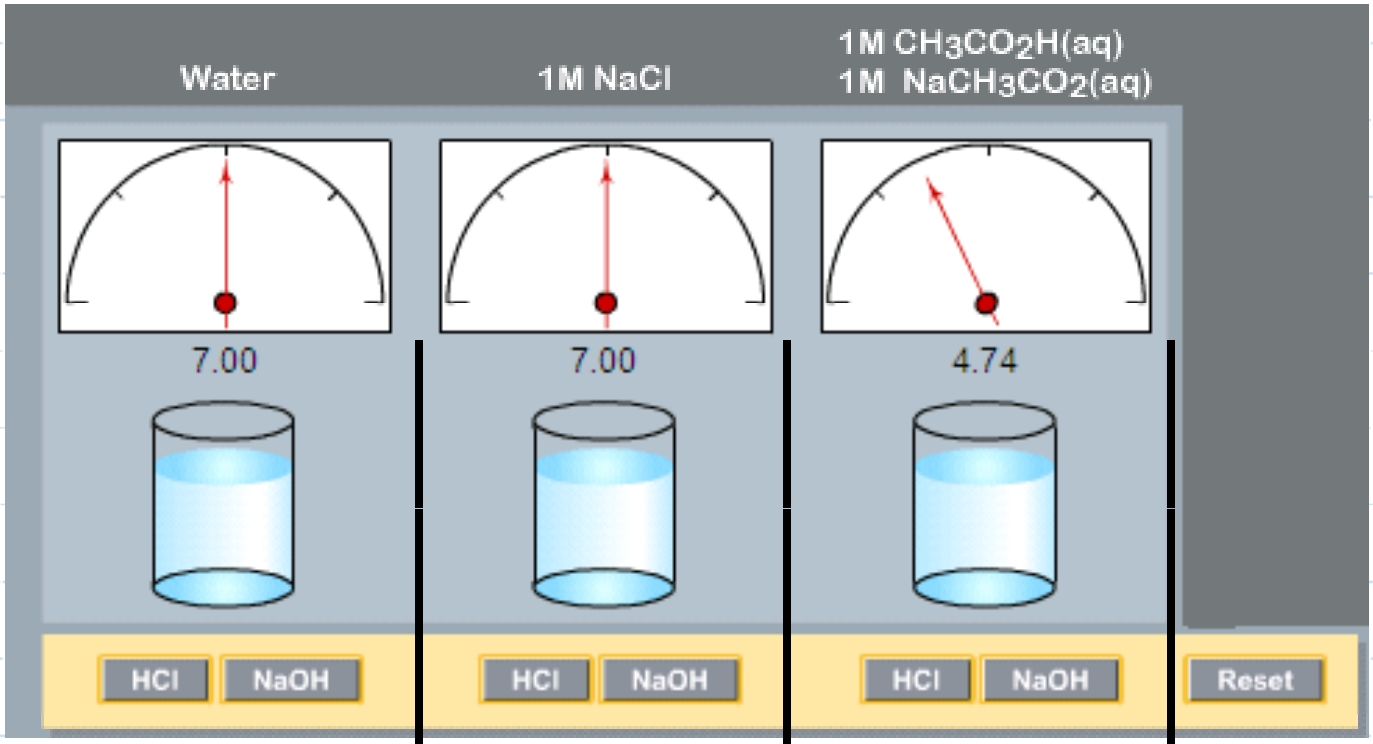
b) $pH = -\log_{10}[H_3O^+]$

$= -\log_{10}(0.45) = 0.35$ ... expected pH if HB is a strong acid ... 100%

$HA + H_2O(l) \rightarrow H_3O^+ + A^-$ ... a strong acid

$HB + H_2O(l) \Leftrightarrow H_3O^+ + B^-$ ... a weak acid

8.10 What Are Buffers?



pH	7.00	7.00	4.74	Initial
pH	1.04	1.04	4.65	Add H_3O^+
pH	12.96	12.96	4.83	Add OH^-

Large pH change

Small pH change

CH_3CO_2H ... acid

$CH_3CO_2^-$ ... base ... ?!!