Class Announcements

LAB 5 : Sat, Nov 12th, 1:30-4:30pm

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

$K_w = 1 \times 10^{-14}$ @ 25°C

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

a) acidic   b) basic   c) neutral

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

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

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

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

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

@ 25°C $[H_3O^+][OH^-] = 1\times10^{-14}$

$\log_{10}$ of both sides : $\log_{10}\{[H_3O^+][OH^-]\} = \log_{10}(1\times10^{-14})$

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

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

$\underbrace{\qquad\qquad}_{pH} \quad \underbrace{\qquad\qquad}_{pOH}$

$$\boxed{pH + pOH = 14 \quad @ \; 25°C}$$

The pH Scale

Soil pH

Very acid soil
Moderately acid soil
Slightly acid soil
Best for most plants (6.5 to 7.0)
Very alkaline soil

More acidic

More basic

Adult : Acidosis, pH < 7.35
Alkalosis, pH > 7.45

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

Lemon juice (2.0)
Stomach acid (2.0)
Peat moss (3.0)
Orange juice (4.0)
Blood (7.3)
Seawater (8.2)
Baking soda (8.5)
Ammonia (11.0)
Garden lime (13.0)
Strong lye (14.0)

Slide - 4
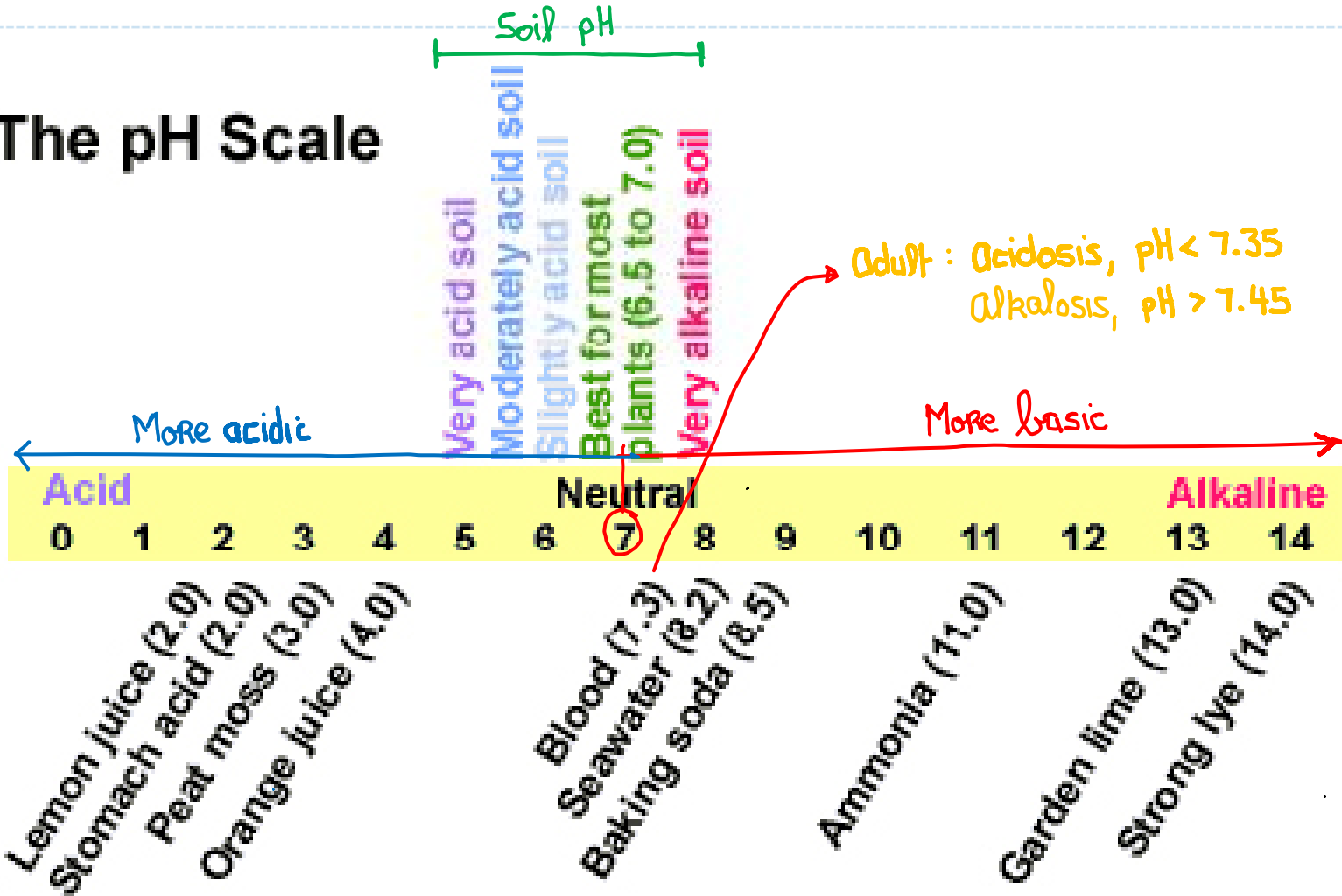
pH – Acidity and Basicity

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			

pH – Acidity and Basicity – Example I

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

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

$$pH + pOH = 14$$

$$pH = 9$$

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

         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
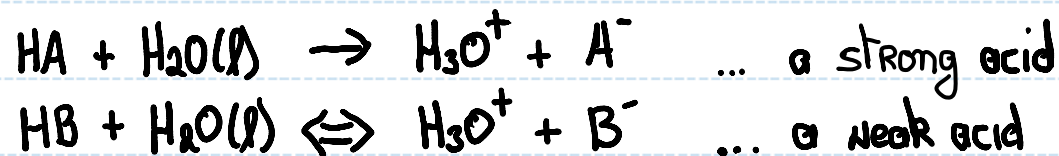c)   Tom, I have no idea.

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

pH – Acidity and Basicity – Example IV

An aqueous solution has a pH of 6 @ 25°C
a)   What is the $[OH^-]$
b)   What is the $[H_3O^+]$

$[OH^-] = 1 \times 10^{-?}$? = 8

$pH + pOH = 14$

$6 + pOH = 14$

$pOH = 8$

$-\log_{10}[OH^-] = 8$

$\log_{10}[OH^-] = -8$

$[OH^-] = 1 \times 10^{-8}$

$[H_3O^+] = 1 \times 10^{-?}$? = 6

$pH = 6$

$-\log_{10}[H_3O^+] = 6$

$\log_{10}[H_3O^+] = -6$

$[H_3O^+] = 1 \times 10^{-6}$