CH142 Exam 1
Spring 2019
Answer Key

1. *C*
2. *A*
3. *D*
4. *E*
5. *B*
6. *A*
7. *D*
8. *C*
9. *E*
10. *C*

11.

A) Lewis Acid

B) Lewis Base

C) Neither

D) Lewis Acid

12.

A) Acidic

B) Neutral

C) Acidic

D) Basic

13.

A) Decreases

B) Increases

C) Stays the same

14.

A) $HY^- + H_2O \leftarrow \rightarrow H_2Y + OH^-$

B) $HY^- + H_2O \leftarrow \rightarrow H_3O^+ + Y^{2-}$

C) acidic

15.

A) $K_a = [H_3O^+][A^-]/[HA] = 3.0 \times 10^{-8}$

Need an ICE table.

	$[HA]$	$[H_3O^+]$	$[A^-]$
I	*0.70 M*	*0*	*0*
C	*-x*	*+x*	*+x*
E	*0.70 -x*	*x*	*x*

$K_a = x^2/[0.70 - x] = 3.0 \times 10^{-8}$

Easiest way to solve is to ignore x in the denominator.

$K_a = x^2/0.70 = 3.0 \times 10^{-8}$

$x = 1.5 \times 10^{-4}$ M.

% dissociation = $1.5 \times 10^{-4}/0.70 \times 100 = 0.021\%$

B) After 100 mL added:

0.7 mol/L x 0.1 L = 0.07 mol HA initially

0.7 mol/L x 0.1 L = 0.07 mol OH^- added

$HA + OH^- \rightarrow H_2O + A^-$

mol HA at equilibrium = 0.07 mol – 0.07 mol = 0 mol

mol A^- at equilibrium = 0.07 mol

This is a weak base problem, with $[A^-] = 0.07$ mol/0.2 L = 0.35 M

$x^2/0.35\text{-}x = 3.33 \times 10^{-7}$ (K_b)

$x = 3.4 \times 10^{-4} = [OH^-]$, so pOH = 3.47, ***so pH = 10.53***

16. *$K_{sp} = [Pb^{2+}][Cl^-]^2$*

$[Pb^{2+}] = 0.032$ M/2 = 0.016 M; $[Cl^-] = 0.020$ M/2 = 0.010 M

$Q = 0.016 \times (0.010)^2 = 1.6 \times 10^{-6}$; Q < K. ***NO***

Note that a very common error was not to account for the dilution when the solutions were mixed in equal volumes (factor of 2 dilution).

17.

A) You need solid Tris base, HCl, and water.

B) Tris needed: 0.1 mol/L x 1 L x 121.1 g/mol = ***12 g Tris***

pH = pKa + log $[A^-]/[HA]$

8.58 = 8.1 + log $[A^-]/[HA]$ *(Note that $pK_a = pK_w - pK_b = 14 - 5.9 = 8.1$)*

log $[A^-]/[HA] = 0.48$, so $[A^-]/[HA] = 3$

So for every 3 A^-, we need 1 HA. Or of every 4 Tris molecules, 3 are A^- and 1 is HA.

We started with all A^-, so we need to titrate ¼ of it to HA.

0.1 mol x 0.25 = 0.025 mole of HCl needed.

HCl is 1 M, so we need 0.025 L, or ***25 mL HCl.***

Add ***975 mL H_2O*** *to get to 1.0 liters of the buffer.*