CHM 130: Chapter 15 Homework Answer Key

1) Check all of the following that are **properties of acids**:
   a) produce hydrogen ions, H^+, in solution
   d) taste sour
   g) turn blue litmus paper red

2) Check all of the following that are **properties of bases**:
   b) produce hydroxide ions, OH^-, in solution
   c) taste bitter
   e) feel soapy or slippery
   f) turn red litmus paper blue

3) Check all of the substances below that are **strongly acidic**:
   c) lime juice, pH=1.8 g) stomach acid, pH=1

   Explanation: **Strongly acidic** substances have a pH between 0 and 2. Thus, the following substances are strongly acidic: lime juice (pH=1.8) and stomach acid (pH=1).

4) Check all of the substances below that are **weakly acidic**:
   b) champagne, pH=3.7 h) carbonated soda, pH=4.0

   Explanation: **Weakly acidic** substances have a pH between 2 and 7. Thus, the following substances are weakly acidic: champagne (pH=3.7) and carbonated soda (pH=4.0).

5) Check all of the substances below that are **neutral**:
   d) NaCl, pH=7.0

   Explanation: **Neutral** substances have a pH exactly equal to 7. Thus, NaCl (pH=7.0) is neutral.

6) Check all of the substances below that are **weakly basic**:
   a) egg white, pH=7.9 e) baking soda, pH=8.3

   Explanation: **Weakly basic** substances have a pH between 7 and 12. Thus, the following substances are weakly basic: egg white (pH=7.9) and baking soda (pH=8.3).

7) Check all of the substances below that are **strongly basic**:
   f) oven cleaner, pH=13.5 i) drain cleaner, pH=13

   Explanation: **Strongly basic** substances have a pH between 12 and 14. Thus, the following substances are strongly basic: oven cleaner (pH=13.5) and drain cleaner (pH=13)

8) An acid-base ____________ is a solution that is pH sensitive and changes color with changes in the pH.

   Answer: indicator

9) An acid-base _____________ is the gradual addition of a standard solution to another solution of unknown concentration until the reaction between the two is complete as signaled by the indicator changing color.

   Answer: titration

10) The _____________ of an acid-base neutralization reaction corresponds to the point when one reactant has completed reacted with the other as evidenced by the indicator changing color.

    Answer: endpoint

11) Determine the pH for the following: shampoo, $[H^+]$ = 0.000001 M

    We can relate the hydrogen ion concentration, $[H^+]$, and pH as follows: $\mathbf{[H^+]=10^{-pH}}$.

Thus, if $[H^+]$=0.000001 M = $\mathbf{10^{-6}}$ **pH=6.**

12) Determine the pH for the following: egg white, $[H^+]$ = 0.00000001 M

Thus, if $[H^+]$=0.00000001 M = $\mathbf{10^{-8}}$ **pH=8.**

13) Determine the pH for the following: soda, $[H^+]$ = 0.001 M

Thus, if $[H^+]$=0.001 M = $\mathbf{10^{-3}}$ **pH=3.**

14) Determine the pH for the following: coffee, $[H^+]$ = 0.00001 M

Thus, if $[H^+]$=0.00001 M = $\mathbf{10^{-5}}$ **pH=5.**

15) Calculate the pH of urine which has a pOH of 9.25.

Since **pH + pOH = 14.00**, pH = 14.00 – 9.25 = **4.75**.

16) Calculate the pOH of saliva which has a pH of 6.55.

Since **pH + pOH = 14.00**, pOH = 14.00 – 6.55 = **7.45**.

17) Calculate the pOH of blood which has a pH of 7.50.

Since **pH + pOH = 14.00**, pOH = 14.00 – 7.50 = **6.50**.

18) Pure water has a pH of ________.
Explanation: Pure water has a pH of ___**7**___ since it is neutral.

19) Consider the following reaction: $\mathbf{H_2O\ (l) + NH_3\ (aq) \rightarrow NH_4^+\ (aq) + OH^-\ (aq)}$.
Check all the statements below that are correct.

a) H_2O (l) is an Arrhenius acid and a Bronsted-Lowry acid.
h) NH_3 (aq) is a Bronsted-Lowry base but not an Arrhenius base.

Explanation: In the reaction above, **NH_3 gained a proton (H^+)** while **H_2O lost a proton (H^+)**, so **NH_3 is a Bronsted-Lowry base and H_2O is a Bronsted-Lowry acid.** Because **an Arrhenius acid also releases protons (H^+), H_2O is also an Arrhenius acid.** However, **an Arrhenius base releases OH^-. Because NH_3 does not release OH^-, it is not an Arrhenius base.**

20) Consider the following reaction: $\mathbf{HBr\ (aq) + H_2PO_4^-\ (aq) \rightarrow H_3PO_4\ (aq) + Br^-\ (aq)}$.
Check all the statements below that are correct.

a) HBr (aq) is an Arrhenius acid and a Bronsted-Lowry acid.
h) $H_2PO_4^-$ (aq) is a Bronsted-Lowry base but not a an Arrhenius base.

Explanation: In the reaction above, **$H_2PO_4^-$ (aq) gained a proton (H^+)** while **HBr (aq) lost a proton (H^+)**, so **$H_2PO_4^-$ (aq) is a Bronsted-Lowry base and HBr (aq) is a Bronsted-Lowry acid.** Because **an Arrhenius acid also releases protons (H^+), HBr (aq) is also an Arrhenius acid.** However, **an Arrhenius base releases OH^-. Because $H_2PO_4^-$ (aq) does not release OH^-, it is not an Arrhenius base.**