HAYOLE EDUCATION PROJECT
FURRA MODEL ACADEMY, HAWASSA
WORK SHEET 1 FOR ACID BASE EQUILBRIUM
GRADE 12, CHEMISTRY

1. **The magnitude of Kw indicates that _____.**
   A) water autoionizes very slowly
   B) water autoionizes very quickly
   C) water autoionizes only to a very small extent
   D) the autoionization of water is exothermic
2. **Which of the following pairs does not show an acid and its conjugate base?**
   A) NH_3 and NH_2^- C) NH_4^+ and NH_3
   B) H_3PO_4 and $H_2PO_4^-$ D) NH_4^+ and NH_2^-
3. **Which solution below has the highest concentration of hydroxide ions?**
   A) pH = 3.21 B) pH = 9.82 C) pH = 7.93 D) pH = 12.59
4. **Consider the reaction; $NO_{2(aq)} + H_2BO_3^-{}_{(aq)} \rightleftharpoons NO_2^-{}_{(aq)} + H_3BO_{3(aq)}$**
   A conjugate acid-base pair in the reaction is
   A) $H_2BO_3^-{}_{(aq)}$ and $NO_2^-{}_{(aq)}$ C. $H_3BO_{3(aq)}$ and $H_2BO_3^-{}_{(aq)}$
   B) $HNO_{2\,(aq)}$ and $H_2BO_3^-{}_{(aq)}$ D. $H_3BO_{3(aq)}$ and $NO_2^-{}_{(aq)}$
5. **Chemical equation below shows the reaction of $Al(OH)_3$:**

$$Al(OH)_3(s) + OH^-(aq) \leftrightarrows Al(OH)_4^-(aq)$$

$$Al(OH)_3(s) + 3H_3O^+(aq) \leftrightarrows Al^{3+}(aq) + 3H_2O(l)$$

   In this reaction, $Al(OH)_3$ is acting as ____
   B) A Lewis acid and Lewis base respectively
   C) A Bronsted base only
   D) A Lewis acid and a Bronsted base respectively
   E) A Lewis base and Lewis acid respectively
6. **Sodium hydroxide is a strong base. This means that _____.**
   A) aqueous solutions of NaOH contain equal concentrations of $H^+{}_{(aq)}$ and $OH^-{}_{(aq)}$
   B) NaOH does not dissociate at all when it is dissolved in water
   C) NaOH dissociates completely to $Na^+{}_{(aq)}$ and $OH^-{}_{(aq)}$ when it dissolves in water
   D) NaOH cannot be neutralized by a weak acid
7. **Using the data in the table, which of the conjugate bases below is the strongest base?**

ACID	Ka
HOAc	1.8×10^{-5}
$HCHO_2$	1.8×10^{-4}
HClO	3.0×10^{-8}
HF	6.8×10^{-4}

   A. F^- B) ClO^- C) CHO_2^- D) OAc^-
8. **A 0.010M acid solution has a pH of 2.00. The acid could be**
   A. HNO_3 B. H_2SO_3 C. HCOOH D. CH_3COOH

9. The relationship $\frac{[H_3BO_3][OH^-]}{[H_2BO_3^-]}$ is the expression for

A) K_a for H_3BO_3
B) K_a for $H_2BO_3^-$
C. K_b for H_3BO_3
D. K_b for $H_2BO_3^-$

10. The Relevant p^{ka} values are given below.

Acetic acid, CH_3COOH	**pKa = 4.76**
Carbonic acid, H_2CO_3	**pKa = 6.35**
Hydrofluoric acid, HF	**pKa = 3.17**
Nitrous acid, HNO_2	**pKa = 3.12**

Which of the following acid is the strongest of all?

A) HNO_2 B. H_2CO_3 C. HF D. CH_3COOH

11. Which of the following is a general characteristic of Bronsted acids?

A They donate a proton.
B) They produce H^+ in solution.
C. They accept an H^+ from water.
D. They accept a proton

12. What is the $[OH^-]$ of a solution with $[H_3O^+] = 9.3 \times 10^{-2}$ M?

A. 9.3×10^{-16} M
B. 1.1×10^{-13} M
C. 8.6×10^{-13} M
D. 9.3×10^{-2} M

13. In which of the following is HSO_3^- acting as a Bronsted-Lowry acid?

A. $HSO_3^- + H_2O \rightarrow H_2SO_3 + OH^-$
B. $HSO_3^- + HPO_4^{2-} \rightarrow H_2SO_3 + PO_4^{3-}$
C. $NH_3 + HSO_3^- \rightarrow NH_4^+ + SO_3^{2-}$
D. $H_2C_2O_4 + HSO_3^- \rightarrow HC_2O_4^- + H_2SO_3$

14. Consider the reaction; $HNO_{2(aq)} + H_2BO_3^-{}_{(aq)} \rightleftharpoons NO_2^-{}_{(aq)} + H_3BO_{3(aq)}$

The amphiprotic species in the reaction above is

A. $H_2BO_3^-{}_{(aq)}$ B. $HNO_{2(aq)}$ C. $NO_2^-{}_{(aq)}$ D. $H_3BO_{3\,(aq)}$

15. As the $[H_3O^+]$in a solution decreases, the $[OH^-]$

A. Increases and the pH increases.
B. Decreases and the pH increases.
C. Increases and the pH decreases.
D. Decreases and the pH decreases.

16. In the reaction; $SnCl_4 + 2Cl^- \longrightarrow [SnCl_6]^{2-}$, the $SnCl_4$ functions as

A. Brønsted-Lowry acid
B. Arrhenius base
C. Brønsted-Lowry base
D. Lewis acid

17. Calculate the pH range in which an acid indicator with K_{acid} (indicator) $=1.0\times10^{-5}$ changes colour? .

A. 5 B. 11 C. 3 D. 8

18. In the titration of a strong acid and a weak base, which of the following is used as an indicator?

A. Methyl orange
B. Thymol blue
C. Phenolphthalein
D. Fluorescein

19. What is the concentration of the sulphuric acid solution if 50 ml of 0.5 N $Ba(OH)_2$ solution is added to 100 ml of the solution?

A. 0.25 N B, 0.5 N C. 25 N D. 50 N

20. When 30 ml of acid is neutralised by 15 ml of 0.2 N alkali, the acid concentration is _

A. 0.1 N B. 0.2 N C. 0.3 N D. 0.4 N

21. Which of the following is an example of a buffer solution?

A. $CH_3COOH + CH_3COONH_4$ C. $H_2SO_4 + CuSO_4$

B. $CH_3COONa + CH_3COOH$ D. NaCl + NaOH

22. In the titration of a weak acid and a strong base, which of the following is utilised as an indicator?

A. Methyl orange (3 to 4.6) C. Bromothymol blue (6 to 7.5)

B. Phenolphthalein (8 to 9.6) D. Methyl red (5 to 6.9)

23. Which of the following titrations has an equivalence point at pH greater than 7?

A. CH_3COOH and NaOH C. HCl and NaOH

B. CH_3COOH and NH_3 D. HCl and NH_3

24. How concentrated are H_3O^+ ions in pure water?

A. 10^{-7} M B. 0.7 M C, 56 M D. 10^7 M

25. .A solution's pH is 10.0. What is the concentration of OH^- in it?

A. 1.0×10^{-10} B. 1.0×10^{-7} C. 1.0×10^{-4} D. 10 M

26. What is the difference between strong and weak acid?

A. presence and absence of halogen ions

B. negative and positive pH

C. complete and partial ionisation

D. proton donation and electron acceptance

27. Determine the concentration of HCl if 10 ml of 0.5 N $Ca(OH)_2$ is required to titrate 50 ml of HCl.

A. 5 N B. 1/10 N C. 10 N D. 1/5 N

28. A solution of known concentration is the definition of a

A. Buffer solution C. Neutral solutions

B. Standard solution D. Standard solutions

29. Which sentence is false about Henderson-Hasselbalch equation ?

A. It is used to determine pKa value of solutions.

B. pH of solutions containingcomparable and appreciable conc. of a conjugate acid-base pair to ratio of their concentrations.

C. It is used to calculate valency of molecule.

D. pH = pka + log [conjugated base]/[acid]

30. Which sentence is false about indicator?

A. Phenolphthalein give colorless solutions at pH 8.3-11.0 in acidic medium.

B. Methyl red give red solutions at pH 4.2-6.6 in acidic medium.

C. Methyl orange give orange solutions at pH 3.1-4.4 in base medium.

D. Methyl red give red solutions at pH 4.2-6.6 in basic medium.

31. Which of the following combinations cannot produce a buffer solution?

A. HNO_2 and $NaNO_2$ C. HCN and NaCN

B. $HClO_4$ and $NaClO_4$ D. NH_3 and $(NH_4)_2SO_4$

32. What is a Equivalence point ? Equivalent point refers to
A. A point at which the added titrant is chemically equivalent to the sample analyte
B. A point at which the added titrant is chemically greater than the sample analyte
C. A point at which the added titrant is chemically less than the sample analyte
D. A point in a reaction when the indicator changes color.

33. Which is not limitation of Arrhenius concept ?
A. The theory is not able to explain acidic and basic properties of substance in non aqueous solvent eg,NH_4NO_3 in liquid NH_3 acts as an acid though it dose not give H+ ions.
B. It cannot explained the acidic character of certain salts such as $AlCl_3$ in aqueous solutions.
C. The definition of acid and base are only in term of aqueous solutions and not in terms of substance.
D. Proton donor is acid.

34. What is the end point? End point refers to
A. Physical change occurs which related to the chemical change.
B. A reagent of a known concentration which used in the titrimetric analysis.
C. A solutions of one reactant of accurately known concentration.
D. A point at which the amount of titrant becomes equal with the amount of analyte in a sample.

35. What is the pH of a solution composed of 0.020 M NH_3 and 0.16 M NH_4Cl? $K_b = 1.8 \times 10^{-5}$
A. 10.16 B. 5.64 C. 8.36 D. 3.84

36. Consider a solution which is 0.10 M in CH_3COOH and 0.20 M in $NaCH_3COO$. Which of the following statements is true?
A. If a small amount of NaOH is added, the pH decreases very slightly.
B. If NaOH is added, the OH^- ions react with the CH_3COO^- ions.
C. If a small amount of HCl is added, the pH decreases very slightly.
D. If HCl is added, the H^+ ions react with CH_3COOH ions.

37. Consider an indicator that ionized as shown below for which its Ka = 1.0 x 10-4

$$\underset{\text{yellow}}{HIn} + H_2O \rightleftharpoons H_3O^+ + \underset{\text{red}}{In^-}$$

Which of the responses contains all the true statements and no others?
1. The predominant color in its acid range is yellow.
2. At pH =4 the color of a solution containing the indicator will probably be orange.
3. At pH = 7.00, a solution containing this indicator will be red.
4. At pH = 7.00, most of the indicator is in the un-ionized form.
5. The pH at which the indicator changes color is pH = 4.

A. 1, 3, 5 B 2, 4 C. 3, 4, 5 D. 1, 2, 3, 5

38. Consider the titrations of the pairs of aqueous acids and bases listed on the left. For which pair is the pH at the equivalence point stated incorrectly?

Acid-Base Pair	pH at Equivalence Point
A. $NH_3 + HCl$	less than 7
B. $HNO_3 + Ca(OH)_2$	equal to 7
C. $HClO_4 + NaOH$	equal to 7
D. $HClO + NaOH$	Less than 7
E. $CH_3COOH + KOH$	greater than 7

39. Which of the following salts give acidic aqueous solutions?

(1) KNO_3 (2) CH_3COOK (3) NH_4NO_3 (4) RbI
(5) $(NH_4)_2SO_4$ (6) $BaCl_2$ (7) NaCN (8) KNO_2

A. 2, 3,4,7, 8 B. 3, 5 C. 2, 3,4, 5,6 D. 1, 4, 7, 8

40. A more generalized acid-base concept is that of:

A. Brønsted and Lowry C. Lewis
B. Arrhenius D. Handerson

41. Phosphoric acid reacts with calcium hydroxide to form calcium hydrogen phosphate and water. The equivalent mass of phosphoric acid in this reaction will be:

A. 98 g/eq B. 32.6 g/eq C. 49 g/eq D. 14 g/eq

42. Identify the correct statement(s) for the given reaction.

$$HCl + H_2O \leftrightarrow H_3O^+ + Cl^-$$

I. Conjugate base of HCl is Cl^-
II. Conjugate acid-base pair is H_3O^+ and H_2O
III. Conjugate base of H_2O is H_3O^+
IV. Conjugate acid-base pair is HCl and H_3O^+

A. I and II C. I and III
B. III and IV D. I and IV

43. The normality of a solution that contains 15.75g nitric acid (HNO_3)in 250 ml of the solution is.

A. 0.5N B. 1.0N C. $1.0x10^{-3}N$ D. $2.0x10^{-3}N$

44. To a solution of 0.2M HF,a solution of 0.1M HCl is added, which statement is true as regarding the solution after HCl is added?

A. The dissociation extent of HF increases. C. Cl^- ion is the common ion.
B. The equilibrium shift to the left. D. The solution become buffered