CCS Chemistry Exam VI

Name: Jen

Matching

Match each item with the correct statement below.

- a. acid dissociation constant
- b. diprotic acid
- c. hydrogen-ion donor
- d. Lewis acid
- e. pH
- f. oxidizing agent
- g. reducing agent
- h. buffer capacity
- i. equivalence point
- j. end point
- k. salt hydrolysis
- l. titration

__d__ 1. can accept an electron pair

__b__ 2. acid with two ionizable protons

__c__ 3. Bronsted-Lowry acid

__e__ 4. negative logarithm of the hydrogen ion concentration

__a__ 5. ratio of the concentration of the dissociated to the undissociated form

__l__ 6. process of adding a known amount of solution of known concentration to determine the concentration of another solution.

__i__ 7. the number of moles of hydrogen ions equals the number of moles of hydroxide

__j__ 8. indicator changes color in titration

__k__ 9. cations or anions of a dissociated salt remove hydrogen ions from or donate hydrogen ions to water.

__h__ 10. the amount of acid or base that can be added to a buffer solution before a significant change in pH occurs

__f__ 11. substance that accepts electrons

__g__ 12. substance that donates electrons

LEO = RED AGENT
GER = OX AGENT

Multiple Choice
Identify the choice that best completes the statement or answers the question.

13. What is the formula for phosphoric acid?
    a. H_2PO_3
    b. H_3PO_4
    c. HPO_2
    d. HPO_4

14. What is a property of a base?
    a. bitter taste
    b. watery feel
    c. strong color
    d. unreactive

15. What is an acid according to the Arrhenius definition?
   a. a substance that ionizes to yield protons in aqueous solution
    b. a substance that is a hydrogen ion
    c. a substance that accepts an electron pair in aqueous solution
    d. a substance that is a hydrogen ion acceptor

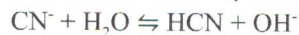16. What is transferred between a conjugate acid-base pair?
    a. an electron
    b. a proton
    c. a hydroxide ion
    d. a hydronium ion

17. In the reaction $CO_3^{2-} + H_2O \leftrightharpoons HCO_3^- + OH^-$, the carbonate ion is acting as a(n) _____ .
    a. Arrhenius base
    b. Arrhenius acid
    c. Bronsted-Lowry base
    d. Bronsted-Lowry acid

$$CO_3^{2-} + H_2O \rightleftharpoons HCO_3^- + OH^-$$
BL Base   BL Acid
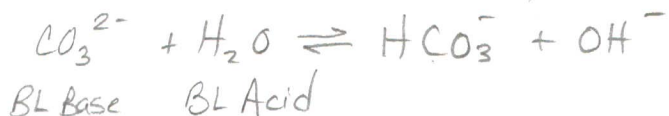
18. What are the Bronsted-Lowry acids in the following equilibrium reaction?
    $$CN^- + H_2O \leftrightharpoons HCN + OH^-$$
    a. CN^-, H_2O
    b. H_2O, HCN
    c. CN^-, OH^-
    d. H_2O, OH^-

$$CN^- + H_2O \leftrightharpoons HCN + OH^-$$
Base   Acid   Acid   Base
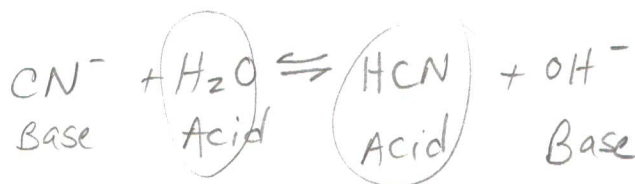
19. What is the charge on the hydronium ion?
    a. 2-
    b. 1-
    c. 0
    d. 1+

H_3O^+

20. What is the best description for a solution with a <u>hydroxide-ion</u> concentration equal to 1×10^{-4} M?
    a. acidic
    b. basic
    c. neutral
    d. The answer cannot be determined.

$[OH] = 10^{-4}$ ∴ $[H] = 10^{-10}$

$pH = 10$ ∴ Basic

21. Which type of solution is one with a pH of 8?
    a. acidic
    b. basic
    c. neutral
    d. The type varies, depending on the solution

22. What is another name for the acid dissociation constant?
    a. equilibrium constant
    b. ionization constant
    c. rate constant
    d. mole fraction

23. Which of the following pairs of compounds consists of a weak acid and a strong base?
    a. sulfuric acid, sodium hydroxide
    b. acetic acid, ammonia
    c. acetic acid, sodium hydroxide
    d. nitric acid, calcium hydroxide

24. Which base has the smallest base dissociation constant?
    a. potassium hydroxide strong
    b. sodium hydroxide strong
    c. calcium hydroxide strong
    d. ammonia weak

smallest K_b means weakest base...

25. What is the process of adding a known amount of solution of known concentration to determine the concentration of another solution called?
    a. neutralization
    b. hydrolysis
    c. titration
    d. buffer capacity

26. In a titration, what happens when the number of moles of hydrogen ions equals the number of moles of hydroxide ions?
    a. the equivalence point has been reached
    b. the end point has been reached
    c. the point of neutralization has been reached
    d. the titration has failed

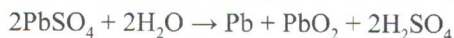27. In which of the following types of reaction are electrons gained?
    a. decomposition
    b. oxidation
    c. neutralization
    d. reduction

GER
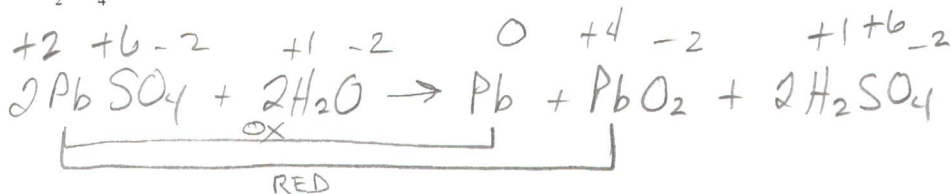
28. What particles are transferred in an oxidation-reduction reaction?
   a. protons
   b. ions
   c. electrons
   d. atoms

29. Which element is oxidized in the following reaction?
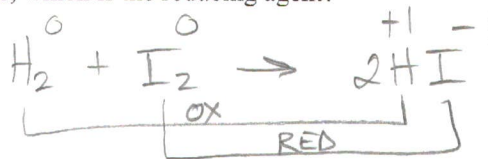 $2PbSO_4 + 2H_2O \rightarrow Pb + PbO_2 + 2H_2SO_4$

   a. lead
   b. sulfur
   c. hydrogen
   d. oxygen

   $\overset{+2\ +6\ -2}{2Pb\ SO_4} + \overset{+1\ -2}{2H_2O} \rightarrow \overset{0}{Pb} + \overset{+4\ -2}{PbO_2} + \overset{+1\ +6\ -2}{2H_2SO_4}$
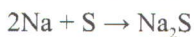
   OX
   RED

30. In the reaction of hydrogen with iodine, which is the reducing agent?
   a. hydrogen
   b. iodine
   c. hydrogen ion
   d. iodide ion

   $\overset{0}{H_2} + \overset{0}{I_2} \rightarrow \overset{+1\ -1}{2HI}$

   OX
   RED

31. What is the reducing agent in the following reaction?
   $2Na + S \rightarrow Na_2S$

   a. Na
   b. S
   c. Na_2S
   d. Na^+

   $\overset{0}{2Na} + \overset{0}{S} \rightarrow \overset{+1\ -2}{Na_2S}$

   RED
   OX
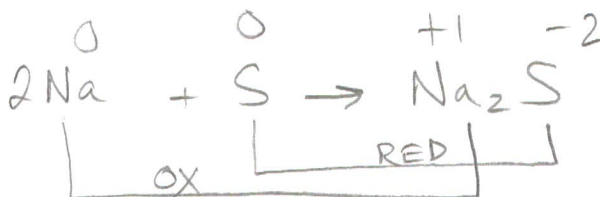
32. Which statement is true about the following reaction? $S + Cl_2 \rightarrow SCl_2$
   a. Sulfur is reduced to SCl_2.
   b. Chlorine is reduced to SCl_2.
   c. Chlorine is oxidized to SCl_2.
   d. Sulfur is the oxidizing agent.

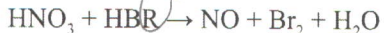 $\overset{0}{S} + \overset{0}{Cl_2} \rightarrow \overset{+2\ -1}{SCl_2}$

   OX
   RED
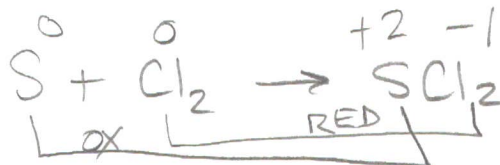
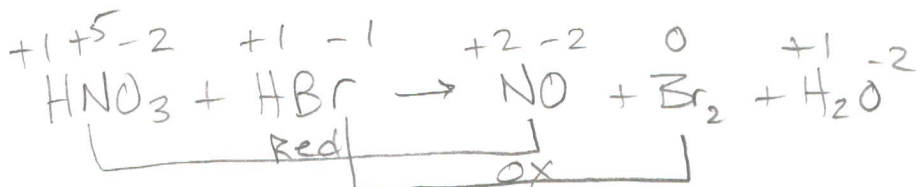33. Why is oxygen reduced in the reaction of hydrogen with oxygen to make water?
   a. Oxygen pulls electrons toward itself.
   b. Oxygen pushes electrons toward the hydrogens.
   c. Oxygen absorbs a proton.
   d. Oxygen releases a proton.

   $\overset{0}{2H_2} + \overset{0}{O_2} \rightarrow \overset{+1\ -2}{2H_2O}$

   OX
   RED
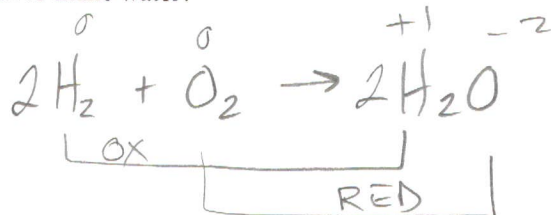
34. In the following unbalanced reaction, which atom is oxidized?
   $HNO_3 + HBr \rightarrow NO + Br_2 + H_2O$

   a. hydrogen
   b. nitrogen
   c. oxygen
   d. bromine

   $\overset{+1\ +5\ -2}{HNO_3} + \overset{+1\ -1}{HBr} \rightarrow \overset{+2\ -2}{NO} + \overset{0}{Br_2} + \overset{+1\ -2}{H_2O}$

   Red
   OX

35. Which element increases its oxidation number in the following reaction?

$3KOH + H_3PO_4 \rightarrow K_3PO_4 + 3H_2O$

a. oxygen
b. potassium
c. phosphorus
d. no changes in oxidation number

$\overset{+1\ -2\ +1}{3KOH} + \overset{+1\ +5\ -2}{H_3PO_4} \rightarrow \overset{+1\ +5\ -2}{K_3PO_4} + \overset{+(}{3H_2O}$
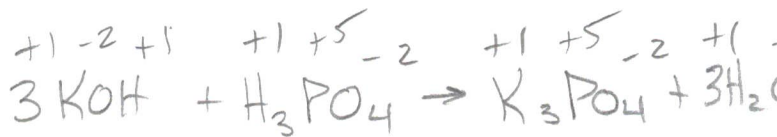
Short Answer

36. What is the ion-product constant for water?

1×10^{-14}

37. Calculate the hydrogen-ion concentration [H$^+$] for an aqueous solution in which [OH$^-$] is 1 x 10^{-11} mol/L. Is this solution <u>acidic</u>, <u>basic</u>, or <u>neutral</u>?
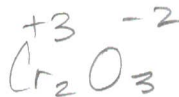
$[H^+] = 1 \times 10^{-3}$ $pH = 3$ ACIDIC

38. If the hydroxide-ion concentration is 1 x 10^{-12} M, what is the pH of the solution?

$[H^+] = 10^{-2}$ $pH = 2$

39. Give the oxidation number of chromium in Cr$_2$O$_3$.
40

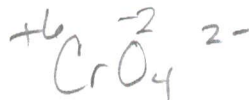$\overset{+3\ -2}{Cr_2O_3}$ $+3$

40. Give the oxidation number of chromium in CrO$_4^{2-}$
41

$\overset{+6\ -2}{CrO_4}{}^{2-}$ $+6$

41. Show the oxidation number above each element in the following:
42

$\overset{0}{Sb} + \overset{+1\ +5\ -2}{HNO_3} \rightarrow \overset{+5\ -2}{Sb_2O_5} + \overset{+2\ -2}{NO} + \overset{+1\ -2}{H_2O}$

$39. \ 3KOH + H_3PO_4 = K_3PO_4 + 2H_2O$

$\dfrac{x}{3} = \dfrac{1.54\,mol}{1}$

$x = 4.68\,mol$