

Name: _____

Acids & Bases

Multiple Choice

- ___ 1. In a chemical reaction ammonia, NH_3 , was found to donate a hydrogen ion and turned into the amide (NH_2^-) ion. In this reaction NH_3 is behaving as (1) a Bronsted acid; (2) a Bronsted base; (3) a Lewis acid; (4) an Arrhenius acid; (5) a Lewis base; (1,2) an Arrhenius base; (1,3) a Usanovich acid; (1,4) a Usanovich base
- ___ 2. Which of the answers in question 1 would describe ammonia if it donated a pair of electrons in a chemical reaction?
- ___ 3. Which of the answers in question 1 would describe a substance that produced a hydronium ion when placed in a water solution?
- ___ 4. Professor Lucy Lutetium gave her assistant a weak acid solution to work with. This solution (1) is one that does not ionize extensively; (2) does ionize extensively; (3) contains a lot of solute; (4) does not contain a lot of solute.
- ___ 5. Which of the following best describes the formation of a concentrated solution? (1) 1 G of NaOH in 1 L of solution; (2) 0.5 G of NaOH in 500 mL of solution; (3) 50 G of NaOH in 1 L of solution; (4) 5 G of KOH in 2 L of solution.
- ___ 6. Which of the following unbalanced processes best describes a neutralization reaction of an Arrhenius acid and an Arrhenius base?
(1) $\text{NaOH} + \text{Al} \rightarrow \text{NaAlO}_3 + \text{H}_2$
(2) $\text{Al}(\text{OH})_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Al}(\text{HSO}_4)_3 + \text{H}_2\text{O}$
(3) $\text{Al}(\text{OH})_3 + \text{H}_2\text{SO}_4 \rightarrow \text{Al}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
(4) $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$
(5) both 1 and 2;
(1,2) both 2 and 3;
(1,3) both 3 and 4.
- ___ 7. Which of the following would describe a basic anhydride? (1) $\text{KAl}(\text{SO}_4)_2$; (2) magnesium oxide; (3) selenium (IV) oxide; (4) H_2SO_4 ; (5) lithium hydroxide; (1,2) $\text{Cu}_2(\text{OH})_2\text{CO}_3$; (1,3) K_2HPO_4 ; (1,4) potassium chloride; (1,5) none of the above.
- ___ 8. Which of the answers in question 7 would describe a normal salt?
- ___ 9. Which of the answers in question 7 would describe a basic salt?
- ___ 10. Which of the answers in question 7 would describe a double salt?
- ___ 11. What is the pH of a solution whose hydronium ion concentration is 0.0001 moles per liter? (1) 1; (2) 10; (3) 14; (4) 4.

- ___ 12. What is the pH of a solution whose hydroxide ion concentration is 0.0001 moles per liter? (1) 1; (2) 10; (3) 14; (4) 4.
- ___ 13. Ten mL of a 0.2 M solution of sodium hydroxide was needed to titrate 10 mL of a sulfuric acid solution to the endpoint. The unbalanced reaction is:

$$\text{NaOH} + \text{H}_2\text{SO}_4 \text{ -----} > \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$$
 What is the concentration of the sulfuric acid solution? (1) 0.1; (2) 0.4; (3) 1.0; (4) 4.0; (5) 0.2 M; (1,2) none of the above.
- ___ 14. In which of the following reactions is ammonia (NH_3) behaving as a Bronsted base.
 (1) $\text{NH}_4^+ + \text{H}_2\text{O} \text{ -----} > \text{NH}_3 + \text{H}_3\text{O}^+$ (2) $\text{NH}_3 + \text{H}_3\text{O}^+ \text{ -----} > \text{NH}_4^+ + \text{H}_2\text{O}$
 (3) $\text{CH}_3\text{NH}_2 + \text{HCl} \text{ -----} > \text{CH}_3\text{NH}_4^+ + \text{Cl}^-$ (4) $\text{NH}_3 + \text{CH}_3^- \text{ -----} > \text{CH}_4 + \text{NH}_2^-$
- ___ 15. Given the following process:

$$\text{NH}_3 + \text{HCl} \text{ <=====} > \text{NH}_4^{1+} + \text{Cl}^{1-}$$
 The two Bronsted acids are (1) NH_3 and HCl ; (2) NH_3 and OH^{1-} ; (3) NH_4^{1+} and HCl ; (4) NH_4^{1+} and Cl^{1-} ; (5) none of the above.
- ___ 16. The formula HI would describe (1) hypoiodous acid; (2) iodous acid; (3) iodic acid; (4) periodic acid; (5) hydroiodic acid.
- ___ 17. Carrots have a pH of 5.2. What would be the hydronium ion concentration? (1) 6.31×10^6 ; (2) -6.31×10^6 ; (3) 10^4 ; (4) 10^{-4} ; (5) 6.31×10^{-6} ; (1,2) -6.31×10^{-6} .
- ___ 18. Blackberries have a hydronium ion concentration of 3.98×10^{-4} . What is the pH of blackberries? (1) 4.0; (2) 3.98; (3) -3.4; (4) 3.4; (5) -3.98; (1,2) -4.0
- ___ 19. A ternary acid is one that contains (1) one element in addition to hydrogen; (2) two or more elements in addition to hydrogen; (3) exactly three elements in addition to hydrogen; (4) none of the above.
- ___ 20. The color of phenolphthalein in a water solution of a base is (1) colorless; (2) red; (3) blue; (4) yellow; (5) green
- ___ 21. H_2Se would be an example of a (an) (1) ternary acid; (2) amphoteric substance; (3) basic anhydride; (4) acid anhydride; (5) binary acid
- ___ 22. H_2SeO_4 would be an example of a (an) (1) ternary acid; (2) amphoteric substance; (3) basic anhydride; (4) acid anhydride; (5) binary acid; (6) quaternary acid.
- ___ 23. The conjugate base of ammonia (NH_3), that is, the substance produced when ammonia acted as an acid, would be (1) NH_3 ; (2) NH_2^{1-} ; (3) NH_3^{1+} ; (4) NH_4^{1+} ; (5) NH_3O ; (1,2) H^+ ; (1,3) H_3O^{1+} .
- ___ 24. Which of the answers in question 23 would describe the conjugate acid of ammonia?

- ___ 25. How many grams of NaOH is in 20 mL of a 3 M solution? (1) 2400; (2) 240; (3) 2.4; (4) 0.24; (5) 6 G.
- ___ 26. Professor Erbie Terbium dissolved 10 G of $\text{Co}(\text{NO}_3)_2$ in 500 mL of ethanol ($\text{C}_2\text{H}_5\text{OH}$). After the cobalt (II) nitrate had dissolved, he diluted the solution with additional ethanol until the volume was exactly 1 L. What was the concentration of the solution? (1) 2 M; (2) 0.055 M; (3) 0.11; (4) 0.5; (5) 1.0; (1,2) 20
- ___ 27. pH was originally defined by Sorensen as the negative log of the hydronium ion concentration. Two years later he discovered that this definition was not entirely correct and redefined pH. His new definition stated that pH was (1) -log of the hydroxide ion concentration; (2) -log of the sodium ion concentration; (3) -log of the concentration of water; (4) +log of the hydronium ion concentration; (5) + log of the hydroxide ion concentration; (1,2) -log of the activity of the hydronium ion concentration.
- ___ 28. What approximate volume of a 0.1 M solution of sulfuric acid would be needed to obtain 1 gram of sulfuric acid? (1) 25 mL; (2) 50 mL; (3) 75 mL; (4) 100 mL; (5) 125 mL; (6) 150 mL.
- ___ 29. The formula for sulfuric acid is (1) H_2SO_3 ; (2) H_2SO_4 ; (3) H_2S ; (4) HCl ; (5) H_2PO_3 ; (1,2) H_2PO_4 ; (1,3) H_2PO_5 ; (1,4) $\text{HC}_2\text{H}_3\text{O}_2$; (1,5) HNO_2 ; (2,3) HNO_3 ; (2,4) H_2SeO_4 .
- ___ 30. Which of the responses in question 29 above is the correct formula for acetic acid?

For question 31 you must select two answers, unless you pick answer number 5.

- ___ 31. A dilute, weak solution is one that (1) is not ionized extensively; (2) is ionized extensively; (3) contains only a small amount of solute; (4) contains a large amount of solute; (5) no two of the above describe this solution.
- ___ 32. An electron pair donor would be an example of (1) a Lewis acid; (2) an Arrhenius acid; (3) a Lewis base; (4) an Arrhenius base; (5) a Bronsted acid; (1,2) a Bronsted base; (1,3) a Usanovich acid; (1,4) a Usanovich base
- ___ 33. The number of significant digits in the measurement 102.30 are (1) 1; (2) 2; (3) 3; (4) 4; (5) 5; (1,2) 6; (1,3) 7.
- ___ 34. When the measurement "23.04" is added to the measurement "1.2", the number of significant digits allowed in the answer are (1) 1; (2) 2; (3) 3; (4) 4; (5) 5; (1,2) 6; (1,3) 7.
- ___ 35. The formula H_2Se would describe (1) hyposelenous acid; (2) selenous acid; (3) selenic acid; (4) hydroselenic acid.

Short Answer

1. A water solution consisting of 1.0 gram of a lime sample required 20.0 mL of a 1.0 M solution of HCl for neutralization. What percent of the sample was lime? (Assume lime to be calcium hydroxide and that complete neutralization took place.)

Extra Credit

1. What is a donkey's subconscious?
2. Determine the pH of a solution which was prepared by mixing 500 mL of a 2.02 M solution of HCl with 500 mL of a 2.00 M solution of NaOH.