

ANSWER KEY	Chapter 17 Test Answer Key	BLM 17.5.1A
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Answers to Multiple-Choice Questions

1. c
2. a
3. d
4. a
5. d
6. d
7. b
8. d
9. c
10. a
11. b
12. b
13. c
14. d
15. c

Answers to Numerical Response Questions

16. a) $\text{pH} = 1.32$ b) $\text{pH} = 11.765$
17. $[\text{H}_3\text{O}^+(\text{aq})] = 1.3 \times 10^{-4}$ $[\text{OH}^-(\text{aq})] = 7.8 \times 10^{-11}$
18. $\text{pH} = 3.20$
19. $K_b = 1.7 \times 10^{-6}$
20. $K_b = 6.7 \times 10^{-11}$
21. $\text{pH} = 8.36$

Answers to Written Response Questions

22. a) The answer should include the fact that unpolluted rain has pH about 5.3. Mention should be made that the pH scale is logarithmic, and the student should describe what this means, or use analogies with other logarithmic scales to make a point that the rainwater is quite acidic. The answer should elaborate on why this rainwater presents a threat to the environment.

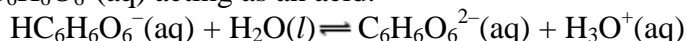
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- b) The acidic rainwater might be caused by a number of factors, including a nearby coal-burning electric generating plant, a gas-processing facility, or even being downwind from a source of acidic emissions from far away.

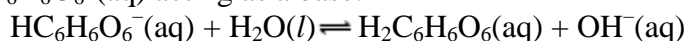
23. Soils that contain carbonates (typically present in limestone, chalk and sandstone) react with acids and reduce the concentration of hydronium ions. Thus, soils that contain carbonates have ground water with higher pH than soils that do not contain carbonates. Acid deposition lowers the pH of ground water, which affects the health of aquatic animals and plants. Acidic water leaches aluminium from the soil, and the aluminium can clog the gills of fish. Acid rain may remove the waxy coating that protects leaves, making the trees vulnerable to insects and diseases.

24. a) Acid, $\text{NH}_4^+(\text{aq})$; base, $\text{CN}^-(\text{aq})$; conjugate acid, $\text{HCN}(\text{aq})$; conjugate base, $\text{NH}_3(\text{aq})$.
 b) Base, $(\text{CH}_3)_3\text{N}(\text{aq})$; acid, $\text{H}_2\text{O}(\text{l})$; conjugate acid, $(\text{CH}_3)_3\text{NH}^+(\text{aq})$; conjugate base, $\text{OH}^-(\text{aq})$
 c) Acid, $\text{H}_2\text{S}(\text{aq})$; base, $\text{NH}_3(\text{aq})$; conjugate acid, $\text{NH}_4^+(\text{aq})$; conjugate base, $\text{HS}^-(\text{aq})$
 d) Acid, $\text{HF}(\text{aq})$; base, $\text{NH}_3(\text{aq})$; conjugate acid, $\text{NH}_4^+(\text{aq})$; conjugate base, $\text{F}^-(\text{aq})$.

25. $\text{HC}_6\text{H}_6\text{O}_6^-(\text{aq})$ acting as an acid:



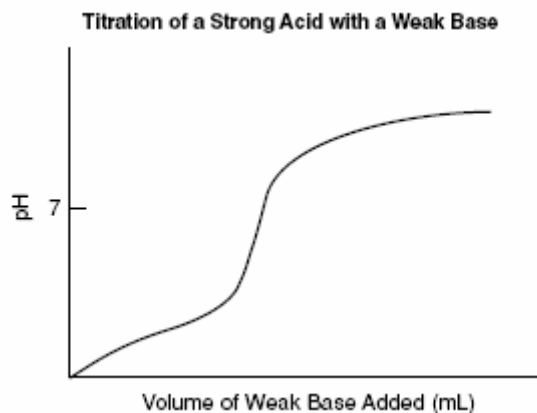
$\text{HC}_6\text{H}_6\text{O}_6^-(\text{aq})$ acting as a base:



26. $\text{HSO}_4^-(\text{aq})$ is the stronger acid; therefore, the position of equilibrium will be to the right and products will be favoured.

27. Both statements are true. Equivalence occurs when a stoichiometric amount of acid and base are present. If the acid is weak, its conjugate base will dissociate and affect the pH at equivalence.

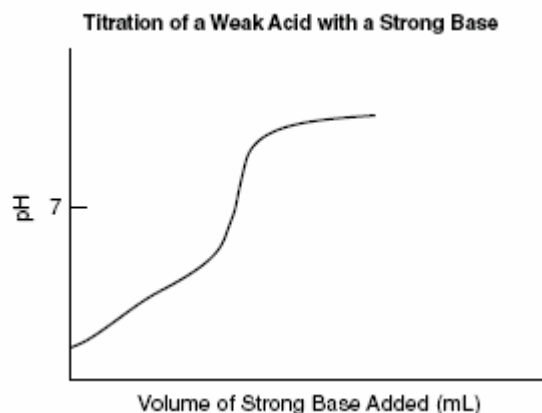
28.



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The curves have different pH at equivalence. The titration of a strong acid with a weak base results in equivalence at pH less than 7, while the weak acid with a strong base has pH at equivalence greater than 7. Both curves show a rapid change in pH near equivalence.

29. An aqueous mixture of Na_2SO_4 and H_2SO_3 does not act as a buffer because the sulfate ion is such a weak conjugate base that there is essentially no reaction with water. An aqueous mixture of NH_3 and $(\text{NH}_4)_2\text{SO}_4$ is a buffer because the ammonium ion acts as a weak acid and aqueous ammonia is a weak base. NH_3 and NH_4^+ is a conjugate acid-base pair, and each species will react with water.
30. (a) Hyperventilating increases blood pH because rapid breathing removes more $\text{CO}_2(\text{aq})$ from the blood. This causes the equilibrium to shift to the left, removing $\text{H}_3\text{O}^+(\text{aq})$.
- (b) When a person breathes into a paper bag, they recycle their breath and soon breath air with a greater concentration of $\text{CO}_2(\text{g})$ than usual. This increases the concentration of $\text{CO}_2(\text{aq})$ in the blood and restores the equilibrium concentrations.