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| 1. For the equilibrium that exists in an aqueous solution of nitrous acid (HNO2, a weak acid), the equilibrium constant expression is:   |  |  |  | | --- | --- | --- | |  | a. | *K* = | |  | b. | *K* = | |  | c. | *K* = [H+][NO2–] | |  | d. | *K* = | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 2. Which of the following is a conjugate acid/base pair?   |  |  |  | | --- | --- | --- | |  | a. | HCl/OCl– | |  | b. | H2SO4/SO42– | |  | c. | NH4+/NH3 | |  | d. | H3O+/OH– | |  | e. | more than one of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 3. The equilibrium constant for the reaction A– + H+ HA is called:   |  |  |  | | --- | --- | --- | |  | a. | *K*a | |  | b. | *K*b | |  | c. |  | |  | d. |  | |  | e. | *K*w*K*a |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 4. What is the equilibrium constant for the following reaction? N3– + H3O+ HN3 + H2O The *K*a value for HN3 = 1.9 × 10–5.   |  |  |  | | --- | --- | --- | |  | a. | 5.3 × 10–10 | |  | b. | 1.9 × 10–9 | |  | c. | 1.9 × 10–5 | |  | d. | 5.3 × 104 | |  | e. | 1.9 × 109 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 5. The hydrogen sulfate or bisulfate ion HSO4– can act as either an acid or a base in water solution. In which of the following equations does HSO4– act as an acid?   |  |  |  | | --- | --- | --- | |  | a. | HSO4– + H2O → H2SO4 + OH– | |  | b. | HSO4– + H3O+ → SO3 + 2H2O | |  | c. | HSO4– + OH– → H2SO4 + O2– | |  | d. | HSO4– + H2O → SO42– + H3O+ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 6. Which of the following is the equilibrium constant expression for the dissociation of the weak acid HOCl?   |  |  |  | | --- | --- | --- | |  | a. | *K* = | |  | b. | *K* = [H+][OCl–] | |  | c. | *K* = | |  | d. | *K* = | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 7. Consider the reaction HNO2(*aq*) + H2O(*l*) H3O+(*aq*) + NO2–(*aq*). Which species is a conjugate base?   |  |  |  | | --- | --- | --- | |  | a. | HNO2(*aq*) | |  | b. | H2O(*l*) | |  | c. | H3O+(*aq*) | |  | d. | NO2–(*aq*) | |  | e. | two of these |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 8. In which of the following reactions does the H2PO4– ion act as an acid?   |  |  |  | | --- | --- | --- | |  | a. | H3PO4 + H2O → H3O+ + H2PO4– | |  | b. | H2PO4– + H2O → H3O+ + HPO42– | |  | c. | H2PO4– + OH– → H3PO4 + O2– | |  | d. | The ion cannot act as an acid. | |  | e. | Two of these. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| Consider the following reactions:   |  |  |  | | --- | --- | --- | | a) | Al3+ + 6H2O Al(OH2)63+ | | | b) | Al(OH2)63+ Al(OH)(OH2)52+ + H+ | | | c) | OCl– + H2O HOCl + OH– | | | d) | CN– + H+ HCN | | | e) | none of these |  | |

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| 9. Which is associated with the definition of *K*a?   |  |  |  | | --- | --- | --- | |  | a. | a | |  | b. | b | |  | c. | c | |  | d. | d | |  | e. | e |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-1 | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 10. Which is associated with the definition of *K*b?   |  |  |  | | --- | --- | --- | |  | a. | a | |  | b. | b | |  | c. | c | |  | d. | d | |  | e. | e |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-1 | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 11. Using the following *K*a values, indicate the correct order of base strength.   |  |  | | --- | --- | | HNO2 | *K*a = 4.0 × 10–4 | | HF | *K*a = 7.2 × 10–4 | | HCN | *K*a = 6.2 × 10–10 |  |  |  |  | | --- | --- | --- | |  | a. | CN– > NO2– > F– > H2O > Cl– | |  | b. | Cl– > H2O > F– > NO2– > CN– | |  | c. | CN– > F– > NO2– > Cl– > H2O | |  | d. | H2O > CN– > NO2– > F– > Cl– | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 12. The equilibrium constants (*K*a) for HCN and HF in H2O at 25°C are 6.2 × 10–10 and 7.2 × 10–4, respectively. The relative order of base strengths is:   |  |  |  | | --- | --- | --- | |  | a. | F– > H2O > CN– | |  | b. | H2O > F– > CN– | |  | c. | CN– > F– > H2O | |  | d. | F– > CN– > H2O | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 13. Given the following acids and *K*a values:   |  |  |  |  | | --- | --- | --- | --- | | HClO4 | HOAc | HCN | HF | | 1 × 107 | 1.76 × 10–5 | 4.93 × 10–10 | 3.53 × 10–4 |   What is the order of increasing base strength?   |  |  |  | | --- | --- | --- | |  | a. | CN–, F–, OAc–, ClO4– | |  | b. | CN–, OAc–, F–, ClO4– | |  | c. | CN–, ClO4–, F–, OAc– | |  | d. | ClO4–, OAc–, CN–, F– | |  | e. | ClO4–, F–, OAc–, CN– |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 14. Which of the following is *not* true for a solution at 25°C that has a hydroxide concentration of 2.5 × 10–6 *M*?   |  |  |  | | --- | --- | --- | |  | a. | *K*w = 1 × 10–14 | |  | b. | The solution is acidic. | |  | c. | The solution is basic. | |  | d. | The [H+] is 4.0 × 10–9 *M*. | |  | e. | The *K*w is independent of what the solution contains. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| Consider the reaction HOCl + F– HF + OCl– |

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| 15. Given that *K*a for HOCl is 3.5 × 10–8 and the *K*a for HF is 7.2 × 10–4 (both at 25°C), which of the following is true concerning *K* for the above reaction at 25°C?   |  |  |  | | --- | --- | --- | |  | a. | *K* is greater than 1. | |  | b. | *K* is less than 1. | |  | c. | *K* is equal to 1. | |  | d. | Cannot be determined with the above information. | |  | e. | None of these (A-D). |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-2 | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | equilibrium constant for the sum of reactions | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 16. Assuming that the value for *K* in the above reaction is greater than 1, this means that HF is a stronger acid than HOCl.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-2 | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 17. HA and HB are both weak acids in water, and HA is a stronger acid than HB. Which of the following statements is correct?   |  |  |  | | --- | --- | --- | |  | a. | A– is a stronger base than B–, which is a stronger base than H2O, which is a stronger base than Cl–. | |  | b. | B– is a stronger base than A–, which is a stronger base than H2O, which is a stronger base than Cl–. | |  | c. | B– is a stronger base than A–, which is a stronger base than Cl–, which is a stronger base than H2O. | |  | d. | Cl– is a stronger base than A–, which is a stronger base than B–, which is a stronger base than H2O. | |  | e. | None of these (A-D) is correct. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 18. True or false: The species Cl– is not a good base in aqueous solution.   |  |  |  | | --- | --- | --- | |  | a. | True. This is because Cl– is the conjugate base of a weak acid. | |  | b. | False. The species Cl– is a good base in aqueous solution because it is the conjugate base of a strong acid. | |  | c. | True. This is because Cl– is a good proton donor. | |  | d. | False. The species Cl– is a good base in aqueous solution because of its high electronegativity. | |  | e. | True. This is because water has a stronger attraction for protons than does Cl–. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 19. The autoionization of water, as represented by the below equation, is known to be endothermic. Which of the following correctly states what occurs as the temperature of water is raised? H2O(*l*) + H2O(*l*) H3O+(*aq*) + OH–(*aq*)   |  |  |  | | --- | --- | --- | |  | a. | The pH of the water does not change, and the water remains neutral. | |  | b. | The pH of the water decreases, and the water becomes more acidic. | |  | c. | The pH of the water decreases, and the water remains neutral. | |  | d. | The pH of the water increases, and the water becomes more acidic. | |  | e. | The pH of the water increases and the water remains neutral. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | self-ionization of water | self-ionization of water and pH | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| The following three equations represent equilibria that lie far to the right.   |  |  |  | | --- | --- | --- | |  | HNO3(*aq*) + CN–(*aq*) HCN(*aq*) + NO3–(*aq*) | | |  | HCN(*aq*) + OH–(*aq*) H2O(*l*) + CN–(*aq*) | | |  |  | H2O(*l*) + CH3O–(*aq*) CH3OH(*aq*) + OH–(*aq*) | |

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| 20. Identify the strongest acid.   |  |  |  | | --- | --- | --- | |  | a. | HCN | |  | b. | HNO3 | |  | c. | H2O | |  | d. | OH– | |  | e. | CH3OH |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-3 | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 21. Identify the strongest base.   |  |  |  | | --- | --- | --- | |  | a. | CH3O– | |  | b. | CH3OH | |  | c. | CN– | |  | d. | H2O | |  | e. | NO3– |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-3 | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 22. A solution in which the pH is 1.6 would be described as   |  |  |  | | --- | --- | --- | |  | a. | very acidic | |  | b. | slightly acidic | |  | c. | neutral | |  | d. | very basic | |  | e. | slightly basic |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 23. Calculate the [H+] in a solution that has a pH of 9.48.   |  |  |  | | --- | --- | --- | |  | a. | 4.5 *M* | |  | b. | 9.5 *M* | |  | c. | 3.0 × 10–5 *M* | |  | d. | 3.3 × 10–10 *M* | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 24. Calculate the [H+] in a solution that has a pH of 2.84.   |  |  |  | | --- | --- | --- | |  | a. | 2.8 *M* | |  | b. | 11.2 *M* | |  | c. | 1.4 × 10–3 *M* | |  | d. | 6.9 × 10–12 *M* | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 25. Calculate the [H+] in a solution that has a pH of 8.55.   |  |  |  | | --- | --- | --- | |  | a. | 2.8 × 10–9 *M* | |  | b. | 3.5 × 10–6 *M* | |  | c. | 8.6 × 10–9 *M* | |  | d. | 9.3 × 10–1 *M* | |  | e. | 7.4 × 10–1 *M* |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 26. The pH of a solution at 25°C in which [OH–] = 3.7 × 10–5 *M* is:   |  |  |  | | --- | --- | --- | |  | a. | 4.43 | |  | b. | 3.70 | |  | c. | 9.57 | |  | d. | 4.78 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 27. In deciding which of two acids is the stronger, one must know:   |  |  |  | | --- | --- | --- | |  | a. | the concentration of each acid solution | |  | b. | the pH of each acid solution | |  | c. | the equilibrium constant of each acid | |  | d. | all of the above | |  | e. | both A and C must be known |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 28. Solid calcium hydroxide is dissolved in water until the pH of the solution is 11.50. The hydroxide ion concentration [OH–] of the solution is:   |  |  |  | | --- | --- | --- | |  | a. | 3.2 × 10–12 *M* | |  | b. | 6.3 × 10–3 *M* | |  | c. | 3.2 × 10–3 *M* | |  | d. | 1.6 × 10–3 *M* | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 29. As water is heated, its pH decreases. This means that:   |  |  |  | | --- | --- | --- | |  | a. | The water is no longer neutral. | |  | b. | [H+] > [OH–] | |  | c. | [OH–] > [H+] | |  | d. | A and B are correct. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | self-ionization of water and pH | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 30. As water is heated, its pH decreases. This means that:   |  |  |  | | --- | --- | --- | |  | a. | The water is no longer neutral. | |  | b. | The *K*w value is decreasing. | |  | c. | The water has a lower [OH–] than cooler water. | |  | d. | The dissociation of water is an endothermic process. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | self-ionization of water and pH | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 31. At 60°C, the ion-product constant of water, *K*w, is 9.25 × 10–14. The pH of pure water at 60°C is:   |  |  |  | | --- | --- | --- | |  | a. | 7.000 | |  | b. | 6.617 | |  | c. | 5.937 | |  | d. | 6.517 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | self-ionization of water | self-ionization of water and pH | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 32. What is the pOH of pure water at 40oC? (*K*w at 40oC = 2.87 × 10–14)   |  |  |  | | --- | --- | --- | |  | a. | 7.229 | |  | b. | 7.000 | |  | c. | 14.000 | |  | d. | 13.542 | |  | e. | 6.771 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | self-ionization of water | self-ionization of water and pH | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 33. Which of the following indicates the most basic solution?   |  |  |  | | --- | --- | --- | |  | a. | [H+] = 1 × 10–10 *M* | |  | b. | pOH = 6.7 | |  | c. | [OH–] = 7 × 10–5 *M* | |  | d. | pH = 4.2 | |  | e. | At least two of the solutions are equally basic. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.3 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 34. Calculate the pH of 0.271 *M* HNO3(*aq*).   |  |  |  | | --- | --- | --- | |  | a. | 0.567 | |  | b. | 2.710 | |  | c. | –1.138 | |  | d. | 13.729 | |  | e. | 1.306 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 35. Calculate the pOH of a 5.1 *M* solution of HCl.   |  |  |  | | --- | --- | --- | |  | a. | –0.71 | |  | b. | 13.29 | |  | c. | 14.71 | |  | d. | 0.71 | |  | e. | –0.95 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 36. You have 100.0 mL of a solution of hydrochloric acid that has a pH of 3.00. You add 100.0 mL of water to this solution. What is the resulting pH of the solution?   |  |  |  | | --- | --- | --- | |  | a. | The pH = 5.00 (the average of 3.00 and 7.00). | |  | b. | The pH = 10.00 (3.00 + 7.00 = 10.00). | |  | c. | The pH = 3.00 (water is neutral and does not affect the pH). | |  | d. | None of the above is correct, but the pH must be greater than 3.00. | |  | e. | None of the above is correct, but the pH must be less than 3.00. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 37. What volume of water must be added to 10.5 mL of a pH 2.0 solution of HNO3 in order to change the pH to 4.0?   |  |  |  | | --- | --- | --- | |  | a. | 10.5 mL | |  | b. | 90 mL | |  | c. | 104 mL | |  | d. | 1.04 × 103 mL | |  | e. | 26 mL |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 38. Calculate the pH of a 0.035 *M* strong acid solution.   |  |  |  | | --- | --- | --- | |  | a. | –1.46 | |  | b. | 1.46 | |  | c. | 12.54 | |  | d. | 15.46 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 39. For nitrous acid, HNO2, *K*a = 4.0 × 10–4. Calculate the pH of 0.54 *M* HNO2.   |  |  |  | | --- | --- | --- | |  | a. | 1.83 | |  | b. | 0.27 | |  | c. | 3.67 | |  | d. | 12.17 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 40. The p*K*a of HOCl is 7.5. Calculate the pH of a 0.41 *M* solution of HOCl.   |  |  |  | | --- | --- | --- | |  | a. | 7.50 | |  | b. | 6.50 | |  | c. | 3.94 | |  | d. | 10.06 | |  | e. | 0.41 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/21/2017 6:06 AM | |

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| 41. For weak acid, HX, *K*a = 5.1 × 10–6. Calculate the pH of a 0.17 *M* solution of HX.   |  |  |  | | --- | --- | --- | |  | a. | 0.77 | |  | b. | 3.03 | |  | c. | 6.06 | |  | d. | 10.97 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 42. Calculate the pH of a 0.25 *M* solution of HOCl, *K*a = 3.5 × 10–8.   |  |  |  | | --- | --- | --- | |  | a. | 4.03 | |  | b. | 8.06 | |  | c. | 9.97 | |  | d. | 1.00 | |  | e. | 3.79 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 43. Calculate the pOH of a 0.74 *M* solution of acetic acid (*K*a = 1.8 × 10–5).   |  |  |  | | --- | --- | --- | |  | a. | 2.44 | |  | b. | 9.12 | |  | c. | 4.88 | |  | d. | 11.56 | |  | e. | 2.31 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 44. Acetic acid, (HC2H3O2) is a weak acid (*K*a = 1.8 × 10–5). Calculate the pH of a 12.1 *M* HC2H3O2 solution.   |  |  |  | | --- | --- | --- | |  | a. | –1.08 | |  | b. | 3.66 | |  | c. | 1.83 | |  | d. | 1.08 | |  | e. | 12.17 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 45. Calculate the [H+] in a 0.028 *M* solution of HCN, *K*a = 6.2 × 10–10.   |  |  |  | | --- | --- | --- | |  | a. | 1.0 × 10–7 *M* | |  | b. | 4.2 × 10–6 *M* | |  | c. | 1.7 × 10–11 *M* | |  | d. | 8.3 × 10–6 *M* | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 46. Determine the concentration of a solution of the weak acid HClO2 (*K*a = 1.10 × 10–2) if it has a pH of 1.074.   |  |  |  | | --- | --- | --- | |  | a. | 0.647 *M* | |  | b. | 0.0843 *M* | |  | c. | 7.67 *M* | |  | d. | 12.9 *M* | |  | e. | 1.293 *M* |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 47. How many moles of benzoic acid, a monoprotic acid with *K*a = 6.4 × 10–5, must be dissolved in 250. mL of H2O to produce a solution with pH = 2.17?   |  |  |  | | --- | --- | --- | |  | a. | 0.71 | |  | b. | 0.00169 | |  | c. | 0.18 | |  | d. | 26 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 48. What concentration of acetic acid (*K*a = 1.80 × 10–5) has the same pH as that of 5.01 × 10–3 *M* HCl?   |  |  |  | | --- | --- | --- | |  | a. | 16.7 *M* | |  | b. | 12.6 *M* | |  | c. | 1.39 *M* | |  | d. | 5.01 × 10–3 *M* | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 49. Calculate the pH of the following aqueous solution:           0.63 *M* HOCl (p*K*a = 7.46)   |  |  |  | | --- | --- | --- | |  | a. | 10.17 | |  | b. | 3.83 | |  | c. | 7.66 | |  | d. | 6.34 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 50. Hypobromous acid, HOBr, has an acid dissociation constant of 2.5 × 10–9 at 25°C. What is the pOH of a 0.015 *M* HOBr solution?   |  |  |  | | --- | --- | --- | |  | a. | 2.00 | |  | b. | 3.57 | |  | c. | 5.21 | |  | d. | 8.79 | |  | e. | 12.00 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/13/2017 7:41 AM | |

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| 51. In a solution prepared by dissolving 0.100 mole of propanoic acid in enough water to make 1.00 L of solution, the pH is observed to be 2.924. The *K*a for propanoic acid (HC3H5O2) is:   |  |  |  | | --- | --- | --- | |  | a. | 1.19 × 10–3 | |  | b. | 1.44 × 10–5 | |  | c. | 1.21 × 10–2 | |  | d. | 6.96 × 10–10 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 52. The pH of a 0.107 *M* solution of an aqueous weak acid (HA) is 3.20. The *K*a for the weak acid is:   |  |  |  | | --- | --- | --- | |  | a. | 5.9 × 10–3 | |  | b. | 4.0 × 10–7 | |  | c. | 3.7 × 10–6 | |  | d. | 3.2 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 53. Saccharin is a monoprotic acid. If the pH of a 4.71 × 10–3 *M* solution of this acid is 2.53, what is the *K*a of saccharin?   |  |  |  | | --- | --- | --- | |  | a. | 8.7 × 10–6 | |  | b. | 1.8 × 10–3 | |  | c. | 5.0 × 10–3 | |  | d. | 2.9 × 10–3 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 54. When 2.4 × 10–2 mol of nicotinic acid (a monoprotic acid) is dissolved in 350 mL of water, the pH is 3.05. Calculate the *K*a of nicotinic acid.   |  |  |  | | --- | --- | --- | |  | a. | 1.3 × 10–2 | |  | b. | 1.2 × 10–5 | |  | c. | 6.8 × 10–2 | |  | d. | 3.4 × 10–5 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 55. Approximately how much water should be added to 10.0 mL of 11.2 *M* HCl so that it has the same pH as 0.90 *M* acetic acid (*K*a = 1.8 × 10–5)?   |  |  |  | | --- | --- | --- | |  | a. | 28 mL | |  | b. | 278 mL | |  | c. | 3 L | |  | d. | 28 L | |  | e. | 278 L |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 56. The pH of a 0.22 *M* solution of a weak monoprotic acid, HA, is 2.92. Calculate the *K*a for this acid.   |  |  |  | | --- | --- | --- | |  | a. | 0.22 | |  | b. | 1.2 × 10–3 | |  | c. | 5.5 × 10–3 | |  | d. | 6.6 × 10–6 | |  | e. | 4.4 × 10–11 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 57. A monoprotic weak acid when dissolved in water is 0.66% dissociated and produces a solution with a pH of 3.04. Calculate the *K*a of the acid.   |  |  |  | | --- | --- | --- | |  | a. | 6.6 × 10–3 | |  | b. | 1.4 × 10–1 | |  | c. | 6.1 × 10–6 | |  | d. | Need to know the initial concentration of the acid. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | experimental determination of Ka | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 58. A 4.5 × 10–3 *M* solution of a weak acid is 6.3% dissociated at 25°C. In a 4.5 × 10–4 *M* solution, the percentage of dissociation would be   |  |  |  | | --- | --- | --- | |  | a. | the same | |  | b. | > 6.3% | |  | c. | < 6.3% | |  | d. | zero | |  | e. | need to know the *K*a of the acid to answer this |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 59. A solution of 2.4 *M* weak acid is 0.52% ionized. What is the *K*a value of this acid?   |  |  |  | | --- | --- | --- | |  | a. | 6.5 × 10–5 | |  | b. | 1.2 | |  | c. | 1.2 × 10–2 | |  | d. | 5.2 × 10–3 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | experimental determination of Ka | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 60. A solution of 7.97 *M* formic acid (HCOOH) is 0.47% ionized. What is the *K*a value of formic acid?   |  |  |  | | --- | --- | --- | |  | a. | 3.7 × 10–2 | |  | b. | 1.8 × 10–4 | |  | c. | 4.7 × 10–3 | |  | d. | 3.7 | |  | e. | more data is needed |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | experimental determination of Ka | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 61. If an acid, HA, is 10.8% dissociated in a 1.0 *M* solution, what is the *K*a for this acid?   |  |  |  | | --- | --- | --- | |  | a. | 1.2 × 10–1 | |  | b. | 1.3 × 10–2 | |  | c. | 1.1 × 10–1 | |  | d. | 7.6 × 101 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | experimental determination of Ka | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 62. Determine the percent dissociation of a 0.13 *M* solution of hypochlorous acid, HClO. The *K*a for the acid is 3.5 × 10–8.   |  |  |  | | --- | --- | --- | |  | a. | 3.5 × 10–6 % | |  | b. | 4.6 × 10–9 % | |  | c. | 6.7 × 10–3 % | |  | d. | 5.2 × 10–2 % | |  | e. | 1.3 × 10–2 % |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | experimental determination of Ka | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 63. The following question refers to a solution that contains 1.93 *M* hydrofluoric acid, HF  (*K*a = 7.2 × 10–4), and 3.00 *M* hydroponic acid, HCN (*K*a =  6.2 × 10–10).  What is the pH of this mixture of weak acids?   |  |  |  | | --- | --- | --- | |  | a. | 1.43 | |  | b. | 2.86 | |  | c. | 4.46 | |  | d. | 8.92 | |  | e. | 12.57 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/21/2017 7:55 AM | |

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| 64. The following question refers to a solution that contains 1.56 *M* hydrofluoric acid, HF (*K*a = 7.2 × 10–4), and 3.00 *M* hydrocyanic acid, HCN (*K*a = 6.2 × 10–10). Determine the [CN–] at equilibrium.   |  |  |  | | --- | --- | --- | |  | a. | 1.9 × 10–9 *M* | |  | b. | 3.4 × 10–2 *M* | |  | c. | 5.5 × 10–8 *M* | |  | d. | 6.2 × 10–10 *M* | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | calculations with Ka | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 65. Consider a 0.70 *M* solution of HOCl. If the molarity was decreased to 0.3 *M*, which of the following statements would be true?   |  |  |  | | --- | --- | --- | |  | a. | The percent dissociation would not change. | |  | b. | The percent dissociation would increase. | |  | c. | The percent dissociation would decrease. | |  | d. | The equilibrium constant would stay the same. | |  | e. | Two of these. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 66. Consider a solution made by mixing HCN (*K*a = 6.2 × 10–10) with HC2H3O2 (*K*a = 1.8 × 10–5) in aqueous solution. What are the major species in solution?   |  |  |  | | --- | --- | --- | |  | a. | H+, CN–, H+, C2H3O2–, H2O | |  | b. | HCN, H+, C2H3O2–, H2O | |  | c. | H+, CN–, HC2H3O2, H2O | |  | d. | H+, CN–, H+, C2H3O2–, OH–, H2O | |  | e. | HCN, HC2H3O2, H2O |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 67. Which of the following solutions contains the strongest acid?   |  |  |  | | --- | --- | --- | |  | a. | 5.00 *M* HCN (*K*a = 6.2 × 10–10) | |  | b. | 3.50 *M* H2C6H6O6 (*K*a1 = 7.9 × 10–5, *K*a2 = 1.6 × 10–12). | |  | c. | 2.50 *M* HC2H3O2 (*K*a = 1.8 × 10–5) | |  | d. | 4.00 *M* HOCl (*K*a = 3.5 × 10–8) | |  | e. | 1.00 *M* HF (*K*a = 7.2 × 10–4) |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 68. Which of the following statements are true?   |  |  |  | | --- | --- | --- | |  | a. | The pH of a strong acid is always lower than the pH of a weak acid. | |  | b. | The pH of a solution can never be negative. | |  | c. | For a conjugate acid-base pair, *K*a = 1/*K*b. | |  | d. | At least two of the statements A-C are true. | |  | e. | All of the statements A-C are false. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 69. Which of the following reactions is associated with the definition of *K*b?   |  |  |  | | --- | --- | --- | |  | a. | Zn(OH2)62+ [Zn(OH2)5OH]+ + H+ | |  | b. | CN– + H+ HCN | |  | c. | F– + H2O HF + OH– | |  | d. | Cr3+ + 6H2O Cr(OH2)63+ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 70. Calculate the pH of a 0.03 *M* solution of KOH.   |  |  |  | | --- | --- | --- | |  | a. | 1.5 | |  | b. | 15.5 | |  | c. | 14.0 | |  | d. | 12.5 | |  | e. | cannot calculate answer unless a volume is given |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 71. Calculate the pH of a 0.31 *M* solution of KOH.   |  |  |  | | --- | --- | --- | |  | a. | 14.00 | |  | b. | 13.49 | |  | c. | 0.51 | |  | d. | 0.31 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 72. Calculate the pH of a 0.045 *M* solution of Ca(OH)2.   |  |  |  | | --- | --- | --- | |  | a. | 12.95 | |  | b. | 12.65 | |  | c. | 1.05 | |  | d. | 1.35 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 73. Calculate the pOH of a 0.16 *M* solution of Ba(OH)2.   |  |  |  | | --- | --- | --- | |  | a. | 0.80 | |  | b. | 0.49 | |  | c. | 13.51 | |  | d. | 13.20 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 74. A 0.385-g sample of NaOH(*s*) is added to enough water to make 250.0 mL of solution. The pH of this solution is:   |  |  |  | | --- | --- | --- | |  | a. | 1.415 | |  | b. | 0.415 | |  | c. | 11.983 | |  | d. | 12.585 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 75. Calculate the pH of a 5.0 × 10–3 *M* KOH solution.   |  |  |  | | --- | --- | --- | |  | a. | 2.30 | |  | b. | 12.70 | |  | c. | 11.70 | |  | d. | 1.30 | |  | e. | 10.70 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 76. Calculate the pH of a 3.24 *M* solution of NaOH.   |  |  |  | | --- | --- | --- | |  | a. | 0.511 | |  | b. | 13.489 | |  | c. | 14.511 | |  | d. | 3.24 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | pH of a solution | solutions of a strong acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 77. The pain killer morphine is a weak base when added to water. The *K*b is 1.6 × 10–6. What is the pH of a 3.97 × 10–3 *M* solution of morphine?   |  |  |  | | --- | --- | --- | |  | a. | 4.10 | |  | b. | 9.90 | |  | c. | 5.80 | |  | d. | 9.75 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 78. The [OH–] in a 0.87 *M* pyridine (C5H5N; *K*b = 1.7 × 10–9) solution is   |  |  |  | | --- | --- | --- | |  | a. | 1.5 × 10-9 *M* | |  | b. | 3.8 × 10-5 *M* | |  | c. | 0.87 *M* | |  | d. | 4.4 × 10-5 *M* | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 79. Calculate the pH of a 5.7 *M* solution of aniline (C6H5NH2; *K*b = 3.8 × 10–10):   |  |  |  | | --- | --- | --- | |  | a. | 4.33 | |  | b. | 9.67 | |  | c. | 5.34 | |  | d. | 8.66 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 80. Calculate the pH of a 0.35 *M* solution of pyridine (C5H5N; *K*b = 1.7 × 10–9):   |  |  |  | | --- | --- | --- | |  | a. | 4.61 | |  | b. | 4.77 | |  | c. | 9.39 | |  | d. | 9.23 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 81. Calculate the percentage of pyridine (C5H5N) that forms pyridinium ion, C5H6N+, in a 0.87 *M* aqueous solution of pyridine (*K*b = 1.7 × 10–9).   |  |  |  | | --- | --- | --- | |  | a. | 1.7 × 10–7 % | |  | b. | 3.8 × 10–3 % | |  | c. | 2.0 × 10–7 % | |  | d. | 5.1 × 10–3 % | |  | e. | 4.4 × 10–3 % |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 82. Which of the following aqueous solutions will have the highest pH? For NH3, *K*b = 1.8 × 10–5; for C2H3O2–, *K*b = 5.6 × 10–10.   |  |  |  | | --- | --- | --- | |  | a. | 2.0 *M* NaOH | |  | b. | 2.0 *M* NH3 | |  | c. | 2.0 *M* HC2H3O2 | |  | d. | 2.0 *M* HCl | |  | e. | all the same |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 83. Calculate the pH of a 0.67 *M* NH3 (*K*b = 1.8 × 10–5) solution.   |  |  |  | | --- | --- | --- | |  | a. | 2.46 | |  | b. | 9.08 | |  | c. | 4.92 | |  | d. | 0.67 | |  | e. | 11.54 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 84. The equilibrium constant for the reaction NH4+ + OH– NH3 + H2O is:   |  |  |  | | --- | --- | --- | |  | a. |  | |  | b. |  | |  | c. |  | |  | d. |  | |  | e. |  |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 85. The pH of a 0.150 *M* solution of a weak base is 10.98. Calculate the pH of a 0.0621 *M* solution of the base.   |  |  |  | | --- | --- | --- | |  | a. | 3.21 | |  | b. | 10.79 | |  | c. | 7.58 | |  | d. | 6.42 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 86. Calculate the pH of the following aqueous solution:           0.93 *M* aniline (p*K*b = 9.42)   |  |  |  | | --- | --- | --- | |  | a. | 4.73 | |  | b. | 4.55 | |  | c. | 9.45 | |  | d. | 9.27 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 87. Calculate the pH of the following aqueous solution:           0.78 *M* H2S (p*K*a1 = 7.00; p*K*a2 = 12.89)   |  |  |  | | --- | --- | --- | |  | a. | 10.45 | |  | b. | 3.55 | |  | c. | 7.11 | |  | d. | 6.89 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 88. Determine the pH of a 0.042 *M* solution of H2SO4. The dissociation occurs in two steps.  *K*a1 is extremely large; *K*a2 is 1.2 × 10–2.   |  |  |  | | --- | --- | --- | |  | a. | 12.73 | |  | b. | 1.38 | |  | c. | 1.92 | |  | d. | 1.3 | |  | e. | 2.09 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 2/23/2017 8:08 AM | | *DATE MODIFIED:* | 3/27/2017 7:11 AM | |

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| 89. Calculate the pH of the following aqueous solution: 0.5 *M* H2CO3 (p*K*a1 = 6.37; p*K*a2 = 10.25). Choose your answer from the following pH ranges:   |  |  |  | | --- | --- | --- | |  | a. | pH 0.00–2.99 | |  | b. | pH 3.00–5.99 | |  | c. | pH 6.00–8.99 | |  | d. | pH 9.00 –10.99 | |  | e. | pH 11.00–14.00 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 90. A 0.21-mol sample of a diprotic acid, H2A, is dissolved in 250 mL of water. The *K*a1 of this acid is 1.0 × 10–5 and *K*a2 is 1.0 × 10–10. Calculate the concentration of A2– in this solution.   |  |  |  | | --- | --- | --- | |  | a. | 1.0 × 10–5 *M* | |  | b. | 1.4 × 10–3 *M* | |  | c. | 2.9 × 10–3 *M* | |  | d. | 1.0 × 10–10 *M* | |  | e. | 0.84 *M* |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 91. For the stepwise dissociation of aqueous H3PO4, which of the following is not a conjugate acid–base pair?   |  |  |  | | --- | --- | --- | |  | a. | HPO42– and PO43– | |  | b. | H3PO4 and H2PO4– | |  | c. | H2PO4– and HPO42– | |  | d. | H2PO4– and PO43– | |  | e. | H3O+ and H2O |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 92. The pH of a solution of 1.1 *M* H2A (*K*a1= 1.0 × 10–6 and *K*a2 is 1.0 × 10–10) is:   |  |  |  | | --- | --- | --- | |  | a. | 10.00 | |  | b. | 5.96 | |  | c. | 11.02 | |  | d. | 2.98 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 93. Calculate the pH of a 0.02 *M* solution of ascorbic acid (*K*a1= 7.9 × 10–5; *K*a2 is 1.6 × 10–12).   |  |  |  | | --- | --- | --- | |  | a. | 11.1 | |  | b. | 2.9 | |  | c. | 5.8 | |  | d. | 8.2 | |  | e. | 11.8 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 94. The dihydrogenphosphate ion, H2PO4–, has both a conjugate acid and a conjugate base. These are, respectively:   |  |  |  | | --- | --- | --- | |  | a. | H3PO4, PO43– | |  | b. | H3PO4, HPO42– | |  | c. | H2PO4–, HPO42– | |  | d. | HPO42–, PO43– | |  | e. | HPO42–, H3PO4 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 95. For which of the following 0.10 *M* diprotic acids would the second dissociation affect the pH significantly?   |  |  |  | | --- | --- | --- | |  | a. | H2A; *K*a1 = 4.2 × 10–2, *K*a2 = 1.8 × 10–7 | |  | b. | H2B; *K*a1 = 2.4 × 10–4, *K*a2 = 6.1 × 10–8 | |  | c. | H2C; *K*a1 = 1.3 × 10–4, *K*a2 = 5.2 × 10–9 | |  | d. | H2D; *K*a1 = 1.8 × 10–3, *K*a2 = 9.3 × 10–4 | |  | e. | The second dissociation never affects the pH significantly. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 96. The conjugate acid and conjugate base of bicarbonate ion, HCO3–, are, respectively:   |  |  |  | | --- | --- | --- | |  | a. | H3O+ and OH– | |  | b. | H3O+ and CO32– | |  | c. | H2CO3 and OH– | |  | d. | H2CO3 and CO32– | |  | e. | CO32– and OH– |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 97. Which of the following species is present in the greatest concentration in a 0.100 M H2SO4 solution in H2O?   |  |  |  | | --- | --- | --- | |  | a. | H3O+ | |  | b. | HSO4– | |  | c. | H2SO4 | |  | d. | All species are in equilibrium and therefore have the same concentration. | |  | e. | SO42– |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 98. Which of the following is true about the pH of a solution of sulfuric acid?   |  |  |  | | --- | --- | --- | |  | a. | If the solution is dilute the pH can not be calculated. | |  | b. | If the solution is dilute the pH is completely controlled by the first dissociation. | |  | c. | If the solution is dilute the pH is completely controlled by the second dissociation. | |  | d. | If the solution is concentrated the pH is partially controlled by the second dissociation. | |  | e. | If the solution is dilute the pH is partially controlled by the second dissociation. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 99. What is the equilibrium concentration of PO43– in a 0.351 *M* solution of H3PO4(*aq*)? (*K*a1 = 7.5 × 10–3, *K*a2 = 6.2 × 10–8, *K*a3 = 4.8 × 10–13)   |  |  |  | | --- | --- | --- | |  | a. | 4.8 × 10–2 *M* | |  | b. | 1.5 × 10–4 *M* | |  | c. | 4.8 × 10–13 *M* | |  | d. | 4.1 × 10–7 *M* | |  | e. | 6.2 × 10–8 *M* |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 100. What is the equilibrium concentration of HPO42– in a 0.380 *M* solution of H3PO4(*aq*)? (*K*a1 = 7.5 × 10–3, *K*a2 = 6.2 × 10–8, *K*a3 = 4.8 × 10–13)   |  |  |  | | --- | --- | --- | |  | a. | 1.5 × 10–4 *M* | |  | b. | 5.0 × 10–2 *M* | |  | c. | 4.8 × 10–13 *M* | |  | d. | 6.2 × 10–8 *M* | |  | e. | 4.3 × 10–7 *M* |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 101. What is the equilibrium concentration of H2PO4– in a 0.650 *M* solution of H3PO4(*aq*)? (*K*a1 = 7.5 × 10–3, *K*a2 = 6.2 × 10–8, *K*a3 = 4.8 × 10–13)   |  |  |  | | --- | --- | --- | |  | a. | 2.0 × 10–4 *M* | |  | b. | 6.6 × 10–2 *M* | |  | c. | 7.0 × 10–2 *M* | |  | d. | 7.5 × 10–3 *M* | |  | e. | 6.2 × 10–8 *M* |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 102. What is the equilibrium pH of a 0.227 *M* solution of H3PO4(*aq*)? (*K*a1 = 7.5 × 10–3, *K*a2 = 6.2 × 10–8, *K*a3 = 4.8 × 10–13)   |  |  |  | | --- | --- | --- | |  | a. | 1.42 | |  | b. | 3.93 | |  | c. | 12.32 | |  | d. | 6.48 | |  | e. | 7.21 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 103. Carbonic acid is a diprotic acid, H2CO3, with *K*a1 = 4.2 × 10–7 and *K*a2 = 4.8 × 10–11 at 25°C. The ion product for water is *K*w = 1.0 × 10–14 at 25°C. What is the OH– concentration of a solution that is 0.37 *M* in Na2CO3?   |  |  |  | | --- | --- | --- | |  | a. | 8.8 × 10–3 *M* | |  | b. | 2.1 × 10–4 *M* | |  | c. | 9.4 × 10–5 *M* | |  | d. | 4.2 × 10–6 *M* | |  | e. | 3.9 × 10–4 *M* |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 104. The two acid dissociation constants for carbonic acid, H2CO3, are 4.3 × 10–7 and 4.8 × 10–11 at 25°C. The base constant, *K*b, or hydrolysis constant for HCO3– is:   |  |  |  | | --- | --- | --- | |  | a. | 4.3 × 10–7 | |  | b. | 4.8 × 10–11 | |  | c. | 2.1 × 10–17 | |  | d. | 2.3 × 10–8 | |  | e. | 6.2 × 10–22 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 14.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-ionization equilibria | acids and bases | Chemistry | general chemistry | polyprotic acids | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 105.   |  |  | | --- | --- | | HOAc | *K*a = 1.8 × 10–5 | | H2CO3 | *K*a1 = 4.3 × 10–7 | |  | *K*a2 = 5.6 × 10–11 |   Which of the following 0.01 *M* solutions has the highest pH?   |  |  |  | | --- | --- | --- | |  | a. | HOAc | |  | b. | NaOAc | |  | c. | Na2CO3 | |  | d. | H2CO3 | |  | e. | NaHCO3 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 106. The sodium salt, NaA, of a weak acid is dissolved in water; no other substance is added. Which of these statements (to a close approximation) is true?   |  |  |  | | --- | --- | --- | |  | a. | [H+] = [A–] | |  | b. | [H+] = [OH–] | |  | c. | [A–] = [OH–] | |  | d. | [HA] = [OH–] | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 107. Which of the following would give the highest pH when dissolved in water to form a 0.10 *M* solution?   |  |  |  | | --- | --- | --- | |  | a. | a strong acid | |  | b. | a weak acid | |  | c. | the potassium salt of a weak acid | |  | d. | the potassium salt of a strong acid | |  | e. | the ammonium salt of a strong acid |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| Select the answer that best describes an aqueous solution made from each of the following substances: |

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| 108. solid sodium nitrate (NaNO3)   |  |  |  | | --- | --- | --- | |  | a. | acidic | |  | b. | basic | |  | c. | neutral | |  | d. | cannot tell | |  | e. | none of these (A-D) |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-4 | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 109. solid aluminum chloride (AlCl3)   |  |  |  | | --- | --- | --- | |  | a. | acidic | |  | b. | basic | |  | c. | neutral | |  | d. | cannot tell | |  | e. | none of these (A-D) |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-4 | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 110. solid sodium carbonate (Na2CO3)   |  |  |  | | --- | --- | --- | |  | a. | acidic | |  | b. | basic | |  | c. | neutral | |  | d. | cannot tell | |  | e. | none of these (A-D) |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-4 | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 111. solid ammonium acetate (NH4C2H3O2). For NH4+, *K*a = 5.6 × 10–10; for C2H3O2–, *K*b = 5.6 × 10–10.   |  |  |  | | --- | --- | --- | |  | a. | acidic | |  | b. | basic | |  | c. | neutral | |  | d. | cannot tell | |  | e. | none of these (A-D) |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-4 | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 112. solid ammonium perchlorate (NH4ClO4) For NH4+, *K*a = 5.6 × 10–10; for ClO4–, *K*b ≈ 10–21.   |  |  |  | | --- | --- | --- | |  | a. | acidic | |  | b. | basic | |  | c. | neutral | |  | d. | cannot tell | |  | e. | none of these (A-D) |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-4 | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 113. Which of the following correctly labels the salts?   |  |  |  | | --- | --- | --- | | HF  (*K*a = 7.2 × 10–4) | NH3  (*K*b = 1.8 × 10–5) | HCN  (*K*a= 6.2 × 10–10) |  |  |  |  | | --- | --- | --- | |  | a. | NaCN = acidic, NH4F = basic, KCN = neutral | |  | b. | NaCN = acidic, NH4F = neutral, KCN = basic | |  | c. | NaCN = basic, NH4F = basic, KCN= neutral | |  | d. | NaCN = basic, NH4F = neutral, KCN = basic | |  | e. | NaCN = basic, NH4F = acidic, KCN = basic |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 114. The pH of a 1.0 *M* aqueous solution of NaCl is:   |  |  |  | | --- | --- | --- | |  | a. | 7.0 | |  | b. | greater than 7.0 | |  | c. | less than 7.0 | |  | d. | not enough information given | |  | e. | none of these (A-D) |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 115. The pH of a 1.0 *M* sodium acetate solution is:   |  |  |  | | --- | --- | --- | |  | a. | 7.0 | |  | b. | greater than 7.0 | |  | c. | less than 7.0 | |  | d. | not enough information given | |  | e. | none of these (A-D) |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 116. Calculate the pH of the following aqueous solution:           0.31 *M* NaF (p*K*a for HF = 3.14)   |  |  |  | | --- | --- | --- | |  | a. | 5.68 | |  | b. | 2.63 | |  | c. | 8.32 | |  | d. | 11.37 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | pH of a salt solution | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 117. Calculate the pH of the following aqueous solution:           0.40 *M* NH4Cl (p*K*b for NH3 = 4.74)   |  |  |  | | --- | --- | --- | |  | a. | 9.17 | |  | b. | 4.83 | |  | c. | 9.66 | |  | d. | 4.34 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | pH of a salt solution | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 118. Calculate the [H+] in 1.0 *M* solution of Na2CO3 (for H2CO3, *K*a1= 4.3 × 10–7; *K*a2= 5.6 × 10–11).   |  |  |  | | --- | --- | --- | |  | a. | 7.5 × 10–6 *M* | |  | b. | 6.6 × 10–4 *M* | |  | c. | 1.3 × 10–2 *M* | |  | d. | 7.5 × 10–13 *M* | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | pH of a salt solution | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 119. The [H3O+] of a 0.52 *M* solution of NH4Cl in H2O at 25°C is (*K*b for NH3 = 1.8 × 10–5):   |  |  |  | | --- | --- | --- | |  | a. | 2.9 × 10–10 *M* | |  | b. | 3.1 × 10–3 *M* | |  | c. | 1.7 × 10–5 *M* | |  | d. | 0.52 *M* | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | pH of a salt solution | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 120. Calculate the pH of a 0.46 *M* solution of NH4Cl. (*K*b for NH3 = 1.8 × 10–5)   |  |  |  | | --- | --- | --- | |  | a. | 9.20 | |  | b. | 4.80 | |  | c. | 9.59 | |  | d. | 4.41 | |  | e. | 0.34 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | pH of a salt solution | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 121. What is the pH of a 0.32 *M* KCl solution?   |  |  |  | | --- | --- | --- | |  | a. | 0.49 | |  | b. | 7.00 | |  | c. | 13.51 | |  | d. | 1.60 | |  | e. | 9.20 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | pH of a salt solution | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 122. Calculate the pH of a 0.12 *M* solution of NaC2H3O2 (for HC2H3O2 *K*a = 1.8 × 10–5).   |  |  |  | | --- | --- | --- | |  | a. | 5.09 | |  | b. | 8.91 | |  | c. | 8.33 | |  | d. | 5.67 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | pH of a salt solution | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 123. Given that the *K*a for HOCl is 3.51 × 10–8, calculate the *K* value for the reaction of HOCl with OH–.   |  |  |  | | --- | --- | --- | |  | a. | 3.51 × 106 | |  | b. | 3.51 | |  | c. | 3.51 × 10–22 | |  | d. | 2.85 × 10–7 | |  | e. | 2.85 × 1021 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | equilibrium constant for the sum of reactions | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 124. Which of the following is the correct order for increasing pHs for equimolar solutions of HNO3, KCl, NH4Cl, KOH, and NaC2H3O2? (*K*a for HC2H3O2 is 1.80 × 10–5, *K*a for NH4+ is 5.56 × 10–10).   |  |  |  | | --- | --- | --- | |  | a. | KCl, NH4Cl, HNO3, KOH, NaC2H3O2 | |  | b. | HNO3, KCl, NH4Cl, KOH, NaC2H3O2 | |  | c. | NH4Cl, HNO3, KCl, KOH, NaC2H3O2 | |  | d. | HNO3, NH4Cl, KCl, NaC2H3O2, KOH | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 125. Which of the following is the strongest base? (*K*b for NH3 is 1.8 × 10–5, *K*a2 for H2SO4 is 1.2 × 10–2, *K*a3 for H3PO4 is 4.8 × 10–13) NH3, HSO4–, PO43–, or NO3–   |  |  |  | | --- | --- | --- | |  | a. | NH3 | |  | b. | HSO4– | |  | c. | NO3– | |  | d. | PO43– | |  | e. | Two of these are equally strong. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 126. The salt BX, when dissolved in water, produces an acidic solution. Which of the following could be true?   |  |  |  | | --- | --- | --- | |  | a. | HX is a weak acid. | |  | b. | HX is a strong acid. | |  | c. | The cation B+ is a weak acid. | |  | d. | All of the above could be true. | |  | e. | Only A and C could be true. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 127. Calculate the *K*a for an unknown monoprotic acid HX, given that a solution of 0.48 *M* LiX has a pH of 8.90.   |  |  |  | | --- | --- | --- | |  | a. | 1.3 × 10–10 | |  | b. | 6.0 × 10–10 | |  | c. | 3.0 × 103 | |  | d. | 1.5 × 10–4 | |  | e. | 7.6 × 10–5 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 128. If *K*a for HCN is 6.22 × 10–10, what is Kb for CN–?    Note: CN– + H2O HCN + OH–   |  |  |  | | --- | --- | --- | |  | a. | 6.22 × 10–24 | |  | b. | 6.22 × 104 | |  | c. | 1.61 × 10–5 | |  | d. | 1.24 × 10–9 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 129. A 0.340 *M* solution of the salt NaA has a pH of 8.40. Calculate the *K*a value of the acid HA.   |  |  |  | | --- | --- | --- | |  | a. | 1.9 × 10–11 | |  | b. | 1.4 × 10–9 | |  | c. | 5.4 × 10–4 | |  | d. | 2.1 × 102 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 130. If you know *K*b for ammonia, NH3, you can calculate the equilibrium constant, *K*a, for the following reaction: NH4+  NH3 + H+ by the equation:   |  |  |  | | --- | --- | --- | |  | a. | *K*a = *K*w × *K*b | |  | b. | *K*a = *K*w / *K*b | |  | c. | *K*a = 1 / *K*b | |  | d. | *K*a = *K*b / *K*w | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | base-ionization equilibria | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 131. The hydrogen halides (HF, HCl, HBr, and HI) are all polar molecules. The strength of the acid each forms in water is based on which of the following?   |  |  |  | | --- | --- | --- | |  | a. | the polarity of the molecule | |  | b. | the size of the molecule | |  | c. | the strength of the bond | |  | d. | two of these | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | molecular structure and acid strength | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 132. Which factor listed below is most important in determining the strength of an oxyacid?   |  |  |  | | --- | --- | --- | |  | a. | the size of the molecule | |  | b. | the ability of the molecule to change atomic orientation | |  | c. | the identity of the central atom in the molecule | |  | d. | the number of oxygen atoms present in the molecule | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | molecular structure and acid strength | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 133. Which is the strongest acid of the following?   |  |  |  | | --- | --- | --- | |  | a. | HClO2 | |  | b. | HClO | |  | c. | HBrO | |  | d. | HIO | |  | e. | HOAt |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | molecular structure and acid strength | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 134. Which of the following would produce a basic aqueous solution?   |  |  |  | | --- | --- | --- | |  | a. | P4O10 | |  | b. | KCl | |  | c. | CO2 | |  | d. | NH4Cl | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 135. Calculate the pH of a 0.005 *M* solution of potassium oxide, K2O.   |  |  |  | | --- | --- | --- | |  | a. | 12.0 | |  | b. | 11.7 | |  | c. | 7.0 | |  | d. | 2.3 | |  | e. | 2.0 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 136. Which of the species below, when dissolved in H2O, will not produce a basic solution?   |  |  |  | | --- | --- | --- | |  | a. | SO2 | |  | b. | NH3 | |  | c. | BaO | |  | d. | Ba(OH)2 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 137. Which of the following species cannot act as a Lewis base?   |  |  |  | | --- | --- | --- | |  | a. | O2– | |  | b. | OH– | |  | c. | BH3 | |  | d. | H2S | |  | e. | PH3 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.11 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base concepts | acids and bases | Chemistry | general chemistry | Lewis concept of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 138. Which of the following species cannot act as a Lewis base?   |  |  |  | | --- | --- | --- | |  | a. | Mg2+ | |  | b. | O2– | |  | c. | OH– | |  | d. | H2O | |  | e. | H2O2 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.11 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base concepts | acids and bases | Chemistry | general chemistry | Lewis concept of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 139. Which of the following species cannot act as a Lewis base?   |  |  |  | | --- | --- | --- | |  | a. | N3– | |  | b. | NH2– | |  | c. | NH2– | |  | d. | NH3 | |  | e. | NH4+ |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.11 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Chemistry | general chemistry | Lewis concept of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 140. Which of the following species cannot act as a Lewis acid?   |  |  |  | | --- | --- | --- | |  | a. | K+ | |  | b. | Mg2+ | |  | c. | Al3+ | |  | d. | H+ | |  | e. | H– |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.11 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Chemistry | general chemistry | Lewis concept of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 141. Which of the following species cannot act as a Lewis acid?   |  |  |  | | --- | --- | --- | |  | a. | NH4+ | |  | b. | H+ | |  | c. | BF3 | |  | d. | BeCl2 | |  | e. | Ag+ |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.11 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Chemistry | general chemistry | Lewis concept of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 142. In the reaction: CaO(*s*) + CO2(*g*) → CaCO3(*s*)   |  |  |  | | --- | --- | --- | |  | a. | Ca2+ acts as a Lewis acid and CO32– acts as a Lewis base. | |  | b. | O2– acts as a Lewis base and CO2 acts as a Lewis acid. | |  | c. | O2– acts as a Lewis base and Ca2+ acts as a Lewis acid. | |  | d. | CaO is the Lewis acid and CaCO3 is its conjugate base. | |  | e. | CO2 is the Lewis acid and CaCO3 is its conjugate base. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.11 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | acid-base concepts | acids and bases | Chemistry | general chemistry | Lewis concept of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 143. Consider the following reaction: AgBr(*s*) + 2CN–(*aq*) → Ag(CN)2–(*aq*) + Br–(*aq*) The species that are acting as a Lewis acid and Lewis base, respectively, are   |  |  |  | | --- | --- | --- | |  | a. | AgBr and Ag(CN)2– | |  | b. | Ag(CN)2– and Ag+ | |  | c. | Ag+ and Br– | |  | d. | Br– and CN– | |  | e. | Ag+ and CN– |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.11 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Chemistry | general chemistry | Lewis concept of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 144. Define amphoteric substance.   |  |  | | --- | --- | | *ANSWER:* | A substance that can behave either as an acid or a base is amphoteric. Water is a common example of an amphoteric substance.  See Sec. 14.2 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base concepts | acids and bases | Bronsted-Lowry concept of acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 145. Explain why 0.1 *M* NaCN is basic while 0.1 *M* NaNO3 is neutral.   |  |  | | --- | --- | | *ANSWER:* | When NaCN dissolves in water, it produces Na+ and CN– ions. The Na+ ion is the cation of a strong base, and so does not have any effect on the [H+] or [OH–] in water. The CN– ion, however, is the anion of a weak acid. It will react with water to produce OH– and the conjugate acid, HCN. Since [OH–] increases by this reaction, the solution is basic. When NaNO3 dissolves in water, the solvated ions are Na+ and NO3–. Again, Na+ does not affect [H+] or [OH–]. Neither does NO3– since it is the anion of a strong acid, and so it does not act as a base, and does not affect [H+] or [OH–].  See Sec. 14.8 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 146. Explain why Al2(SO4)3 produces an acidic solution when it is dissolved in water.   |  |  | | --- | --- | | *ANSWER:* | The ions from this salt are: Al3+ and SO42–. The sulfate ion is the anion of a strong acid. It is the anion from the second ionization of H2SO4, for which *K*a2 = 1.2 × 10–2. The aluminum ion reacts with water to produce Al(OH)3 (which is actually only slightly soluble), thus increasing [H+].  See Sec. 14.8 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| Determine whether the following oxides produce an acidic, basic, or neutral solution when dissolved in water: |

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| 147. K2O   |  |  | | --- | --- | | *ANSWER:* | basic  K2O(*s*) + H2O(*l*) → 2KOH(*aq*); see Sec 14.10, Zumdahl *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-5 | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 148. NO2   |  |  | | --- | --- | | *ANSWER:* | acidic  2NO2(*g*) + H2O(*l*) → HNO3(*aq*) + HNO2(*aq*); see Sec 14.10, Zumdahl *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-5 | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 149. Cl2O   |  |  | | --- | --- | | *ANSWER:* | acidic  Cl2O(*g*) + H2O(*l*) → 2HClO(*aq*); see Sec 14.10, Zumdahl *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-5 | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 150. CaO   |  |  | | --- | --- | | *ANSWER:* | basic  CaO(*s*) + H2O(*l*) → Ca(OH)2(*aq*); see Sec 14.10, Zumdahl *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-5 | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 151. SO2   |  |  | | --- | --- | | *ANSWER:* | acidic  SO2(*g*) + H2O(*l*) → H2SO3(*aq*); see Sec 14.10, Zumdahl *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 14-5 | | *KEYWORDS:* | acids and bases | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 152. Given the following values of pKa, determine which is the weakest base of the answers listed.  ​  Acid                      pKa  HClO2                  1.95  HClO                    7.54  HCOOH               3.74  HF                        3.17  HNO2                   3.15   |  |  |  | | --- | --- | --- | |  | a. | ClO2- | |  | b. | ClO- | |  | c. | HCOO- | |  | d. | F- | |  | e. | Cl- |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 14.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | relative strengths of acids and bases | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 2/22/2017 1:43 AM | |

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| 153. Which of the following solutions is incorrectly described?   |  |  |  | | --- | --- | --- | |  | a. | 0.25 M NaH would be basic | |  | b. | 0.15 M KBr would be neutral | |  | c. | 0.25 M NH4Cl would be acidic | |  | d. | 0.15 M HN3 would be acidic | |  | e. | 0.20 M ClOH would be basic |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 154. Which of the following statements is incorrect?   |  |  |  | | --- | --- | --- | |  | a. | A solution of ammonium chloride will have a pH less than 7. | |  | b. | A solution of potassium bromide will have a pH of 7. | |  | c. | A solution of cobalt(II) chloride will have a pH less than 7. | |  | d. | Given that the Kb of ammonia is 1.8 x 10-5 and the Ka of hydrofluoric acid is 6.8 x 10-4, a solution of ammonium fluoride will have a pH of less than 7. | |  | e. | A solution of sodium phosphate will have a pH of less than 7. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 155. Which of the following solutions is INCORRECTLY described?  ​  I.       0.2 M NaCN has a pH > 7.  II.      0.2 M FeBr3 is acidic  III.     0.25 M NH4Cl is acidic   |  |  |  | | --- | --- | --- | |  | a. | II only | |  | b. | II and III only | |  | c. | I and II only | |  | d. | I and III only | |  | e. | All are correctly described |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 2/22/2017 1:49 AM | |

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| 156. Describe the pH of the following salts? NaF, NH4Cl, KI, NH4F   |  |  |  | | --- | --- | --- | |  | a. | acidic, basic, neutral, cannot tell without further information | |  | b. | neutral, acidic, neutral, cannot tell without further information | |  | c. | neutral, acidic, neutral, neutral | |  | d. | basic, acidic, neutral, cannot tell without further information | |  | e. | basic, acidic, neutral, neutral |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.8 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid-base properties of salt solutions | acids and bases | Chemistry | general chemistry | prediction of salt solution acid-base properties | solutions of a weak acid or base | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 157. For each group of compounds listed, which is the strongest acid? I.  HIO2, HIO3, HIO4 II. H2Se, H2S, H3As III. HPO2, HClO2, HBrO2   |  |  |  | | --- | --- | --- | |  | a. | I. HIO2, H2Se, HBrO2 | |  | b. | I. HIO4, H2Se, HBrO2 | |  | c. | I. HIO2, H3As, HPO2 | |  | d. | I. HIO3, H3As, HClO2 | |  | e. | I. HIO4, H2Se, HClO2 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | molecular structure and acid strength | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 158. Select the stronger acid from each pair:  ​  I.         HBr, HI  II         HClO2, HClO3  III        H2SO3, HClO3   |  |  |  | | --- | --- | --- | |  | a. | HI        HClO2     HClO3 | |  | b. | HBr     HClO3        H2SO3 | |  | c. | HI        HClO3        H2SO3 | |  | d. | HBr     HClO2         HClO3 | |  | e. | HI        HClO3         HClO3 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | molecular structure and acid strength | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 2/22/2017 2:02 AM | |

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| 159. Which is the stronger acid in each of the following pairs?  ​  I.       HClO2 or HClO3  II.      H2S or H2Se  III.     H3AsO4 or H2SeO4   |  |  |  | | --- | --- | --- | |  | a. | I. HClO3      II. H2S         III. H2SeO4 | |  | b. | I.HClO2       II. H2S         III. H2SeO4 | |  | c. | I. HClO3      II. H2Se       III. H3AsO4 | |  | d. | I. HClO2      II. H2Se       III. H3AsO4 | |  | e. | I. HClO3      II. H2Se       III. H2SeO4 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | molecular structure and acid strength | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 2/22/2017 2:01 AM | |

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| 160. Which of the following statements is false?   |  |  |  | | --- | --- | --- | |  | a. | HBrO3 is a stronger acid than HBrO2 | |  | b. | H2S is a stronger acid than H2O | |  | c. | nitrite is a stronger base than nitrate | |  | d. | HClO3 is a weaker acid than H2SO3 | |  | e. | SbH3 is a weaker acid than H2Te |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | molecular structure and acid strength | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |

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| 161. Which of the following statements is false?   |  |  |  | | --- | --- | --- | |  | a. | HClO3 is a weaker acid than HBr | |  | b. | H3PO3 is a weaker acid than H3PO4 | |  | c. | HClO3 is a stronger acid than H3PO3 | |  | d. | F- is a weaker base than Br- | |  | e. | The anion ClO3- is a weaker base than the anion H2PO3- |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 14.9 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | acid and base strength | acids and bases | Chemistry | general chemistry | molecular structure and acid strength | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:29 PM | | *DATE MODIFIED:* | 3/4/2016 4:29 PM | |