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| 1. Which of the following is true about a system at equilibrium?   |  |  |  | | --- | --- | --- | |  | a. | The concentration(s) of the reactant(s) is equal to the concentration(s) of the product(s). | |  | b. | No new product molecules are formed. | |  | c. | The concentration(s) of reactant(s) is constant over time. | |  | d. | The rate of the reverse reaction is equal to the rate of the forward reaction and both rates are equal to zero. | |  | e. | None of the above (A-D) is true. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | 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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| 2. Which of the following is true about chemical equilibrium?   |  |  |  | | --- | --- | --- | |  | a. | It is microscopically and macroscopically static. | |  | b. | It is microscopically and macroscopically dynamic. | |  | c. | It is microscopically static and macroscopically dynamic. | |  | d. | It is microscopically dynamic and macroscopically static. | |  | e. | None of these are true about chemical equilibrium. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | 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. Equilibrium is reached in chemical reactions when:   |  |  |  | | --- | --- | --- | |  | a. | The rates of the forward and reverse reactions become equal. | |  | b. | The concentrations of reactants and products become equal. | |  | c. | The temperature shows a sharp rise. | |  | d. | All chemical reactions stop. | |  | e. | The forward reaction stops. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | 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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| 4. For a particular system at a particular temperature there \_\_\_\_\_\_ equilibrium constant(s) and there \_\_\_\_\_\_\_ equilibrium position(s).   |  |  |  | | --- | --- | --- | |  | a. | are infinite; is one | |  | b. | is one; are infinite | |  | c. | is one; is one | |  | d. | are infinite; are infinite | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | 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. For the reaction given below, 2.00 moles of A and 3.00 moles of B are placed in a 6.00-L container.    At equilibrium, the concentration of A is 0.261 mol/L. What is the concentration of B at equilibrium?   |  |  |  | | --- | --- | --- | |  | a. | 0.261 mol/L | |  | b. | 0.355 mol/L | |  | c. | 0.500 mol/L | |  | d. | 0.522 mol/L | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 5:46 AM | |

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| 6. The value of the equilibrium constant, *K*, is dependent on:   |  |  | | --- | --- | | I. | the temperature of the system | | II. | the nature of the reactants and products | | III. | the concentration of the reactants | | IV. | the concentration of the products |   ​   |  |  |  | | --- | --- | --- | |  | a. | I, II | |  | b. | II, III | |  | c. | III, IV | |  | d. | It is dependent on three of the above choices. | |  | e. | It is not dependent on any of the above choices. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/8/2017 12:35 AM | |

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| 7. If the equilibrium constant for A + B  C is 0.175, then the equilibrium constant for 2C  2A + 2B is   |  |  |  | | --- | --- | --- | |  | a. | 0.650 | |  | b. | 5.71 | |  | c. | 0.350 | |  | d. | 32.7 | |  | e. | 0.175 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | 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. Indicate the mass action expression for the following reaction: 2X(*g*) + Y(*g*) 3W(*g*) + V(*g*)   |  |  |  | | --- | --- | --- | |  | a. | [X]2[Y][W]3[V] | |  | b. |  | |  | c. |  | |  | d. |  | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | definition of equilibrium constant Kc | equilibrium constant | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 9. If, at a given temperature, the equilibrium constant for the reaction H2(*g*) + Cl2(*g*)  2HCl(*g*) is *K*p, then the equilibrium constant for the reaction HCl(*g*) → H2(*g*) + Cl2 (*g*) can be represented as:   |  |  |  | | --- | --- | --- | |  | a. |  | |  | b. | *K*p2 | |  | c. |  | |  | d. |  | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | definition of equilibrium constant Kc | equilibrium constant | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 10. Apply the law of mass action to determine the equilibrium expression for 2NO2Cl(*aq*) 2NO2(*aq*) + Cl2(*aq*).   |  |  |  | | --- | --- | --- | |  | a. | *K* = 2[NO2][Cl2]/2[NO2Cl] | |  | b. | *K* = 2[NO2Cl]/2[NO2][Cl2] | |  | c. | *K* = [NO2Cl]2/[NO2]2[Cl2] | |  | d. | *K* = [NO2]2[Cl2]/[NO2Cl]2 | |  | e. | *K* = [NO2Cl]2[NO2]2[Cl2] |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | definition of equilibrium constant Kc | equilibrium constant | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 11. At a given temperature, *K* = 0.035 for the equilibrium:  PCl5(*g*)    PCl3(*g*) + Cl2(*g*)  What is *K* for:  Cl2(*g*) + PCl3(*g*)    PCl5(*g*)?   |  |  |  | | --- | --- | --- | |  | a. | 0.035 | |  | b. | 29 | |  | c. | 0.00123 | |  | d. | 35 | |  | e. | 810 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *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 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 5:50 AM | |

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| 12.  Given the equilibrium constants for the following reactions:  ​  4Cu(*s*) + O2(*g*)    2Cu2O(*s*), *K*1 2CuO(*s*)    Cu2O(*s*) + O2(*g), K*2  ​  what is *K* for the system  ​  2Cu(*s*) + O2(*g*)    2CuO(*s*)  ​  equivalent to?   |  |  |  | | --- | --- | --- | |  | a. | (*K*1)(*K*2) | |  | b. | [(K2) / (K1)] | |  | c. | [(K1) / (K2)] | |  | d. | (K1) / (K2) | |  | e. | (*K*1)(*K*2) |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.2 | | *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:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 4/5/2017 7:15 AM | |

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| 13. Which expression correctly describes the equilibrium constant for the following reaction?  2C2H2(*g*) + 5O2(*g*)    4CO2(*g*) + 2H2O(*g*)   |  |  |  | | --- | --- | --- | |  | a. | *K* =  ( 2C2H2] + 5[O2] ) / ( 4[CO2] + 2[H2O] ) | |  | b. | *K* =  ( 4[CO2] + 2[H2O] ) / (2C2H2] + 5[O2] ) | |  | c. | *K* = ( [CO2][H2O] ) / ( [C2H2][O2] ) | |  | d. | *K* = ( [CO2]4[H2O]2 ) / ( [[C2H2]2[O2]5 ) | |  | e. | *K* = ( [C2H2]2[O2]5 )   / ( [CO2]4[H2O]2 ) |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | definition of equilibrium constant Kc | equilibrium constant | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 5:17 AM | |

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| Consider the chemical system CO + Cl2 COCl2; *K* = 4.6 × 109 L/mol. |

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| 14. How do the equilibrium concentrations of the reactants compare to the equilibrium concentration of the product?   |  |  |  | | --- | --- | --- | |  | a. | They are much smaller. | |  | b. | They are much bigger. | |  | c. | They are about the same. | |  | d. | They have to be exactly equal. | |  | e. | You can't tell from the information given. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-1 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | qualitatively interpreting the equilibrium constant | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 15. If the concentration of the product were to double, what would happen to the equilibrium constant?   |  |  |  | | --- | --- | --- | |  | a. | It would double its value. | |  | b. | It would become half its current value. | |  | c. | It would quadruple its value. | |  | d. | It would not change its value. | |  | e. | It would depend on the initial conditions of the product. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-1 | | *KEYWORDS:* | chemical equilibrium | Chemistry | definition of equilibrium constant Kc | equilibrium constant | 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. Determine the equilibrium constant for the system N2O4  2NO2 at 25°C. The  concentrations are shown here: [N2O4] = 2.48× 10–2*M*, [NO2] = 1.41 × 10–2*M*.   |  |  |  | | --- | --- | --- | |  | a. | 0.569 | |  | b. | 1.76 | |  | c. | 1.25 × 102 | |  | d. | 0.323 | |  | e. | 8.02 × 10–3 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | definition of equilibrium constant Kc | equilibrium constant | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 6:11 AM | |

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| 17. If *K* = 0.121 for A2 + 2B    2AB, then for 4AB    2A2 + 4B, *K* would equal:   |  |  |  | | --- | --- | --- | |  | a. | 0.242 | |  | b. | 0.121 | |  | c. | –0.121 | |  | d. | 4.13 | |  | e. | 68.3 |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *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:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 18. Consider the gaseous reaction CO(*g*) + Cl2(*g*) COCl2(*g*). What is the expression for *K*p in terms of *K*?   |  |  |  | | --- | --- | --- | |  | a. | *K*(*RT*) | |  | b. | *K*/(*RT*) | |  | c. | *K*(*RT*)2 | |  | d. | *K*/(*RT*)2 | |  | e. | 1/*K*(*RT*) |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | the equilibrium constant Kp | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 19. For the reaction N2O4(*g*)  2NO2(*g*), *K*p = 0.148 at a temperature of 298 K. What is *K*p for the following reaction?  16NO2(*g*)  8N2O4(*g*)   |  |  |  | | --- | --- | --- | |  | a. | 6.76 | |  | b. | 1.18 | |  | c. | 0.845 | |  | d. | 4.34 × 106 | |  | e. | 2.3 × 10–7 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.3 | | *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:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 6:19 AM | |

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| 20. For the reaction H2(*g*) + Cl2(*g*)  2HCl(*g*), *K*c = 4.59 × 1031 at a temperature of 315 K. What is *K*p at this temperature?   |  |  |  | | --- | --- | --- | |  | a. | 4.59 × 1031 | |  | b. | 1.19 × 1033 | |  | c. | 1.77 × 1030 | |  | d. | 3.07 × 1034 | |  | e. | 6.87 × 1028 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | the equilibrium constant Kp | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/13/2017 3:17 AM | |

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| 21. For the reaction NO(*g*) + O2(*g*)   NO2(*g*) at 750°C, the equilibrium constant *K*c equals:   |  |  |  | | --- | --- | --- | |  | a. | 1.0 | |  | b. | *K*p | |  | c. | *K*p (*RT*) | |  | d. | *K*p (*RT*) | |  | e. | *K*p(*RT*) |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | the equilibrium constant Kp | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 4/5/2017 7:26 AM | |

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| 22. An equilibrium reaction, A2(*g*) + 3B2(*g*)  2C(*g*), has a *K*p at 225°C of 4.5 × 10–3 /atm2. What is *K* for this reaction at that temperature?   |  |  |  | | --- | --- | --- | |  | a. | 2.7 × 10–6 | |  | b. | 1.3 × 10–5 | |  | c. | 7.5 | |  | d. | 1.1 × 10–4 | |  | e. | 2.7 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | the equilibrium constant Kp | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/6/2017 6:34 AM | |

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| 23. Find the value of the equilibrium constant (*K*) (at 500 K) for N2(*g*) + 3H2(*g*) 2NH3(*g*). The value for *K*p at 500 K is 1.5 × 10–5/atm2.   |  |  |  | | --- | --- | --- | |  | a. | 7.5 × 10–2 | |  | b. | 1.3 × 10–2 | |  | c. | 9.6 × 10–2 | |  | d. | 2.5 × 10–2 | |  | e. | 6.0 × 10–2 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | the equilibrium constant Kp | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 24. Consider the following reaction: CS2(*g*) + 4H2(*g*)  CH4(*g*) + 2H2S(*g*). The equilibrium constant *K* is about 0.27 at 900.°C. What is *K*p at this temperature?   |  |  |  | | --- | --- | --- | |  | a. | 2.5 × 103 | |  | b. | 2.8 × 10–3 | |  | c. | 2.9 × 10–5 | |  | d. | 2.6 × 101 | |  | e. | 1.1 × 10–3 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | the equilibrium constant Kp | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 25. Given the equation 2NOCl2(*g*)  2NO(*g*) + Cl2(*g*), the equilibrium constant is about 0.0151 at 115°C. Calculate *K*p.   |  |  |  | | --- | --- | --- | |  | a. | 0.0151 | |  | b. | 0.481 | |  | c. | 0.142 | |  | d. | 15.3 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | the equilibrium constant Kp | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 26. Calculate *K*p for using the following data:   |  |  | | --- | --- | |  | *K*p = 2.3 × 106 | |  | *K*p = 1.8 × 1037 |  |  |  |  | | --- | --- | --- | |  | a. | 4.1 × 1043 | |  | b. | 2.1 × 1043 | |  | c. | 2.9 × 10–25 | |  | d. | 5.4 × 10–13 | |  | e. | 9.8 × 10–13 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.3 | | *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:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 27. Consider the reaction:           CaCl2(s) + 2H2O(g) CaCl2·2H2O(s)  The equilibrium constant for the reaction as written is:   |  |  |  | | --- | --- | --- | |  | a. | *K* = | |  | b. |  | |  | c. |  | |  | d. | *K* = [H2O]2 | |  | e. | *K* = |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | heterogeneous and homogeneous equilibrium | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 6:45 AM | |

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| 28. Consider the reaction At 1273 K, the *K*p value is 167.5. What is the at equilibrium if the is 0.25 atm at this temperature?   |  |  |  | | --- | --- | --- | |  | a. | 3.2 atm | |  | b. | 0.130 atm | |  | c. | 13 atm | |  | d. | 6.5 atm | |  | e. | 9.2 atm |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| Consider the following equilibrium: H2(*g*) + I2(*s*) 2HI(*g*) |

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| 29. The proper *K*eq expression is:   |  |  |  | | --- | --- | --- | |  | a. |  | |  | b. |  | |  | c. |  | |  | d. |  | |  | e. |  |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-2 | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | heterogeneous and homogeneous equilibrium | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 30. Which of the following statements about the equilibrium is false?   |  |  |  | | --- | --- | --- | |  | a. | If the system is heated, the right side is favored. | |  | b. | This is a heterogeneous equilibrium. | |  | c. | If the pressure on the system is increased by changing the volume, the left side is favored. | |  | d. | Adding more H2(*g*) increases the equilibrium constant. | |  | e. | Removing HI as it forms forces the equilibrium to the right. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-2 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 31. Consider the reaction: 2SO2(*g*) + O2(*g*) 2SO3(*g*) at constant temperature. Initially a container is filled with pure SO3(*g*) at a pressure of 2 atm, after which equilibrium is reached. If *y* is the partial pressure of O2 at equilibrium, the value of *K*p is:   |  |  |  | | --- | --- | --- | |  | a. |  | |  | b. |  | |  | c. |  | |  | d. |  | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-2 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 32. Which of the following is true for a system whose equilibrium constant is relatively small?   |  |  |  | | --- | --- | --- | |  | a. | It will take a short time to reach equilibrium. | |  | b. | It will take a long time to reach equilibrium. | |  | c. | The equilibrium lies to the left. | |  | d. | The equilibrium lies to the right. | |  | e. | Two of these. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | qualitatively interpreting the equilibrium constant | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 33. The reaction quotient for a system is 7.2 × 102. If the equilibrium constant for the system is 36, what will happen as equilibrium is approached?   |  |  |  | | --- | --- | --- | |  | a. | There will be a net gain in product. | |  | b. | There will be a net gain in reactant. | |  | c. | There will be a net gain in both product and reactant. | |  | d. | There will be no net gain in either product or reactant. | |  | e. | The equilibrium constant will decrease until it equals the reaction quotient. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | predicting the direction of reaction | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 34. Consider the following reaction:            2HF(*g*)  H2(*g*) + F2(*g*)          (*K* = 1.00  10–2)  Given 1.00 mole of HF(*g*), 0.291 mole of H2(*g*), and 0.750 mole of F2(*g*) are mixed in a 5.00 L flask, determine the reaction quotient, *Q*.   |  |  |  | | --- | --- | --- | |  | a. | *Q* = 0.0437 | |  | b. | *Q* = 0.218 | |  | c. | *Q* = 0.0546 | |  | d. | *Q* = 2.04 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | predicting the direction of reaction | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| Nitric oxide, an important pollutant in air, is formed from the elements nitrogen and oxygen at high temperatures, such as those obtained when gasoline burns in an automobile engine. At 2000°C, *K* for the reaction N2(*g*) + O2(*g*) 2NO(*g*) is 0.01. |

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| 35. Predict the direction in which the system will move to reach equilibrium at 2000°C if 0.4 moles of N2, 0.1 moles of O2, and 0.08 moles of NO are placed in a 1.0-liter container.   |  |  |  | | --- | --- | --- | |  | a. | The system remains unchanged. | |  | b. | The concentration of NO will decrease; the concentrations of N2 and O2 will increase. | |  | c. | The concentration of NO will increase; the concentrations of N2 and O2 will decrease. | |  | d. | The concentration of NO will decrease; the concentrations of N2 and O2 will remain unchanged. | |  | e. | More information is necessary. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-3 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | predicting the direction of reaction | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 36. A 1-L container originally holds 0.4 mol of N2, 0.1 mol of O2, and 0.08 mole of NO. If the volume of the container holding the equilibrium mixture of N2, O2, and NO is decreased to 0.5 L without changing the quantities of the gases present, how will their concentrations change?   |  |  |  | | --- | --- | --- | |  | a. | The concentration of NO will increase; the concentrations of N2 and O2 will decrease. | |  | b. | The concentrations of N2 and O2 will increase; and the concentration of NO will decrease. | |  | c. | The concentrations of N2, O2, and NO will increase. | |  | d. | The concentrations of N2, O2, and NO will decrease. | |  | e. | There will be no change in the concentrations of N2, O2, and NO. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-3 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 37. Consider the following equilibrated system: 2NO2(*g*)  2NO(*g*) + O2(*g*). If the *K*p value is 0.648, find the equilibrium pressure of the O2 gas if the NO2 gas pressure is 0.520 atm and the *P*NO is 0.300 atm at equilibrium.   |  |  |  | | --- | --- | --- | |  | a. | 1.12 atm | |  | b. | 26.6 atm | |  | c. | 0.374 atm | |  | d. | 0.216 atm | |  | e. | 1.95 atm |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 6:56 AM | |

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| 38. For the reaction given below, 2.00 moles of A and 3.00 moles of B are placed in a 6.00-L container.            A(*g*) + 2B(*g*)  C(*g*)  At equilibrium, the concentration of A is 0.232 mol/L. What is the value of *K*?   |  |  |  | | --- | --- | --- | |  | a. | 1.47 | |  | b. | 1.15 | |  | c. | 0.232 | |  | d. | 4.94 | |  | e. | 0.437 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 39. A 10.0-g sample of solid NH4Cl is heated in a 5.00-L container to 900.°C. At equilibrium the pressure of NH3(*g*) is 1.27 atm.            NH4Cl(*s*)  NH3(*g*) + HCl(*g*)  The equilibrium constant, *K*p, for the reaction is:   |  |  |  | | --- | --- | --- | |  | a. | 1.27 | |  | b. | 1.61 | |  | c. | 2.54 | |  | d. | 5.81 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | heterogeneous and homogeneous equilibrium | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 40. Consider the reaction H2 + I2  2HI for which *K* = 39.1 at a high temperature. If an equimolar mixture of reactants gives the concentration of the product to be 0.50 *M* at equilibrium, determine the equilibrium concentration of the hydrogen.   |  |  |  | | --- | --- | --- | |  | a. | 1.1 × 10–1 *M* | |  | b. | 8.0 × 10–2 *M* | |  | c. | 4.0 × 10–2 *M* | |  | d. | 1.3 × 101 *M* | |  | e. | 6.4 × 10–3 *M* |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 41. Consider the equation A(*aq*) + 2B(*aq*) 3C(*aq*) + 2D(*aq*). In one experiment, 45.0 mL of 0.050 *M* A is mixed with 25.0 mL 0.100 *M* B.  At equilibrium the concentration of C is 0.0410 *M*. Calculate *K*.   |  |  |  | | --- | --- | --- | |  | a. | 7.3 | |  | b. | 0.34 | |  | c. | 0.040 | |  | d. | 0.14 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 42. The reaction:            H2(*g*) + I2(*g*)  2HI(*g*)  has *K*p = 45.9 at 763 K. A particular equilibrium mixture at that temperature contains gaseous HI at a partial pressure of 4.00 atm and hydrogen gas at a partial pressure of 0.185 atm. What is the partial pressure of I2?   |  |  |  | | --- | --- | --- | |  | a. | 0.185 atm | |  | b. | 0.471 atm | |  | c. | 1.88 atm | |  | d. | 11.0 atm | |  | e. | 86.5 atm |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 43. For the equilibrium system:  CO2(*g*) + H2(*g*)    CO(*g*) + H2O(*g*)     *H* = +42 kJ/mol  *K* equals 1.6 at 1260 K. If 0.15 mol each of CO2, H2, CO, and H2O (all at 1260 K) were placed in a 1.0-L thermally insulated vessel that was also at 1260 K, then as the system came to equilibrium:   |  |  |  | | --- | --- | --- | |  | a. | The temperature would decrease and the mass of CO2 would increase. | |  | b. | The temperature would decrease and the mass of CO2 would decrease. | |  | c. | The temperature would remain constant and the mass of CO2 would increase. | |  | d. | The temperature would increase and the mass of CO2 would increase. | |  | e. | The temperature would increase and the mass of CO2 would decrease. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | predicting the direction of reaction | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 44. CS2(*g*) + 3Cl2(*g*)    CCl4(*g*) + S2Cl2(*g*)  At a given temperature, the reaction above is at equilibrium when [CS2] = 0.050 *M*, [Cl2] = 0.25 *M*, [CCl4] = 0.15 *M*, and [S2Cl2] = 0.35 *M*. What would be the direction of the reaction when the reactants and products have the following concentrations: CS2 = 0.15 *M*, Cl2 = 0.22 *M*, CCl4 = 0.31 *M*, and S2Cl2 = 0.36 *M*?   |  |  |  | | --- | --- | --- | |  | a. | to the right | |  | b. | to the left | |  | c. | no change | |  | d. | cannot predict unless we know the temperature | |  | e. | cannot predict unless we know whether the reaction is endothermic or exothermic |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | predicting the direction of reaction | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 45. A mixture of nitrogen and hydrogen was allowed to come to equilibrium at a given temperature.  3H2 + N2    2NH3  An analysis of the mixture at equilibrium revealed 2.0 mol N2, 3.2 mol H2, and 1.8 mol NH3. How many moles of H2 were present at the beginning of the reaction?   |  |  |  | | --- | --- | --- | |  | a. | 3.2 | |  | b. | 4.8 | |  | c. | 5.0 | |  | d. | 5.9 | |  | e. | 4.4 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 46. Carbon disulfide and chlorine react according to the following equation:  CS2(*g*) + 3Cl2(*g*)    S2Cl2(*g*) + CCl4(*g*)  When 1.14 mol of CS2 and 4.80 mol of Cl2 are placed in a 2.00-L container and allowed to come to equilibrium, the mixture is found to contain 0.650 mol of CCl4. How many moles of Cl2 are present at equilibrium?   |  |  |  | | --- | --- | --- | |  | a. | 0.490 mol | |  | b. | 0.650 mol | |  | c. | 2.85 mol | |  | d. | 3.50 mol | |  | e. | 1.43 mol |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 47. Initially 2.0 moles of N2(*g*) and 4.0 moles of H2(*g*) were added to a 1.0-liter container and the following reaction then occurred:            3H2(*g*) + N2(*g*)  2NH3(*g*)  The equilibrium concentration of NH3(*g*) = 0.62 moles/liter at 700.°C. The value for *K* at 700.°C for the formation of ammonia is:   |  |  |  | | --- | --- | --- | |  | a. | 1.2 × 10–1 | |  | b. | 7.4 × 10–2 | |  | c. | 7.9 × 10–3 | |  | d. | 3.8 × 10–1 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| Consider the following reaction (assume an ideal gas mixture): 2NOBr(*g*) 2NO(*g*) + Br2(*g*)  A 1.0-liter vessel was initially filled with pure NOBr, at a pressure of 4.0 atm, at 300 K. |

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| 48. After equilibrium was established, the partial pressure of NOBr was 3.1 atm. What is *K*p for the reaction?   |  |  |  | | --- | --- | --- | |  | a. | 0.26 | |  | b. | 0.038 | |  | c. | 0.13 | |  | d. | 0.45 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *PREFACE NAME:* | Ref 13-4 | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 49. After equilibrium was reached, the volume was increased to 2.0 liters, while the temperature was kept at 300 K. The result of this change was   |  |  |  | | --- | --- | --- | |  | a. | an increase in *K*p | |  | b. | a decrease in *K*p | |  | c. | a shift in the equilibrium position to the right | |  | d. | a shift in the equilibrium position to the left | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-4 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 50. Nitrogen gas (N2) reacts with hydrogen gas (H2) to form ammonia (NH3). At 200°C in a closed container, 1.0 atm of nitrogen gas is mixed with 2.0 atm of hydrogen gas. At equilibrium, the total pressure is 1.9 atm. Calculate the partial pressure of hydrogen gas at equilibrium.   |  |  |  | | --- | --- | --- | |  | a. | 1.9 atm | |  | b. | 0.35 atm | |  | c. | 2 atm | |  | d. | 0.0 atm | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 51. The following reaction is investigated (assume an ideal gas mixture):            2N2O(*g*) + N2H4(*g*)  3N2(*g*) + 2H2O(*g*)  Initially there are 0.10 moles of N2O and 0.25 moles of N2H4, in a 10.0-L container. If there are 0.048 moles of N2O at equilibrium, how many moles of N2 are present at equilibrium?   |  |  |  | | --- | --- | --- | |  | a. | 2.6 × 10–2 | |  | b. | 5.2 × 10–2 | |  | c. | 7.8 × 10–2 | |  | d. | 1.6 × 10–1 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 7:59 AM | |

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| 52. A 3.00-liter flask initially contains 3.00 mol of gas A and 1.50 mol of gas B. Gas A decomposes according to the following reaction:            3A  2B + C  The equilibrium concentration of gas C is 0.144 mol/L. Determine the equilibrium concentration of gas A.   |  |  |  | | --- | --- | --- | |  | a. | 0.144 *M* | |  | b. | 0.568 *M* | |  | c. | 0.788 *M* | |  | d. | 0.856 *M* | |  | e. | 0.432 *M* |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 53. A 3.00-liter flask initially contains 3.00 mol of gas A and 1.50 mol of gas B. Gas A decomposes according to the following reaction:            3A  2B + C  The equilibrium concentration of gas C is 0.106 mol/L. Determine the equilibrium concentration of gas B.   |  |  |  | | --- | --- | --- | |  | a. | 0.106 *M* | |  | b. | 0.606 *M* | |  | c. | 0.712 *M* | |  | d. | 0.288 *M* | |  | e. | 0.212 *M* |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 8:02 AM | |

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| 54. A 3.00-liter flask initially contains 3.00 mol of gas A and 1.50 mol of gas B. Gas A decomposes according to the following reaction:            3A  2B + C  The equilibrium concentration of gas C is 0.134 mol/L. Determine the value of the equilibrium constant, *K*.   |  |  |  | | --- | --- | --- | |  | a. | 0.172 | |  | b. | 0.132 | |  | c. | 3.19 × 10–3 | |  | d. | 0.370 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 55. A sample of solid NH4NO3 was placed in an evacuated container and then heated so that it decomposed explosively according to the following equation:            NH4NO3(*s*)  N2O(*g*) + 2H2O(*g*)  At equilibrium the total pressure in the container was found to be 2.34 atm at a temperature of 500.°C. Calculate *K*p.   |  |  |  | | --- | --- | --- | |  | a. | 0.608 | |  | b. | 1.22 | |  | c. | 0.475 | |  | d. | 1.90 | |  | e. | 51.3 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 8:07 AM | |

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| Given the equation 2A(*g*) 2B(*g*) + C(*g*). At a particular temperature, *K* = 1.6 × 104. |

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| 56. If you mixed 5.0 mol B, 0.10 mol C, and 0.0010 mol A in a one-liter container, which direction would the reaction initially proceed?   |  |  |  | | --- | --- | --- | |  | a. | To the left. | |  | b. | To the right. | |  | c. | The above mixture is the equilibrium mixture. | |  | d. | Cannot tell from the information given. | |  | e. | None of these (A-D). |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-5 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | predicting the direction of reaction | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 57. Addition of chemical B to an equilibrium mixture of the above will   |  |  |  | | --- | --- | --- | |  | a. | cause [A] to increase | |  | b. | cause [C] to increase | |  | c. | have no effect | |  | d. | cannot be determined | |  | e. | none of the above |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-5 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | removing products or adding reactants | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 58. At a higher temperature, *K* = 1.8 × 10–5. Placing the equilibrium mixture in an ice bath (thus lowering the temperature) will   |  |  |  | | --- | --- | --- | |  | a. | cause [A] to increase | |  | b. | cause [B] to increase | |  | c. | have no effect | |  | d. | cannot be determined | |  | e. | none of the above |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-5 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | temperature change | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 59. Raising the pressure by lowering the volume of the container will   |  |  |  | | --- | --- | --- | |  | a. | cause [A] to increase | |  | b. | cause [B] to increase | |  | c. | have no effect | |  | d. | cannot be determined | |  | e. | none of the above |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-5 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | pressure change | | *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 equilibrium: 2NOCl(*g*) 2NO(*g*) + Cl2(*g*) with *K* = 1.6 × 10–5. In an experiment, 1.00 mole of pure NOCl and 1.00 mole of pure Cl2 are placed in a 1.00-L container. |

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| 60. If *x* moles of NOCl react, what is the equilibrium concentration of NO?   |  |  |  | | --- | --- | --- | |  | a. | *x* | |  | b. | 2*x* | |  | c. | –*x* | |  | d. | –2*x* | |  | e. | *x*2 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-6 | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 61. If *x* moles of NOCl react, what is the equilibrium concentration of Cl2?   |  |  |  | | --- | --- | --- | |  | a. | *x* | |  | b. | *x* | |  | c. | 1 + *x* | |  | d. | 1 + *x* | |  | e. | 1 + 2*x* |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-6 | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 62. At a certain temperature *K* for the reaction 2NO2 N2O4 is 7.5 liters/mole. If 2.0 moles of NO2 are placed in a 2.0-liter container and permitted to react at this temperature, calculate the concentration of N2O4 at equilibrium.   |  |  |  | | --- | --- | --- | |  | a. | 0.39 moles/liter | |  | b. | 0.65 moles/liter | |  | c. | 0.82 moles/liter | |  | d. | 7.5 moles/liter | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 63. Exactly 1.0 mol N2O4 is placed in an empty 1.0-L container and is allowed to reach equilibrium described by the equation  N2O4(*g*)    2NO2(*g*)  If at equilibrium the N2O4 is 25% dissociated, what is the value of the equilibrium constant, *K*c,  for the reaction under these conditions?   |  |  |  | | --- | --- | --- | |  | a. | 0.67 | |  | b. | 0.33 | |  | c. | 3.0 | |  | d. | 0.25 | |  | e. | 2.72 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/20/2017 8:18 AM | |

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| 64. At 500.0 K, one mole of gaseous ONCl is placed in a one-liter container. At equilibrium it is 5.2% dissociated according to the equation shown here: 2ONCl  2NO + Cl2. Determine the equilibrium constant.   |  |  |  | | --- | --- | --- | |  | a. | 7.8 × 10–5 | |  | b. | 1.5 × 10–3 | |  | c. | 5.5 × 10–2 | |  | d. | 9.5 × 10–1 | |  | e. | 1.3 × 104 |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 65. Consider the following equilibrium:            2NOCl(*g*)  2NO(*g*) + Cl2(*g*)  with *K* = 1.6 × 10–5. 1.00 mole of pure NOCl and 0.981 mole of pure Cl2 are placed in a 1.00-L container. Calculate the equilibrium concentration of NO(*g*).   |  |  |  | | --- | --- | --- | |  | a. | 2.02 × 10–3 *M* | |  | b. | 9.81 × 10–1 *M* | |  | c. | 1.02 *M* | |  | d. | 5.71 × 10–3 *M* | |  | e. | 4.04 × 10–3 *M* |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 66. Consider the following equilibrium:            2NOCl(*g*)  2NO(*g*) + Cl2(*g*)  with *K* = 1.6 × 10–5. 1.00 mole of pure NOCl and 0.932 mole of pure Cl2 are placed in a 1.00-L container. Calculate the equilibrium concentration of Cl2(*g*).   |  |  |  | | --- | --- | --- | |  | a. | 1.6 × 10–5 *M* | |  | b. | 0.934 *M* | |  | c. | 0.467 *M* | |  | d. | 2.07 × 10–3 *M* | |  | e. | 4.14 × 10–3 *M* |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 67. For the reaction below, *K*p = 1.16 at 800.°C.            CaCO3(*s*)  CaO(*s*) + CO2(*g*)  If a 39.8-gram sample of CaCO3 is put into a 10.0-L container and heated to 800.°C, what percent of the CaCO3 will react to reach equilibrium?   |  |  |  | | --- | --- | --- | |  | a. | 17.1% | |  | b. | 33.1% | |  | c. | 44.4% | |  | d. | 100.0% | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 68. At –80°C, *K* for the reaction            N2O4(*g*)  2NO2(*g*)  is 4.66 × 10–8. We introduce 0.059 mole of N2O4 into a 1.0-L vessel at –80°C and let equilibrium be established. The total pressure in the system at equilibrium will be:   |  |  |  | | --- | --- | --- | |  | a. | 0.39 atm | |  | b. | 0.93 atm | |  | c. | 1.7 atm | |  | d. | 0.059 atm | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 69. The equilibrium system 2A 2B + C has a very small equilibrium constant: *K* = 2.6 × 10–6. Initially 3.0 moles of A are placed in a 1.5-L flask. Determine the concentration of C at equilibrium.   |  |  |  | | --- | --- | --- | |  | a. | 0.011 *M* | |  | b. | 0.024 *M* | |  | c. | 0.032 *M* | |  | d. | 0.048 *M* | |  | e. | 2.0 *M* |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calculating equilibrium concentrations | chemical equilibrium | Chemistry | general chemistry | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 70. Which of the following statements concerning equilibrium is *not* true?   |  |  |  | | --- | --- | --- | |  | a. | A system that is disturbed from an equilibrium condition responds in a manner to restore equilibrium. | |  | b. | Equilibrium in molecular systems is dynamic, with two opposing processes balancing one another. | |  | c. | The value of the equilibrium constant for a given reaction mixture is the same regardless of the direction from which equilibrium is attained. | |  | d. | A system moves spontaneously toward a state of equilibrium. | |  | e. | The equilibrium constant is independent of temperature. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | 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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| The questions below refer to the following system:   |  |  |  |  | | --- | --- | --- | --- | |  | | Co(H2O)62+ + 4 Cl– CoCl42– + 6H2O | | |  |  | (pink) | (blue) |   When cobalt(II) chloride is added to pure water, the Co2+ ions hydrate. The hydrated form then reacts with the Cl– ions to set up the equilibrium shown here. |

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| 71. Which statement below describes the change that the system will undergo if hydrochloric acid is added?   |  |  |  | | --- | --- | --- | |  | a. | It should become more blue. | |  | b. | It should become more pink. | |  | c. | The equilibrium will shift to the right. | |  | d. | The equilibrium will shift to the left. | |  | e. | Two of these. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-7 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 72. Which statement below describes the change that the system will undergo if water is added?   |  |  |  | | --- | --- | --- | |  | a. | More chloride ions will be produced. | |  | b. | More water will be produced. | |  | c. | The equilibrium will shift to the right. | |  | d. | The color will become more blue. | |  | e. | There will be less of the hydrated cobalt ion at the new equilibrium position. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-7 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 73. Which statement below describes the change that the system will undergo if silver nitrate is added?   |  |  |  | | --- | --- | --- | |  | a. | It should become more blue. | |  | b. | It should become more pink. | |  | c. | Water will be produced. | |  | d. | The silver ion will react with the CoCl42–. | |  | e. | Nothing will change. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-7 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| The following questions refer to the equilibrium shown here: 4NH3(*g*) + 5O2(*g*) 4NO(*g*) + 6H2O(*g*) |

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| 74. What would happen to the system if oxygen were added?   |  |  |  | | --- | --- | --- | |  | a. | More ammonia would be produced. | |  | b. | More oxygen would be produced. | |  | c. | The equilibrium would shift to the right. | |  | d. | The equilibrium would shift to the left. | |  | e. | Nothing would happen. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-8 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | removing products or adding reactants | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 75. What would happen to the system if the pressure were decreased?   |  |  |  | | --- | --- | --- | |  | a. | Nothing would happen. | |  | b. | More oxygen would be produced. | |  | c. | The water vapor would become liquid water. | |  | d. | The ammonia concentration would increase. | |  | e. | The NO concentration would increase. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-8 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | pressure change | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 76. For a certain reaction at 25.0°C, the value of *K* is 1.2 × 10–3.  At 50.0°C the value of *K* is 3.4 × 10–1.  This means that the reaction is   |  |  |  | | --- | --- | --- | |  | a. | exothermic | |  | b. | endothermic | |  | c. | never favorable | |  | d. | more information needed | |  | e. | none of these (A-D) |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-8 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | temperature change | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 77. Ammonia is prepared industrially by the reaction: N2(*g*) + 3H2(*g*) 2NH3(*g*) for the reaction: Δ*H*° = –92.2 kJ and *K* (at 25°C) = 4.0 × 108. When the temperature of the reaction is increased to 500°C, which of the following is true?   |  |  |  | | --- | --- | --- | |  | a. | *K* for the reaction will be larger at 500°C than at 25°C. | |  | b. | At equilibrium, more NH3 is present at 500°C than at 25°C. | |  | c. | Product formation (at equilibrium) is not favored as the temperature is raised. | |  | d. | The reaction of N2 with H2 to form ammonia is endothermic. | |  | e. | None of the above is true. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | temperature change | | *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 equilibrium: 2H2(*g*) + X2(*g*) 2H2X(*g*) + energy |

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| 78. Addition of X2 to a system described by the above equilibrium   |  |  |  | | --- | --- | --- | |  | a. | will cause [H2] to decrease | |  | b. | will cause [X2] to decrease | |  | c. | will cause [H2X] to decrease | |  | d. | will have no effect | |  | e. | cannot possibly be carried out |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-9 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | removing products or adding reactants | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 79. Addition of argon to the above equilibrium   |  |  |  | | --- | --- | --- | |  | a. | will cause [H2] to decrease | |  | b. | will cause [X2] to increase | |  | c. | will cause [H2X] to increase | |  | d. | will have no effect | |  | e. | cannot possibly be carried out |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-9 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 80. Increasing the pressure by decreasing the volume will cause   |  |  |  | | --- | --- | --- | |  | a. | the reaction to occur to produce H2X | |  | b. | the reaction to occur to produce H2 and X2 | |  | c. | the reaction to occur to produce H2 but no more X2 | |  | d. | no reaction to occur | |  | e. | X2 to dissociate |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-9 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | pressure change | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 81. Increasing the temperature will cause   |  |  |  | | --- | --- | --- | |  | a. | the reaction to occur to produce H2X | |  | b. | the reaction to occur to produce H2 and X2 | |  | c. | the reaction to occur to produce H2 but no more X2 | |  | d. | no reaction to occur | |  | e. | an explosion |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 13-9 | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | temperature change | | *OTHER:* | Conceptual | | *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 statements is true?   |  |  |  | | --- | --- | --- | |  | a. | When two opposing processes are proceeding at identical rates, the system is at equilibrium. | |  | b. | Catalysts are an effective means of changing the position of an equilibrium. | |  | c. | The concentration of the products equals that of reactants and is constant at equilibrium. | |  | d. | An endothermic reaction shifts toward reactants when heat is added to the reaction. | |  | e. | None of the above statements is true. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | 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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| 83. Consider the following system at equilibrium: N2(*g*) + 3H2(*g*) 2NH3(*g*) + 92.94 kJ Which of the following changes will shift the equilibrium to the right?   |  |  | | --- | --- | | I. | increasing the temperature | | II. | decreasing the temperature | | III. | increasing the volume | | IV. | decreasing the volume | | V. | removing some NH3 | | VI. | adding some NH3 | | VII. | removing some N2 | | VIII. | adding some N2 |   ​   |  |  |  | | --- | --- | --- | |  | a. | I, IV, VI, VII | |  | b. | II, III, V, VIII | |  | c. | I, VI, VIII | |  | d. | I, III, V, VII | |  | e. | II, IV, V, VIII |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/8/2017 12:44 AM | |

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| 84. Consider the reaction A(*g*) + B(*g*) C(*g*) + D(*g*). You have the gases A, B, C, and D at equilibrium. Upon adding gas A, the value of *K*:   |  |  |  | | --- | --- | --- | |  | a. | increases, because by adding A more products are made, increasing the product to reactant ratio | |  | b. | decreases, because A is a reactant so the product to reactant ratio decreases | |  | c. | does not change, because A does not figure into the product to reactant ratio | |  | d. | does not change, as long as the temperature is constant | |  | e. | depends on whether the reaction is endothermic or exothermic |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 85. Consider the combustion of methane (as represented by the following equation). This is the reaction that occurs for a Bunsen burner, which is a source of heat for chemical reactions in the laboratory.   CH4(*g*) + 2O2(*g*)   CO2(*g*) + 2H2O(*g*) For the system at chemical equilibrium, which of the following explains what happens if the temperature is raised?   |  |  |  | | --- | --- | --- | |  | a. | The equilibrium position is shifted to the right and the value for *K* increases. | |  | b. | The equilibrium position is shifted to the right and the value for *K* decreases. | |  | c. | The equilibrium position is shifted to the left and the value for *K* decreases. | |  | d. | The equilibrium position is shifted to the left and the value for *K* increases. | |  | e. | The equilibrium position is shifted but the value for *K* stays constant. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | temperature change | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 86. Consider the reaction represented by the equation  2SO2(*g*) + O2(*g*) 2SO3(*g*). For the system at chemical equilibrium, which of the following explains what happens after the addition of oxygen gas (assume constant temperature)?   |  |  |  | | --- | --- | --- | |  | a. | The amount of SO3(*g*) increases and the value for *K* increases. | |  | b. | The amount of SO3(*g*) decreases and the value for *K* increases. | |  | c. | The amount of SO3(*g*) stays the same and the value for *K* decreases. | |  | d. | The amount of SO3(*g*) decreases and the value for *K* stays the same. | |  | e. | The amount of SO3(*g*) increases and the value for *K* stays the same. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | removing products or adding reactants | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 87. Consider the reaction represented by the equation: N2(*g*) + 3H2(*g*) 2NH3(*g*). What happens to the equilibrium position when an inert gas is added to this system (as represented above) at equilibrium?   |  |  |  | | --- | --- | --- | |  | a. | If the container is rigid, nothing happens to the equilibrium position. If the container is fitted with a moveable piston, the equilibrium position shifts. | |  | b. | If the container is rigid, the equilibrium position shifts. If the container is fitted with a moveable piston, nothing happens to the equilibrium position. | |  | c. | The equilibrium position shifts no matter what the container is like. | |  | d. | Nothing happens to the equilibrium position no matter what the container is like. | |  | e. | The value of the equilibrium constant must be known to answer this question. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/13/2017 6:00 AM | |

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| 88. Which of the following are true at equilibrium for the reaction A  B?  ​  ​  I.      [A] is no longer changing.  II.     The overall rate of change of [B] is zero.  III.    No new molecules of A are converting into B.  IV.    The value of [B]/[A] is changing in time.   |  |  |  | | --- | --- | --- | |  | a. | I, II, III | |  | b. | I, II | |  | c. | I, II, IV | |  | d. | I, IV | |  | e. | II, III |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/13/2017 6:23 AM | |

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| 89. Which of the following statements is FALSE:   |  |  |  | | --- | --- | --- | |  | a. | At equilibrium, the concentrations of all species are constant | |  | b. | The value of the equilibrium constant depends on the temperature | |  | c. | At equilibrium, the reaction has stopped | |  | d. | At equilibrium, the forward and reverse reactions are happening at the same rate | |  | e. | Pure solids are not included in the equilibrium constant expression. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.1 to 13.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | heterogenous equilibria | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 90. Which of the following statements is true?   |  |  |  | | --- | --- | --- | |  | a. | At equilibrium BOTH the rate of the forward reaction equals that of the reverse reaction AND the rate constant for the forward reaction equals that of the reverse. | |  | b. | The equilibrium state is dynamic even though there is no change in concentrations. | |  | c. | The equilibrium constant for a particular reaction is constant under all conditions. | |  | d. | Starting with different initial concentrations will yield different individual equilibrium concentrations and a different relationship of equilibrium concentrations. | |  | e. | None of these is true. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 91. Which of the following statements concerning equilibrium is TRUE?   |  |  |  | | --- | --- | --- | |  | a. | Catalysts effectively change the position of an equilibrium. | |  | b. | The concentration of the products equals the concentration of reactants for a reaction at equilibrium. | |  | c. | The equilibrium constant may be expressed in terms of pressure or in terms of concentration for **any** reaction. | |  | d. | When two opposing processes proceed at the same rate, the system is at equilibrium. | |  | e. | A system at equilibrium cannot be disturbed. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 to 13.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | heteroegenous equilibria | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 92. In general, the value of the equilibrium constant for a chemical reaction does NOT depend on   |  |  |  | | --- | --- | --- | |  | a. | The temperature of the reaction vessel. | |  | b. | The initial amounts of reactants present. | |  | c. | The total pressure of the reaction vessel. | |  | d. | The volume of the reaction vessel. | |  | e. | The rate constants of the forward and reverse reactions. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |

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| 93. Which of the following statements is true?  I.       The concentration of a pure liquid does not appear in the mass-action expression II.      If Q > K, the reaction will produce more products and less reactants to reach equilibrium  III.     The equilibrium constant of an overall reaction is the product of the equilibrium constants of the individual reactions that add up to the overall reaction IV.     If A   B has a reaction quotient, Q, then n A  n B has a reaction quotient, Qn V.      An equilibrium constant expressed in terms of concentrations can be greater than the corresponding equilibrium constant expressed in terms of pressure, depending on the reaction   |  |  |  | | --- | --- | --- | |  | a. | II, III, IV and V | |  | b. | I, III, IV and V | |  | c. | III and IV | |  | d. | III, IV and V | |  | e. | All are true |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.2 to 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | equilibrium constant | general chemistry | heterogeneous equilibria | preidicting the direction of a reaction | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/13/2017 6:28 AM | |

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| 94. For the gaseous reaction, 2 H2 + 2 NO <=> 2 H2O + N2, Kp at 120oC = 2.42.  At a given moment, it is found that the partial pressures of H2, NO, H2O and N2 are 1.1, 1.3, 0.78 and 2.2 atm, respectively.  Which of the following statements describes the situation?   |  |  |  | | --- | --- | --- | |  | a. | Qp = 1.2 so the reaction goes to the right | |  | b. | Qp = 1.2 so the reaction goes to the left | |  | c. | Qp = 0.65 so the reaction goes to the right | |  | d. | Qp = 0.65 so the reaction goes to the left | |  | e. | The reaction is at equilibrium |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | predicting the direction of reaction | using the equilibrium constant | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 2/21/2017 2:06 AM | |

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| 95. What effect does a) increasing the total pressure and b) increasing the temperature have on the equilibrium H2(g) + CO2(g)  H2O(g) + CO(g), ΔHo = 41.2 kJ/mol.  ​   |  |  |  | | --- | --- | --- | |  | a. | a)  equilibrium shifts towards products,     b) equilibrium shifts towards products. | |  | b. | a)  equilibrium shifts towards reactants,     b) equilibrium shifts towards products. | |  | c. | a)  equilibrium shifts towards products,     b) equilibrium shifts towards reactants. | |  | d. | a)  no change in the equilibrium,                b) equilibrium shifts towards products. | |  | e. | a)  no change in the equilibrium,                b) equilibrium shifts towards reactants. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/13/2017 6:42 AM | |

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| 96. Consider the endothermic reaction 2 BrCl(g)  Br2(g) + Cl2(g). What will be the effect on the equilibrium of  a)       changing the volume at constant temperature?  b)       increasing the temperature at constant volume   |  |  |  | | --- | --- | --- | |  | a. | a) equilibrium shifts towards products,       b) equilibrium shifts towards products. | |  | b. | a) equilibrium shifts towards reactants,       b) equilibrium shifts towards products. | |  | c. | a) equilibrium shifts towards products,        b) equilibrium shifts towards reactants. | |  | d. | a) no change in the equilibrium,                   b) equilibrium shifts towards products. | |  | e. | a) no change in the equilibrium,                   b) equilibrium shifts towards reactants. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/13/2017 6:44 AM | |

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| 97. Consider the reaction, which is exothermic as written, PCl5(g)  PCl3(g) + Cl2(g).  Which of the following changes would result in the production of MORE Cl2(g)?  ​  I.       adding PCl3(g)  II.      removing PCl3(g)  III.     reducing the volume of the container  IV.     removing PCl5(g)  V.       increasing the temperature  VI.     increasing the volume of the container  VII.    adding PCl5(g)  VIII.   reducing the temperature  IX.     adding a suitable catalyst   |  |  |  | | --- | --- | --- | |  | a. | I, IV, V, VI | |  | b. | II, VI, VII, VIII | |  | c. | II, III, VII, VIII | |  | d. | II, V, VI, VII | |  | e. | II, VI, VII, VIII, IX |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/13/2017 6:45 AM | |

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| 98. Consider the reaction, which is exothermic as written, PCl5(g)  PCl3(g) + Cl2(g).  Which of the following changes would result in the production of LESS Cl2(g)?  ​  I.       adding PCl3(g)  II.      removing PCl3(g)  III.     reducing the volume of the container  IV.     removing PCl5(g)  V.       increasing the temperature  VI.     increasing the volume of the container  VII.    adding PCl5(g)  VIII.   reducing the temperature  IX.     adding a suitable catalyst   |  |  |  | | --- | --- | --- | |  | a. | II, III, VII, VIII | |  | b. | I, III, IV, V | |  | c. | I, III, IV, VIII | |  | d. | I, V, VI, VII | |  | e. | I, III, IV, V,  IX |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/13/2017 6:46 AM | |

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| 99. The following reaction is allowed to reach equilibrium is a glass bulb at a given temperature.  2 HgO(s) ⇔ 2 Hg(l) + O2(g) ΔH = 43.4 kcal/mol.  The mass of HgO in the bulb could be increased by:   |  |  |  | | --- | --- | --- | |  | a. | removing some Hg | |  | b. | reducing the volume of the bulb | |  | c. | adding more Hg | |  | d. | increasing the temperature | |  | e. | removing some O |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 13.7 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | chemical equilibrium | Chemistry | general chemistry | Le Chatelier's principle | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:28 PM | | *DATE MODIFIED:* | 3/4/2016 4:28 PM | |