1. Calculate the molarity of a solution made by dissolving 23.4g of sodium sulfate in enough water to form 125ml of solution?
2. 2.62M
3. 1.32M
4. 4.24M
5. 0.18M
6. 1.87M
7. The average adult human male has a total blood volume of 5.0L. If the concentration of sodium ion in this average individual is 0.135M, What is the mass of sodium ion circulating in the blood?
8. 25g
9. 22.9g
10. 15.5g
11. 30g
12. 7.5g
13. What mass of lithium nitrate would have to be dissolved in 30.0 g of water in order to make an 18.0% solution?
14. 12.4g
15. 2.45g
16. 5.86g
17. 6.59g
18. 9.73g
19. What is the molarity of a solution that contains 390.0 g of acetic acid, CH3COOH, dissolved in enough acetone to make 1000.0 mL of solution?
20. 8.73g
21. 2.34g
22. 6.49g
23. 1.23g
24. 5.23g
25. What mass of ammonium chloride is dissolved in 300. mL of a 0.875 M solution?
26. 14.0g
27. 28.0g
28. 7.0g
29. 3.5g
30. 12.0g

**S-35\***

1. Describe what you would do to prepare 100.0 g of a 3.5% solution of ammonium sulfate in water.
2. 0.035g (NH4)2SO4 in 100g H2O
3. 3.5g (NH4)2SO4 in 100g H2O
4. 3.5g (NH4)2SO4 in 1g H2O
5. 3.5g (NH4)2SO4 in 96.5ml H2O
6. 0.35g (NH4)2SO4 in 100g H2O
7. What mass of barium nitrate is dissolved in 21.29 mL of a 3.38 M solution?
8. 261.37g
9. 25.34g
10. 18.8g
11. 130.5g
12. 15.34g

|  |  |
| --- | --- |
| 1 | B |
| 2 | C |
| 3 | D |
| 4 | C |
| 5 | A |
| 6 | D |
| 7 | C |

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| --- | --- | --- |
| 1. | In a KCl Solution, water is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_, and Potassium Chloride is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_. | |
| A) | Solute, Solution |
| B) | Solute, Solvent |
| C) | Solvent, Solute |
| D) | Solvent, Solution |
| E) | Solution, Solute |

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| --- | --- | --- |
| 2. | An oven-cleaning solution is 40.0% (by mass) NaOH. If one jar of this product contains 465 g of solution, how much NaOH does it contain? | |
| A) | 1.16  103 g |
| B) | 11.6 g |
| C) | 186 g |
| D) | 18.6 g |
| E) | none of these |

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| 3. | A 118.2-g sample of nitric acid solution that is 70.0% HNO3 (by mass) contains | |
| A) | 82.7 mol HNO3 |
| B) | 1.31 mol HNO3 |
| C) | 1.88 mol HNO3 |
| D) | 5.21  103 mol HNO3 |
| E) | none of these |

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| 4. | You have two solutions of sodium chloride. One is a 2.00 *M* solution, the other is a 4.00 *M* solution. You have much more of the 4.00 *M* solution, and you add the solutions together. Which of the following could be the concentration of the final solution? | |
| A) | 2.60 *M* |
| B) | 3.00 *M* |
| C) | 3.80 *M* |
| D) | 6.00 *M* |
| E) | 7.20 *M* |

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| 5. | A 60.7-g sample of SrCl2 is dissolved in 112.5 mL of solution. Calculate the molarity of this solution. | |
| A) | 0.383 *M* |
| B) | 3.40 *M* |
| C) | 0.0431 *M* |
| D) | 4.72 *M* |
| E) | none of these |

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| --- | --- | --- |
| 6. | What volume of 12.0 *M* nitric acid is required to prepare 6.67 L of 0.100 *M* nitric acid? | |
| A) | 0.180 L |
| B) | 18.0 L |
| C) | 0.667 L |
| D) | 0.0556 L |
| E) | 1.80 L |

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| 7. | What volume of 13.1 *M* H2SO4 is required to prepare 12.0 L of 0.156 *M* sulfuric acid? (Ignore significant figures for this problem.) | |
| A) | 170 mL |
| B) | 2.04 L |
| C) | 84 mL |
| D) | 143 mL |
| E) | 1.01 L |

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| 8. | Determine the molarity of a solution containing 6.92 g BaCl2 in 750.0 mL of solution. | |
| A) | 3.32  10-2 M |
| B) | 2.49  10-2 M |
| C) | 9.23  10-3M |
| D) | 4.43  10-2 M |
| E) | 9.23 M |

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| 9. | What is the molarity of a HNO3 solution prepared by adding 164.8 mL of water to 350.0 mL of 12.3 M HNO3? | |
| A) | 26.1 M |
| B) | 6.33 M |
| C) | 8.36 M |
| D) | 2.22 M |
| E) | 2.03 M |

**Answer Key**

|  |  |
| --- | --- |
| 1. | C |
| 2. | C |
| 3. | B |
| 4. | C |
| 5. | B |
| 6. | D |
| 7. | D |
| 8. | D |
| 9. | C |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1. | Tabulated below are initial rate data for the reaction  **2Fe(CN)63– + 2I–  2Fe(CN)64– + I2**   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  |  |  |  |  | Initial | | **Run** | [Fe(CN)63–]0 | [I–]0 | [Fe(CN)64–]0 | [I2]0 | Rate (M/s) | | 1 | 0.01 | 0.01 | 0.01 | 0.01 | 1  10–5 | | 2 | 0.01 | 0.02 | 0.01 | 0.01 | 2  10–5 | | 3 | 0.02 | 0.02 | 0.01 | 0.01 | 8  10–5 | | 4 | 0.02 | 0.02 | 0.02 | 0.01 | 8  10–5 | | 5 | 0.02 | 0.02 | 0.02 | 0.02 | 8  10–5 |   The experimental rate law is: | |
| A) | = *k*[Fe(CN)63–]2[I–]2[Fe(CN)64–]2[I2] |
| B) | = *k*[Fe(CN)63–]2[I–][Fe(CN)64–][I2] |
| C) | = *k*[Fe(CN)63–)]2[I–] |
| D) | = *k*[Fe(CN)63–][I–]2 |
| E) | = *k*[Fe(CN)63–][I–] [Fe(CN)64–] |

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| 2. | **4NH3 + 7O2  4NO2 + 6H2O** At a certain instant the initial rate of disappearance of the oxygen gas is X. What is the value of the appearance of water at the same instant? | |
| A) | 1.2 X |
| B) | 1.1 X |
| C) | 0.86 X |
| D) | 0.58 X |
| E) | cannot be determined from the data |

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| 3. | **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* = |

|  |  |  |
| --- | --- | --- |
| 4. | **H2(g) + I2(s) ⇌ 2HI(g)** The proper *K*eq expression is: | |
| A) |  |
| B) |  |
| C) |  |
| D) |  |
| E) |  |

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| 5. | At a certain temperature *K* for the reaction  **2NO2 ⇌ N2O4** is 7.5. 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 |

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| 6. | Equilibrium is reached in chemical reactions when: | |
| A) | the rates of the forward and reverse rxns become equal. |
| B) | the [ ]s of reactants and products become equal. |
| C) | the temperature shows a sharp rise. |
| D) | all chemical reactions stop. |
| E) | the forward reaction stops. |

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| 7. | Determine the equilibrium constant for the system **N2O4 ⇌ 2NO2** at 25°C. The concentrations are shown here: [N2O4] = 2.72  10-2 M, [NO2] = 1.41  10-2 M. | |
| A) | 0.518 |
| B) | 1.93 |
| C) | 1.37  102 |
| D) | 0.269 |
| E) | 7.31  10-3 |

8. The average value for the rate constant k (without units) is

**H2O2 + 3I- + 2H+  I3- + 2H2O**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | [H2O2] | [I-] | [H+] | rate |
| I | 0.100 M | 5.00 10-4 M | 1.00  10-2 M | 0.137 M/sec |
| II. | 0.100 M | 1.00  10-3 M | 1.00  10-2 M | 0.268 M/sec |
| III. | 0.200 M | 1.00  10-3 M | 1.00  10-2 M | 0.542 M/sec |
| IV. | 0.400 M | 1.00  10-3 M | 2.00  10-2 M | 1.084 M/sec |

|  |  |
| --- | --- |
| A) | 2710 |
| B) | 2.74  104 |
| C) | 137 |
| D) | 108 |
| E) | none of these |

|  |  |  |
| --- | --- | --- |
| 9. | Apply the law of mass action to determine the equilibrium expression for  **2NO2Cl(*aq*) ⇌ 2NO2(*aq*) + Cl2(*aq*)** | |
| A) | 2[NO2][Cl2]/2[NO2Cl] |
| B) | 2[NO2Cl]/2[NO2][Cl2] |
| C) | [NO2Cl]2/[NO2]2[Cl2] |
| D) | [NO2]2[Cl2]/[NO2Cl]2 |
| E) | [NO2Cl]2[NO2]2[Cl2] |

Use the following to answer questions 10-12:

Consider the reaction **2H2*(g)* + O2*(g)*  2H2O*(g)***at some equilibrium position. Using the following choices, indicate what will happen if the changes below are made.

a. shifts to the left

b. shifts to the right

c. no change

|  |  |
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| 10. | Additional H2O*(g)* is injected into the reaction vessel. |

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| --- | --- |
| 11. | Some H2*(g)* is removed from the reaction vessel. |

|  |  |
| --- | --- |
| 12. | Some He*(g)* is injected into the reaction vessel. |

Use the following to answer questions 13-14:

The following questions refer to the reaction shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  | Initial Rate of |
|  | Initial [A] | Initial [B] | Disappearance of A |
| Experiment | (mol/L) | (mol/L) | (mol/L·s) |
| 1 | 0.16 | 0.15 | 0.08 |
| 2 | 0.16 | 0.30 | 0.30 |
| 3 | 0.08 | 0.30 | 0.08 |

|  |  |  |
| --- | --- | --- |
| 13. | What is the overall order of this reaction? | |
| A) | 4 |
| B) | 3 |
| C) | 2 |
| D) | 1 |
| E) | 0 |

|  |  |  |
| --- | --- | --- |
| 14. | What is the rate law for this reaction? | |
| A) | Rate = *k*[A][B] |
| B) | Rate = *k*[A]2[B] |
| C) | Rate = *k*[A][B]2 |
| D) | Rate = *k*[A]2[B]2 |
| E) | Rate = *k*[B] |

Use the following to answer questions 15-16:

The reaction **H2SeO3(*aq*) 6I–(*aq*) + 4H+(*aq*)  2I3–(*aq*) + 3H2O(*l*) + Se(s)** was studied at 0°C by the method of initial rates:

|  |  |  |  |
| --- | --- | --- | --- |
| **[H2SeO3]0** | **[H+]0** | **[I–]0** | **Rate (mol/L s)** |
| 1.0  10–4 | 2.0  10–2 | 2.0  10–2 | 1.66  10–7 |
| 2.0  10–4 | 2.0  10–2 | 2.0  10–2 | 3.33  10–7 |
| 3.0  10–4 | 2.0  10–2 | 2.0  10–2 | 4.99  10–7 |
| 1.0  10–4 | 4.0  10–2 | 2.0  10–2 | 6.66  10–7 |
| 1.0  10–4 | 1.0  10–2 | 2.0  10–2 | 0.42  10–7 |
| 1.0  10–4 | 2.0  10–2 | 4.0  10–2 | 13.4  10–7 |
| 1.0  10–4 | 4.0  10–2 | 4.0  10–2 | 3.36  10–7 |

|  |  |  |
| --- | --- | --- |
| 15. | The numerical value of the rate constant is | |
| A) | 5.2  105 |
| B) | 2.1  102 |
| C) | 4.2 |
| D) | 1.9  10–6 |
| E) | none of these |

|  |  |  |
| --- | --- | --- |
| 16. | The rate law is | |
| A) | Rate = *k*[H2SeO3][H+][I–] |
| B) | Rate = *k*[H2SeO3][H+]2[I–] |
| C) | Rate = *k*[H2SeO3][H+][I–]2 |
| D) | Rate = *k*[H2SeO3]2[H+][I–] |
| E) | Rate = *k*[H2SeO3][H+]2[I–]3 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 17. | | What is the rate of reaction for hydrogen ion in the following reaction as it relates to the rate of reaction of dichromate ions ?  **2CrO42- (aq) + 2H+(aq) --> Cr2O72-(aq) + H2O(l)** | | | |
| A) | |  | |
| B) | |  | |
| C) | |  | |
| D) | |  | |
| E) | |  | |
| 18. | | **F2(*g*)  2F(*g*)** at a particular temperature, the concentrations at equilibrium were observed to be [F2] = 3.0  10–2 mol/L and [F] = 2.0  10–4 mol/L. Calculate the value of the equilibrium constant from these data | | | |
| A) | | 6.0  10–2 | |
| B) | | 1.5 | |
| C) | | 7.5  105 | |
| D) | | 1.3  10–6 | |
| E) | | none of these | |

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| --- | --- | --- |
| 19. | **2NO(*g*) + O2(*g*)  2NO2(*g*)**  at a certain temperature, the equilibrium concentrations were found to be [NO2] = 5.7  10–3 *M*, [O2] = 1.0  10–2 *M*,and [NO] = 2.0  10–3 *M*. Calculate the value of the equilibrium constant from these data | |
| A) | 8.1  102 |
| B) | 14.2  104 |
| C) | 2.8  102 |
| D) | 1.2  10–3 |
| E) | none of these |

Use the following to answer question 20:

Consider the following data concerning the equation:

**H2O2 + 3I- + 2H+  I3- + 2H2O**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | [H2O2] | [I-] | [H+] | rate |
| I | 0.100 M | 5.00 10-4 M | 1.00  10-2 M | 0.137 M/sec |
| II. | 0.100 M | 1.00  10-3 M | 1.00  10-2 M | 0.268 M/sec |
| III. | 0.200 M | 1.00  10-3 M | 1.00  10-2 M | 0.542 M/sec |
| IV. | 0.400 M | 1.00  10-3 M | 2.00  10-2 M | 1.084 M/sec |

|  |  |  |
| --- | --- | --- |
| 20. | The rate law for this reaction is | |
| A) | rate = k[H2O2][I-][H+] |
| B) | rate = k[H2O2]2[I-]2[H+]2 |
| C) | rate = k[I-][H+] |
| D) | rate = k[H2O2][H+] |
| E) | rate = k[H2O2][I-] |

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| --- | --- | --- |
| 21. | **CaCO3*(s)*  CaO*(s)* + CO2*(g)***  What would happen to the system if the total pressure were increased by adding CO2*(g)*? | |
| A) | Nothing would happen. |
| B) | More CO2*(g)* would be produced. |
| C) | The amount of CaO would increase. |
| D) | The amount of CaCO3 would increase. |
| E) | Equilibrium would shift to the right. |

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| --- | --- | --- |
| 22. | Write the equilibrium expression for the following reaction:  S*(s)* + O2*(g)* SO2*(g)* | |
| A) | *K* = |
| B) | *K* = |
| C) | *K* = |
| D) | *K* = |
| E) | none of these |

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| --- | --- | --- |
| 23. | The average rate of disappearance of ozone in the reaction is found to be 8.29  10-3 atm over a certain interval of time. What is the rate of appearance of O2 during this interval? | |
| A) | 12.4  10-3 atm/s |
| B) | 8.29  10-3atm/s |
| C) | 5.53  10-3atm/s |
| D) | 285  10-3atm/s |
| E) | 22.9  10-3atm/s |

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| --- | --- | --- |
| 24. | The rate law for a particular reaction is rate = *k*[A][B]2. If the initial concentration of B is increased from 0.1 M to 0.3 M, the initial rate will increase by which of the following factors? | |
| A) | 2 |
| B) | 6 |
| C) | 12 |
| D) | 3 |
| E) | 9 |

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| 25. | Consider a system of four gases. The equilibrium concentration of each product is 1.8 *M*. The equilibrium concentrations of the reactants are equal. The equilibrium is shown here:  **A + B  C + D *K* = 2.6**  What is the equilibrium concentration of gas A? | |
| A) | 1.2 *M* |
| B) | 8.4 *M* |
| C) | 4.7 *M* |
| D) | 1.1 *M* |
| E) | 0.90 *M* |

Use the following to answer questions 26-27:

Given the equation A*(g)*  B*(g)* + 2C*(g)*. At a particular temperature, *K* = 1.4  105.

|  |  |  |
| --- | --- | --- |
| 26. | If you mixed 1.2 mol B, 0.050 mol C, and 0.003 mol A in a 1-L container, in which direction would the reaction initially proceed? | |
| A) | to the left |
| B) | to the right |
| C) | The mixture is in the equilibrium state. |
| D) | cannot tell from the information given |

|  |  |  |
| --- | --- | --- |
| 27. | Raising the pressure by decreasing the volume of the container | |
| A) | will cause [A] to increase |
| B) | will cause [B] to increase |
| C) | will have no effect |
| D) | cannot be determined |
| E) | none of the above |

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| --- | --- | --- |
| 28. | The correct equilibrium expression for the reaction of sulfur dioxide gas with oxygen gas to produce sulfur trioxide gas is | |
| A) |  |
| B) |  |
| C) |  |
| D) |  |
| E) | none of these |

Use the following to answer question 29:

The following questions refer to the equilibrium shown here:

**CaCO3*(s)*  CaO*(s)* + CO2*(g)***

|  |  |  |
| --- | --- | --- |
| 29. | What would happen to the system if the total pressure were increased by adding Ar*(g)*? | |
| A) | Nothing would happen. |
| B) | More CO2*(g)* would be produced. |
| C) | The amount of CaO would increase. |
| D) | The amount of CaCO3 would increase. |
| E) | Equilibrium would shift to the right. |

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| --- | --- | --- |
| 30. | A sample of a substance burns more rapidly in pure oxygen than in air. Which factor is most responsible for this high rate of reaction? | |
| A) | the properties of the reactants |
| B) | temperature |
| C) | concentration of the substance |
| D) | Surface area exposed to air |
| E) | Catalyst |

**Answer Key**

|  |  |
| --- | --- |
| 1. | C |
| 2. | C |
| 3. | B |
| 4. | E |
| 5. | A |
| 6. | A |
| 7. | E |
| 8. | A |
| 9. | D |
| 10. | a |
| 11. | a |
| 12. | c |
| 13. | A |
| 14. | D |
| 15. | A |
| 16. | E |
| 17. | D |
| 18. | D |
| 19. | A |
| 20. | E |
| 21. | D |
| 22. | A |
| 23. | A |
| 24. | E |
| 25. | D |
| 26. | B |
| 27. | A |
| 28. | B |
| 29. | A |
| 30. | C |