Dougherty Valley HS Chemistry
Spring Test #2 Review – Extra Practice

S-35*

1. Calculate the molarity of a solution made by dissolving 23.4g of sodium sulfate in enough water to form 125ml of solution?
   a. 2.62M
   b. 1.32M
   c. 4.24M
   d. 0.18M
   e. 1.87M

2. 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?
   a. 25g
   b. 22.9g
   c. 15.5g
   d. 30g
   e. 7.5g

3. What mass of lithium nitrate would have to be dissolved in 30.0 g of water in order to make an 18.0% solution?
   a. 12.4g
   b. 2.45g
   c. 5.86g
   d. 6.59g
   e. 9.73g

4. What is the molarity of a solution that contains 390.0 g of acetic acid, CH_3COOH, dissolved in enough acetone to make 1000.0 mL of solution?
   a. 8.73g
   b. 2.34g
   c. 6.49g
   d. 1.23g
   e. 5.23g

5. What mass of ammonium chloride is dissolved in 300. mL of a 0.875 M solution?
   a. 14.0g
   b. 28.0g
   c. 7.0g
   d. 3.5g
   e. 12.0g

6. Describe what you would do to prepare 100.0 g of a 3.5% solution of ammonium sulfate in water.
   a. 0.035g $(NH_4)_2SO_4$ in 100g H_2O
   b. 3.5g $(NH_4)_2SO_4$ in 100g H_2O
   c. 3.5g $(NH_4)_2SO_4$ in 1g H_2O
   d. 3.5g $(NH_4)_2SO_4$ in 96.5ml H_2O
   e. 0.35g $(NH_4)_2SO_4$ in 100g H_2O

7. What mass of barium nitrate is dissolved in 21.29 mL of a 3.38 M solution?
   a. 261.37g
   b. 25.34g
   c. 18.8g
   d. 130.5g
   e. 15.34g

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

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

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) 1.16×10^3 g
   B) 11.6 g
   C) 186 g
   D) 18.6 g
   E) none of these

3. A 118.2-g sample of nitric acid solution that is 70.0% HNO_3 (by mass) contains
   A) 82.7 mol HNO_3
   B) 1.31 mol HNO_3
   C) 1.88 mol HNO_3
   D) 5.21×10^3 mol HNO_3
   E) none of these

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*

5. A 60.7-g sample of $SrCl_2$ 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

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

7. What volume of 13.1 *M* H_2SO_4 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

8. Determine the molarity of a solution containing 6.92 g $BaCl_2$ in 750.0 mL of solution.
   A) 3.32×10^{-2} M
   B) 2.49×10^{-2} M
   C) 9.23×10^{-3} M
   D) 4.43×10^{-2} M
   E) 9.23 M

9. What is the molarity of a HNO_3 solution prepared by adding 164.8 mL of water to 350.0 mL of 12.3 M HNO_3?
   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

1. Tabulated below are initial rate data for the reaction

$2Fe(CN)_6^{3-} + 2I^- \rightarrow 2Fe(CN)_6^{4-} + I_2$

Run	$[Fe(CN)_6^{3-}]_0$	$[I^-]_0$	$[Fe(CN)_6^{4-}]_0$	$[I_2]_0$	Initial 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) $\frac{\Delta[I_2]}{\Delta t} = k[Fe(CN)_6^{3-}]^2[I^-]^2[Fe(CN)_6^{4-}]^2[I_2]$

B) $\frac{\Delta[I_2]}{\Delta t} = k[Fe(CN)_6^{3-}]^2[I^-][Fe(CN)_6^{4-}][I_2]$

C) $\frac{\Delta[I_2]}{\Delta t} = k[Fe(CN)_6^{3-})]^2[I^-]$

D) $\frac{\Delta[I_2]}{\Delta t} = k[Fe(CN)_6^{3-}][I^-]^2$

E) $\frac{\Delta[I_2]}{\Delta t} = k[Fe(CN)_6^{3-}][I^-]\,[Fe(CN)_6^{4-}]$

2. **$4NH_3 + 7O_2 \rightarrow 4NO_2 + 6H_2O$** 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

3. **$CaCl_2(s) + 2H_2O(g) \rightleftharpoons CaCl_2 \cdot 2H_2O(s)$** The equilibrium constant for the reaction as written is

A) $K = \frac{[CaCl_2 \cdot 2H_2O]}{[CaCl_2][H_2O]^2}$

B) $K = \frac{1}{[H_2O]^2}$

C) $K = \frac{1}{2[H_2O]}$

D) $K = [H_2O]^2$

E) $K = \frac{[CaCl_2 \cdot 2H_2O]}{[H_2O]^2}$

4. **$H_2(g) + I_2(s) \rightleftharpoons 2HI(g)$** The proper K_{eq} expression is:

A) $\frac{[H_2][I_2]}{[HI]}$

B) $\frac{\sqrt{([H_2][I_2])}}{[HI]^2}$

C) $\frac{[HI]}{\sqrt{([H_2])}}$

D) $\frac{[HI]^2}{[H_2][I_2]}$

E) $\frac{[HI]^2}{[H_2]}$

5. At a certain temperature *K* for the reaction **$2NO_2 \rightleftharpoons N_2O_4$** is 7.5. If 2.0 moles of NO_2 are placed in a 2.0-liter container and permitted to react at this temperature, calculate the concentration of N_2O_4 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

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.

7. Determine the equilibrium constant for the system **$N_2O_4 \rightleftharpoons 2NO_2$** at 25°C. The concentrations are shown here: $[N_2O_4] = 2.72 \times 10^{-2}$ M, $[NO_2] = 1.41 \times 10^{-2}$ M.

A) 0.518
B) 1.93
C) 1.37×10^2
D) 0.269
E) 7.31×10^{-3}

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

$H_2O_2 + 3I^- + 2H^+ \rightarrow I_3^- + 2H_2O$

	$[H_2O_2]$	$[I^-]$	$[H^+]$	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) 2.74×10^4
C) 137
D) 108
E) none of these

9. Apply the law of mass action to determine the equilibrium expression for

$2NO_2Cl(aq) \rightleftharpoons 2NO_2(aq) + Cl_2(aq)$

A) $2[NO_2][Cl_2]/2[NO_2Cl]$
B) $2[NO_2Cl]/2[NO_2][Cl_2]$
C) $[NO_2Cl]^2/[NO_2]^2[Cl_2]$
D) $[NO_2]^2[Cl_2]/[NO_2Cl]^2$
E) $[NO_2Cl]^2[NO_2]^2[Cl_2]$

Use the following to answer questions 10-12:

Consider the reaction **$2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g)$** 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

10. Additional $H_2O(g)$ is injected into the reaction vessel.

11. Some $H_2(g)$ 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:

Experiment	Initial [A] (mol/L)	Initial [B] (mol/L)	Initial Rate of Disappearance of A (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 **$H_2SeO_3(aq)$ $6I^-(aq)$ + $4H^+(aq) \rightarrow 2I_3^-(aq)$ + $3H_2O(l)$ + Se(s)** was studied at 0°C by the method of initial rates:

$[H_2SeO_3]_0$	$[H^+]_0$	$[I^-]_0$	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) 5.2×10^5
B) 2.1×10^2
C) 4.2
D) 1.9×10^{-6}
E) none of these

16. The rate law is
A) Rate = $k[H_2SeO_3][H^+][I^-]$
B) Rate = $k[H_2SeO_3][H^+]^2[I^-]$
C) Rate = $k[H_2SeO_3][H^+][I^-]^2$
D) Rate = $k[H_2SeO_3]^2[H^+][I^-]$
E) Rate = $k[H_2SeO_3][H^+]^2[I^-]^3$

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 ?

$2CrO_4^{2-}(aq) + 2H^+(aq) \rightarrow Cr_2O_7^{2-}(aq) + H_2O(l)$

A) $-\frac{\Delta[H^+]}{\Delta t}$
B) $-\frac{2\Delta[H^+]}{\Delta t}$
C) $\frac{2\Delta[H^+]}{\Delta t}$
D) $-\frac{\Delta[H^+]}{2\Delta t}$
E) $\frac{\Delta[H^+]}{2\Delta t}$

18. **$F_2(g) \rightleftharpoons 2F(g)$** at a particular temperature, the concentrations at equilibrium were observed to be $[F_2] = 3.0 \times 10^{-2}$ mol/L and $[F] = 2.0 \times 10^{-4}$ mol/L. Calculate the value of the equilibrium constant from these data
A) 6.0×10^{-2}
B) 1.5
C) 7.5×10^5
D) 1.3×10^{-6}
E) none of these

19. **$2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$**
at a certain temperature, the equilibrium concentrations were found to be $[NO_2] = 5.7 \times 10^{-3}$ *M*, $[O_2] = 1.0 \times 10^{-2}$ *M*,and $[NO] = 2.0 \times 10^{-3}$ *M*. Calculate the value of the equilibrium constant from these data
A) 8.1×10^2
B) 14.2×10^4
C) 2.8×10^2
D) 1.2×10^{-3}
E) none of these

Use the following to answer question 20:
Consider the following data concerning the equation:

$$H_2O_2 + 3I^- + 2H^+ \rightarrow I_3^- + 2H_2O$$

	$[H_2O_2]$	$[I^-]$	$[H^+]$	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 = $k[H_2O_2][I^-][H^+]$
B) rate = $k[H_2O_2]^2[I^-]^2[H^+]^2$
C) rate = $k[I^-][H^+]$
D) rate = $k[H_2O_2][H^+]$
E) rate = $k[H_2O_2][I^-]$

21. **$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$**
What would happen to the system if the total pressure were increased by adding $CO_2(g)$?
A) Nothing would happen.
B) More $CO_2(g)$ would be produced.
C) The amount of CaO would increase.
D) The amount of $CaCO_3$ would increase.
E) Equilibrium would shift to the right.

22. Write the equilibrium expression for the following reaction:
$S(s) + O_2(g)$ $SO_2(g)$
A) $K = \dfrac{[SO_2]}{[O_2]}$
B) $K = \dfrac{[O_2]}{[SO_2]^2}$
C) $K = \dfrac{[SO_2]}{[O_2]^2}$
D) $K = \dfrac{[SO_2]^2}{[O_2]}$
E) none of these

23. The average rate of disappearance of ozone in the reaction $2O_3(g) \rightarrow 3O_2(g)$ is found to be 8.29×10^{-3} atm over a certain interval of time. What is the rate of appearance of O_2 during this interval?
A) 12.4×10^{-3} atm/s
B) 8.29×10^{-3}atm/s
C) 5.53×10^{-3}atm/s
D) 285×10^{-3}atm/s
E) 22.9×10^{-3}atm/s

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

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:
$A + B \rightleftharpoons C + D$ **$K = 2.6$**
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 $A(g) \rightleftharpoons B(g) + 2C(g)$. At a particular temperature, $K = 1.4 \times 10^5$.

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

28. The correct equilibrium expression for the reaction of sulfur dioxide gas with oxygen gas to produce sulfur trioxide gas is

A) $\frac{[SO_3]}{[SO_2][O_2]}$

B) $\frac{[SO_3]^2}{[SO_2]^2[O_2]}$

C) $\frac{[SO_3]}{[SO_2]^2[O_2]}$

D) $\frac{[O_2][SO_2]^2}{[SO_3]^2}$

E) none of these

Use the following to answer question 29:

The following questions refer to the equilibrium shown here:

$$\mathbf{CaCO_3}\textbf{\textit{(s)}} \rightleftharpoons \mathbf{CaO}\textbf{\textit{(s)}} + \mathbf{CO_2}\textbf{\textit{(g)}}$$

29. What would happen to the system if the total pressure were increased by adding Ar*(g)*?
    A) Nothing would happen.
    B) More CO_2*(g)* would be produced.
    C) The amount of CaO would increase.
    D) The amount of $CaCO_3$ would increase.
    E) Equilibrium would shift to the right.

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