Toronto High School

Name:_____ SCH4U-*Test #4* Ms. S. Nikoudad

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Knowledge/ Understanding	Thinking/Inquiry	Communication	Application	Total
10	10	9	13	42

Knowledge/Understanding: […….. /10]

1- An equation representing the reaction of a <u>weak acid</u> with water is:

A. $HCl + H_2O \rightleftarrows H_3O^+ + Cl^-$ B. $NH + HO \rightleftarrows NH^+ + OH^-$

C. $HCO^-HO \rightleftarrows HCO + OH^-$ D. $HCOOH + H_2O \rightleftarrows H_3O^+ + HCOO^-$

2- The conjugate acid of $C_6H_5O^-$ is

A. $C_6H_4O^-$ B. C_6H_5OH C. $C_6H_4O^{2-}$ D. $C_6H_5OH^+$

3- In a solution with a pOH of 4.22, the [OH-] is

A. 1.7×10^{-10} M B. 6.0×10^{-5} M C. 6.3×10^{-1} M D. 1.7×10^{4} M

4- The $[H_3O^+]$ in a solution with pH of 0.253 is

A. 5.58×10^{-15} M B. 1.79×10^{-14} M C. 5.58×10^{-1} M D. 5.97×10^{-1} M

5- The ionization of water at room temperature is represented by

A. $H_2O \rightleftarrows 2H^+ + O^{2-}$ B. $2H_2O \rightleftarrows 2H_2 + O_2$ C. $2\,H_2O \rightleftarrows H_2 + 2OH^-$ D. $2\,H_2O \rightleftarrows H_3O^+ + OH^-$

6- Consider the following:

I $H_2CO_3 + F^- \rightleftarrows HCO_3^- + HF$

II $HCO_3^- + HC_2O_4^- \rightleftarrows H_2CO_3 + C_2O_4^{2-}$

III $HCO_3^- + H_2C_6H_6O_7^- \rightleftarrows H_2CO_3 + HC_6H_5O_7^{2-}$

The HCO_3^- is a base / conjugate base in

A. I only B. I and II only C. II and III only D. I , II, and III

7- The pOH of 0.015 M HCl solution is

A.0.97 B.1.80 C.12.18 D. 13.03

8- Calculate the pH in a 0.200 M solution of $Sr(OH)_2$.

A 1.40 B 1.70 C 13.30 D 13.60

9- In which one of the following equations are the Bronsted-Lowry acids and bases all correctly identified?

	Acid	+	Base	⇄	Base	+	Acid
A	H_2O_2		SO_3^{2-}	⇄	HO_2^-		HSO_3^-
B	H_2O_2		SO_3^{2-}	⇄	HSO_3^-		HO_2^-
C	SO_3^{2-}		H_2O_2	⇄	HO_2^-		HSO_3^-
D	SO_3^{2-}		H_2O_2	⇄	HSO_3^-		HO_2^-

10- Both acidic and basic solutions

A. taste sour B. feel slippery C. conduct electricity D. turn blue litmus red

Thinking/Inquiry: **[…….. /10]**

1- In the manufacture of an important organic solvent, toluene, (C7H8), from methyl cyclohexane, (C7H14), the following reaction occurs:

$$C_7H_{14(g)} \rightleftharpoons C_7H_{8\,(g)} + 3\,H_{2\,(g)}$$

Calorimetric studies show that the forward reaction is endothermic. Based on this information, which one , if any, of the following additional changes would increase the concentration of C7H8 at equilibrium?

a) increase the pressure at constant temperature

b) increase the temperature at constant pressure

c) decrease the concentration of C7H8

d)) add a catalyst

e) None of the above

2- A 1.00 L flask contains a gaseous equilibrium system. The addition of reactants to this flask results in a

A. shift left and a decrease in the concentration of the products. B. shift left and a increase in the concentration of the products.

C. shift right and a decrease in the concentration of the products. D. shift right and a increase in the concentration of the products.

3- Consider the following equilibrium: $CH_{4(g)} + H_2O_{(g)} + heat \rightleftarrows CO_{(g)} + 3H_{2(g)}$

In which of the following will both stresses results in more CO (g)?

A. a decrease in temperature and a decrease in volume B.an increase in temperature and a decrease in volume

C. a decrease in temperature and an increase in volume D. an increase in temperature and an increase in volume

4- Consider the following equilibrium: $4KO_{2(s)} + 2H_2O_{(g)} \rightleftarrows 4KOH_{(s)} + 3O_{2(g)}$ *The equilibrium expression is*

A. $K_{eq} = [KOH]^4[O_2]^3 / [KO_2]^2[H_2O]^2$

B. $K_{eq} = [O_2]^3 / [H_2O]^2$

C. $K_{eq} = [KO_2]^4[H_2O]^2 / [KOH]^4[O_2]^3$

D. $K_{eq} = [H_2O]^2 / [O_2]^3$

5- Consider the following equilibrium: $2NO_{(g)} \rightleftarrows N_{2(g)} + O_{2(g)}$ $K_{eq} = 2.01 \times 10^{-30}$
The value of the equilibrium constant indicates that the

a. $[NO]^2 < [N_2][O_2]$

b. $[NO]^2 > [N_2][O_2]$

b. $[NO] = [N_2][O_2]$

d. $[NO] > [N_2][O_2]$

6- Consider the following equilibrium: $SO_{2(g)} + NO_{2(g)} \rightleftarrows SO_{3(g)} + NO_{(g)}$ + *energy* *The equilibrium does <u>not</u> shift with a change in*

a. volume b. temperature c. concentration of products d. concentration of reactants

7- Consider the following equilibrium : $SO_2Cl_{2(g)}$ + *energy* $\rightleftarrows SO_{2(g)} + Cl_{2(g)}$
When the temperature is decreased, the equilibrium shifts

a. left and the $[SO_2Cl_2]$ increases b. left and the $[SO_2Cl_2]$ decreases

c. right and the $[SO_2Cl_2]$ increases d. right and the $[SO_2Cl_2]$ decreases

8- Consider the following reaction: $C_{(s)} + 2H_{2(g)} \rightleftarrows CH_{4(g)}$ $\Delta H = -74.8$ *kJ*
Which of the following will cause a decrease in the value of the Keq?

a. Decreasing $[H_2]$ b. decreasing the volume

c. Finely powdering the $C_{(s)}$ d. increasing the temperature

9- Consider the following equilibrium: $2O_{3(g)} \rightleftarrows 3O_{2(g)}$ $K_{eq} = 65$

Initially 0.10 mole of O_3 and 0.10 mole of O_2 are placed in a 1.0 L container, Which of the following describes the changes in concentrations as the reaction proceeds towards equilibrium?

	$[O_3]$	$[O_2]$
A.	decreases	decreases
B.	decreases	increases
C.	increases	decreases
D.	increases	increases

10- The conjugate base of an acid is produced by

a. adding a proton to the acid

b. adding an electron to the acid

c. removing a proton from the acid

d. removing an electron from the acid

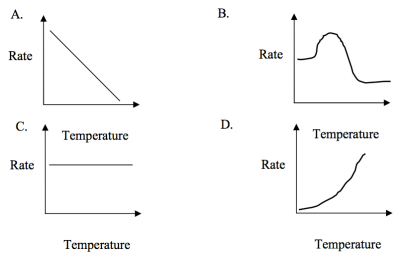
Communication: **[…….. /9]**

1- Explain why the colour of container first gets darker and then gets lighter when compressed in a syringe. The equation is: *(……/3)*

$$\underset{\text{colourless}}{N_2O_{4(g)}} \rightleftarrows \underset{\text{dark brown}}{2NO_{2(g)}}$$

2- Consider the following system: $2SO_{2(g)} + O_{2(g)} \rightleftarrows 2SO_{3(g)}$ $\Delta H = -99$ *kJ/mol*
List four things which could be done in order to increase the formation of SO_3*?* (……./2)

3- *Consider the following reaction:* $CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)} + heat$
The diagram that represents the relationship between rate and temperature is: (……./1)



4- *In a container at 450°C, N_2 and H_2 react to produce NH_3. K = 0.064. When the system is analyzed, $[N_2]$ = 4.0 mol/L, $[H_2] = 2.0 \times 10^{-2}$ mol/L, and $[NH_3] = 2.2 \times 10^{-4}$ mol/L. Is the system at equilibrium, if not, predict the direction in which the reaction will proceed. (……/3)*

$$N_{2(g)} + 3H_{2(g)} \leftrightarrow 2NH_{3(g)}$$

Application: **[……. /13]**

1- Consider the following equilibrium: $H_{2(g)} + I_{2(g)} \rightleftarrows 2HI_{(g)}$ At equilibrium $[H_2]$ = 0.00220 M, $[I_2]$ = 0.00220 M, and [HI] = 0.0156 M. Calculate the value of the Keq. (……./1)

2-What is the pOH of a solution prepared by adding 0.50 moles of NaOH to prepare 0.50 L of solution?(…../2)

3-Determine if a precipitate forms if 5.0 mL of 3.0×10^{-4} M $Pb(NO_3)_2$ is mixed with 5.0 mL of 3.0×10^{-4} M Na_2CrO_4. The value for K_{sp} of $PbCrO_4$ is 2×10^{-14}. (……../5)

4- Calculate the percent dissociation of a 3.1×10^{-4} mol/L solution of a weak acid, HA, if the pH of the solution is 6.10. (……../2)

5- The pOH of 0.17 M of CH_3COOH is 11.13 . Calculate the Ka for this acid. (……. /3)