# AP Chemistry Practice Test 9

Real AP Past Papers with Multiple-Choice Questions

**Questions 1-4** refer to the following information.

Consider the Lewis structures for the following molecules:

$CO_2$, $CO_3^{2-}$, $NO_2^-$, and $NO_3^-$

**1.** Which molecule would have the shortest bonds?

- A. $CO_2$
- B. $CO_3^{2-}$
- C. $NO_2^-$
- D. $NO_3^-$

**2.** Which molecules are best represented by multiple resonance structures?

- A. $CO_2$ and $CO_3^{2-}$
- B. $NO_2^-$ and $NO_3^-$
- C. $CO_3^{2-}$ and $NO_3^-$
- D. $CO_3^{2-}$, $NO_2^-$ and $NO_3^-$

**3.** Which molecule or molecules exhibit $sp^2$ hybridization around the central atom?

- A. $CO_2$ and $CO_3^{2-}$
- B. $NO_2^-$ and $NO_3^-$
- C. $CO_3^{2-}$ and $NO_3^-$
- D. $CO_3^{2-}$, $NO_2^-$ and $NO_3^-$

**4.** Which molecule would have the smallest bond angle between terminal atoms?

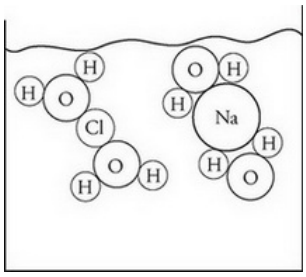
- A. $CO_2$
- B. $CO_3^{2-}$
- C. $NO_2^-$
- D. $NO_3^-$

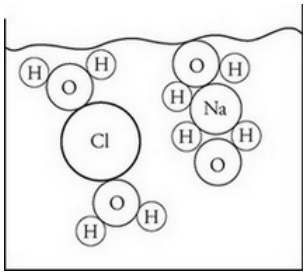
**5.** $NH_4^+(aq) + NO_2^-(aq) \rightarrow N_2(g) + 2H_2O(l)$

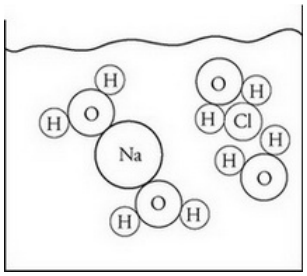
Increasing the temperature of the above reaction will increase the rate of reaction. Which of the following is NOT a reason that increased temperature increases reaction rate?

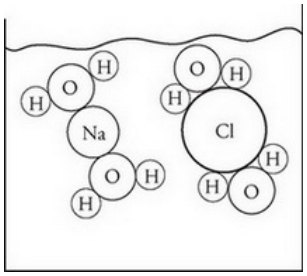
- A. The reactants will be more likely to overcome the activation energy.
- B. The number of collisions between reactant molecules will increase.
- C. A greater distribution of reactant molecules will have high velocities.
- D. Alternate reaction pathways become available at higher temperatures.

**6.** Which of the following diagrams best represents what is happening on a molecular level when NaCl dissolves in water?

A. 


B. 


C. 


D. 


**7.** Nitrous acid, $HNO_2$, has a p$K_a$ value of 3.3. If a solution of nitrous acid is found to have a pH of 4.2, what can be said about the concentration of the conjugate acid/base pair found in solution?

- A. $[HNO_2] > [NO_2^-]$
- B. $[NO_2^-] > [HNO_2]$
- C. $[H_2NO_2^+] > [HNO_2]$
- D. $[HNO_2] > [H_2NO_2^+]$

**8.** Which of the following processes is an irreversible reaction?

- A. $CH_4(g) + O_2(g) \rightarrow CO_2(g) + H_2O(l)$
- B. $HCN(aq) + H_2O(l) \rightarrow CN^-(aq) + H_3O^+(aq)$
- C. $Al(NO_3)_3(s) \rightarrow Al^{3+}(aq) + 3NO_3^-(aq)$
- D. $2Ag^+(aq) + Ti(s) \rightarrow 2Ag(s) + Ti^{2+}(aq)$

**Questions 9-13** refer to the following information.

A sample of $H_2S$ gas is placed in an evacuated, sealed container and heated until the following decomposition reaction occurs at 1000 K:

$2H_2S(g) \rightarrow 2H_2(g) + S_2(g)$ $\quad K_c = 1.0 \times 10^{-6}$

**9.** Which of the following represents the equilibrium constant for this reaction?

- A. $K_c = \dfrac{[H_2]^2[S_2]}{[H_2S]^2}$

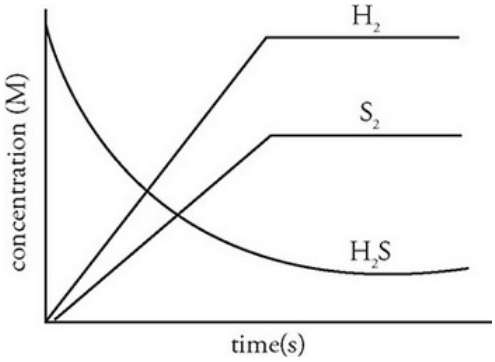
B. $K_c = \frac{[H_2S]^2}{[H_2]^2[S_2]}$

C. $K_c = \frac{2[H_2][S_2]}{2[H_2S]}$

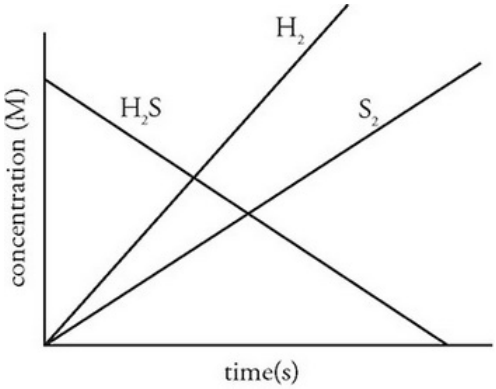
D. $K_c = \frac{2[H_2S]}{2[H_2][S_2]}$

**10.** Which of the following graphs would best represent the change in concentration of the various species involved in the reaction over time?

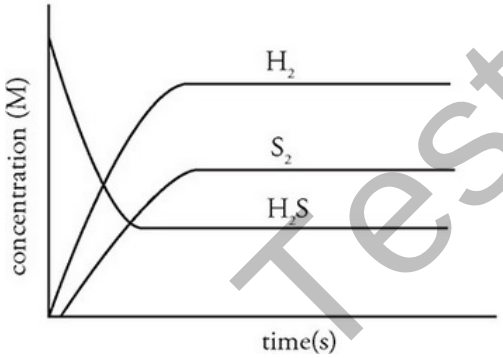
A.



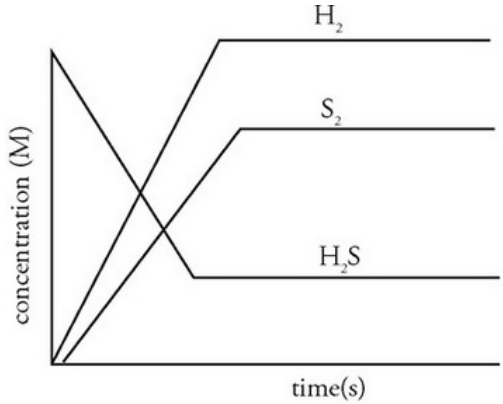

B.




C.




D.




**11.** Which option best describes what will immediately occur to the reaction rates if the pressure on the system is increased after it has reached equilibrium?

A. The rate of both the forward and reverse reactions will increase.

B. The rate of the forward reaction will increase while the rate of the reverse reaction decreases.

C. The rate of the forward reaction will decrease while the rate of the reverse reaction increases.

○ D. Neither the rate of the forward nor reverse reactions will change.

**12.** If, at a given point in the reaction, the value for the reaction quotient *Q* is determined to be $2.5 \times 10^{-8}$, which of the following is occurring?

○ A. The concentration of the reactant is decreasing while the concentration of the products is increasing.

○ B. The concentration of the reactant is increasing while the concentration of the products is decreasing.

○ C. The system has passed the equilibrium point and the concentration of all species involved in the reaction will remain constant.

○ D. The concentrations of all species involved are changing at the same rate.

**13.** As the reaction progresses at a constant temperature of 1,000K, how does the value for the Gibbs free energy constant for the reaction change?

○ A. It stays constant.

○ B. It increases exponentially.

○ C. It increases linearly.

○ D. It decreases exponentially.