

## Multiple Choice

1. For the reaction:



The value of  $-\Delta[\text{Br}^-]/\Delta t = 7.5 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$  at a particular time. What will be the value of  $\Delta[\text{Br}_2]/\Delta t$  at the same instant (in  $\text{mol L}^{-1} \text{ s}^{-1}$ )?

- A)  $1.25 \times 10^{-2}$     B)  $1.5 \times 10^{-2}$     C)  $4.5 \times 10^{-2}$     D)  $1.25 \times 10^{-1}$

2. Nitric oxide reacts with chlorine to form nitrosyl chloride.



Use the following data to determine the rate law (rate equation) for this reaction:

Experiment	[NO]	[Cl <sub>2</sub> ]	Initial rate
1	0.22	0.064	$0.96 \text{ mol L}^{-1} \text{ min}^{-1}$
2	0.66	0.064	$8.64 \text{ mol L}^{-1} \text{ min}^{-1}$
3	0.22	0.032	$0.48 \text{ mol L}^{-1} \text{ min}^{-1}$

- A) Rate =  $k [\text{NO}]^2 [\text{Cl}_2]^2$     B) Rate =  $k [\text{NO}]^2 [\text{Cl}_2]^{1/2}$   
C) Rate =  $k [\text{NO}] [\text{Cl}_2]^{1/2}$     D) Rate =  $k [\text{NO}]^2 [\text{Cl}_2]$

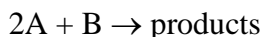
3. At 25°C, the rate constant for the first order decomposition of a pesticide solution is  $6.4 \times 10^{-3} \text{ min}^{-1}$ . If the starting concentration of pesticide is  $0.0314 \text{ mol L}^{-1}$ . What concentration (in  $\text{mol L}^{-1}$ ) will remain after 62.0 min at 25°C?

- A) 0.011    B) 0.0131    C) 0.0191    D) 0.0211

4. The reaction  $2\text{A} \rightarrow \text{B}$  is first order in A with a rate constant of  $2.8 \times 10^{-2} \text{ s}^{-1}$ . How long (in seconds) will it take for A to decrease from  $0.88 \text{ mol L}^{-1}$  to  $0.14 \text{ mol L}^{-1}$ ?

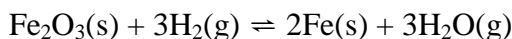
- A) 59.5    B) 65.7    C) 74.8    D) 88.6

5. Which of the following would alter the value of the rate constant (k) for the reaction?



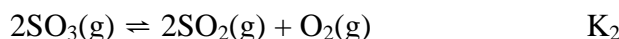
- A) Increasing the concentration of A only.  
B) Increasing the concentration of B only.  
C) Increasing the concentration of both A and B.  
D) Increasing the temperature.

6. Which is the correct equilibrium constant expression for the following reaction?



- A)  $K_c = [\text{H}_2\text{O}]^3 / [\text{H}_2]^3$     B)  $K_c = [\text{Fe}]^2 [\text{H}_2\text{O}]^3 / [\text{Fe}_2\text{O}_3] [\text{H}_2]^3$   
C)  $K_c = [\text{Fe}_2\text{O}_3] [\text{H}_2]^3 / [\text{Fe}]^2 [\text{H}_2\text{O}]^3$     D)  $K_c = [\text{H}_2\text{O}] / [\text{H}_2]$

7. Consider the following equilibria:



The values of the equilibrium constants  $K_1$  and  $K_2$  are related by:

- A)  $K_2 = (K_1)^2$     B)  $(K_2)^2 = K_1$     C)  $K_2 = (K_1)^{-2}$     D)  $K_2 = (K_1)^{-1}$

8. For the following reaction  $K_c = 1.2 \times 10^{-4}$  at 295.0 K.



Calculate (in atm) the partial pressure of  $\text{NH}_3$  gas at equilibrium.

- A) 0.117      B) 0.265      C) 0.344      D) 0.424
- 

9. Consider the following reaction at equilibrium:



Which of the following statements could be true?

- 1)  $K_p$  increases with decreasing temperature.
- 2)  $K_p$  increases with increasing temperature.
- 3)  $K_p$  increases with decreasing total pressure.
- 4)  $K_p$  increases with increasing total pressure.

- A) 1 only      B) 1 and 4      C) 2 only      D) 2 and 3
- 

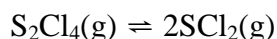
10. The isomerization of cyclopropane follows first order kinetics. The rate constant at 700 K is  $6.2 \times 10^{-4} \text{ min}^{-1}$ , and the half life at 760 K is 29.0 min. Calculate (in kJ/mol) the activation energy for this reaction.

- A) 269.2      B) 250.6      C) 240.8      D) 283.4
- 

11. The unit for a third order reaction rate constant is:

- A)  $\text{s}^{-1}$       B)  $\text{mol}^{-2} \text{L}^2 \text{s}^{-1}$       C)  $\text{mol}^2 \text{L}^{-2} \text{s}^{-1}$       D)  $\text{mol}^3 \text{L}^{-3} \text{s}^{-1}$
- 

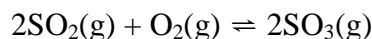
12. 4.21 moles of  $\text{S}_2\text{Cl}_4$  gas are introduced in 2.0 L vessel. The reaction



Comes to equilibrium and 1.25 moles of  $\text{S}_2\text{Cl}_4$  are found in the reaction vessel. Calculate  $K_c$  for the reaction.

- A) 14.0      B) 17.0      C) 19.5      D) 21.5
- 

13. At 700 K, the reaction



has an equilibrium constant  $K_c = 4.3 \times 10^6$ , and the following concentrations are present:

$[\text{SO}_2] = 0.01 \text{ M}$ ;  $[\text{SO}_3] = 10.0 \text{ M}$  and  $[\text{O}_2] = 0.10 \text{ M}$

Therefore:

- A) The reaction mixture is at equilibrium.  
B) The reaction must proceed to the right to reach equilibrium.  
C) The reaction must proceed to the left to reach equilibrium.  
D) There is not enough information to answer.
- 

14. What is the pH of 1.0 L buffer solution that is 0.12 M lactic acid,  $\text{HC}_3\text{H}_5\text{O}_3$ , and 0.10 M sodium lactate,  $\text{NaC}_3\text{H}_5\text{O}_3$ , after the addition of 0.01 mole of gaseous HCl (assuming that this will not change the volume of the solution)? For lactic acid:  $K_a = 1.4 \times 10^{-4}$ .

- A) 3.27      B) 3.45      C) 3.69      D) 3.95
-

15. The conjugated acid of  $\text{NH}_2^-$  is:

- A)  $\text{HNO}_3$       B)  $\text{HNO}_2$       C)  $\text{NH}_4^+$       D)  $\text{NH}_3$
- 

16. The pOH of  $2.5 \times 10^{-3}$  M  $\text{Ba}(\text{OH})_2$  solution is:

- A) 5.0      B) 2.5      C) 2.3      D) 2.1
- 

17. The pH of 100 ml of 0.002 M HCl solution is:

- A) 0.27      B) 2.0      C) 0.2      D) 2.7
- 

18. The pH of 1.6 M KOH solution is:

- A) 13.8      B) 14.2      C) 12.4      D) 1.6
- 

19. The pH of 0.05 M acetic acid ( $K_a = 1.8 \times 10^{-5}$ ) solution is:

- A) 3      B) 4      C) 5      D) 6
- 

20. The pH of 0.1 M ammonia ( $K_b = 1.8 \times 10^{-5}$ ) solution is:

- A) 2.87      B) 11.13      C) 8.94      D) 12.56
-