

Test 11: Equilibrium

Name: _____

Sunday, April 05, 2009

1.

Given the reaction at equilibrium: $2\text{SO}_2(g) + \text{O}_2(g) \leftrightarrow 2\text{SO}_3(g) + \text{heat}$

Which change will shift the equilibrium to the right?

- A. increasing the temperature C. decreasing the amount of $\text{SO}_2(g)$
B. increasing the pressure D. decreasing the amount of $\text{O}_2(g)$

2.

Given the reaction at equilibrium: $2\text{CO}(g) + \text{O}_2(g) \leftrightarrow 2\text{CO}_2(g)$

When the reaction is subjected to stress, a change will occur in the concentration of

- A. reactants, only C. both reactants and products
B. products, only D. neither reactants nor products

3.

Given the reaction at equilibrium: $\text{H}_2(g) + \text{Br}(g) \rightleftharpoons 2\text{HBr}(g)$

The rate of the forward reaction is

- A. greater than the rate of the reverse reaction C. equal to the rate of the reverse reaction
B. less than the rate of the reverse reaction D. independent of the rate of the reverse reaction

4.

A system is said to be in a state of dynamic equilibrium when the

- A. concentration of products is greater than the concentration of reactants C. rate at which products are formed is greater than the rate at which reactants are formed
B. concentration of products is the same as the concentration of reactants D. rate at which products are formed is the same as the rate at which reactants are formed

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5.

Given the system at equilibrium: $\text{N}_2\text{O}_4(\text{g}) + 58.1\text{kJ} \leftrightarrow 2\text{NO}_2(\text{g})$

What will be the result of an increase in temperature at constant pressure?

- A. The equilibrium will shift to the left, and the concentration of $\text{NO}_2(\text{g})$ will decrease.
- B. The equilibrium will shift to the left, and the concentration of $\text{NO}_2(\text{g})$ will increase.
- C. The equilibrium will shift to the right, and the concentration of $\text{NO}_2(\text{g})$ will decrease.
- D. The equilibrium will shift to the right, and the concentration of $\text{NO}_2(\text{g})$ will increase.

6.

Given the reaction at equilibrium: $\text{N}_2(\text{g}) + \text{O}_2(\text{g}) \leftrightarrow 2\text{NO}(\text{g})$

As the concentration of $\text{N}_2(\text{g})$ increases, the concentration of $\text{O}_2(\text{g})$ will

- A. decrease
- B. increase
- C. remain the same

7.

Given the equilibrium reaction in a closed system: $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) + \text{heat} \leftrightarrow 2\text{HI}(\text{g})$

What will be the result of an increase in temperature?

- A. The equilibrium will shift to the left and $[\text{H}_2]$ will increase.
- B. The equilibrium will shift to the left and $[\text{H}_2]$ will decrease.
- C. The equilibrium will shift to the right and $[\text{HI}]$ will increase.
- D. The equilibrium will shift to the right and $[\text{HI}]$ will decrease.

8.

A sample of water in a sealed flask at 298 K is in equilibrium with its vapor. This is an example of

- A. chemical equilibrium
- B. phase equilibrium
- C. solution equilibrium
- D. static equilibrium

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9.

In which reaction at equilibrium will the point of equilibrium shift to the right when the pressure decreases at constant temperature?

- A. $\text{N}_2(g) + 3\text{H}_2(g) \leftrightarrow 2\text{NH}_3(g)$
- B. $\text{H}_2(g) + \text{Br}_2(g) \leftrightarrow 2\text{HBr}(g)$
- C. $\text{CaCO}_3(s) \leftrightarrow \text{CaO}(s) + \text{CO}_2(g)$
- D. $\text{N}_2(g) + \text{O}_2(g) \leftrightarrow 2\text{NO}(g)$

10.

Which statement must be true when solution equilibrium occurs?

- A. The solution is at STP.
- B. The solution is supersaturated.
- C. The concentration of the solution remains constant.
- D. The masses of the dissolved solute and the undissolved solute are equal.

11.

Given the reaction at equilibrium: $\text{N}_2(g) + 3\text{H}_2(g) \leftrightarrow 2\text{NH}_3(g)$

If the pressure is increased at a constant temperature, there will be an increase in the number of moles of

- A. $\text{NH}_3(g)$, only
- B. $\text{N}_2(g)$, only
- C. $\text{H}_2(g)$, only
- D. both $\text{N}_2(g)$ and $\text{H}_2(g)$

12.

Given the equation representing a reaction at equilibrium:



Which change causes the equilibrium to shift to the right?

- A. decreasing the concentration of $\text{H}_2(g)$
- B. decreasing the pressure
- C. increasing the concentration of $\text{N}_2(g)$
- D. increasing the temperature

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13.

Given the equilibrium reaction at STP: $\text{N}_2\text{O}_4(g) \leftrightarrow 2\text{NO}_2(g)$

Which statement correctly describes this system?

- A. The forward and reverse reaction rates are equal. C. The concentrations of N_2O_4 and NO_2 are equal.
B. The forward and reverse reaction rates are both increasing. D. The concentrations of N_2O_4 and NO_2 are both increasing.

14.

A solution in which the crystallizing rate of the solute equals the dissolving rate of the solute must be

- A. saturated C. concentrated
B. unsaturated D. dilute

15.

The reaction $\text{Ba}(\text{NO}_3)_2(aq) + \text{Na}_2\text{SO}_4(aq) \rightarrow 2\text{NaNO}_3(aq) + \text{BaSO}_4(s)$ goes to completion because a

- A. gas is formed C. nonionized product is formed
B. precipitate is formed D. soluble salt is formed

16.

Given the reaction: $2\text{N}_2(g) + \text{O}_2(g) \leftrightarrow 2\text{N}_2\text{O}(g)$

Which statement is true when this system reaches equilibrium?

- A. All of the $\text{N}_2(g)$ has been consumed. C. Pressure changes no longer occur.
B. All of the $\text{O}_2(g)$ has been consumed. D. The forward reaction no longer occurs.

17.

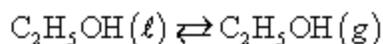
A solution exhibiting equilibrium between the dissolved and undissolved solute must be

- A. saturated C. dilute
B. unsaturated D. concentrated

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18.

Given the equation representing a phase change at equilibrium:



Which statement is true?

- A. The forward process proceeds faster than the reverse process.
- B. The reverse process proceeds faster than the forward process.
- C. The forward and reverse processes proceed at the same rate.
- D. The forward and reverse processes both stop.

19.

Given the reaction at equilibrium: $2A(\text{g}) + 3B(\text{g}) \leftrightarrow A_2B_3(\text{g}) + \text{heat}$

Which change will not affect the equilibrium concentrations of $A(\text{g})$, $B(\text{g})$, and $A_2B_3(\text{g})$?

- A. adding more $A(\text{g})$
- B. adding a catalyst
- C. increasing the temperature
- D. increasing the pressure

20.

Which statement must be true for any chemical reaction at equilibrium?

- A. The concentration of the products is greater than the concentration of the reactants.
- B. The concentration of the products is less than the concentration of the reactants.
- C. The concentration of the products and the concentration of the reactants are equal.
- D. The concentration of the products and the concentration of the reactants are constant.

21.

Given the closed system at equilibrium: $\text{CO}_2(\text{g}) \leftrightarrow \text{CO}_2(\text{aq})$

As the pressure on the system increases, the solubility of the $\text{CO}_2(\text{g})$

- A. decreases
- B. increases
- C. remains the same

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22.

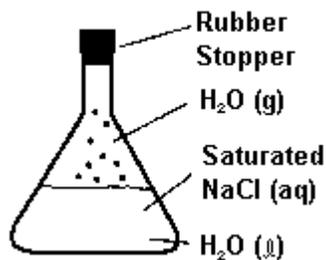


Figure 1

The diagram represents a sealed flask. Which equation represents a system that will reach equilibrium in the flask?

- A. $\text{NaCl}(s) \leftrightarrow \text{NaCl}(l)$
- B. $\text{NaCl}(s) \leftrightarrow \text{H}_2\text{O}(l)$
- C. $\text{H}_2\text{O}(g) \leftrightarrow \text{NaCl}(aq)$
- D. $\text{H}_2\text{O}(g) \leftrightarrow \text{H}_2\text{O}(l)$

23.

Given the reaction at equilibrium: $\text{A}(g) + \text{B}(g) \rightleftharpoons \text{AB}(g) + \text{heat}$

The concentration of $\text{A}(g)$ can be increased by

- A. lowering the temperature
- B. adding a catalyst
- C. increasing the concentration of $\text{AB}(g)$
- D. increasing the concentration of $\text{B}(g)$

24.

Which statement about a system at equilibrium is true?

- A. The forward reaction rate is less than the reverse reaction rate.
- B. The forward reaction rate is greater than the reverse reaction rate.
- C. The forward reaction rate is equal to the reverse reaction rate.
- D. The forward reaction rate stops and the reverse reaction rate continues.

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25.

Which statement correctly describes a chemical reaction at equilibrium?

- A. The concentrations of the products and reactants are equal.
- B. The concentrations of the products and reactants are constant.
- C. The rate of the forward reaction is less than the rate of the reverse reaction.
- D. The rate of the forward reaction is greater than the rate of the reverse reaction.

26.

Given the reaction at equilibrium: $2\text{CO}(g) + \text{O}_2(g) \leftrightarrow 2\text{CO}_2(g)$

Which statement regarding this reaction is always true?

- A. The rates of the forward and reverse reactions are equal.
- B. The reaction occurs in an open system.
- C. The masses of the reactants and products are equal.
- D. The concentrations of the reactants and products are equal.

27.

Given the reaction: $\text{HC}_2\text{H}_3\text{O}_2(aq) + \text{H}_2\text{O} \leftrightarrow \text{H}_3\text{O}^+(aq) + \text{C}_2\text{H}_3\text{O}_2^-(aq)$

When the reaction reaches a state of equilibrium, the concentrations of the reactants

- A. are less than the concentrations of the products
- B. are equal to the concentrations of the products
- C. begin decreasing
- D. become constant

28.

Given the equilibrium reaction at constant pressure:



When the temperature is increased, the equilibrium will shift to the

- A. right, and the concentration of $\text{HBr}(g)$ will decrease
- B. right, and the concentration of $\text{HBr}(g)$ will increase
- C. left, and the concentration of $\text{HBr}(g)$ will decrease
- D. left, and the concentration of $\text{HBr}(g)$ will increase

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29.

A solution that is at equilibrium must be

- A. concentrated C. saturated
B. dilute D. unsaturated

30.

A chemical reaction is at equilibrium. Compared to the rate of the forward reaction, the rate of the reverse reaction is

- A. faster and more reactant is produced C. the same and the reaction has stopped
B. faster and more product is produced D. the same and the reaction continues in both directions

31.

Given the reaction: $2\text{Na}(s) + 2\text{H}_2\text{O}(l) \rightarrow 2\text{Na}^+(aq) + 2\text{OH}^-(aq) + \text{H}_2(g)$

This reaction goes to completion because one of the products formed is

- A. an insoluble base C. a precipitate
B. a soluble base D. a gas

32.

Given the reaction: $\text{AgI}(s) \leftrightarrow \text{Ag}^+(aq) + \text{I}^-(aq)$

Solution equilibrium is reached in the system when

- A. the rate of dissolving reaches zero C. the rate of dissolving is zero and the rate of crystallization is greater than zero
B. the rate of crystallization reaches zero D. both the rate of dissolving and the rate of crystallization are equal and greater than zero

33.

In which reaction will the point of equilibrium shift to the left when the pressure on the system is increased?

- A. $\text{C}(s) + \text{O}_2(g) \leftrightarrow \text{CO}_2(g)$
B. $\text{CaCO}_3(s) \leftrightarrow \text{CaO}(s) + \text{CO}_2(g)$
C. $2\text{Mg}(s) + \text{O}_2(g) \leftrightarrow 2\text{MgO}(s)$
D. $2\text{H}_2(g) + \text{O}_2(g) \leftrightarrow 2\text{H}_2\text{O}(g)$

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34.

Ammonia is produced commercially by the Haber reaction: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \leftrightarrow 2\text{NH}_3(\text{g}) + \text{heat}$
The formation of ammonia is favored by

- A. an increase in pressure C. removal of $\text{N}_2(\text{g})$
B. a decrease in pressure D. removal of $\text{H}_2(\text{g})$

35.

Given the reaction at equilibrium: $\text{X}_2(\text{g}) + 2\text{Y}_2(\text{g}) \leftrightarrow 2\text{XY}_2(\text{g}) + 80 \text{ kcal}$
The equilibrium point will shift to the right if the pressure is

- A. increased and the temperature is increased C. decreased and the temperature is increased
B. increased and the temperature is decreased D. decreased and the temperature is decreased

36.

Which balanced equation represents a phase equilibrium?

- A. $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightleftharpoons 2\text{HI}(\text{g})$
B. $2\text{NO}_2(\text{g}) \rightleftharpoons \text{N}_2\text{O}_4(\text{g})$
C. $\text{Cl}_2(\text{g}) \rightleftharpoons \text{Cl}_2(\ell)$
D. $3\text{O}_2(\text{g}) \rightleftharpoons 2\text{O}_3(\text{g})$

37.

An increase in the temperature of a system at equilibrium favors the

- A. endothermic reaction and decreases its rate C. exothermic reaction and decreases its rate
B. endothermic reaction and increases its rate D. exothermic reaction and increases its rate

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38.

Which statement best describes a chemical reaction when it reaches equilibrium?

- A. The concentrations of reactants and products are the same. C. The forward and reverse reaction rates are the same.
B. The concentrations of the reactants decrease to zero. D. The forward reaction rate decreases to zero.

39.

Given the reaction at equilibrium: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \leftrightarrow 2\text{NH}_3(\text{g})$

Increasing the concentration of $\text{N}_2(\text{g})$ will increase the forward reaction rate due to

- A. a decrease in the number of effective collisions C. a decrease in the activation energy
B. an increase in the number of effective collisions D. an increase in the activation energy

40.

Given the reaction: $\text{AgCl}(\text{s}) \xrightleftharpoons{\text{H}_2\text{O}} \text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq})$

Once equilibrium is reached, which statement is accurate?

- A. The concentration of $\text{Ag}^+(\text{aq})$ is greater than the concentration of $\text{Cl}^-(\text{aq})$. C. The rates of the forward and reverse reactions are equal.
B. The $\text{AgCl}(\text{s})$ will be completely consumed. D. The entropy of the forward reaction will continue to decrease.

41.

Which type or types of change, if any, can reach equilibrium?

- A. a chemical change, only C. both a chemical and a physical change
B. a physical change, only D. neither a chemical nor a physical change

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42.

Given the reaction at equilibrium: $2\text{SO}_2(g) + \text{O}_2(g) \leftrightarrow 2\text{SO}_3(g) + \text{heat}$

Which change will shift the equilibrium to the right?

- A. adding a catalyst C. decreasing the pressure
B. adding more $\text{O}_2(g)$ D. increasing the temperature

43.

Given the reaction: $\text{N}_2(g) + 3\text{H}_2(g) \leftrightarrow 2\text{NH}_3(g) + 22.0 \text{ kcal}$

When equilibrium is reached in this system, the rate of the forward reaction is

- A. less than the rate of the reverse reaction C. equal to the rate of the reverse reaction
B. greater than the rate of the reverse reaction D. unrelated to the rate of the reverse reaction

Test 11: Equilibrium

Answer Key for Test 11: Equilibrium

1. B
2. C
3. C
4. D
5. D
6. A
7. C
8. B
9. C
10. C
11. A
12. C
13. A
14. A
15. B
16. C
17. A
18. C
19. B
20. D
21. B
22. D
23. C
24. C
25. B
26. A
27. D
28. A
29. C
30. D
31. D
32. D
33. B
34. A
35. B
36. C
37. B
38. C
39. B
40. C
41. C
42. B
43. C