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Be sure to mention the filename:
Chemistry_Questions_0108

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1.

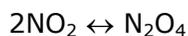
At equilibrium, _____.

Student Response

1. all chemical reactions have ceased
2. the rates of the forward and reverse reactions are equal
3. the rate constants of the forward and reverse reactions are equal
4. the value of the equilibrium constant is 1
5. the limiting reagent has been consumed

2.

A flask is initially charged with 0.2 atm of pure NO_2 , which then reacts to form N_2O_4 according to the equilibrium:



At what point does the conversion of NO_2 to N_2O_4 stop?

3.

For the following reaction, the rate coefficients are:

$$k_1 = 5.82 \cdot 10^{-21} \text{ s}^{-1}$$

$$k_{-1} = 8.19 \cdot 10^{15} \text{ M}^{-2} \text{ s}^{-1}$$

The equilibrium constant for this reaction is $K = \text{_____} \text{ M}^{-2}$

4-7 EQUILIBRIUM CONSTANT

4.

If the equilibrium constant for the reaction

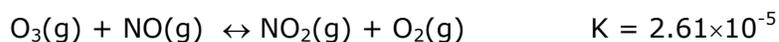


is 444, what is the equilibrium constant for the reaction



5.

At some temperature, the following reactions have the equilibrium constants shown:



What is the equilibrium constant for the reaction



6.

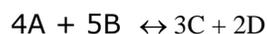
Consider the generic reaction:



If the equilibrium constant in terms of pressures is $K_p = 157$ at 19°C , what is the value of equilibrium constant in terms of concentrations, K_c . [Assume pressures are in atmosphere and concentrations are in moles/liter, $R = 0.08206 \text{ atm/M-K}$.]

7.

Consider the following equilibrium:



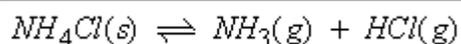
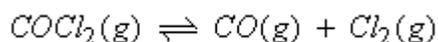
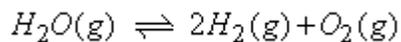
If the equilibrium pressures are $P_A = 4.69 \text{ atm}$, $P_B = 2.53 \text{ atm}$, $P_C = 1.24 \text{ atm}$, and $P_D = 2.34 \text{ atm}$, what is K_p

8-12 REACTION QUOTIENT

8.

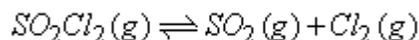
For each of the following systems at equilibrium and at constant temperature indicate whether increasing the volume would cause the reaction to shift towards reactants, towards products, or have no effect.

Statement



9.

The following equilibrium:



is endothermic ($\Delta H = 67$ kJ). What change (if any) in each of the following parameters would result in an increase yield of products.

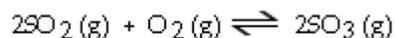
Statement

Pressure

Temperature

10.

The reaction below is exothermic:



Le Châtelier's Principle predicts that _____ will result in an increase in the number of moles of $SO_3(g)$ in the reaction container.

Student Response

1. increasing the pressure

2. decreasing the pressure

3. increasing the temperature

4. removing some oxygen

5. increasing the volume of the container

11.

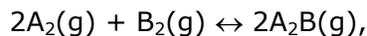
For the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$, $K_c = 0.0454$ at 261°C . If a vessel is filled with these gases such that the initial concentrations are $[PCl_5] = 0.25\text{M}$, $[PCl_3] = 0.20\text{M}$, and $[Cl_2] = 2.25\text{M}$, in which direction will a reaction occur and why?

Student Response

- a. toward products because $Q = 0.56$
- b. toward reactants because $Q = 1.8$
- c. toward products because $Q = 2.8$
- d. toward reactants because $Q = 0.0454$
- e. it is at equilibrium

12.

A reaction flask is charged with 2.9 atm of A_2 and 4.1 atm of A_2B . When equilibrium occurs via:



the equilibrium partial pressure of B_2 is 0.2 atm. Determine K_p .

13-14 HETERO EQUILIBRIUM

13.

A solution of NaF is added dropwise to a solution that is 0.0144 M in Ba^{2+} . When the concentration of F^- exceeds _____ M, BaF_2 will precipitate. Neglect volume

changes. For BaF_2 ,

Student Response

- 1. 5.9×10^{-5}
- 2. 1.1×10^{-2}

$$3. 2.4 \times 10^{-8}$$

$$4. 2.7 \times 10^{-3}$$

$$5. 1.2 \times 10^{-4}$$

14.

The hypothetical solid A_4B_2 decomposes according to:



If the equilibrium constant is 523.1 atm⁽⁴⁺²⁾ at 159K, what is the total pressure at equilibrium, if 30.5-g of A_4B_2 is placed in a 12-L vessel and decomposed at this temperature?

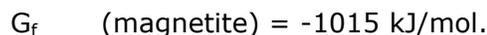
15-17 THERMODYNAMICS

15.

Is it possible for a reaction to be endothermic but at the same time be spontaneous. Conversely is it possible for a reaction to be exothermic yet nonspontaneous? Explain.

16.

Calculate the standard free energy change, and determine whether or not hematite spontaneously converts to magnetite under standard conditions. $3Fe_2O_3(s)$ (hematite)



Student Response

a. $G = -272.8 \text{ kJ}$; spontaneous

b. $G = 272.8 \text{ kJ}$; not spontaneous

c. $G = 469.4 \text{ kJ}$; spontaneous

d. $G = 196.6 \text{ kJ}$; not spontaneous

e. $G = -196.6 \text{ kJ}$; spontaneous

17.

For the hypothetical reaction $A_2 + B_2 \rightarrow 2AB$

$\Delta H^\circ = 68.3 \text{ kJ/mol}$, and $\Delta S^\circ = 123.9 \text{ J/(mol}\cdot\text{K)}$. What is ΔG° for this reaction at 215 K?

18-20 THERMODYNAMIC EQUILIBRIUM

18.

At 1,720 K, the equilibrium constant for a given reaction is $K = 0.0918$. What is the free energy for this reaction in kJ/mol?

19.

For a certain equilibrium process, the equilibrium constant is 9.45×10^{-5} at 105 K, and 4.03×10^{11} at 536 K. What is ΔH° (in kJ/mol) for this reaction?

20.

A certain equilibrium reaction has an equilibrium constant of $K = 5.51$ at a temperature of 360K. If the reaction quotient is 7.20 what is ΔG (in kJ/mol)?