

CHEMISTRY

BOOKS - A N EXCEL PUBLICATION

EQUILIBRIUM

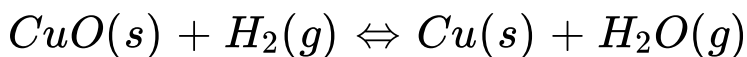
Question Bank

1. Write expressions for the equilibrium constant for the following reactions.



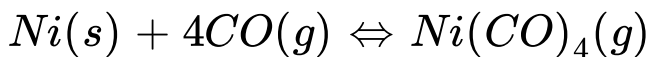
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2. Write expressions for the equilibrium constant for the following reactions.



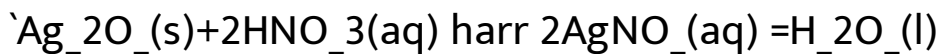
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3. Write expressions for the equilibrium constant for the following reactions.



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4. write equation for equilibrium constant in terms of concentration (K_c) for the equilibrium reaction given below.



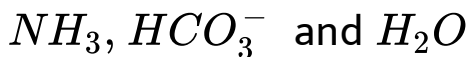
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5. Write the conjugate bases of the following:



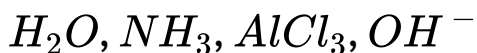
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6. Write the conjugate acids of the following :



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7. According to Lewis theory classify the following into acids and bases:



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8. The concentration of hydrogen ion in a soft drink is 3.8×10^{-3} . What is its pH?

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9. Calculate the hydronium ion concentration of a solution whose pH is 4.4.

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10. Calculate the pH of a 0.2M solution of hydrocyanic acid (HCN). Ionisation constant (K_a) of

HCN at 298K is 7.2×10^{-10}



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11. Calculate the p^{K_a} of 0.1M solution of acetic acid if the degree of dissociation of acetic acid is 1.32×10^{-2}



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12. Calculate the pH of the buffer solution formed by mixing 0.2M NH_4Cl and 0.1M NH_3 if K_b of ammonia is 1.77×10^{-5}





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13. The solubility of $BaSO_4$ in water at 298K is $1.1 \times 10^{-5} \text{ mol L}^{-1}$. Calculate the solubility product of $BaSO_4$ at 298K.



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14. The solubility product of silver chloride is 1.2×10^{-10} at 298K. Calculate the solubility of AgCl at 298K.



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15. The solubility product of silver chromate (Ag_2CrO_4) at 298K is 4.0×10^{-12} . Calculate its solubility at 298K.



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16. Calculate the solubility of $Ni(OH)_2$ in 0.1M NaOH solution. K_{sp} of $Ni(OH)_2$ is 2×10^{-15}



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17. A liquid is in equilibrium with its vapour in a sealed container at a fixed temperature. The

volume of the container is suddenly increased. What is the initial effect of the change on vapour pressure?



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18. A liquid is in equilibrium with its vapour in a sealed container at a fixed temperature. The volume of the container is suddenly increased.

How do rate of evaporation and condensation change initially?



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19. A liquid is in equilibrium with its vapour in a sealed container at a fixed temperature. The volume of the container is suddenly increased. What happens when equilibrium is restored finally and what will be the final vapour pressure?



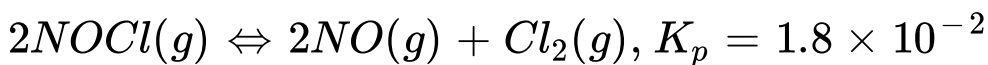
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20. At a certain temperature and total pressure of 10^5 Pa, iodine vapour contains 40% by volume of iodine atoms. Calculate K_p for the equilibrium, $I_2(g) \rightleftharpoons 2I(g)$.



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21. Find out the value of K_c for each of the following equilibria from the value of K_p

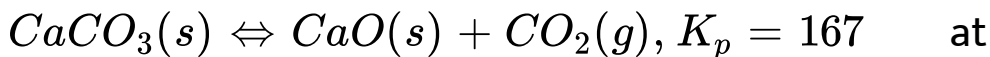


at 500 K



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22. Find out the value of K_c for each of the following equilibria from the value of K_p



1073 K



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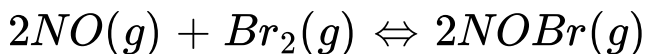
23. For the following equilibrium, $K_c = 6.3 \times 10^{14}$ at 1000 K



What is K_c for the reverse reactions?

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24. Nitric oxide reacts with bromine to form nitrosyl bromide as follows



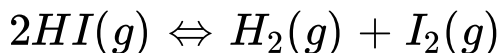
When 0.087 mol of NO and 0.0437 mole of Br_2 are mixed in a closed container at constant

temperature, 0.0518 mol of NOBr is obtained at equilibrium. Calculate equilibrium amount of NO and Br_2 .



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25. A sample of HI(g) is placed in a flask at a pressure of 0.2 atm. At equilibrium, the partial pressure of HI(g) is 0.04 atm. What is K_p for the equilibrium



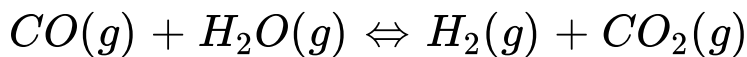
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26. A mixture of 1.57 mol of N_2 , 1.92 mol of H_2 and 8.13 mol of NH_3 is introduced into a 20L vessel at 500K. K_c for the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ is 1.7×10^2 at 500K. Is the reaction mixture at equilibrium. If not, what is the direction of the net reaction.



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27. One mole of H_2O and one mole of CO are taken in a 10L vessel and heated to 725K. At equilibrium 40% of water (by mass) reacts with CO according to the equation



Calculate the equilibrium constant for the reaction.

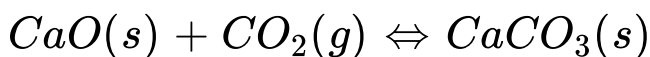
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28. Do the number of moles of reaction products increase, decrease or remain or remain same when each of the following equilibria is subjected to a decrease in pressure by increasing the volume?



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29. Do the number of moles of reaction products increase, decrease or remain or remain same when each of the following equilibria is subjected to a decrease in pressure by increasing the volume?



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30. Does the number of moles of reaction products increase, decrease or remain same when the following equilibria is subjected to a decrease in pressure by increasing the volume?





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31. It has been found that pH of 0.01 M solution of an organic acid is 4.15. Calculate the concentration of the anion, the ionisation constant of the acid and its pKa.



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32. The degree of ionisation of 0.1 M bromoacetic acid solution is 0.132. Calculate the pH of the solution and the pKa of bromoacetic acid.



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33. If 0.561 g of KOH is dissolved in water to give 200 mL of solution at 298K, calculate the concentrations of potassium, hydrogen and hydroxyl ions. What is its pH?



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34. The solubility of Sr $(OH)_2$ at 298 K is 19.23g/L of solution. Calculate the concentration of strontium and hydroxyl ions. What is its pH? (Atomic mass of Sr=87.6)



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35. The ionic product of water at 310 K is 2.7×10^{-14} . What is the pH of neutral water at this temperature.

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36. When some sodium acetate is added to a solution of acetic acid, the concentration of unionized acetic acid increases.

What is the phenomenon involved? Substantiate.

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37. Consider the equilibrium,

$AgCl_s \leftrightarrow Ag^+ + Cl^-$ the solubility of AgCl is

$1.06 \times 10^{-5} molL^{-1}$ at 298K. Find out its K_{sp} at

this temperature.



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38. what happens to the value of solubility and solubility product when HCl is passed through an AgCl solution?



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39. Lowry-Bronsted concept of acids and bases is based on the exchange of H^+ during a reaction.

Illustrate with an example of the conjugate acid-base pair.



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40. explain the Lewis concept of acids and base.



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41. According to Lewis theory classify the following into acids and bases:

$H_2O, NH_3, AlCl_3, OH^-$

A. H_2O

B. NH_3

C. $AlCl_3$

D. OH^-

Answer:



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42. Common ion effect is a phenomenon based on the Le-Chatelies principle. Illustrate the common ion effect using an example.



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43. if the concentration of the hydrogen ion in soft drink is $3 \times 10^{-3} \text{M}$, calculate its pH.



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44. identify the Lewis acids from the following:

A. OH

B. BCl_3

C. NH_3

D. H^+

Answer:



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45. The principle goal of chemical synthesis is to maximize the conversion of reactants into products. Le-Chatlier's principle can be applied to achieve this goal.

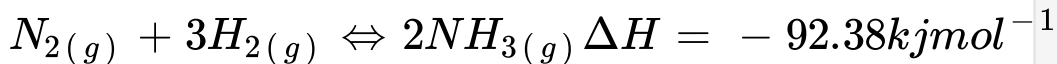
State Le-Chatlier's principle.



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46. The principle goal of chemical synthesis is to maximize the conversion of reactants into products. Le-Chatlier's principle can be applied to achieve this goal.

Predict the conditions to be applied to maximize the production of ammonia in the following reaction:



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47. The principle goal of chemical synthesis is to maximize the conversion of reactants into products. Le-Chatlier's principle can be applied to achieve this

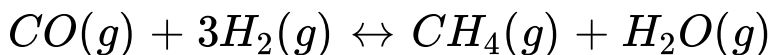
goal.

State Le-Chatlier's principle.



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48. Apply the Le- Chatelier principle in the following equilibrium and predict the effect of pressure



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49. The behaviour of acid and bases can be explained using different concepts.

Select the Lewis acid from the following:

$(\text{NH}_3, \text{OH}^-, \text{BCl}_3, \text{Cl}^-)$



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50. Lowry-Bronsted concept of acids and bases is based on the exchange of H^+ during a reaction.

Illustrate with an example of the conjugate acid-base pair.



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51. The behaviour of acid and bases can be explained using different concepts

Out of the following, which can produce an acidic solution in water?

$(CH_3COONa, NH_4Cl, CH_3COONH_4, NaCl)$



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52. Common ion effect is a phenomenon based on the Le-Chatelies principle. Illustrate the common ion effect using an example.



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53. Write an expression for equilibrium constant,

K_c for the reaction, $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \rightleftharpoons$

$4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$



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54. What is the equilibrium constant (K) in the following case? Reaction is reversed

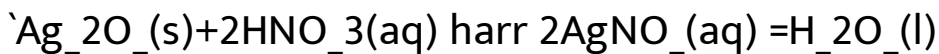


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55. Calculate the solubility (S) of $CaSO_4$ at 298K if its solubility product constant (K_{sp}) at this temperature is 9×10^{-6}

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56. write equation for equilibrium constant in terms of concentration (K_c) for the equilibrium reaction given below.



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57. what are buffer solution? Given an example for a buffer solution.

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58. The concentration of H^+ ion in a sample of soft drink is 3.8×10^{-3} M. determine its pH.

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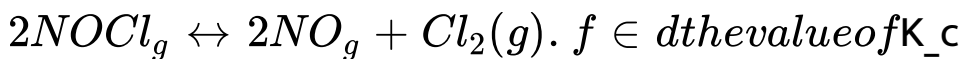
59. give the arrhenius concept about acids and bases.

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60. Give one example each for arrhenius acid and base

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61. Write the expression for equilibrium if the value of K_p for the following equilibrium.

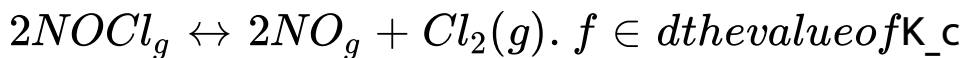


f or *abovaequilibrium* if *thevalueofK_pis*

$1.8 \times 10^{-2} \text{atm}$ at 600K . $R = 0.0821 \text{L atm K}_1 \text{mol}_1^{-1}$

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62. Write the expression for equilibrium if the value of K_p for the following equilibrium.



f or above equilibrium if the value of K_p is

1.8×10^{-2} at 600K . $R = 0.0821\text{L atm K}^{-1}\text{mol}^{-1}$



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63. Equilibrium constant helps in predicting the direction helps in predicting the direction in which a given reaction will proceed at any stage. In which one of the following conditions a chemical reaction proceeds in the forward direction?



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64. Equilibrium constant helps in predicting the direction helps in predicting the direction in which a given reaction will proceed at any stage. In which one of the following conditions a chemical reaction proceeds in the forward direction?

A. $Q_c < K_c$

B. $Q_c > K_c$

C. $Q_c = \frac{1}{K_c}$

D. $Q_c = K_c$

Answer:



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65. write whether the following statement is true or false.

" high value of equilibrium constant suggest high concentration of the reactants in the equilibrium mixture"



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66. State the le-chatelier's principle.

applying this principle, explain the effect of pressure in the following equilibrium.



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67. Write the expression for equilibrium constant K_p for the following equilibrium



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68. the solubility product of $Al(OH)_3$ is 1×10^{-36} .

Calculate the solubility of $Al(OH)_3$.



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69. explain the concept of Lewis acids and Lewis bases with Suitable examples.



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70. write the Henderson-Hasselbalch equation for an acidic buffer, calculate the pH of an acidic buffer

containing 0.1M CH_3COOH and 0.5M

CH_3COONa [K_{af} or CH_3COOH is 1.8×10^{-5}]



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