CHEMISTRY

BOOKS - OMEGA PUBLICATION

EQUILIBRIUM

Questions

1. What is phase transformation ?

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2. What is physical equilibrium ? Give examples.

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3. What is saturated solution ?

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4. State Henry's law and mention its some important applications.

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5. Give the general characteristics of equilibria involving physical processes ?

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6. STATEMENT-1: The physical equilibrium is not static but dynamic in nature.

STATEMENT-2: The pysical equilibrium is a state in which two opposing process are proceeding at the same rate.

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7. What is chemical equilibrium ? Give an example.

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8. State and explain the law of mass action.

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9. Derive the law of chemical equilibrium from law of mass action.

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10. Apply law of mass action for a reversible reaction and state law of chemical equilibrium.

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11. What do you understand by equilibrium constant ? What are its characteristics ?

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12. What is K_c for the following equilibirum when the equilibrium concentration of each substance is : $[SO_2] = 0.60M, [O_2] = 0.82M$ and $[SO_3] = 1.90M$?

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

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

What is the initial effect of the change on vapour pressure ?

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14. A liquid is equilibrium with its vapours in a sealed container at a fixed temperature. The volume of the container suddenly increased. How do rates of evaporations and condensation changes initially ?

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

What happens when equilibrium is restored finally and what will be the final vapour pressure.

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16. What is homogeneous equilibirum ? Give an example.

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17. Derive a relationship between and K_p and k_c.

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18. Derive a relationship between and K_p and k_c.

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19. For the reaction :

$PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$:

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20. Find out the value of K_c for each of the following equilibrium from the value of K_p :

$2NOCl(g) \Leftrightarrow 2NO(g) + Cl_2(g), K_p = 1.8 \times 10^{-2}$

at 500 K.

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

$CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g), K_p = 167$

atm at 1073 K.

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

$2NOCl(g) \Leftrightarrow 2NO(g) + Cl_2(g), K_p = 1.8 \times 10^{-2}$

at 500 K.

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23. At a certain temperature and total pressure of 10^5 Pa, iodine vapours contains 40% by volume of 1 atoms.

$I_2(g) \Leftrightarrow 2I(g)$

Calculate K_p for the equilibrium.

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24. 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 given equilibrium ?

$2HI(g) \Leftrightarrow H_2(g) + I_2(g)$

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25. What is heterogeneous equilibrium ? Give an example.

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26. Write the equilibrium constant expression for the following reactions.

$CH_3COCH_3(l) \Leftrightarrow CH_3COCH_3(g)$

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27. Write the equilibrium constant expression for the following reactions.

$CH_4(g) + 2O_2(g) \Leftrightarrow CO_2(g) + 2H_2O(l)$

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28. Determine K_p for the reaction :

$A(g) + B(s) \Leftrightarrow C(g) + D(g), K_c = 49at$ 127^(@)C`.

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29. The concentration of a pure solid or liquid phase is not include in the expression of equilibrium constant becase :

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30. Give the characteristics of equilibrium constant.

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31. State Le Chatelier's principle.

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32. Why does the dissociation of PCl_5 decreases in the presence of Cl_2 ?

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33. What is the effect of increasing pressure on the equilibrium

$H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$?

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34. What is the effect of increasing pressure on the equilibrium ?

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

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35. Discuss the effect of addition of inert gas at constant pressure on reaction.

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

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36. Discuss the effect of temperature on resistivity of metals.

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37. Why does solubility of CO_2 decreases the rise in temperature ?

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38. For the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$, what is the effect

of the temperature and pressure to get more yield of ammonia ?

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39. Using Le-Chatelier's principle predict the effect of

increasing the pressure on following equilibrium :

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g) +$ Heat

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40. Using Le-Chatelier's principle predict the effect of

increasing the pressure on following equilibrium :

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g) +$ Heat

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41. Equilibrium constant, K_C for the reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at 500 K is 0.061

At a particular time, the analysis shows that composition of the reaction mixture is 3.0 mol $L^{-1} N_2$, $2.0 \text{mol L}^{-1} H_2$, 0.5 mol $L^{-1} NH_3$. Is the

reaction at equilibrium ? If not, in which direction does the reaction tends to proceed to reach equilibirum ?

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42. Describe the effect of :

addition of H_2 on the given equilibrium:

$2H_2(g) + CO(g) \Leftrightarrow CH_3OH$

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43. Describe the effect of :

addition of CH_3OH on the given equilibrium:

$2H_2(g) + CO(g) \Leftrightarrow CH_3OH$

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44. Describe the effect of :

removal of CO on the given equilibrium:

$2H_2(g) + CO(g) \Leftrightarrow CH_3OH$

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45. Describe the effect of :

removal of CH_3OH on the equilibrium of the reaction $2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

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46. Explain the effect of catalyst on the rate of reaction with diagram.

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47. What is arrhenius concept of acid?

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48. Give Bronsted concept of acids.

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49. What is meant by conjugate acid base pair ?

Explain with the help of a chemical reaction.

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50. Give the conjugate bases of followings :

HCO_3^-

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51. Give the conjugate bases of followings :

H_2S

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52. Give the conjugate bases of followings :

NH_3

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53. Give the conjugate bases of followings :

OH^-

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54. Give the conjugate bases of followings :

HNO_3

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55. Give the conjugate bases of followings :

NH_4^+

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56. Give the conjugate bases of followings :

HCO_3^-

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57. Label the conjugate acid-base pair in the following :

$CO_3^{2-} + H_2O \Leftrightarrow HCO_3^- + OH^-$

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58. Write the conjugate acids for the following Bronsted bases :

NH_2^-, NH_3, O^{2-}, NO_3^- and $HCOO^-$

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59. What are aryl halides? Give one example?

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60. What is the Lewis concept of acids ?

61. What is the Lewis concept of bases ?

62. What is the Lewis concept of acids ?

63. Classify the followings into Lewis acids and Lewis bases and show how these act as Lewis acid/base ?

OH^-

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64. Classify the followings into Lewis acids and Lewis bases and show how these act as Lewis acid/base ?

F^-

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65. Classify the followings into Lewis acids and Lewis bases and show how these act as Lewis acid/base ?

H^+

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66. Classify the followings into Lewis acids and Lewis bases and show how these act as Lewis acid/base ?

BCl_3

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67. Write conjugate acids of (i) CO_3^{2-} (ii) H_2O (iii) OH^- (iv) HSO_4^-.

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68. Explain why all Arrhenius are also Bronsted acids, but Arrhenius bases are not Bronsted bases.

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69. All Bronsted bases are also Lewis bases but all Bronsted acid are not Lewis acids. Explain.

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70. What is pH scale ? How does is respresent acidic and basic nature of a solution? .

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71. Define pH.

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72. Calculate the pH value of the followings :

0.001 M HCl

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73. Calculate the pH value of the followings :

0.01 M NaOH

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74. Calculate the pH of the followings :

$0.001 M HNO_3$

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75. Calculate the pH of the followings :

$0.001 M Ba(OH)_2$

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76. What happens to ionic product of water if some acid is added ?

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77. 0.63 g of HNO_3 dissolved in 100 ml of solution. Calculate its pH value.

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78. Calculate the pH of the solution containing 2g of NaOH per liter of the solution.

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79. Calculate the pH of 0.005 M NaOH solution.

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80. Calculate the pH of 0.003 M HCl.

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81. What is the pH of 0.1 M HCl ?

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82. What is the ph of 0.01 M HCl ?

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83. What are polybasic or polyprotic acids ? Given an example.

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84. What is common ion effect ? Explain with an example.

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85. Using s, p, d and f notations, describe the orbital with the quantum number. n = 3 , l = 2

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86. Explain buffer solutions and their types.

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87. Explain the action of basic buffer.

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88. Define basic buffer with an example.

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89. Define acidic buffer with an example.

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90. Explain the action of acidic buffer.

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91. Define solubility product of a salt.

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92. Define solubility product. How does it differ from ionic product ?

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93. The solubility product of $PbBr_2$ is 8.0×10^{-5}. Calculate its solubility.

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94. Solubility of Ag_2CrO_4 is 8×10^{-5} mol L^{-1}. Calculate the solubility product.

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95. The solubility of silver chloride (AgCl) in water at $25^\circ C$ ia 1.06×10^{-5} mol L^{-1}.

Calculate the solubility product of AgCl at this temperature.

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96. Solubility of Ag_2CrO_4 is 8×10^{-5} mol L^{-1}. Calculate the solubility product.

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97. Determine the solubilities of silver chromate at 298 K from their solubility product constants

1.1×10^{-12}.

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98. At 298 K the solubility of silver chloride in water is 0.00188 g/L. What is its K_{sp} ?

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99. Solubility of Ag_2CrO_4 is 8×10^{-5} mol L^{-1}. Calculate the solubility product.

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100. Determine the solubilities of silver chromate at 298 K from their solubility product constants 1.1×10^{-12}.

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Multiple Choice Questions Mcqs

1. List the value of n and l for the following orbitals : 4s

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2. For the reaction , $2HI \Leftrightarrow H_2 + I_2$

A. $K_p > K_c$

B. $K_c > K_p$

C. $K_p = K_c$

D. none of these

Answer: C

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3. Equilibrium constant for the reaction $2NO(g) + Cl_2(g) \Leftrightarrow 2NOCl(g)$ is correctly given by the expression

A. $K = \frac{[2NOCl]}{[2NO][Cl_2]}$

B. $K = \frac{[NOCl]^2}{[NO]^2[Cl_2]}$

C. $K = \frac{[NO]^2[Cl_2]^2}{[NO]^2[Cl_2]}$

D. $K = \frac{[NO]^2[Cl_2]^2}{[NOCl]}$

Answer: B

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4. k_1 and k_2 are the velocity constants of forward and backward reactions. The equilibrium constant K of the reaction is

A. $k_1 \times k_2$

B. $k_1 - K_2$

C. $\frac{k_1}{k_2}$

D. $\frac{k_1 + k_2}{k_1 - k_2}$

Answer: C

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5. The number of electrons present in 3d of Cu+ is .....

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6. Consider the reaction

$$2CO(g) + O_2(g) \Leftrightarrow 2CO_2(g) + Heat$$

Under what conditions shift is undeterminable ?

A. increasing temperature as well as pressure

B. lowering the temperature and increasing the pressure.

C. any value of temperature and pressure

D. lowering of temperature as well as pressure

Answer: B

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7. Using s, p, d notations, describe the orbital with the quantum number. n = 7 , l = 0

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8. Using s, p, d notations, describe the orbital with the quantum number. n = 7 , l = 1

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9. Which of the following is strongest acid ?

A. Cl^-

B. NH_3

C. BF_3

D.

Answer: C

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10. What is the structural formula of 2-Chloro-2-methylpropane?

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11. What is the structural formula of 2-Chlorobutane?

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12. What is the structural formula of 1-Chloro-3-methylpentane?

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13. What is the structural formula for 1-Chloro-2,2-dimethylpropane?

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14. What is the structural formula for Ethylene dibromide?

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15. What is the structural formula of 1-Bromo-2,3-dichlorobutane?

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16. The pH indicators are

A. salt of strong and strong base

B. salts of weak acids and weak bases

C. either weak acids or weak bases

D. either strong acids or strong bases

Answer: C

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17. What is incorrect about buffer solution ?

A. it contains a weak acid and its conjugate base

B. It contains a weak base and its conjugate acid

C. It shows change in pH on adding small amount of acid or base

D. All of the above

Answer: C

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18. Precipitation takes place when the ionic product

A. equals to the solubility product

B. exceeds the solubility product

C. is less than the solubility product

D. is almost zero

Answer: B

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19. Which of the following is an example of heterogeneous equilibrium ?

A. $CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

B. $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

C. $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

D. $N_2O(g) \Leftrightarrow 2NO_2(g)$

Answer: A

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20. For the reaction, $aA + bB \rightarrow$ Products.

According to law of mass action,

A. rate of reaction $\propto [A][B]$

B. rate of reaction $\propto [A]^a[B]^b$

C. Rate of reaction $\propto \frac{1}{[A]^a[B]^b}$

D. rate of reaction $\propto \frac{1}{[A][B]}$

Answer: B

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21. What is the structural formula of 5-Bromo-1-chloro-2-iodohexane?

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22. Name any one plant that grows in water and eaten as food?

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23. Using s, p, d notations, describe the orbital with the quantum number. n = 6 , l = 1

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24. How ionic product of water change with temperature ?

A. $\left[H_3O^+(aq)\right]\left[OH^-(aq)\right] = K_w$

B. $\frac{[H_3O^+(aq)]}{[OH^-(aq)]} = K_w$

C. $\frac{[OH^-(aq)]}{[H_3O^+(aq)]} = K_w$

D. None of these

Answer: C

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25. Argon is an inert gas used in light bulbs to retard the vaporization of the filament. A certain light-bulb containing argon at 1.25 atm and $18^{\circ}C$ is heated to $85^{\circ}C$ at constant volume. Calculate its final pressure.

A. pH increases

B. pH decreases

C. pH remains 7

D. none of these

Answer: B