CHEMISTRY

BOOKS - DISHA CHEMISTRY (HINGLISH)

EQUILIBRIUM

Mcq

1. If 1.0 mole of I_2 is introduced into 1.0 litre flask at 1000 K, at quilibrium $\left(K_e = 10^{-6}\right)$, which one is correct ?

A. $[I_2(g)] > \left[1^{-1}(g)\right]$

B. $[I_2(g)] < [1^-(g)]$

C. $[I_2(g)] = [I^-(g)]$

D. $[I_2(g)] = \frac{1}{2}[I^-(g)]$

Answer: A

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2. In a reaction, $A + 2B \Leftrightarrow 2C$, 2.0 mole of A, 3.0 mole of B and 2.0 mole of C are placed in a 2.0 L flask and the equilibrium concentration of C is 0.5 mol/L. The equilibrium constant (K) for the reaction is

A. 0.073

B. 0.147

C. 0.05

D. 0.026

Answer: C

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3. K_e for the reaction

$N_2(g) + O_2 \Leftrightarrow 2NO(g)$

at 300 K is 4.0×10^{-6}. K_p for the above reaction will be $\left(R = 2 \text{ cal mol}^{-1}K^{-1}\right)$

A. 2.4×10^{-3}

B. 4×10^{-6}

C. $4 \times 10^{-6}(RT)^2$

D. 16×10^{-12}

Answer: B

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4. ΔG° for the reaction $X + Y \Leftrightarrow Z$ is -4.606 kcal. The equilibrium constant for the reaction at $227^\circ C$ is

A. 100

B. 10

C. 2

D. 0.01

Answer: A

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5. The equilibrium constant for the reaction

$$SO_3(g) \Leftrightarrow SO_2(g) + \frac{1}{2}O_2(g)$$

is $K_e = 4.9 \times 10^{-2}$. The value of K_e for the reaction

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

A. 9.8×10^{-2}

B. 4.9×10^{-2}

C. 416

D. 2.40×10^{-3}

Answer: C

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6. Four species are listed below :

$i.\ HCO_3^-$ $ii.\ H_3O^+$ $iii.\ HSO_4^-$ $iv.\ HSO_3F$

Which one of the following is the correct sequence of their acid strength ?

A. $iv < ii < iii < i$

B. $ii < iii < I < iv$

C. $I < iii < ii < iv$

D. $iii < I < iv < ii$

Answer: C

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7. The degree of dissociation of dinitrogen tetroxide $N_2O_4(g) \rightarrow 2NO_2(g)$ at ature T and total pressure P is α. Which one of the following is the correct expression for the equilibrium constant (K_p) at this temperature ?

A. $\frac{2\alpha}{(1-\alpha^2)}$

B. $\frac{\alpha^2 P}{1-\alpha}$

C. $\frac{4\alpha^2}{(1-\alpha^2)}$

D. $\frac{4\alpha^2 P}{(1-\alpha^2)}$

Answer: D

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8. The equilibrium constants K_{p1} and K_{p2} for the reactions $X \Leftrightarrow 2Y$ and $Z \Leftrightarrow P + Q$, respectively are in the ratio of the ratio of total pressures at these equilibria is

A. $1:1$

B. $1:36$

C. $1:3$

D. $1:9$

Answer: B

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9. The dissociation of a gas AB_2 at equilibrium can be represented as :

$2AB_2(g) \Leftrightarrow 2AB(g) + B_2(g)$

The degree of dissociation is x and is small compared to I. The expression relating the degree of dissociation

(x) with equilibrium constant K_p and total pressure P is :

A. $(2K_1 / P)$

B. $(2K_p / P)^{1/3}$

C. $(2K_p / P)^{1/2}$

D. (K_p / P)

Answer: B

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10. The exothermic formation of ClF_3 is represented by the equation :

$Cl_2(g) + 3F_2(g) \Leftrightarrow 2ClF_3(g), \Delta H = -329kJ$

Which of the following will increase the quantity of ClF_3 in an equilibrium mixture of Cl_2, F_2 and ClF_3 ?

A. Adding F_2

B. Increasing the volume of the container

C. Removing Cl_2

D. Increasing the temperature

Answer: A

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11. Which of the following statement(s) is /are correct ?

(i) ΔG is negative, then the reaction is spontaneous and proceeds in the forward direction.

(ii) ΔG is positive, then reaction is non-spontancous

(iii) ΔG is 0, then reaction is at equilibrium

A. I, ii and iii are correct

B. I and ii

C. ii and iii are correct

D. only iii is correct

Answer: A

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12. On the basis of Lc Chatclier's principle, predict which of the following conditions would be unfavourable for the formation of SO_3 ? Given that

$2SO_2 + O_2 \Leftrightarrow 2SO_3, \Delta H = -42$ kcal

A. Low pressure and low temperature

B. High pressure and low temperature

C. High temperature and low pressure

D. High concentration of SO_2

Answer: C

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13. The standard Gibbs energy change at 300 K for the reaction $2A \Leftrightarrow B + C$ is 2494.2J. At a given time, the composition of the reaction mixture is $[A] = \frac{1}{2}, [B] = 2$ and $[C] = \frac{1}{2}$. The reaction proceeds in the : $[R = 8.314J/K/\text{mol}, e = 2.718]$

A. forward direction because $Q < K_e$

B. reverse direction because $Q < K_e$

C. forward direction because $Q > K_e$

D. reverse direction because $Q > K_e$

Answer: D

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14. If the equilibrium constant for

$N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$ is K,

the equilibrium constant for

$\frac{1}{2}N_2(g) + \frac{1}{2}O_2(g) \Leftrightarrow NO(g)$ will be :

A. $K^{\frac{1}{2}}$

B. $\frac{1}{2}K$

C. K

D. K^2

Answer: A

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15. The following reaction is performed at 298 K.

$2NO(g) + O_2(g) \Leftrightarrow 2NO_2(g)$

The standard free energy of formation of NO(g) is 86.6 kJ/mol at 298 K. What is the standard free energy of formation of $NO_2(g)$ at 298 K ? $\left(K_p = 1.6 \times 10^{12}\right)$

A. $86600 - \dfrac{\text{In}\left(1.6 \times 10^{12}\right)}{R(298)}$

B. $0.5\left[2 \times 86,600 - R(298) \ \ \text{In} \ \ \left(1.6 \times 10^{12}\right)\right]$

C. R (298) In $\left(1.6 \times 10^{12}\right) - 86600$

D. 86600+R(298) In $\left(1.6 \times 10^{12}\right)$

Answer: B

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16. Which of the following pairs constitutes a buffer ?

A. NaOH and NaCl

B. HNO_3 and NH_4NO_3

C. HCl and KCl

D. HNO_2 and $NaNO_2$

Answer: D

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17. For dibasic acid correct order is

A. $K_{a1} < K_{a2}$

B. $K_{a1} > K_{a2}$

C. $K_{a1} = K_{a2}$

D. not certain

Answer: B

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18. Consider the expression $\Delta G = -RT \text{ In } K_p + RT \text{ In } Q_p$ and select the correct statement at equilibrium

where Q_p and K_p term refer to reaction quotient and eq uilibrium constant at constant pressure respectively.

A. $\Delta G = 0, Q_p > K_p$ the equilibrium reaction will shift from left to right

B. $\Delta G = 0, Q_p = K_p$ the equilibrium reaction will shift from left to right

C. $\Delta G = \infty, Q_p < K_p$ the equilibrium reaction will shift from right to left

D. $\Delta G < 0, Q_p > K_p$ the equilirbium reaction will shift from right to left

Answer: B

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19. K_e for $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ is 0.04 at $250^\circ C$. How many moles of PCl_5 must be added to a 3L flask to obtain a Cl_2 concentration of 0.15 M

A. 4.2 moles

B. 2.1 moles

C. 5.5 moles

D. 6.3 moles

Answer: B

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20. In the following hypothetical reaction

$A + 3B \Leftrightarrow 2C + D$

initial moles of A are twice that of B. If at equilibrium moles of B and C are equal. Percentage of B reacted is

A. 0.6

B. 0.4

C. 0.1

D. 0.2

Answer: A

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21. Which of the following can act as both Bronsted acid and Bronsted base ?

A. Na_2CO_3

B. OH^-

C. HCO_3^-

D. NH_3

Answer: C

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22. Match the columns :

A. A-II, B-I, C-IV, D-III

B. A-I, B-II, C-III, D-IV

C. A-III, B-I, C-IV, D-II

D. A-IV, B-II, C-I, D-III

Answer: A

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23. Which of the following statements are correct ?

(i) Ionic product of water $(K_w) = [H^+][OH^-] = 10^{-14} M^2$

(ii) At $298K [H^+] = [OH^-] = 10^{-7}$

(iii) K_w does not depend upon temperature

(iv) Molarity of pure water = 55.55 M

A. I, ii and iii

B. I, ii and iv

C. I and iv

D. ii and iii

Answer: C

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24. At a certain temperature the dissocation constants of formic acid and acetic acid are

1.8×10^{-4} and 1.8×10^{-6} respectively. The concentration of acetic acid solution in which the hydrogen ion has the same concentration as in 0.001 M formic acid solution is equal to

A. 0.001 M

B. 0.01 M

C. 0.1 M

D. 0.0001 M

Answer: B

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25. The first and second dissociation constants of an acid H_2A are 1.0×10^{-5} and 5.0×10^{-10} respectively. The overall dissociation constant of the acid will be

A. 0.2×10^{5}

B. 5.0×10^{-5}

C. 5.0×10^{15}

D. 5.0×10^{-15}

Answer: D

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26. Equal volumes of three acid solutions of pH 3, 4 and 5 are mixed in a vessel. What will be the H^+ ion concentration in the mixture ?

A. $1.11 \times 10^{-4} M$

B. $3.7 \times 10^{-4} M$

C. $3.7 \times 10^{-3} M$

D. $1.11 \times 10^{-3} M$

Answer: B

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27. The solubility product of $AgCl$ is 4.0×10^{-10} at 298 K. The solubility of AgCl in $0.04MCaCl_2$ will be

A. $2.0 \times 10^{-5}M$

B. $1.0 \times 10^{-4}M$

C. $5.0 \times 10^{-9}M$

D. $2.2 \times 10^{-4}M$

Answer: C

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28. The pH of a buffer containing equal molar concentrations of a weak base and its chloride (K_b) forweak base $= 2 \times 10^{-5}$, log 2=0.3) is

A. 5

B. 9

C. 4.7

D. 9.3

Answer: D

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29. In a saturated solution of the sparingly soluble strong electrolyte $AglO_3(s) \Leftrightarrow Ag^+(aq) + IO_3^-(aq)$. If the solubility product constant K_{sp} of $AgIO_3$ at a given temperature is 1.0×10^{-8}, what is the mass of $AgIO_3$ contained in 100 ml of its saturated solution ?

A. $1.0 \times 10^{-4} g$

B. $28.3 \times 10^{-2} g$

C. $2.83 \times 10^{-3} g$

D. $1.0 \times 10^{-7} g$

Answer: C

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30. What is $\left[H^{+}\right]$ is mol/ L of a solution that is 0.20 M in CH_3COONa and 0.10 M in CH_3COOH ? K_a for $CH_3COOH = 1.8 \times 10^{-5}$

A. 3.5×10^{-4}

B. 1.1×10^{-5}

C. 1.8×10^{-5}

D. 9.0×10^{-6}

Answer: D

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31. The K_{sp} for $Cr(OH)_3$ is 1.6×10^{-30}. The solubility of this compound in water is :

A. $\sqrt[4]{1.6 \times 10^{-30}}$

B. $\sqrt[4]{1.6 \times 10^{-30}/27}$

C. $1.6 \times 10^{-30/27}$

D. $\sqrt{1.6 \times 10^{-30}}$

Answer: B

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32. For the reaction $CO(g) + (1/2)O_2(g) = CO_2(g)$, K_p/k_e is

A. RT

B. $(RT)^{-1}$

C. $(RT)^{-1/2}$

D. $(RT)^{1/2}$

Answer: C

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33. For the reaction : $2NO_{2(g)} \Leftrightarrow 2NO_g + O_2(g)$,

$\left(K_e = 1.8 \times 10^{-6} \text{ at } 184^\circ C\right)(R = 0.0831 kJ/(\text{mol}K))$

When K_P and K_e are compared at $184^\circ C$, it is found that

A. Wheater K_p is greater than, less than or equal to K_e depends upon the total gas pressure

B. $K_p = K_e$

C. K_p is less than K_e

D. K_p is greaterthan K_e

Answer: D

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34. A monobasic weak acid solution has a molarity of 0.005 and pH of 5. What is the percentage ionization in this solution ?

A. 2.0

B. 0.2

C. 0.5

D. 0.25

Answer: B

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35. Values of dissociation constant, K_a are given as follows :

Acid K_a

$HCN 6.2 \times 10^{-10}$

$HF \quad 6.6 \times 10^{-4}$

$HNO_2 \quad 7.2 \times 10^{-4}$

Correct order of increasing base strength of the base CN^-, F^- and NO_2^- will be :

A. $F^- < CN^- < NO_2^-$

B. $NO_2^- < CN^- < F^-$

C. $F^- < NO_2^- < CN^-$

D. $NO_2^- < F^- < CN^-$

Answer: C

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36. How many litres of water must be added to 1 litre of an aqueous solution of HCl with a pH of 1 to create an aqueous solution with pH of 2 ?

A. 0.1 L

B. 0.9 L

C. 2.0 L

D. 9.0 L

Answer: D

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37. The pH of aqueous solution of 1M $HCOONH_4$, pK_a of HCO OH is 3.8 and pK_b of NH_3 is 4.8

A. 6.5

B. 4.8

C. 3.8

D. 8.6

Answer: A

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38. Solid $Ba(NO_3)_2$ is gradually dissolved in a $1.0 \times 10^{-4} M Na_2CO_3$ solution. At what concentration of Ba^{2+} will a precipitate begin to form ? $\left(K_{sp} \text{ for for } BaCO_3 = 5.1 \times 10^{-9}\right)$

A. $5.1 \times 10^{-5} M$

B. $8.1 \times 10^{-8} M$

C. $8.1 \times 10^{-7} M$

D. $4.1 \times 10^{-5} M$

Answer: A

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39. Solubility product of silver bromide is 5.0×10^{-13}. The quantity of potassium bromide (molar mass taken as $120g \ \ \mathrm{mol}^{-1}$) to be added to 1 litre of 0.05 M solution of silver nitrate to start the precipitation of AgBr is

A. $1.2 \times 10^{-10}g$

B. $1.2 \times 10^{-9}g$

C. $6.2 \times 10^{-5}g$

D. $5.0 \times 10^{-8}g$

Answer: B

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40. Three reaction involving $H_2PO_4^-$ are given below :

$(i) H_3PO_4 + H_2O \rightarrow H_3O^+ + H_2PO_4^-$

$(ii) H_2PO_4^- + H_2O \rightarrow HPO_4^{2-} + H_3O^+$

(iii) $H_2PO_4^- + OH^- \rightarrow H_3PO_4 + O^{2-}$

In which of the above does $H_2PO_4^-$ act as an acid ?

A. ii only

B. I and ii

C. iii only

D. I only

Answer: A

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41. Which solution has pH equal to 10 ?

A. $10^{-4}MKOH$

B. $10^{-10}MKOH$

C. $10^{-10}MHCl$

D. $10^{-4}MHCl$

Answer: A

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42. Calculate the pH of 0.5 M aqueous solution of NaCN, the pK_b of CN^- is 4.70

A. 4.70

B. 11.5

C. 7

D. 6.5

Answer: B

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43. For the following three reaction a, b and c, equilibrium constants are given :

(i) $CO(g) \cdot H_2O_g \Leftrightarrow CO_2(g) \cdot H_2(g), K_1$

(ii) $CH_4(g) \cdot H_2O(g) \Leftrightarrow CO(g) \cdot 3H_2(g), K_2$

$(iii) CH_4(g) + 2H_2O(g) \Leftrightarrow CO_2(g) + 4H_2(g), K_3$

A. $K_1\sqrt{K_2} = K_3$

B. $K_2K_3 = K_1$

C. $K_3 = K_1K_2$

D. $K_3.\ K_2^3 = K_1^2$

Answer: C

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44. A vessel at 1000 K contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted into CO on the addition of graphite. If the total pressure at equilibrium is 0.8 atm, the value of K is :

A. 1.8 atm

B. 3 atm

C. 0.3 atm

D. 0.18 atm

Answer: A

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