CHEMISTRY

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CHEMICAL AND IONIC EQUILIBRIUM

LEVEL - I (HOMEWORK)

1. K_C of the reaction $PCl_3 + Cl_2 \Leftrightarrow PCl_5$ (all gases) at 250° C is 26 L mol^{-1}. K_p of the reaction at this temperature is approximately

A. 0.605

B. 0.33

C. 4×10^{-2}

D. $1.1 \times 10^3 (atm^{-1})$

Answer: A

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2. If the K_c of the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at 750 K is 49, then the K_c of the reaction $NH_3(g) \Leftrightarrow \frac{1}{2}N_2(g) + \frac{3}{2}H_2(g)$ at the same temperature is

A. $\frac{1}{49}$

B. 7

C. 49

D. $\frac{1}{7}$

Answer: D

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3. The following equilibria and their equilibrium constants are given

$N_2 + 3H_2 \Leftrightarrow 2NH_3(K_1)$

$N_2 + O_2 \Leftrightarrow 2NO(K_2)$

$H_2 + \frac{1}{2}O_2 \Leftrightarrow H_2O(K_3)$

Therefore, the equilibrium constant of the reaction $2NH_3 + \frac{5}{2}O_2 \Leftrightarrow 2NO + 3H_2O$ in terms of K_1, K_2 and K_3 is :

A. $\frac{K_1K_2}{K_3}$

B. $\frac{K_2K_3^3}{K_1}$

C. $K_1K_2K_3$

D. $\frac{K_1K_3}{K_2}$

Answer: B

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4. $\log\left(\frac{K_p}{K_c}\right) + \log RT = 0$ is a relationship for the reaction

A. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

B. $H_2(g) + l_2(g) \Leftrightarrow 2HI(g)$

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

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

Answer: C

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5. 1 mol of A and 0.5 mol of B were enclosed in a three litre vessel. The following equilibrium was established under suitable conditions:

$A + 2B \Leftrightarrow C$

At equilibrium, the amount of B was found to be 0.3 mol. The equilibrium constant K_c at the experimental temperature will be: 11.1 , 1.11, 0.01, 2.5

A. 11.1

B. 2.5

C. 0.01

D. 5.5

Answer: A

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6. $A + 3B \Leftrightarrow 4C$. The initial concentration of A and B were equal. The equilibrium concentration of A and C also are equal. Hence the K_c of the reaction is

A. $\frac{1}{8}$

B. 0.08

C. 0.8

D. 8

Answer: D

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7. $C(s) + CO_2(g) \Leftrightarrow 2CO(g)$. At equilibrium, 25% of the CO_2 got converted into CO. If the equilibrium pressure is 12 atm, the partial pressure of CO_2 at equilibrium is

A. 0.25 atm

B. 7.2 atm

C. 2.4 atm

D. 9 atm

Answer: B

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8. At 500 K, the K_c of the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ is 61. A mixture of N_2, H_2 and NH_3 with molar concentration $1 \times 10^{-3}, 3 \times 10^{-3} M$ and $2 \times 10^{-3} M$ respectively was prepared at 500 K. Which statement below is true?

A. The system is now in equilibrium

B. The forward reaction occurs

C. The backward reaction occurs

D. More data is needed to predict what happens

Answer: C

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9. At the equilibrium of the reaction $N_2O_4(g) \Leftrightarrow 2NO_2(g)$, the observed molecular mass of N_2O_4 is 80 at 383 K. The $\%$ dissociation of N_2O_4 at 383 K is

A. $10\ \%$

B. $12\ \%$

C. $15\ \%$

D. $18\ \%$

Answer: C

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10. The relationship between the equilibrium constant of a reaction and temperature is

($T_2 > T_1$ in all the options)

A. $\log\left(\frac{K_1}{K_2}\right) = \frac{\Delta H}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

B. $\log\left(\frac{K_1}{K_2}\right) = \frac{Ea}{R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

C. $\log\left(\frac{K_2}{K_1}\right) = \frac{Ea}{2.303R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

D. $\log\left(\frac{K_2}{K_1}\right) = \frac{\Delta H}{2.303R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

Answer: D

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11. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)\Delta H > 0.$ Which of the following conditions will suppress the dissociation of PCl_5?

A. low temperature and high pressure

B. high temperature and low pressure

C. low temperature and low pressure

D. high temperature and high pressure

Answer: A

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12. Consider the following equilibrium in a closed container $N_2O_4(g) \Leftrightarrow 2NO_2(g)$. At a fixed temperature, the volume of the container is halved. For this change, which of the following statements is true regarding the equilibrium constant K_p and degree of dissociation (α) of N_2O_4?

A. neither K_p nor α changes

B. both K_P and α change

C. K_p changes, but α does not

D. K_P does not change, but α changes

Answer: D

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13. if a certain weak acid is only 0.1% ionised in its 0.1 M aq. Solution, the ionisation constant (Ka) of the acid is very close to

A. 1×10^{-3}

B. 1×10^{-7}

C. 1×10^{-5}

D. 1×10^{-4}

Answer: B

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14. For very diprotic and of the type H_2X,how would you relate the ionisation constants K_{a_1} and K_{a_2}?

A. $K(a_1) = K_{a_2}$

B. $K_{a_1} < K_{a_2}$

C. $K_{a_2} < K_{a_1}$

D. K_{a_1} may be greater than or less than K_{a_2}, depending on what acid H_2X is

Answer: C

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15. In the detection of group III cations (eq. Al^{3+}) in the qualitative analysis of salts, NH_4Cl is added before adding NH_4OH. This is meant

A. to provide a definitely basic medium

B. to suppress the ionisation of the NH_4OH

C. to cause the precipitation of the chlorides of group III cations

D. to increase the solubility of the salt in water

Answer: B

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16. Match the following

List-I (salt)	List-II (Solubility in water = x mol/L)
A) Ag_2CrO_4	P) $x = \left(\frac{K_{sp}}{108}\right)^{1/5}$
B) $AgCNS$	Q) $x = \left(\frac{K_{sp}}{27}\right)^{1/4}$
C) Ag_3PO_4	R) $x = \left(\frac{K_{sp}}{4}\right)^{\frac{1}{3}}$
D) Hg_2Cl_2	S) $x = (K_{sp})^{1/2}$

A. $A \rightarrow R, B \rightarrow S, C \rightarrow Q, D \rightarrow R$

B. $A \rightarrow P, B \rightarrow S, C \rightarrow R, D \rightarrow R$

C. $A \rightarrow R, B \rightarrow S, C \rightarrow P, D \rightarrow Q$

D. $A \rightarrow S, B \rightarrow R, C \rightarrow P, D \rightarrow Q$

Answer: A

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17. The solubility of a certain sparingly soluble binary salt (Mol. Mass = 188 $gmol^{-1}$) in water at room temperature is 0.376 gL^{-1}. The K_{sp} of the salt at this temp. Is

A. 2×10^{-3}

B. 3.2×10^{-8}

C. 4×10^{-6}

D. 8×10^{-9}

Answer: C

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18. The K_{sp} of $M(OH)_2$ is $5 \times 10^{-10} M^3$. The molar solubility of $M(OH)_2$ in a 0.1 M NaOH solution is

A. $5 \times 10^{-9} M$

B. $5 \times 10^{-12} M$

C. $5 \times 10^{-8} M$

D. $5 \times 10^{-16} M$

Answer: C

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19. Three sparingly soluble salts MX, M_2X and MX_3 have the same value of solubility product. (K_{sp} is in the range of 10^{-12} for all the three). Their solubilites in water are in the order

A. $MX_3 > MX > M_2X$

B. $MX > M_2X > MX_3$

C. $M_2X > MX_3 > MX$

D. $MX_3 > M_2X > MX$

Answer: D

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20. Suppose the solubilities of AgCl in water, in 0.01 M $CaCl_2$ solution, in 0.01 M NaCl solution and in 0.05 M $AgNO_3$ solution are S_1, S_2, S_3 and S_4 respectively. The correct order of these solubilities is

A. $S_1 > S_2 > S_3 > S_4$

B. $S_1 > S_2 = S_3 > S_4$

C. $S_4 > S_3 > S_2 > S_1$

D. $S_1 > S_3 > S_2 > S_4$

Answer: D

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21. If the K_{sp} of the salt AB is $10^{-8}M^2$ at a certain temp, which of the following solutions of B^- can precipitate AB from a $10^{-3}M$ solution of A^+?

A. $10^{-5}M$

B. $10^{-4}M$

C. $10^{-3}M$

D. all of these

Answer: D

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22. The K_{sp} of Ag_2CrO_4 at 298 K is $1 \times 10^{-12}M^3$ The solubility of Ag_2CrO_4 in a 0.1 M $AgNO_3$ solution at 298 K is

A. $1 \times 10^{-9}M$

B. $1 \times 10^{-10}M$

C. $1 \times 10^{-11}M$

D. $1 \times 10^{13}M$

Answer: B

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23. K_{sp} of $CaSO_4$ at 298 K is $6.4 \times 10^{-5} M^2$. If 9×10^{-3} mol of $CaSO_4$ is added to 1L of water at 298 K, the amount of $CaSO_4$ remaining undissolved is

A. Nil

B. $2.6 \times 10^{-3} mol$

C. $1 \times 10^{-3} mol$

D. $8 \times 10^{-3} mol$

Answer: C

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24. In a saturated solution of the sparingly soluble salt $AgIO_3$ (Mol. Mass = 283 g mol^{-1}), the equilibrium which sets in is $AgIO_3(s) \Leftrightarrow Ag^+(aq) + IO_3^-(aq)$. If the K_{sp} of $AgIO_3$ is $1 \times 10^{-8} M^2$

at 298 K. What is the mass of $AgIO_3$ contained in 100 ml of its saturated solution at 298 K?

A. $1 \times 10^{-7} g$

B. $2.83 \times 10^{-1} g$

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

D. $11 \times 10^{-4} g$

Answer: C

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25. Which of the following cannot be a Lewis acid?

A. BF_3

B. BeF_2

C. $AlCl_3$

D. CCl_4

Answer: D

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26. If the ionic product of water (K_w) at 298 K is $1 \times 10^{-14} M^2$, the pKw of water at 323 K is

A. < 14

B. 14

C. > 14

D. insufficient data

Answer: A

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27. Ka of HCN at 298 K is 1×10^{-9}. The pH of a decimolar aq. Solution of HCN at 298 K is

A. 4

B. 5

C. 3.3

D. 2

Answer: B

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28. 1 ml of a 10^{-5} M aq. solution of NaOH is diluted to 1L. The pH of the resulting solution at 298 K is approximately

A. 6

B. 8

C. 6.98

D. 7.04

Answer: D

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29. The pH of the solution obtained by mixing equal volumes of two solutions of pH = 3 and pH = 5 is

(log 3 = 0, log 5 = 0.7)

A. 3.3

B. 4

C. 8

D. 2.3

Answer: C

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30. 1.095 g of HCl gas was passed through 100 cm^3 of 0.2 M $Ba(OH)_2$ solution. The pH of the resulting solution is

A. 1

B. 2

C. 9

D. 13

Answer: D

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31. At a certain temp, the dissociation constants of HCOOH and CH_3COOH are 1.8×10^{-4} and 1.8×10^{-5} respectively. The molarity of an CH_3COOH solution in which H^+ concentration is the same as in a 0.001 M HCOOH solution is

A. 0.1 M

B. 0.01 M

C. 0.001 M

D. 0.0001 M

Answer: B

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32. Which of the following cannot be a buffer solution?

A. $CH_3COOH + CH_3COONa$

B. $NH_4OH + NH_4Cl$

C. $HClO_4 + NaClO_4$

D. $HCOOH + HCOOK$

Answer: C

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33. The Ka of a certain weak acid is 1×10^{-4} at 298 K. In order to prepare a buffer solution of pH = 5, the [salt]/[acid] ratio should be

A. $10:1$

B. $4:5$

C. $1:10$

D. $5:4$

Answer: A

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34. The sum of pH and pKb for a certain basic buffer solution is 13. The ratio of the concentration of the base to that of the salts in this buffer is

A. 10

B. 0.05

C. 20

D. 0.1

Answer: D

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35. The concentration of H^{+} in a solution containing 0.2 mol of dichloroacetic acid $\left(Ka = 5 \times 10^{-2}\right)$ and 0.1 mol of sodium dichloroacetate in 1L of the solution is

A. 0.1 M

B. 0.05 M

C. 0.025 M

D. 0.005 M (log 5 = 0.7)

Answer: A

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36. When 2 mols of HCl were added to 1L of a certain acidic buffer, the pH of the buffer decreased from 4.4 to 3.9. The buffer capacity of this buffer solution is

A. 0

B. 4

C. 6

D. 8

Answer: B

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37. K_b of NH_4OH at 298 K is 1×10^{-5}. The pH of a 0.01 M aq. solution of NH_4OH at 298 K is :

A. 4

B. 4.5

C. 5

D. 10.5

Answer: D

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38. The K_a of a substituted benzoic acid at 298 K is 1×10^{-4}. The pH of a 0.01 M aq. solution of its sodium salt at 298 K is

A. 8

B. 9

C. 7.5

D. 8.5

Answer: A

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39. Hydrolysis constants of two potassium salts KA and KB of the weak acids HA and HB are 10^{-8} and 10^{-6} respectively. The dissociation constant of a third acid HC at the same temp is 10^{-4}. The acid strengths of the three acids are in the order

A. $HA > HB > HC$

B. $HB > HA > HC$

C. $HC > HA > HB$

D. $HC > HB > HA$

Answer: C

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40. The equilibrium constant for the reaction $OCl^{-}(aq) + H_2O(l) \Leftrightarrow HOCl(aq) + OH^{-}_{(aq)}$ at 298 K is 3.6×10^{-7}. The Ka of HOCl at 298 K is

A. 6×10^{-4}

B. 2.8×10^{-8}

C. 1.8×10^{-7}

D. 2.8×10^{-6}

Answer: B

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41. In the chemical reaction $A + 2B \Leftrightarrow 2C + D$ (all gases), the initial concentration of B was 1.5 times that of A, but the equilibrium ceocentrations of A and B were found to be equal. The equilibrium constant K_c of the reaction is

A. $\frac{1}{4}$

B. 16

C. 1

D. 4

Answer: D

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42. Assertion : For the physical equilibrium, $H_2O(s) \Leftrightarrow H_2O(l)$, increasing the temperature and increasing the pressure result in the formation of more water.

Reason : The shift in the forward direction is both endothermic and accompanied by an increase in volume.

A. Both assertion and reason are correct and reason is the correct explanation of assertion

B. Both assertion and reason are correct and reason is not the correction explanation of assertion

C. Assertion is true, reason is false

D. Assertion is false, reason is true

Answer: C

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43. Assertion : The pH of a 10^{-8} M aq. Solution of HCl at 298 K is about 6.9

Reason : For highly diluted acids, $[H^+]$ form water also is to be considered.

A. Both assertion and reason are correct and reason is the correct explanation of assertion

B. Both assertion and reason are correct and reason is not the correction explanation of assertion

C. Assertion is true, reason is false

D. Assertion is false, reason is true

Answer: A

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44. Assertion : The equilibrium constant of an exothermic reaction decreases as temperature increases.

Reason : $\log\left(\frac{K_2}{K_1}\right)=\frac{\Delta H}{2.303R}\left(\frac{1}{T_1}-\frac{1}{T_2}\right)$ where $T_2>T_1$. Since for an exothermic reaction ΔH is -ve, it follows that $\frac{K_2}{K_1}<1$ or $K_2<K_1$.

A. Both assertion and reason are correct and reason is the correct explanation of assertion

B. Both assertion and reason are correct and reason is not the correction explanation of assertion

C. Assertion is true, reason is false

D. Assertion is false, reason is true

Answer: A

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45. Assertion : When water is heated from $25^{\circ}C$ to $50^{\circ}C$, its pH increases

Reason : The ionic product of water (Kw) increases with increase in temperature.

A. Both assertion and reason are correct and reason is the correct explanation of assertion

B. Both assertion and reason are correct and reason is not the correction explanation of assertion

C. Assertion is true, reason is false

D. Assertion is false, reason is true

Answer: D

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LEVEL - II

1. For which of the following gaseous equilibria is $K_p > K_c$?

A. $H_2 + l_2 \Leftrightarrow 2HI$

B. $2SO_2 + O_2 \Leftrightarrow 2SO_3$

C. $PCl_5 \Leftrightarrow PCl_3 + Cl_2$

D. $N_2 + 3H_2 \Leftrightarrow 2NH_3$

Answer: C

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2. For the homogeneous gaseous reaction $A + B \Leftrightarrow 2C + D$ at 500 K, $K_p = 0.04$ bar. The K_c of the reaction at 500 K is approximately

A. 1×10^{-3}

B. 4×10^{-2}

C. 1×10^{-5}

D. $1.6 \times 10^2 (\text{mol} \quad L^{-1})$

Answer: A

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3. For the reaction $2NO_2(g) \Leftrightarrow 2NO(g) + O_2(g), K_c = 4 \times 10^{-6}$ at 500 K. Hence, the K_c of the reaction $NO(g) + \frac{1}{2}O_2(g) \Leftrightarrow NO_2(g)$ at 500 K is

A. 2×10^{-3}

B. 5×10^{2}

C. 2×10^{-6}

D. 5×10^{7}

Answer: B

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4. Consider the following reversible chemical reactions at the same temperature with equilibrium constants K_1 and K_2 respectively

$A_2(g) + B_2(g) \Leftrightarrow 2AB(g)(K_1)$

$6AB(g) \Leftrightarrow 3A_2(g) + 3B_2(g)(K_2)$

The relation between K_1 and K_2 is

A. $K_2 = K_1^{-3}$

B. $K_1 K_2 = 3$

C. $K_1 K_2 = \frac{1}{3}$

D. $K_1 K_2 = K_1^{-3}$

Answer: D

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5. Two equilibria $AB \Leftrightarrow A^+ + B^-$ and $AB + B^- \Leftrightarrow AB_2^-$ are simultaneously maintained in a solution with equilibrium constants K_1 and K_2 respectively. The ratio of $[A^+]$ to $[AB_2^-]$ in the solution is

A. directly proportional to $[B^-]$

B. inversely proportional to $[B^-]$

C. directly proportional to $[B^-]^2$

D. inversely proportional to $[B^-]^2$

Answer: D

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6. 2 mols of SO_2 gas and 1 mol of O_2 gas are placed in a sealed vessel and heated. The reaction proceeds at constant temperature and when equilibrium is reached, 80%^ of the SO_2 had changed into SO_3. If the initial pressure in the vessel has 30 bar, the equilibrium pressure is

A. 22 bar

B. 20 bar

C. 18 bar

D. 16 bar

Answer: A

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7. The dissociation of N_2O_4 to NO_2 was carried out at 298 K in chloroform medium. When equilibrium was reached, 0.2 mol of N_2O_4 and 0.02 mol of NO_2 were found to be present in a 2L solution. The K_c of the reaction at this temperature is

A. 2×10^{-4}

B. 2×10^{-3}

C. 1×10^{-3}

D. 1×10^{-2}

Answer: B

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8. 3 mols of A and 1 mol of B are mixed in a 1L container. The reaction taking place is $A(g) + B(g) \Leftrightarrow 2C(g)$. If 1.5 mol of C is formed at equilibrium, the K_c of the reaction is

A. 4

B. 2.7

C. 0.5

D. 0.25

Answer: A

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9. Equi molar concentrations of $H_2 \text{ and } l_2$ are heated to equilibrium in a closed container. At equilibrium, the forward and backward rate constants are found to be equal. What % of the initial concentration of H_2 reacted and got consumed at equilibrium?

A. 66%

B. 50%

C. 40%

D. 33%

Answer: D

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10. 2 mols of PCl_5 were heated in a sealed 5L container to constant temperature. If the degree of dissociation of PCl_5 at this temperature is 0.4, the K_c of the reaction $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ is very close to

A. 0.27

B. 0.11

C. 0.35

D. 0.53

Answer: B

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11. For the reaction $C(s) + CO_2(g) \Leftrightarrow 2CO_g, K_p = 63$ atm at 1000 K. If at equilibrium $P_{CO} = 10P_{CO_2}$, then the total pressure of the gases at equilibrium is

A. 6.3 atm

B. 6.93 atm

C. 0.63 atm

D. 0.693 atm

Answer: B

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12. 5.1 g of solid NH_4SH is introduced into a evacuated 3L flask at 600 K. 30% of the NH_4SH dissociated into NH_3 and H_2S gases by the time equilibrium is reached. The K_p of the reaction at 600 K is

(R = 0.082 L atm $mol^{-1}K^{-1}, N = 14, S = 32$)

A. $1 \times 10^{-4} atm^2$

B. $4.9 \times 10^{-3} atm^2$

C. $2.42 \times 10^{-1} atm^2$

D. $3.2 \times 10^{-3} atm^2$

Answer: C

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13. A 20 litre container at 400 K contains CO_2 gas at a pressure of 0.4 atm and an excess of solid SrO and solid $SrCO_3$ (neglect the volume of the solids). The volume of the container is now gradually decreased by moving the piston fitted in the container. The volume of the container, when the pressure of CO_2 attains its maximum value is (Given that $SrCO_3(s) \Leftrightarrow SrO(s) + CO_2(g), K_p = $ 1.6 atm at 400K)

A. 10 L

B. 4 L

C. 2 L

D. 5 L

Answer: D

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14. $2AB_2(g) \Leftrightarrow A_2(g) + 2B_2(g)$. 5 moles of AB_2 were heated in a closed vessel to constant temperature. Equilibrium was attained by the time 2 moles of it dissociated. If the equilibrium pressure was 12 atm, the K_p of the reaction is very close to

A. 0.9

B. 0.72

C. 0.6

D. 0.27

Answer: A

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15. In the reaction $AB(g) \Leftrightarrow A(g) + B(g)$ at $30^{\circ} C$, the K_p for the dissociation equilibrium is 2.56×10^{-2} atm. If the total pressure at equilibrium is 1 atm, then the % disscociation of AB at $30^{\circ} C$ about

A. $13\ \%$

B. $16\ \%$

C. $43.5\ \%$

D. $87\ \%$

Answer: B

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16. At a certain temperature, the K_c of the reaction $SO_2(g) + NO_2 \Leftrightarrow SO_3(g) + NO_g$ is 16. If 1 mol each of all the 4 gases is taken in a 1L vessel, the concentration of NO_2 at equilibrium would be

A. 1.6 M

B. 0.6 M

C. 0.8 M

D. 0.4 M

Answer: D

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17. The standard Gibbs energy change at 300 K for the reaction $2A \Leftrightarrow B + C$ is 4015 J. At a given instant, the composition of the reaction mixture is [A] = 0.5 M, [B] = 2M and [C] = 0.5 M. The reaction proceeds in the

A. Forward direction because $Q_c < K_c$

B. Reverse direction because $Q_c < K_c$

C. Forward direction because $Q_c > K_c$

D. reverse direction because $Q_c > K_c$

Answer: D

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18. Ammonium carbonate vapour (NH_2COONH_4) when heated to $200^\circ C$ dissociates into a mixture of NH_3 and CO_2 vapours with a vapour density of 13. From this data, the degree of dissociation of ammonium carbonate at $200^\circ C$ is

A. 0.5

B. 1.5

C. 1

D. 0.75

Answer: C

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19. The equilibrium constant of a reaction changes when

A. more of a reactant or product is added to the equilibrium mixture

B. a catalyst is added to the equilibrium mixture

C. temperature is changed

D. all these

Answer: C

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20. Four homogeneous, gaseous, equilibrium reactions are given below. Choose the reaction in which both increase in temperature and increase in pressure favour the formation of products.

A. $2A + B \Leftrightarrow C + D, \Delta H = -78KJ$

B. $W + X \Leftrightarrow 2Y + 3Z, \Delta H = +92KJ$

C. $H + G \Leftrightarrow 2K, \Delta H = -95KJ$

D. $2M + 3N \Leftrightarrow P + 2Q, \Delta H = +105KJ$

Answer: D

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21. In what manner will increase of pressure effect the following equilibrium ?

$C(s) + H_2O(g) \Leftrightarrow CO(g) + H_2(g)$

A. A shift in the forward direction

B. A shift in the reverse direction

C. increase in the yield of H_2

D. No effect

Answer: B

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22. At a particular temp, the following equilibrium is attained when 50% of each reactant is converted into products. $A(g) + B(g) \Leftrightarrow C(g) + D(g)$. If the amount of B in moles in doubled, the % of B converted into products is

A. $33\ \%$

B. $75\ \%$

C. $50\ \%$

D. $66\ \%$

Answer: A

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23. Adding an inert gas to the gaseous equilibrium $N_2 + 3H_2 \Leftrightarrow 2NH_3$ maintained at constant V and T results in

A. No change in the concentration of NH_3

B. An increase in the concentration of NH_3

C. A decrease in the concentration of NH_3

D. Total conversion of the N_2 and H_2 into NH_3

Answer: A

Watch Video Solution

24. Adding an inert gas to the gaseous equilibrium $N_2 + 3H_2 \Leftrightarrow 2NH_3$ maintained at constant P and T results in

A. No change in the concentration of NH_3

B. An increase in the concentration of NH_3

C. A decrease in the concentration of NH_3

D. Total conversion of the N_2 and H_2 into NH_3

Answer: C

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25. The K_c of the hypothetical reaction $P + Q \Leftrightarrow R + S$ is 3×10^{-1} at 400 K and 2×10^{-2} at 500 K. From this data, one can infer that, for the reaction

A. $\Delta H > 0$

B. $\Delta H < 0$

C. $\Delta H = 0$

D. unpredictable

Answer: B

Watch Video Solution

26. The dissociation constant (K_a) of a certain weak monoprotic acid at 298 K is 1×10^{-5}. The % dissociation of this acid in its decimolar aqueous solution at 298 K is

A. 0.1

B. 0.05

C. 0.02

D. 0.01

Answer: D

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27. If the degree of dissociation of a certain weak monobasic acid in its 0.1 M aq. Solution at 298 K is 0.01, the degree of dissociation of this acid in its 0.025 M aq. solution at 298 K is

A. 0.02

B. 0.03

C. 0.04

D. 0.05

Answer: A

Watch Video Solution

28. K_a of the weak acids HA and HB at 298 K are 1.6×10^{-5} and 6.4×10^{-5} respectively. The ratio of the acid strengths of the two in their aq. Solutions of the same concentration is

A. $1:4$

B. $4:1$

C. $1:2$

D. $2:3$

Answer: C

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29. When HCl gas is passed through a saturated aqueous solution of NaCl

A. there is no observable change

B. the K_{sp} of NaCl increases

C. the K_{sp} of NaCl decreases

D. Some NaCl precipitates out

Answer: D

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30. In the detection of group II cations in the qualitative analysis of salts. HCl is added before passing H_2S. This is meant

A. to increase the solubility of the salt in water

B. to suppress the ionisation of the salt

C. to suppress the ionisation of the H_2S

D. to cause the precipitation of the chlorides of group II cations

Answer: C

Watch Video Solution

31. If the concentration of F^{-} in a saturated aq. solutions of CaF_2 at room temperature is $4 \times 10^{-3} mol L^{-1}$, the K_{sp} of CaF_2 at the same temperature is

A. 3.2×10^{-8}

B. 2.56×10^{-7}

C. 1.6×10^{-5}

D. 6×10^{-3}

Answer: A

Watch Video Solution

32. At 298 K, the K_{sp} of Hg_2Cl_2 is $3.2 \times 10^{-17} mol^3 L^{-3}$. What is the solubility of Hg_2Cl_2 in water at 298 K?

A. $1.2 \times 10^{-12} M$

B. $2 \times 10^{-6} M$

C. $3 \times 10^{-6} M$

D. $1.2 \times 10^{-16} M$

Answer: B

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33. If the solubility of AgI in water at a given temp is $2 \times 10^{-5} mol \quad L^{-1}$, its solubility in a 0.1 M KI solution at the same temperature is

A. $2 \times 10^{-4} M$

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

C. $2 \times 10^{-6} M$

D. $4 \times 10^{-9} M$

Answer: D

Watch Video Solution

34. The solubility of AgI in water at a given temperature is $2 \times 10^{-5} mol \quad L^{-1}$.Its solubility in a 0.04 M CaI_2 solution at this temp is

A. $1 \times 10^{-4} M$

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

C. $5 \times 10^{-9} M$

D. $1 \times 10^{-8} M$

Answer: C

Watch Video Solution

35. K_{sp} of AgBr at room temperature is $5 \times 10^{-13} M^2$. The quantity of KBr (Mol. mass = 120 g/mol) to be added to 1 litre of a 0.05 M solution of $AgNO_3$ at room temp. to start the precipitation of AgBr is

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

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

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

D. $5 \times 10^{-8} g$

Answer: A

Watch Video Solution

36. The values of K_{sp} of $CaCO_3$ and CaC_2O_4 are 4.7×10^{-9} and $1.3 \times 10^{-9} M^2$ respectively at 298 K. If a solid mixture of these two salts is extracted with water, what is the concentration of Ca^{2+} ions in the aq. extract?

A. $7.75 \times 10^{-5} M$

B. $5.8 \times 10^{-5} M$

C. $6.85 \times 10^{-5} M$

D. $3.6 \times 10^{-5} M$

Answer: A

Watch Video Solution

37. K_{sp} of the salt AB_2 at 298 K is $4 \times 10^{-11} M$. A precipitate of AB_2 is formed when equal volumes of which of the following solutions of A^{2+} and B^{-} are mixed?

A) $2 \times 10^{-4} M \quad A^{2+}$ and $2 \times 10^{-4} M \quad B^{-}$

B) $2 \times 10^{-5} M \quad A^{2+}$ and $2 \times 10^{-3} M \quad B^{-}$

C) $2 \times 10^{-2} M \quad A^{2+}$ and $2 \times 10^{-3} M \quad B^{-}$

A. B only

B. C only

C. B & C only

D. A, B and C only

Answer: B

Watch Video Solution

38. An aq. solution of phenol is weakly acidic. Ka of phenol at 298 K is 1×10^{-10}. The degree of dissociation of 0.05 M phenol in a 0.01 M sodium phenolate solution is

A. 5×10^{-8}

B. 2.2×10^{-6}

C. 5×10^{-10}

D. 1×10^{-8}

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39. Boric acid, H_3BO_3 is a :

A. Arrhenius acid

B. Bronsted acid

C. Lewis acid

D. All these

Answer: C

Watch Video Solution

40. The equilibrium constant for the reaction $HCO_3^-(aq) + HPO_4^{2-}(aq) \Leftrightarrow CO_3^{2-}(aq) + H_2PO_4^-(aq)$ is approximately 10^{-3}. The strongest conjugate base in this reaction is

A. $HPO_4^{2-}(aq)$

B. $HCO_3^-(aq)$

C. $H_2PO_4^-(aq)$

D. $CO_3^{2-}(aq)$

Answer: D

Watch Video Solution

41. For the equilibrium (autoprotolysis of water), $2H_2O \Leftrightarrow H_3O^+ + OH^-$, the value of ΔG^0 at 298 K is approximately?

A. 80 KJ/mol

B. -100 KJ/mol

C. 100 KJ/mol

D. 80 KJ/mol

Answer: D

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42. Assuming complete ionisation, the pH of a 0.005 M aq. solution of H_2SO_4 is

A. 2

B. 3

C. 1.3

D. 2.3

Answer: A

Watch Video Solution

43. The dissociation constant of a weak monoprotic acid at 298 K is found to be numerically equal to the dissociation constant of its conjugate base. The pH of a decimolar aq. Solution of this acid at 298 K is

A. 6

B. 5

C. 4

D. 3

Answer: C

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44. 1 ml of 0.1 M aq. solution a weak monoacidic base is diluted to 100 ml. The pH of the resulting solution at 298 K is (Given pK_b of the base at 298 K = 5)

A. 8

B. 9

C. 10

D. 11

Answer: C

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45. The pH of a 10^{-7} M aq. solution of HCl at 298 K is

7

6.7

7.3

6

A. 7

B. 6.7

C. 7.3

D. 6

Answer: B

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46. If the pH of a saturated aq. solution of $Ba(OH)_2$ is 12, the value of its K_{sp} at 298 K is

A. $5 \times 10^{-7} M^3$

B. $4 \times 10^{-6} M^3$

C. $4 \times 10^{-7} M^3$

D. $5 \times 10^{-6} M^3$

Answer: A

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47. At $100^\circ C$, the K_w of water is 55 times its value at $25^\circ C$. The pH of a neutral aq. solution at $100^\circ C$ is (log 55 = 1.74)

A. 7.0

B. 6.13

C. 7.87

D. 5.1

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48. When 200 ml of an aq. solution of HCl $(pH = 2)$ is mixed with 300 ml of an aq. solution of NaOH (ph = 12), the pH of the resulting solution is

A. 10

B. 2

C. 2.7

D. 11.3

Answer: D

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49. The no. of H^+ ions present in 250 ml of a lemon juice of pH = 3 is

A. 1.5×10^{22}

B. 1.5×10^{20}

C. 1.5×10^{23}

D. 3×10^{21}

Answer: B

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50. At 298 K, the K_{sp} of $Mg(OH)_2$ is $1 \times 10^{-11} M^3$. At what pH will Mg^{2+} ions start precipitating in the form of $Mg(OH)_2$ from a 0.001 M solution of Mg^{2+} ions?

A. 8

B. 9

C. 10

D. 11

Answer: C

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51. How many moles of HCOONa must be added to 1L of a 0.1 M solution of HCOOH in order to prepare a buffer solution of pH = 3.4? (Given : K_a of HCOOH $= 2 \times 10^{-4}$ at 298 K)

A. 0.2

B. 0.1

C. 0.05

D. 0.01

Answer: C

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52. The pKb value of NH_4OH at 298 K is 4.75. An aq. Solution of NH_4OH is titrated against HCl. The pH of the solution when half of the NH_4OH has been neutralized as

A. 9.25

B. 8.5

C. 7.5

D. 4.75

Answer: A

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53. In a buffer solution consisting of equal concentration of B^{-} and the weak acid HB, the Kb of B^{-} is 10^{-9}. The pH of the buffer is

A. 4

B. 5

C. 9

D. 10

Answer: B

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54. 0.1 mol of CH_3NH_2 $\left(K_b = 5 \times 10^{-4} \text{ at } 298K\right)$ is mixed withi 0.08 mol of HCl and the volume made upto 1 litre by adding water. The pH of the resulting solution is

A. 11

B. 8.1

C. 9.1

D. 10.1

Answer: D

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55. The ratio of the pH of solution (I) containing 1 mol of CH_3COONa and 1 mol of HCl in 1L, and solution (II) containing 1 mol of CH_3COONa and 1 mol of CH_3COOH in 1L is

A. $3:1$

B. $2:1$

C. $1:2$

D. $1:3$

Answer: C

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56. The pH values of 0.1 M aq. solutions of (I) NaCl (II), HCl (III) HCOONa and (IV) $C_6H_5NH_3Cl$ at 298 K increase in the order

A. $I < IV < III < II$

B. $II < IV < I < III$

C. $III < IV < I < II$

D. $II < I < III < IV$

Answer: B

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57. 50 ml of 0.2 M NH_4OH and 50 ml of 0.2 M HCl solutions are Mixed. pH of the resulting solution is (Given Kb of $NH_4OH = 1 \times 10^{-5}$)

A. 5

B. 4

C. 7

D. 9

Answer: A

Watch Video Solution

58. The pKa of HCOOH at 298 K = 3.8. The pKb of NH_4OH at 298 K = 4.8. The pH of a 0.1 M aq. solution of ammonium formate at 298 K is

A. 5.5

B. 6

C. 6.5

D. 7

Answer: C

Watch Video Solution

59. A certain weak acid HA has a dissociation constant of 1×10^{-4} at 298 K. The equilibrium constant for its reaction with the strong base NaOH is

A. 1×10^{-8}

B. 1×10^{-10}

C. 1×10^{8}

D. 1×10^{10}

Answer: D

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60. pH of a 0.01 M aq. Solution of potassium propanoate is 8 at 298 K. The Ka of propanoic acid at 298 K is

A. 1×10^{-2}

B. 1×10^{-4}

C. 2×10^{-4}

D. 4.5×10^{-3}

Answer: B

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LEVEL - II (Assertion-Reason)

1. Assertion : A solution which is 10^{-3} M each in $Mn^{2+}, Fe^{2+}, Zn^{2+}$ and Hg^{2+} is treated with an aq. Solution of H_2S in which the S^{2-} concentration is 10^{-16} M. The metal sulphide which precipitates out first is HgS. (The Ksp values of MnS, FeS, ZnS and HgS are respectively $10^{-15}, 10^{-23}, 10^{-20}$ and $10^{-54} M^2$)

Reason : The metal sulphide whose K_{sp} first gets exceeded, will precipitate out first.

A. Both assertion and reason are correct and reason is the correct explanation of assertion

B. Both assertion and reason are correct and reason is not the correction explanation of assertion

C. Assertion is true, reason is false

D. Assertion is false, reason is true

Answer: A

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2. Assertion : pH of boiling water is nearly 6.14. This means that boiling water is not neutral

Reason : Concentration of H^{+} ions in boiling water has decreased because some water has boiled off

A. Both assertion and reason are correct and reason is the correct explanation of assertion

B. Both assertion and reason are correct and reason is not the correction explanation of assertion

C. Assertion is true, reason is false

D. If both A and R are false

Answer: D

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3. Assertion : When HCl gas is passed through a saturated aq. solution of NaCl, some NaCl precipitates out

Reason : K_{sp} of NaCl decreases due to common ion effect

A. Both assertion and reason are correct and reason is the correct explanation of assertion

B. Both assertion and reason are correct and reason is not the correction explanation of assertion

C. Assertion is true, reason is false

D. Assertion is false, reason is true

Answer: C

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4. Assertion : The solubility of AgCl in water decreases in the presence of some NaCl

Reason : NaCl is highly soluble in water whereas AgCl is only sparingly soluble. (1) Both assertion and reason are correct and reason is the correct explanation of assertion (2) Both assertion and reason are correct and reason is not the correction explanation of assertion (3) Assertion is true, reason is false (4) Assertion is false, reason is true

A. Both assertion and reason are correct and reason is the correct explanation of assertion

B. Both assertion and reason are correct and reason is not the correction explanation of assertion

C. Assertion is true, reason is false

D. Assertion is false, reason is true

Answer: B

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5. Assertion : The pH values of 0.1 M and 0.2 M aq. solution of CH_3COONH_4 at 298 K are different.

Reason : pH of the salt solution of a weak acid and weak base is independent of the concentration of the solution.

A. Both assertion and reason are correct and reason is the correct explanation of assertion

B. Both assertion and reason are correct and reason is not the correction explanation of assertion

C. Assertion is true, reason is false

D. Assertion is false, reason is true

Answer: D

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QUESTIONS

1. The equilibrium, concentration of $H_2, I_2,$ and HI are respectively $5.\ 0, 3.\ 0$ and $17 mol L^{-1}$. What will be the value of K_c for the reaction $H_2 + I_2 \rightarrow 2HI$?

Watch Video Solution

2. At $30^\circ C, K_P$ for the reaction $SO_2Cl_2(g) \Leftrightarrow SO_2(g) + Cl_2(g) is 2.9 \times 10^{-2}$ atm. If the total pressure is 1 atm , calculate the degree of dissociation of SO_2Cl_2.

Watch Video Solution

3. Calculate the pressure of CO_2 gas at 700 K in the heterogeneous equilibrium reaction $CaCO_3(s) \Leftrightarrow CaO(s) + 2CO_2(g)$ if ΔG° for the reaction is $130.2kJmol^{-1}$.

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4. Calculate the partial pressure of CO when solid C, $CaCO_3$ and CaO are mixed and allowed to attain equilibrium at the temperature for which the following equilibrium have been studied.

$CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g), \qquad K_p = 4.0 \times 10^{-2} atm \qquad ...(i)$

$C(s) + CO_2(g) \Leftrightarrow 2CO(g), \qquad K_P = 2.0 atm \qquad ...(ii)$

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5. The value of K_c for the reaction $A \Leftrightarrow B + C$ is 2.5×10^{-2} S at given time, the composition of reaction mixture is $[A] = [B] = [C] = 2.3 \times 10^{-3} M$. In which direction will the reaction proceed ?

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6. Calculate K_P for the reaction $\frac{3}{2}O_2(g) \Leftrightarrow O_3(g) at 298K$. ΔG° for the reaction is $163.43 kJ mol^{-1}$.

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7. The value of ΔG° for the phosphorylation of glucose in glycolysis is 13.8 kJ/mol. Find the value of K_c at 298 K.

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8. Calculate the pH of (a) $0.0001 M HCl$ solution (b) $0.04 M HNO_3$ solution, assuming complete dissociation in each case.

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9. the concentration of hydrogen ion in a sample of soft drink is 3.8×10^{-3}M. what is its ph?

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10. The dissociation constants of formic acid and acetic acid are 1.77×10^{-4} and 1.75×10^{-5} respectively. Calculate the relative strengths of the two acids.

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11. Calculate the degree of ionisation of $0.02M$ acetic acid. K_a of acetic acid $= 1.8 \times 10^{-5}$.

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12. Calculate the degree of hydrolysis of $0.15M$ solution of sodium acetate at 298 K . Dissociation constant of CH_3COONa is 1.75×10^{-5} . $K_w = 1.008 \times 10^{-14}$

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13. What is the pH of $0.01M$ solution of CH_3COONa in water at 298 K

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14. The dissociation constant of $NH_4OHat298Kis1.81 \times 10^{-5}$. Calculate the degree of hydrolysis of $0.02M$ solution of ammonium chloride, $K_w = 1.008 \times 10^{-14}$.

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15. What is the pH of $0.1M$ soluton of NH_4Cl in water at 298 K. Kb for NH_3 is 1.8×10^{-5}.

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16. Calculate the degree of hydrolysis of $0.01M$ solution of ammonium acetate at 298 K. Dissociation constants of HCOOH and NH_4OH are $1.75x10^{-5}$ and $1.81J \times 10^{-5}$ respectively. $k_w = 1.008 \times 10^{-14}$.

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17. A buffer solution contains 0.20 mole of NH_4 OH and 0.25 mole of NH_4Cl per litre. Calculate the pH of the solution . Dissociation constant of $NH_4OHat29^\circ C$ is 1.81×10^{-5}.

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18. The solubility product of magnesium hydroxide at $25^{\circ} Cis.1.8 \times 10^{-11}$. Calculate the solubility of magnesium hydroxide.

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19. Calculate the solubility product of $Al(OH)_3 at 25^{\circ} C$ if the solubility is $0.75 \times 10^{-8} mol L^{-1}$.

Watch Video Solution

20. The equilibrium, concentration of $H_2, I_2,$ and HI are respectively $5.0, 3.0$ and $17 mol L^{-1}$. What will be the value of K_c for the reaction $H_2 + I_2 \rightarrow 2HI$?

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Watch Video Solution

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Watch Video Solution

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39. Calculate the solubility product of $Al(OH)_3at25^\circ C$ if the solubility is $0.75 \times 10^{-8}molL^{-1}$.

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LEVEL-I

1. The volume of the reaction vessel containing an equilibrium mixture in the reaction,

$SO_2CL_{2(g)} \Leftrightarrow SO_{2_g} + Cl_{2(g)}$ is increased. When equilibrium is re-established:

A. the amount of SO _(2) will decrease

B. the amount of $SO_2Cl_{2(g)}$ will increase

C. the amount of $Cl_{2(g)}$ will increase

D. the amount of Cl_2 will remain unchanged

Answer: C

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2. cylinder fitted with a movable piston contains liquid water in equilibrium with water vapour at $25^\circ C$. Which operation result in a decrease in the equilibrium vapour pressure?

A. Moving the piston downward a short distance

B. Removing a small amount of vapour

C. Removing a small amount of the liquid water

D. Dissolving salt in the water

Answer: D

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3. For a given exothermic reaction, K_P and K_P' are the equilibrium constants at temperature T_1 and higher temperature T_2 respectively: Assuming that heat of reaction is constant in temperature range between T_1 and T_2 it is readily observed that:

A. $K_P > K_P'$

B. $K_P < K_P'$

C. $K_P = K_P'$

D. $K_P = \frac{1}{K_P'}$

Answer: A

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4. If the value of an equilibrium constant for a particular reaction is 1.6×10^{12} then at equilibrium the system will contain.

A. mostly reactants

B. mostly products

C. similar amounts of reactants and products

D. all reactants

Answer: B

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5. For a hypothetial reaction $4A_{(g)} + 5B_{(g)} \Leftrightarrow 4P_{(g)} + 6Q_{(g)}$. The equilibrium costant K_C has units :

A. $molL^{-1}$

B. $mol^{-1}L$

C. $(molL^{-1})^2$

D. unitless

Answer: A

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6. Consider the following reversible reaction at equilibrium: $2H_2O_{(g)} \Leftrightarrow 2H_{2(g)} + O_{2(g)} \Delta H = +24.7kJ$

which one of the following changes in conditions will lead to maximum decomposition of $H_2O(g)$?

A. Increasing both temperature and pressure

B. Decreasing temperature and increasing pressure

C. Increasing temperature and decreasing pressure

D. Increasing temperature at constant pressure

Answer: C

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7. Which among the following reactions will be favoured at low pressure?

A. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$

B. $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}$

C. $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

D. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

Answer: C

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8. Consider the reactions, i) $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

ii) $N_2O_{4(g)} \Leftrightarrow NO_{2(g)}$

The addition of an inert gas at constant volume:

A. will increase the dissociation of PCl_5 as well as N_2O_4

B. will reduce the dissociation of PCl_5 as well as N_2O_2

C. will increase the dissociation of PCI_5 and step up the formation of

NO_2

D. will not disturb the equilibrium of the reactions

Answer: D

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9. The solubility of $PbSO_4$ at $25^\circ C$ is 1.1×10^{-4} mol/L. Then its solubility product (K_{sp}) is:

A. 1.21×10^{-8}

B. 12.1×10^{-6}

C. 121×10^{-11}

D. 1.21×10^{-10}

Answer: A

Watch Video Solution

10. In the reaction, $HC_2O_4^- + PO_4^{3-} \Leftrightarrow HPO_4^{2-} + C_2O_4^{2-}$ the Bronsted base are:

A. $PO_4^{3-}, C_2O_4^{2-}$

B. PO_4^{3-}, HPO_4^{2-}

C. $HC_2O_4^-, HPO_4^{2-}$

D. $HC_2O_4^-, C_2O_4^{2-}$

Answer: A

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11. The degree of hydrolysis of which of the following salts is independent of the concentration of salt solution?

A. CH_3COONa

B. NH_4Cl

C. CH_3COONH_4

D. $NaCl$

Answer: C

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12. For the reaction : $2A(g) + B(g) \Leftrightarrow 3Cg) + D(g)$

Two moles each of A and B were taken into a flask: The following must always be true when the system attained equilibrium

A. $[A] = [B]$

B. $[A] < [B]$

C. $[B] = [C]$

D. $[A] > [B]$

Answer: B

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13. Given: $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g), K_1$

$N_2(g) + O_2(g) \Leftrightarrow 2NO(g), K_2$,

$H_2(g) + \frac{1}{2}O_2 \Leftrightarrow H_2O(g), K_3$

The equilibrium constant for

$2NH_3(g) + \frac{5}{2}O_2(g) \Leftrightarrow 2NO(g) + 3H_2O(g)$ will be

A. $K_1K_2K_3$

B. $\frac{K_1K_2}{K_3}$

C. $\frac{K_1K_3^2}{K_2}$

D. $\frac{K_2K_3^2}{K_1}$

Answer: D

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

A. $0.36 atm$

B. $6.8 atm$

C. $1:8.\ atm$

D. $3.2 atm$

Answer: C

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15. Equilibrium constants for four different reactions are given as, $K_1 = 10^6, K_2 = 10^{-4}, K_3 = 10,\ \text{and}\ K_4 = 1.$ Which reaction will produce-least amount of:products.at equilibrium?

A. $K_1 = 10^6$

B. $K_2 = 10^{-4}$

C. $K_3 = 10$

D. $K_4 = 1$

Answer: B

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16. For a system, $A + 2B \Leftrightarrow C$, the equilibrium concentrations are $[A] = 0.06[B] = 0.12$ and $[C] = 0.216$. The value of K for the reaction is

A. 120

B. 400

C. 4×10^{-3}

D. 250

Answer: D

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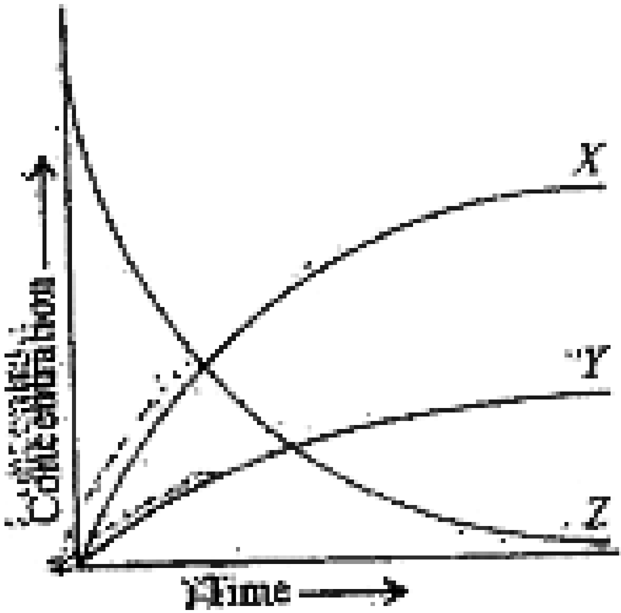
17. Consider the following reaction: $2NO_2(g) \rightarrow 2NO(g) + O_2(g)$

In the figure below, identify the curves X, Y, and Z associated with the three species in the reaction



:

$X = NO, Y = O_2, Z = NO_2$, $X = O_2 Y = NO, Z = NO_2$, $X = NO_2, Y = NO, Z = O_2$, $X = O_2, Y = NO_2, Z = NO$

A. $X = NO, Y = O_2, Z = NO_2$

B. $X = O_2 Y = NO, Z = NO_2$

C. $X = NO_2, Y = NO, Z = O_2$

D. $X = O_2, Y = NO_2, Z = NO$

Answer: A

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18. At $1400K, K_c = 2.5 \times 10^{-3}$ for the reaction. $CH_4(g) + 2H_2S(g) \Leftrightarrow CS_2(g) + 4H_2(g)$ A 10L reaction vessel at 1400 K contains 2.0 mol of $CH_4 3.0$ mol of C$S_2 3.0$ mol of H, and 4.0 mol of H_2S. In which direction does the reaction proceed to reach equilibrium?

A. Forward

B. Backward

C. May be forward or backward

D. Reaction is in equilibrium

Answer: B

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19. The equilibrium of formation of phosgene is represented as: $CO(g) + Cl_2(g) \Leftrightarrow COCl_2(g)$

The reaction is carried out in a 500 ml flask. At equilibrium, 0.3 mol of phosgene, 0.1 mol of CO, and 0.1 mol of Cl, are present. The equilibrium constant of the reaction is

A. 30

B. 15

C. 5

D. 25

Answer: B

Watch Video Solution

20. For the reaction, $H_{2(g)} + CO_2(g) \Leftrightarrow CO(g) + H_2O(g)$, if the initial concentration of $[H_2] = [CO_2]$ and x molL^{-1} of $H_{,2}$ is consumed at equilibrium, the correct expression of K_P is:

A. $\dfrac{x^2}{(1-x)^2}$

B. $\dfrac{(1+x)^2}{(1-x)^2}$

C. $\dfrac{1+x^3}{(2+x)^2}$

D. $\dfrac{x^2}{1+x^2}$

Answer: A

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21. For the reaction : $2NO_2(g) \Leftrightarrow 2NO(g) + O_2(g), K_c = 1.8 \times 10^{-6} at 184^\circ C$ when K_P and K_c are compared at $184^\circ C$, it is found that

A. K_P is greaer than K_c

B. K_P is less than K_c

C. $K_P = K_c$

D. None of the above

Answer: A

Watch Video Solution

22. For the equilibrium $AB(g) \Leftrightarrow A(g) + B(g)$ at a given temperature, one-third of AB is dissociated. The equilibrium pressure of the system is

A. 8 times K_P

B. 16 times K_P

C. 4 times K_P

D. 9 times K_P

Answer: A

Watch Video Solution

23. The vapour density of the equilibrium mixture of the reaction: $SO_2Cl_2(g) \Leftrightarrow SO_2(g) + Cl_2(g) is 50.$ The percent dissociation of SO_2Cl_2 is

A. 33.00

B. 35.0

C. 30.0

D. 66.00

Answer: B

Watch Video Solution

24. In a 10 L vessel, HI was heated to attain equilibrium. At equilibrium 327.68 g HI, 406.4 g I_2 15.6g H_2 were present in the mixture. Calculate K_c if the mixture is transferred to 5L vessel.

A. 0.029

B. 0.059

C. 0.019

D. 0.91

Answer: C

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25. The heat of reaction at constant volume for an endothermic reaction in equilibrium is 1200 cal more than at constant pressure at:300 K, Calculate the ratio of equilibrium constants K_p (atm) and $K_c\left(molL^{-1}\right)$.

A. 2.846×10^{-3}

B. 6.481×10^{-3}

C. 1.856×10^{-3}

D. 1.648×10^{-3}

Answer: D

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26. On applying pressure to the equilibrium : Ice $\Leftrightarrow$ Water, which phenomenon will happen?

A. More ice will be formed

B. More water will be formed

C. Equilibrium will not be disturbed

D. Water will.evaporate

Answer: B

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27. When $NaNO_3$ is heated in a closed vessel, oxygen is liberated and $NaNO_2$ is left behind. At equilibrium:

A. Addition of $NaNO_2$ favours reverse reaction

B. Addition of $NaNO_3$ favours forward reaction

C. Increasing temperature favours forward reaction

D. Decreasing pressure favours reverse reaction

Answer: C

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28. The equilibrium constants for the reaction are:

$$H_3PO_4 \overset{K_1}{\Longleftrightarrow} H^+ + H_2PO_4^-, K_1$$

$$H_2PO_4^- \overset{K_2}{\Longleftrightarrow} H^+ + HPO_4^{2-}, K_2$$

$$HPO_4^{2-} \overset{K_3}{\Longleftrightarrow} H^+ + PO_4^{3-}, K_3$$

The equilibrium constant for $H_3PO_4 \Leftrightarrow 3H^+ + PO_4^{3-}$ will be:

A. K_1 / K_2K_3

B. $K_1 \times K_2 \times K_3$

C. K_2 / K_1K_3

D. $K_1 + K_2 + K_3$

Answer: B

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29. For the reaction, $PCl_{5(g)} \Leftrightarrow PCl_{3(g)}$ The forward reaction at constant temperature is favoured by: Introducing an inert gas at constant volume, Introducing chlorine gas at constant volume, Introducing ani inert gas at constant pressure, None of these

A. Introducing an inert gas at constant volume

B. Introducing chlorine gas at constant volume

C. Introducing ani inert gas at constant pressure

D. None of these

Answer: C

Watch Video Solution

30. The equilibrium constant for, $H_{2(g)} + CO_{2(g)} \Leftrightarrow H_2O_{(g)} + CO_{(g)} is 1.80 at 1000^\circ C$. If 1.0 mole of H_2 and 1.0 mole of CO_2 are placed in one litre flask, the final equilibrium concentration of CO at $1000^\circ C$ will be: $0.573M, 0.385M, 5.73M, 0.295M$

A. $0.573M$

B. $0.385M$

C. $5.73M$

D. $0.295M$

Answer: A

Watch Video Solution

31. In the equilibrium, $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$ the partial pressure of SO_2, O_2 and SO_3 are 0.662,0.101 and 0.331 atm respectively. What should be the partial pressure of oxygen so that the equilibrium

concentration of SO_2 and SO_3 are equal: $0.404 atm$, $1.01 atm$, $0.808 atm$, $0.2475 atm$

A. $0.404 atm$

B. $1.01 atm$

C. $0.808 atm$

D. $0.2475 atm$

Answer: A

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32. For the reaction, $A + B \Leftrightarrow C + D$, the initial concentration of A and B are equal, but the equilibrium concentration of Cis twice that of equilibrium concentration of A. The equilibrium constant is:

A. 4

B. 9

C. $1/4$

D. $1/9$

Answer: A

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33. The equilibrium constant for the reaction, $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$ at temperature Tis 4×10^{-4}. The value of K_c for the reaction. $NO_{(g)} \Leftrightarrow \frac{1}{2}N_{2(g)} + \frac{1}{2}O_{2(g)}$ at the same temperature is :

A. 0.02

B. 50

C. 4×10^{-4}

D. 2.5×10^{-2}

Answer: B

Watch Video Solution

34. Acetic acid undergoes dimerization in benzene solution. When the solution is diluted to twice the original volume, the position of equilibrium in the reaction $2CH_3COOH \Leftrightarrow (CH_3COOH)_2$ is shifted

A. to the right

B. to the left

C. neither to lest nor to right

D. none of these

Answer: B

Watch Video Solution

35. Pure ammonia is placed in a vessel at a temperature where its dissociation constant (a) is appreciable at equilībrium,

A. K_P, does not change with pressure

B. α does not change with pressure.

C. concentration of NH_3 does not change with pressure

D. concentration of H_2 is less than that of N_2

Answer: A

Watch Video Solution

36. The following equilibrium exists in aqueous solution $CH_3COOH \Leftrightarrow CH_3COO^- + H^+$ If dil HCl is added without change in temperature, the

A. concentration of CH_3COO^- will increase.

B. concentration of CH_3COO^- will decrease.

C. the equilibrium constant will increase.

D. the equilibrium constant will ạecrease.

Answer: B

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37. The partial pressures of CH_3OH, CO and H_3 in the equilibrium mixture for the reaction

$CO_{(g)} + 2H_{2(g)} \Leftrightarrow CH_3OH_{(g)}$

$at427^{\circ}$ are 2.0, 1.0 and.0.1 atm, respectively. The value of K_P for the decomposition of CH_3OH to CO and H_2 is

A. 1×10^2 atm

B. 4×10^{-2} atm

C. 5×10^{-3} atm

D. 5×10^3 atm

Answer: C

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38. At $25^{\circ}C$ the dissociation constant of HCN is $4.9 \times 10^{-10}M$. Calculate the degree of dissociation of HCN if the concentration is 0.1 M.

A. 7×10^{-5}

B. 5×10^{-5}

C. 6×10^{-5}

D. 8×10^{-5}

Answer: D

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39. What is the pH value of N/1000 KOH solution?

A. 10^{-11}

B. 3

C. 2

D. 11

Answer: D

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40. The solubility product ofa sparingly soluable salt AB at room temperature is 1.21×10^{-6}. Its molar solubility is

A. 1.21×10^{-6}

B. 1.21×10^{-3}

C. 1.1×10^{-4}

D. 1.1×10^{-3}

Answer: C

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41. A sample of HI was found to be 22% dissociated when equilibrium was reached. What will be the degree of dissociation if hydrogen is added in the proportion of mol for very mole of HI present originally ? Assume temperature and pressure to be constant.

A. 0.065

B. 0.085

C. 0.037

D. 0.052

Answer: B

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42. The pH of solution A is 3. It is mixed with an equal volume of another solution B having pH 2. What is the resultant pH of the solution?

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43. Vapour density of the equilibrium mixture of NO_2 and N_2O_4 is found to be 40 for the equilibrium: $N_2O_4(g) \Leftrightarrow 2NO_2(g)$. Calculate percentage of NO_2 in the mixture.

A. 32

B. 26

C. 25

D. 35

Answer: C

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44. Suppose the solubilities of AgCl in water, in 0.01 M $CaCl_2$ solution, in 0.01 M NaCl solution and in 0.05 M $AgNO_3$ solution are S_1, S_2, S_3 and S_4 respectively. The correct order of these solubilities is

A. $S_1 > S_2 > S_3 > S_4$

B. $S_1 > S_2 = S_3 > S_4$

C. $S_1 > S_3 > S_2 > S_4$

D. $S_4 > S_2 > S_3 > S_1$

Answer: D

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45. For a fairly concentrated solution of a weak electrolyte A_y, B_y the degree of dissociation is given by

A. $\alpha = \sqrt{\frac{K_{aq}XY}{C}}$

B. $\alpha = \sqrt{\frac{K_{eq}C}{(x+y)}}$

C. $\alpha = \sqrt{\frac{K_{aq}XY}{C}}$

D. $\alpha = \left(\frac{K_{eq}}{C^{x+y-1}X^x y^y}\right)^{1(x+y)}$

Answer: A

Watch Video Solution

46. 25.0mL of0.1 M NaOH is titrated with 0.1 MHCl. Calculate pH when i) 20mL.

ii) 24 mL of acid is added

A. $12.0, 11.30$

B. $11.30, 12$

C. $2.0, 2.70$

D. $2.70, 2.0$

Answer: B

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47. The number of $H^{\oplus}$ ions present in 1mL of solution having, pH=13 is

A. 6.02×10^{10}

B. 6.02×10^{7}

C. 6.02×10^{13}

D. 10^{13}

Answer: A

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48. For pure water,

A. Both pH and pOH decrease with increase in temperature.

B. Both pH and pOH increase with increase in temperature.

C. pH decreases and pOH increases with increase in temperature.

D. pH increases and pOH decreases with increase in temperature.

Answer: D

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49. $2H_2O \Leftrightarrow H_3O^{\oplus} + \overset{\oplus}{O}H, K_w = 10^{=14} at 25^{\circ} C,$ hence K_a is

A. 10^{-7}

B. 5.55×10^{-13}

C. 10^{-14}

D. 18×10^{-17}

Answer: B

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50. The addition of NaH_2PO_4 to $0.1MH_3PO_4$ will cause

A. No change in pH value

B. Increase in its pH value

C. Decrease in its pH value

D. Change in pH but cannot be predicted

Answer: A

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51. The pH of a solution containing 0.1 mol of CH_3COOH, 0.05 mol of $NaOH$, and $0.2 mol of CH_3COONa$, in 1.L. $(pK_a of CH_3COOH = 4.74)$ is :

A. 5.44

B. 5.20

C. 5.04

D. 4.74

Answer: A

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52. The pH of blood is maintained by the balance between H_2CO_2 and $NaHCO_2$. If the amount of 'CO_(2)', in blood is increased, how will it affect the pH of blood?

A. pH will remain same

B. pH will be

C. pH will increase

D. pH will decrease

Answer: D

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53. The expression to calculate pH of sodium acetate solution at $25^\circ C$ is

A. $pH = 7 + \frac{1}{2} pK_b(CH_3COOH) - \frac{1}{2} lg$[salt]

B. $pH = 7 + \frac{1}{2} pK_a(CH_3COOH) - \frac{1}{2}\log$ [salt]

C. $pH = 7 + \frac{1}{2} pK_b(CH_3COOH) + \frac{1}{2}\log$ [salt]

D. $pH = 7 + \frac{1}{2} pK_a(CH_3COOH) + \frac{1}{2}\log$ [salt]

Answer: B

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54. In which of the following acid-base titrations, pH is greater than 8 at the equivalence point?

A. Acetic acid vs ammonia

B. Acetic acid vs sodium hydroxide

C. Hydrochloric acid vs ammonia

D. Hydrochloric acid vs sodium hydroxide

Answer: A

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LEVEL-II

1. For the following three reactions (i), (ii) and (iii), equilibrium constants are given:

i) $CO_{(g)} + H_2O_{(g)} \Leftrightarrow CO_{2(g)} + H_{2(g)}, K_1$

ii) $CH_{4(g)} + H_2O_{(g)} \Leftrightarrow CO_{(g)} + 3H_{2(g)}, K_2$

iii) $CH_{4(g)} + 2H_2O_{(g)} \Leftrightarrow CO_{2(g)} + 4H_{2(g)}, K_3$

Which of the following relation is correct?

A. $K_3K_2^3 = K_1^2$

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

C. $K_2K_3 = K_1$

D. $K_3 = K_1K_2$

Answer: D

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2. For the reaction, $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)} K = 47.6$, if the initial number of moles of each reactant and product is 1 mole, then at equilibrium:

A. $[I_2] = [H_2], [I_2] < [HI]$

B. $[I_2] < [H_2], [I_2] = [HI]$

C. $[I_2] = [H_2], [I_2] = [HI]$

D. $[I_2] > [H_2], [I_2] = [HI]$

Answer: C

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3. At equilibrium: $N_2O_4 \Leftrightarrow 2NO_{2(g)}$ the observed molecular weight of N_2O_4 is $80 g mol^{-1}$ at 350 K. The percentage dissociation of $N_2O_{4(g)}$ at 350 K is:

A. 10%

B. 15%

C. 20%

D. 18%

Answer: B

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4. XY_2 dissociates as: $XY_{2(g)} \Leftrightarrow XY_{(g)} + Y_{(g)}$. Initial pressure of XY_2 is 600 mm Hg. The total pressure at equilibrium is 800 mm Hg. Assuming volume of system to remain constant, the value of K_P is:

A. 50

B. 100

C. 200

D. 400

Answer: B

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5. $NH_4COONH_{2(s)} \Leftrightarrow 2NH_{3(g)} + CO_{2(g)}$ If equilibrium pressure is 3 atm for the above reaction: K_P will be:

A. 4

B. 27

C. $4/27$

D. $1/27$

Answer: A

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6. 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: C

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7. For which of the following sparingly soluble salt, the solubility (S) and solubility product(K_{aq}) are related by the expression: $S = \left[\frac{K_{sp}}{4}\right]^{1/2}$

A. $BaSO_4$

B. $Ca_3(PO_4)_2$

C. Hg_2Cl_2

D. Ag_3PO_4

Answer: C

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8. The pH of a solution obtained by mixing 50 mL of 0.4 NHCl and 50 mL of 0.2 N NaOH is:

A. $-\log 2$

B. $-\log 0.2$

C. 1

D. 2

Answer: C

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9. 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. $3.7 \times 10^{-3} M$

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

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

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

Answer: D

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10. The pH of a buffer solution prepared by adding 10 mL of 0.1 MCH_3COOH and $20mLof0.1$ M sodium acetate will be: (given: PK_a for $CH_3COOH = 4.74$)

A. 4.05

B. 3.04

C. 5.04

D. 3.05

Answer: C

Watch Video Solution

11. At $27^{\circ} C, K_P = 1.5 \times 10^{18}$for the reaction, $3NO(g) \Leftrightarrow N_2O(g) + NO_2(g)$. If 0.02 mol of NO were placed in a 1 L vessel and equilibrium were established, what would be the equilibrium concentration of NO? $\left[R = 0.082Latmmol^{-1}K^{-1}\right]$

A. 0

B. $4 \times 10^{-8} M$

C. $1.2 \times 10^{-7} M$

D. $1.4 \times 10^{-8} M$

Answer: D

View Text Solution

12. At temperature T, a compound $AB_2(g)$ dissociates according to the reaction $2AB_2(g) \Leftrightarrow 2AB(g) + B_2(g)$ with degree of dissociation α, which is small compared with unity. The expression for K, in terms of α and the total pressure p_1 is

A. $\frac{p_1 \alpha^3}{2}$

B. $\frac{p_1 \alpha^2}{3}$

C. $\frac{p_1 \alpha^2}{2}$

D. $\frac{p_1 \alpha}{3}$

Answer: A

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13. Ascorbic acid (vitamin C) is a diprotic acid, $H_2C_6H_6O_6$. $[H^+]$, pH and $[C_6H_6O_6]^{2-}$ in a $0.10M$ solution of ascorbic acid will be respectively(Given $K_{a_1} = 6.8 \times 10^{-5}$ and $K_{a_2} = 2.7 \times 10^{-12}$ for ascorbic acid).

A. $3.6 \times 10^{-5}M, 2.58, 2.7 \times 10^{-12}M$

B. $2.6 \times 10^{-3}M, 8.18, 15 \times 10^{-10}M$

C. $2.6 \times 10^{-3}M, 2.58, 2.7 \times 10^{-12}M$

D. $1.5 \times 10^{-4}M, 3.67, 1.7 \times 10^{-14}M$

Answer: C

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14. The pH of a 0.1 M aqueous solution of Na_2CO_3 is adjusted to 12 using a strong base. What is the degree of hydrolysis of carbonate ions? [Given : $K_{a1} = 4.5 \times 10^{-7}$ and $K_{a2} = 4.7 \times 10^{-11}$ for H_2CO_3] 2.1×10^2

A. 2.1×10^2

B. 4.6×10^{-2}

C. 2.2×10^{-4}

D. 4.7×10^{-10}

Answer: A

View Text Solution

15. Which is correct statement if N_2 is added at equilibrium condition?

$N_2 + 3H_2 \Leftrightarrow 2NH_3$

A. The equilibrium will shift to forward direction because according to IInd law of thermodynamics the entropy must increases in the direction of spontaneous reaction.

B. The condition for equilibrium is $G_{N_2} + 3G_{H_2} = 2G_{NH_3}$ where Gibbs free energy per mole of the gaseous species measured at that partial pressure. The condition of equilibrium is unaffected by the use of catalyst, which increases the rate of both the forward and reverse reactions to the same extent.

C. The catalyst will increase the rate of forward reaction bya and that of reverse reaction by β.

D. Catalyst will not alter the rate of either of the reaction.

Answer: B

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16. Ammonia under a pressure of 15 atm at $27^{\circ}C$ is heated to $347^{\circ}C$ in a closed vessel in the presence of catalyst. Under the conditions, NH_3 is partially decomposed according to the equation$2NH_3 \Leftrightarrow N_2 + 3H_2$.

The vessel is such that the volume remains effectively constant, whereas pressure increases at 50 atm. Calculate the percentage of NH_3 actually decomposed.

A. 61.3%

B. 63.5%

C. 65.3%

D. 66.6%

Answer: A

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17. A mixture containing 8.07 mol of hydrogen and 9.08mol of iodine was heated at $448^{\circ}C$ till equilibrium was attained when 13.38 mol of hydrogen iodide was obtained. Calculate the percentage dissociation of hydrogen iodide at $448^{\circ}C$.

A. 13.2%

B. 19.8%

C. 18.9%

D. 21.4%

Answer: D

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18. The equilibrium constant K_C for the reaction $N_2O_4 \Leftrightarrow 2NO_2$ in chloroform at 291 Kis 1, 14. Calculate the free energy change of the reaction when the concentration of the two gases is 0.5 mol dm^{-3} each at the same temperature. ($R = 0.082 LatmK^{-1}$'mol^{-1})

A. $-54.95 Latm$

B. $-38.94 Latm$

C. $-27.2 Latm$

D. $-19.67 Latm$

Answer: D

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19. Suppose 20.85g of $PCI_5(g)$ is introduced in vessel washed with a non-volatile solvent (b.p. = 350 K, molar mass= 154 g mol^{-1}). The equilibrium is established at 523 K when PCI_3 (g) is 52% dissociated and a total pressure was found to be 5.5 bar. If K_P for the decomposition reaction: $PCl_5 \Leftrightarrow PCl_3 + Cl_2$ is 1.78, calculate the weight of solvent left in the vessel during washing.

A. $2.188g$

B. $1.128g$

C. $3.4188g$

D. $4.212g$

Answer: C

View Text Solution

20. The equilibrium constant of the reaction $A_2(g) + B_2(g) \Leftrightarrow 2AB(g) at 100^\circ C is 50$. If a one-litre flask containing one mole of A_2 is connected to a two litre flask conatining two moles of B_2 how many moles of AB will be formed at 373 K?

A. 1.86

B. 0.93

C. 2.32

D. 0.46

Answer: A

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21. A sample of air consisting of N_2 and O_2 was heated to 2500 K until the equilibrium.

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

was established with an equilibrium constant $K_c = 2.1 \times 10^{-3}$. At equilibrium the mole % of NO was 1.8. Estimate the initial composition of air in mole fraction of N_2 and O_2.

A. $0.68, 0.32$

B. $0.46, 0.54$

C. $0.74, 0.26$

D. $0.83, 0.17$

Answer: C

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22. At temperature T, a compound $AB_2(g)$ dissociates according to the reaction:

$2AB_2(g) \Leftrightarrow 2AB(g) + B_2(g)$ with a degree of dissociation 'x' which is small compared to unity. Deduce the expression for 'x' in terms of the equilibrium constant K_P and the total pressure P.

A. $\left(\frac{2K_P}{P}\right)^{\frac{1}{2}}$

B. $\left(\frac{3K_P}{P^2}\right)^{\frac{1}{2}}$

C. $\left(\frac{2K_P}{P}\right)^{\frac{1}{3}}$

D. $\frac{3K_P}{P^2}$

Answer: C

Watch Video Solution

23. An equilibrium mixture at 300 K contains N_2O_4 and NO_2, their partial pressures are 0.28 and 1.1 atmospheres respectively. If the volume of container is doubled, calculate the new equilibrium partial pressure of two gases.

A. $0.095atm, 0.64atm$

B. $0.12atm, 0.86atm$

C. $0.06atm0.47atm$

D. $0.18atm, 0.63atm24$

Answer: A

Watch Video Solution

24. At 540K, 0.10 mole of PCI_5 are heated in a 8 litre flask. The pressure of the equilibrium mixture is found to be 1.0 atm. Calculate K_c and K_p for the reaction.

A. $2 \times 10^{-2} \text{mol litre}^{-1}, 1.69atm$

B. $4 \times 10^{-2} \text{mol litre}^{-1}, 1.77atm$

C. $2.5 \times 10^{-2} \text{mol litre}^{-1}, 1.69atm$

D. $4 \times 10^{-2} \text{mol litre}^{-1}, 2.63atm$

Answer: B

Watch Video Solution

25. The degree of dissociation is 0.4 at 400 K and 1.0 atm for the gaseous reaction. $PCL_5 \Leftrightarrow PCl_3 + Cl_2$ Assuming ideal behaviour of all the gases, calculate the density of equilibrium mixture at 400 K and 1.0 atmosphere. (Atomic mass of P=31.0 and Cl= 35.5)

A. 7.39 g/L

B. 3.54 g/L

C. 6.92 g/L

D. 4.53 g/L

Answer: D

Watch Video Solution

26. A certain amount of $N_2O_4(g)$ is enclosed in a closed container at $127^\circ C$ when following equilibrium got setup at a total pressure of 10 atm. $N_2O_4(g) \Leftrightarrow 2NO_2(g)$

If the concentration (moles) of $NO_2(g)$ in the equilibrium mixture be

8×10^5 ppm, the $K_c(in mol L^{-1})$ for the above reaction at $127^\circ C$ is equal to

A. 3.189

B. 2.051

C. 0.974

D. 1.84227

Answer: C

View Text Solution

27. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$. The equilibrium, K_c for the dissociation of PCl_5 , is 4.0×10^{-2} at $250^\circ C$ in a 3.0L flask when equilibrium concentration of Cl_2 is 0.15 mol/L. What was the pressure of PCl_5 before any dissociation? $(R = 0.082 L - atm K^{-1} mol^{-1})$

A. $37.0 atm$

B. $30.59 atm$

C. $24.05 atm$

D. $6.745 atm$

Answer: B

Watch Video Solution

28. Assume that the decomposition of HNO_3 can be represented by the following equation

$4HNO_3(g) \Leftrightarrow 4NO_2(g) + 2H_2O(g) + O_2(g)$

And at the given temperature 400 K and pressure 30 atm the reaction approaches equilibrium. Atequilibrium partial pressure of HNO_3 is 2 atm. Find K_c in (mol/lit)

A. 32

B. 24

C. 18

D. 16

Answer: A

Watch Video Solution

29. 0.2M KCN and 0.06M $AgNO_2$ solutions are mixed in equal volumes. At $25^\circ C K_c$ for the reaction $Ag(CN)_2^- \Leftrightarrow Ag^+ + 2CN^- is 1.6 \times 10^{-19}$. The conc. of Ag^+ present in solution is

A. $1.5 \times 10^{-19} M$

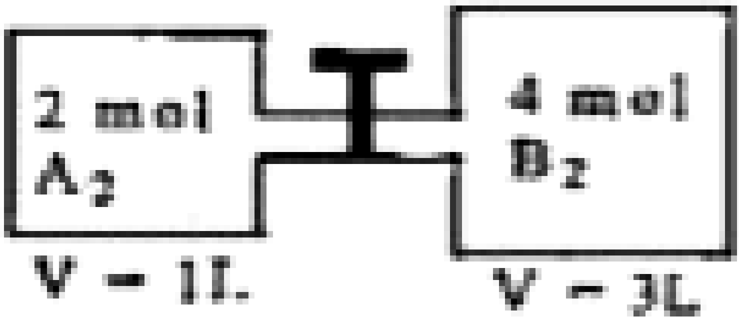
B. $1.5 \times 10^{-18} M$

C. $3 \times 10^{-19} M$

D. $3 \times 10^{-18} M$

Answer: B

Watch Video Solution



30. Gases are

present intwo containers at 300 K separated by a narrow tube of negligible volume having valve in between. On opening the valve the reaction $A_2(g) + B_2(g) \Leftrightarrow 2AB(g)$ attains equilibrium at 300 K. If $K_c = 4$ at 300 K, the concentration of AB at equilibirum is :

A. $1.33M$

B. $2.66M$

C. $1.66M$

D. $0.66M$

Answer: D

Watch Video Solution

31. At constant temperature, the equilibrium constant (K_P) for the decomposition reaction. $N_2O_4 \Leftrightarrow 2NO_2$ is expressed by $K_P = 4x^2P/(1-x^2)$ where, P is pressure, x is extent of decomposition. Which of the following statement is true?

A. K_P increases with increase of P

B. K_P increases with increase ofx

C. K_P increases with decrease of x

D. K_P remains constant with change in P and X.

Answer: D

Watch Video Solution

32. An acid-base indicator $(PK_a = 4.5271)$ has the acid form red and basic form blue. If we need 75% red to be converted into 75% blue form in solution, the change in pH of solution should be:

A. 4.05

B. 5.0

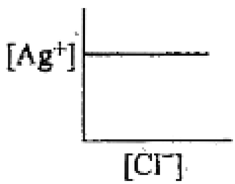
C. 0.95

D. 0.80

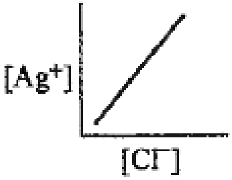
Answer: C

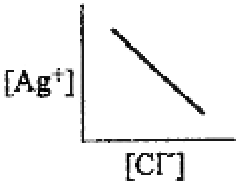
Watch Video Solution

33. In a saturated solution of AgCl, addition of NaCl is made drop by drop in excess. Which graph correctly represents the change?

A. 

B. 

C. 

D. 

Answer: B

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34. 0.1 M solution of H_3A being a weak triprotic acid having K_{a_1}, K_{a_2} and K_{a_3} as $10^{-5}, 10^{-9}$ and 10^{-13} respectively. If pX represents $-\log X$ and $X = \frac{[A^{3-}]}{[HA^{2-}]}$, then the value of pX is:

A. 7

B. 8

C. 10

D. 9

Answer: C

Watch Video Solution

35. When equal volumes of the following solutions are mixed, precipitation of AgCl $(K_{sp} = 1.8 \times 10^{-10})$ will occur only with:

A. $10^{-4}M(Ag^{+})$ and $10^{-4}M(Cl^{-})$

B. $10^{-5}M(Ag^{+})$ and $10^{-5}M(Cl^{-})$

C. $10^{-6}M(Ag^{+})$ and $10^{-6}M(Cl^{-})$

D. $10^{-10}M(Ag^{+})$ and $10^{-10}M(Cl^{-})$

Answer: A

Watch Video Solution

36. 2.5 mL of $\frac{2M}{5}$ weak monoacidic base $\left(K_b = 1 \times 10^{-12} at 25^\circ C\right)$ is titrated with $\frac{2}{15}$MHCl in water at $25^\circ C$. The concentration of that equivalence point is:

A. $3.2 \times 10^{-13} M$

B. $3.2 \times 10^{7} M$

C. $3.2 \times 10^{-2} M$

D. $2.7 \times 10^{-2} M$

Answer: D

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37. The ionization constant of NH_4^+ in water is $5.6 \times 10^{-10} at 25^\circ C$. The rate constant for the reaction of NH_4^+ and $OH-$ to form NH_3 and $H_2O at 25^\circ C is 3.4 \times 10^{10} L mol^{-1} s^{-1}$ calculate the rate constant for proton transfer from water to NH_3.

A. 8.23×10^5

B. 6.07×10^5

C. 12.14×1^4

D. 10.3×10^4

Answer: B

Watch Video Solution

38. The pH of blood stream is maintained by a proper balance of H_2CO_3 concentrations. What volume of $5MNaHCO_3$ solution be mixed with 10 mL sample of blood which is $2M$ in H_2CO_3 in order to maintain a pH of $7.4K_a$ for H_2CO_3in blood is 7.8×10^{-2}?

A. $41.\ 86mL$

B. $83.2mL$

C. $78.36mL$

D. $52.43mL$

Answer: C

Watch Video Solution

39. The solubility of $Pb(OH)_2$ in water is $6.7 \times 10^{-6} M$ Calculate solubility of $Pb(OH)_2$ in a buffer of pH=8.

A. 12.03×10^{-2} mol /L

B. 1.203×10^{-3} mol /L

C. 3.102×10^{-3} mol /L

D. 3.102×10^{-2} mol /L

Answer: B

Watch Video Solution

40. The $K_{sp} of Ca(OH)_2 is 4.42 \times 10^{-4} at 25^\circ C. A 500 mL$ of saturated solution of$Ca(OH)_2$ is mixed with equal volume of 0.4 M NaOH. How much Ca$(OH)_2$ in mg is precipitated?

A. $527.3mg$

B. $638.4mg$

C. $218.3mg$

D. $743mg$

Answer: D

Watch Video Solution

41. An aqueous solution of a metal bromide $MBr_2(0.05M)$ is saturated with H_2S. What is the minimum pH at which MS will precipitate? K_p for $MS = 6.0 \times 10^{-21}$ concentration of saturated $H_2S = 0.1M, k_1 = 10^{-7}$ and $K_2 = 1.3 \times 10^{-13}$ for H_2S.

A. 0.9826

B. 1.3213

C. 2.6931

D. 2.1897

Answer: A

Watch Video Solution

42. What volume must $1 L of 0.5 M CH_3COOH$ solution should be diluted with water in order to double OH^(-) concentration? $K_a = 1.8 \times 10^{-5}$

A. $3.7 \times 10^4 L$

B. $2.76 \times 10^3 L$

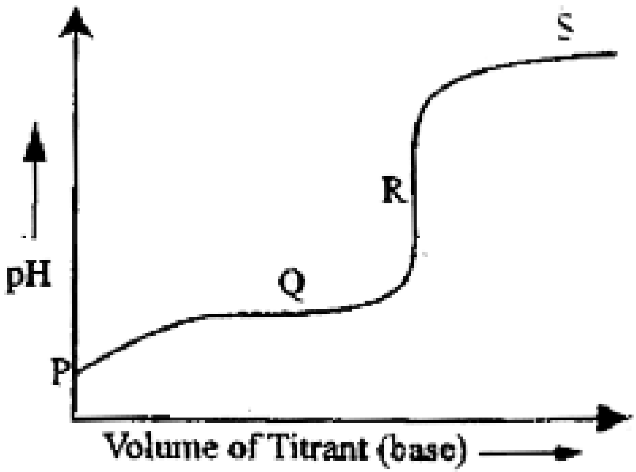
C. $3.10 \times 10^3 L$

D. 4 L`

Answer: A

Watch Video Solution

43. The pH curve of the titration of weak acid with a strong base is given below:



Now choose the correct option among the following:

A. pH at point $P = \frac{1}{3}pK_a - \frac{1}{2}\log[A_0]$ Where A_0 is the initial concentration of weak acid

B. pH at point $Q = pK_a - \frac{1}{2}\log\frac{[\text{weak acid}]}{[\text{Salt}]}$

C. pH at point $R = \frac{1}{2}pK_w + \frac{1}{2}pK_a + \frac{1}{2}\log$ [salt]

D. pH at point $S = \frac{1}{2}pK_w + \frac{1}{2}\log$[Base]

Answer: C

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44. H_2S is bubbled into 0.2 M NaCN solution which is 0.02 M in each $\left[Cd(CN)_4\right]^{2-}$ and $\left[Ag(CN_2)\right]^{-} H_2S$ produces $1 \times 10^{-9} M$ sulphide ion in the solution Given, $K_{ap} Ag_2S = 1 \times 10^{-50} M^3$, $K_{ap} Cds = 7.3 \times 10^{-18} M^2 K_{\text{iost}} \left[Ag(CN)_2\right]^{1} =$

Identify the correct statement.

A. Ag_2S Sprecipitates first from the solution

B. Ag_2 Sprecipitates at a sulphide concentration $1 \times 10^{15} M$

C. Cds precipitates first from the solution

D. None of them precipitates under the given conditions

Answer: C

Watch Video Solution

45. For the equilibrium system $2HX(g) \Leftrightarrow H_2(g) + X_2(g)$ the equilibrium constant is 1.0×10^{-5}. What is the concentration of HX if the equilibrium concentration of H_2 and X_2 are $1.2 \times 10^{-3}M$, and $1.2x10^{-4}M$respectively?

A. $12 \times 10^{-4}M$

B. $12 \times 10^{-3}M$

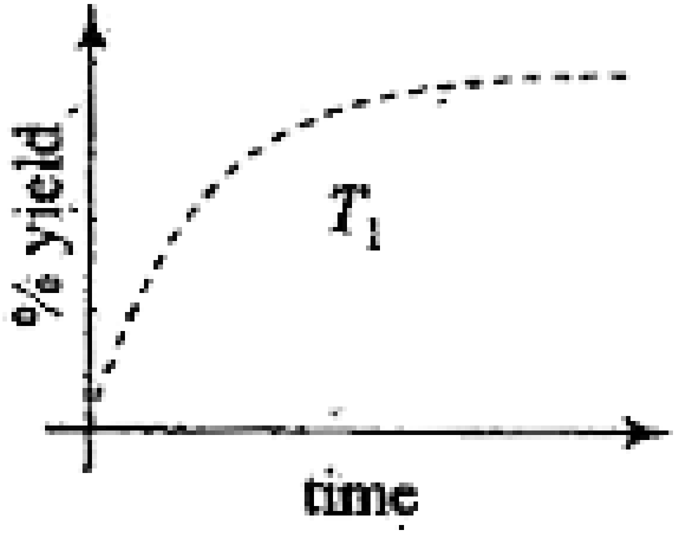
C. $12 \times 10^{-2}M$

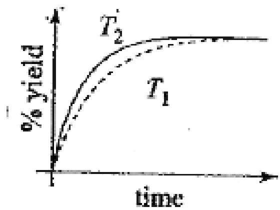
D. $12 \times 10^{-1}M$

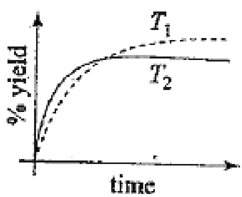
Answer: C

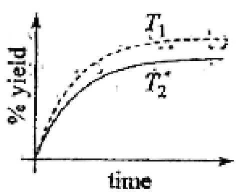
Watch Video Solution

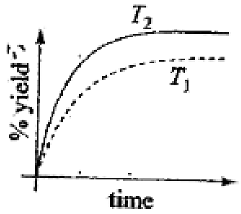
46. The %yield of ammonia as a function of time in the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g). \Delta H < 0at(p, T_1)$ is given below. If this reaction is conducted at (P_1T_2), with $T_2 > T_1$ the % yield of ammonia as a function of time is represented by



A. 

B. 

C. 

D. 

Answer: C

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47. For the reaction $N_2O_4(g) \Leftrightarrow 2NO_2(g)$, the value of K_p is $1.7 \times 10^3 at 500K$ and $1.7 \times 10^4 at 600K$. Which of the following is/are correct?

A. The proportions of NO_2 in the equilibrium mixture is increased by decrease in pressure.

B. The standard enthalpy change for the forward reaction is negative.

C. Units of K_2 are atm^{-2}

D. At 500 K the degree of dissociation of N_2O_4 decreases by 50% by increasing the pressure by 100%

Answer: A

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48. 100 mL of a buffer solution contains 0.1 M each of weak acid HA and salt NaA. How many gram of NaOH should be added to the buffer so that it pH will be 6? $\left(K_a of \Delta A = 10^{-5}\right)$

A. 0.328

B. 0.458

C. 4.19

D. 1.32

Answer: A

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49. The solubility products of MA,MB,MC, and MD are $1.8 \times 10^{-10}, 4 \times 10^{-3}, 4 \times 10^{-8}$ and 6×10^{-5} respectively. Ifa 0.01 M solution of MX is added dropwise to a mixture containing $A^{\ominus}, B^{\ominus}, C^{\ominus}$ and $D^{\ominus}$ ions, then the one to be precipitated first will be

A. MA

B. MB

C. MC

D. MD

Answer: A

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50. $CaCO_3$ and $BaCO_3$ have solubility product values 1×10^{-8} and 5×10^{-9} respectively. If water is shaken up with both solids till equilibrium is reached, the concentration of CO_3^{2-} ion is

A. 1.5×10^{-8}

B. 1.225×10^{-4}

C. 2.25×10^{-9}

D. 2.5×10^{-8}

Answer: B

Watch Video Solution

51. A definite volume of a N/20 $CH_3COOH(pK_a = 4.7447)$ is titrated with a strong base (NaOH). It is found that 80 equal sized drops of NaOH, added from a burette effects the complete neutralisation. Find the pH, when the acid solution is neutralised to the extent of 20%

A. 4.14

B. 9.86

C. 5.34

D. 8.68

Answer: A

Watch Video Solution

52. Equilibrium constant K_P for $2H_2S_{(g)} \Leftrightarrow 2H_{2(g)} + S_{2(g)} is 0.0118 atm at 1065^\circ C$ and heat of dissociation is 42.4 kcal. Find equilibrium constant at $1132^\circ C$.

A. $0.025atm$

B. $0.052atm$

C. $0.52atm$

D. $0.075atm$

Answer: A

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LEVEL-II (ASSERTION-REASON TYPE)

1. Assertion : Adding inert gas to dissociation equilibrium of N_2O_4 at constant pressure and temperature increases the dissociation.

Reason : Molar concentration of the reactants and products decrease.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

2. Assertion: Equilibrium constant of an endothermic reaction increases with increase of temperature.

Reason : With increase in temperature, an endothermic reaction is favoured more in the forward direction.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

3. Assertion: The equilibriurn constant is fixed and characteristic for any given chemical reactionata specified temperature.

Reason : The composition of the final equilibrium mixture at a particular temperature depends upon the starting amount of reactants.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: B

Watch Video Solution

4. Assertion: When a catalyst is added to a reaction mixture in equilibrium, the amount of the products increases.

Reason : The forward reaction alone becomes faster on adding the catalyst.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: D

Watch Video Solution

5. Assertion : The equilibrium constant for the reverse reaction is equal to the inverse of the equilibrium constant for the forward reaction.

Reason The value ofequilibrium constant is independent of initial concentrations of the reactants and products.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: B

Watch Video Solution

6. Assertion : In the dissociation of PCl_5 at constant pressure and temperature addition of helium at equilibrium increases the dissociation of PCI_3.

Reason : Helium reacts with Cl, and hence shifts the equilibrium in forward direction.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: C

Watch Video Solution

7. Assertion : Weak acids have very strong conjugate bases while strong acids have weak conjugate bases.

Reason : Conjugate acid-base pair differ only by one proton.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: B

Watch Video Solution

8. Assertion : A solution of NH_4 Cl in water is acidic in nature,

Reason : Ammonium ions undergo hydrolysis to form$NH_4OH \text{ and } H.$

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

9. Assertion : The pH of an aqueous solution of acetic acid remains unchanged on addition of sodium acetate.

Reason : The ionization of acetic acid is increased by addition of sodium acetate.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: D

Watch Video Solution

10. Assertion : On increasing pressure there occurs a decrease in melting point of ice.

Reason : On melting ice contracts,

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

11. Assertion: The pK_a of a weak acid becomes equal to pH of the solution at the midpoint of its titration.

Reason : The molar concentrations of proton acceptor and proton donor become equal at the midpoint of titration of a weak acid.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

12. Assertion: The solubility of AgCl in water decreases if NaCl is added to it.

Reason : NaCl is highly soluble in water whereas AgCl is sparingly soluble.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: B

Watch Video Solution

13. Assertion : The equilibrium constant may show higher or lower values with increase in temperature.

Reason : The change depends on the heat of reaction.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

14. Assertion : On passing $HCl_{(g)}$ through a saturated solution of $BaCl_2$, a white turbidity appears.

Reason : The common ion effect is responsible for white turbidity.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: C

Watch Video Solution

15. Assertion : Cl^- is weak base than H_2O.

Reason : Stronger is acid, weaker is its conjugate base.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

16. Assertion : The pH of pure water is less than 7 at $60^\circ C$.

Reason : As the temperature increases, pure water becomes slightly acidic.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: C

Watch Video Solution

17. Assertion : Solubility of AgCl is more in conc. HCl than in water.

Reason : AgCl form a complex with conc. HCl and thus solubility of AgCl increases in conc. HCl.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

18. Assertion: Degree of hydrolysis and pH of a salt say NH_4 CNis independent of concentration of NH_4CN.

Reason : The solution of NH_4CNin water has pH greater than 7.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: B

Watch Video Solution

19. Assertion : A reaction $2SO_2 + O_2 \Leftrightarrow 2SO_3$, , has K_p at 298 K and 500 K as 4.0×10^{34} and 8.5×10^{10} respectively.

Reason : The E_a for the forward reaction is lesser than E_b for the backward reaction.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

20. Assertion : Addition of an inert gas at constant pressure to dissociation equilibrium of $PCl_5 \Leftrightarrow PCl_3 + Cl_2$ favours forward reaction.

Reason: $K_c = \frac{\alpha^2}{V(1-\alpha)}$ for the dissociation equilibrium of PCI_5 where alpha is degree of dissociation of PCl_5.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but(R) is not the correct explanation of (A)

C. If(A) is correct, but (R) is incorrect

D. If both (A) and (R) are incorrect

Answer: A

Watch Video Solution

Level -I

1. The volume of the reaction vessel containing an equilibrium mixture in the reaction,

$SO_2CL_{2(g)} \Leftrightarrow SO_{2_g} + Cl_{2(g)}$ is increased. When equilibrium is re-established:

A. the amount of $SO_{2(g)}$ will decrease

B. the amount of $SO_2Cl_{2(g)}$ will increase

C. the amount of $Cl_{2(g)}$ will increase

D. the amount of $Cl_{2(g)}$ will remain unchaned

Answer: C

Watch Video Solution

2. cylinder fitted with a movable piston contains liquid water in equilibrium with water vapour at $25^\circ C$. Which operation result in a decrease in the equilibrium vapour pressure?

A. Moving the piston downwards a short distance

B. Removing a small amount of vaour

C. Removing a small amount of the liquid water

D. Dissolving salt in the water

Answer: D

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3. For a given exothermic reaction, K_P and $K_P{}'$ are the equilibrium constants at temperature T_1 and higher temperature T_2 respectively: Assuming that heat of reaction is constant in temperature range between T_1 and T_2 it is readily observed that:

A. $K_P > K'_P$

B. $K_P < K'_P$

C. $K_P = K'_P$

D. $K_P = \frac{1}{K'_P}$

Answer: A

Watch Video Solution

4. If the value of an equilibrium constant for a particular reaction is 1.6×10^{12} then at equilibrium the system will contain.

A. mostly reactants

B. mostly products

C. similar amount of reactants and products

D. all reactants

Answer: B

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5. For a hypothetial reaction $4A_{(g)} + 5B_{(g)} \Leftrightarrow 4P_{(g)} + 6Q_{(g)}$. The equilibrium costant K_C has units :

A. mol L^{-1}

B. $mol^{-1}L$

C. $(molL^{-1})^{-2}$

D. unitless

Answer: A

Watch Video Solution

6. Consider the following reversible reaction at equilibrium: $2H_2O_{(g)} \Leftrightarrow 2H_{2(g)} + O_{2(g)} \Delta H = +24.7kJ$

which one of the following changes in conditions will lead to maximum decomposition of $H_2O(g)$?

A. Increasing both temperature and pressure

B. Decreasing temperature and increasing pressure

C. Increasing temperature and decreasing pressure

D. Increasing temperature at constant pessure

Answer: C

Watch Video Solution

7. Which among the following reactions will be favoured at low pressure?

A. $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$

B. $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)}$

C. $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

D. $N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}$

Answer: C

Watch Video Solution

8. Consider the reactions, i) $PCl_{5(g)} \Leftrightarrow PCl_{3(g)} + Cl_{2(g)}$

ii) $N_2O_{4(g)} \Leftrightarrow NO_{2(g)}$

The addition of an inert gas at constant volume:

A. will increase the dissociation of PCl_5 as well as N_2O_4

B. will reduce the dissociation of PCl_5 as well as N_2O_4

C. Will increase the dissociation of PCl_5 and step up the formation of NO_2

D. will not disturb the equilibrium of the reactions

Answer: D

Watch Video Solution

9. The solubility of $PbSO_4$ at $25^\circ C$ is 1.1×10^{-4} mol/L. Then its solubility product (K_{sp}) is:

A. 1.21×10^{-8}

B. 12.1×10^{-6}

C. 121×10^{-11}

D. 1.21×10^{-10}

Answer: A

Watch Video Solution

10. In the reaction, $HC_2O_4^- + PO_4^{3-} \Leftrightarrow HPO_4^{2-} + C_2O_4^{2-}$ the Bronsted base are:

A. PO_4^{3-}, $C_2O_4^{2-}$

B. PO_4^{3-}, HPO_4^{2-}

C. $HC_2O_4^-$, HPO_4^{2-}

D. $HC_2O_4^-$, $C_2O_4^{2-}$

Answer: A

Watch Video Solution

11. The degree of hydrolysis of which of the following salts is independent of the concentration of salt solution?

A. CH_3COONa

B. NH_4Cl

C. CH_3COONH_4

D. NaCl

Answer: C

Watch Video Solution

12. For the reaction : $2A(g) + B(g) \Leftrightarrow 3Cg) + D(g)$

Two moles each of A and B were taken into a flask: The following must always be true when the system attained equilibrium

A. $[A] = [B]$

B. $[A] < [B]$

C. $[B] = [C]$

D. $[A] > [B]$

Answer: B

Watch Video Solution

13. Given: $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g), K_1$

$N_2(g) + O_2(g) \Leftrightarrow 2NO(g), K_2$,

$H_2(g) + \frac{1}{2}O_2 \Leftrightarrow H_2O(g), K_3$

The equilibrium constant for

$2NH_3(g) + \frac{5}{2}O_2(g) \Leftrightarrow 2NO(g) + 3H_2O(g)$ will be

A. $K_1K_2K_3$

B. $\frac{K_1K_2}{K_3}$

C. $\frac{K_1K_3^2}{K_2}$

D. $\frac{K_2K_3^3}{K_1}$

Answer: D

Watch Video Solution

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

A. 0.36 atm

B. 6.8 atm

C. 1.8 atm

D. 3.2 atm

Answer: C

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15. Equilibrium constants for four different reactions are given as $K_1 = 10^6$, $K_2 = 10^4$, $K_3 = 10^2$, and $K_4 = 10$. Which reaction will reduce least amount of products at equilibrium ?

A. $K_1 = 10^6$

B. $K_2 = 10^{-4}$

C. $K_3 = 10^2$

D. $K_4 = 10$

Answer: B

Watch Video Solution

16. For a system, $A + 2B \Leftrightarrow C$, the equilibrium concentrations are $[A] = 0.06[B] = 0.12$ and $[C] = 0.216$. The value of K for the reaction is

A. 120

B. 400

C. 4×10^{-3}

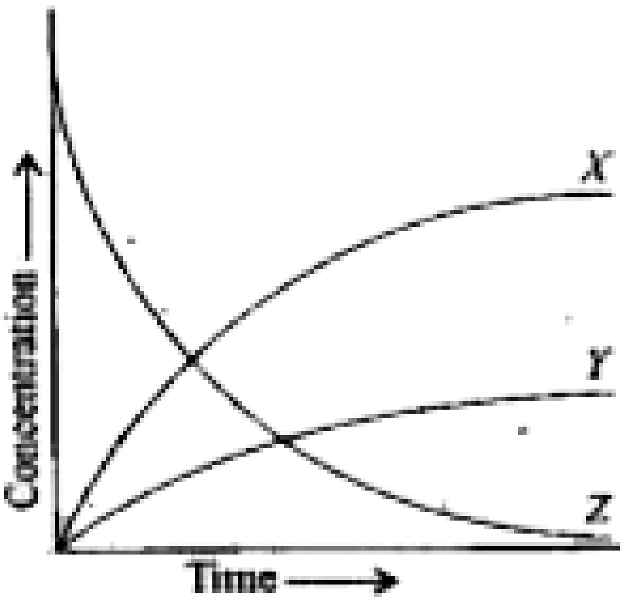
D. 250

Answer: D

Watch Video Solution

17. Consider the following reactions : $2NO_2(g) \rightarrow 2NO(g) + O_2(g)$

In the figure below, identify the curves X, Y and Z associated with the three species in the reaction



A. $X = NO, Y = O_2, Z = NO_2$

B. $X = O_2, Y = NO, Z = NO_2$

C. $X = NO_2, Y = NO, Z = O_2$

D. $X = O_2, Y = NO_2, Z = NO$

Answer: A

Watch Video Solution

18. At $1400K, K_c = 2.5 \times 10^{-3}$ for the reaction. $CH_4(g) + 2H_2S(g) \Leftrightarrow CS_2(g) + 4H_2(g)$ A 10L reaction vessel at 1400 K contains 2.0 mol of $CH_4 3.0$ mol of C$S_2 3.0$ mol of H, and 4.0 mol of H_2S. In which direction does the reaction proceed to reach equilibrium?

A. Forward

B. Backward

C. May be forward or backward

D. Reaction is in equilibrium

Answer: B

Watch Video Solution

19. The equilibrium of formation of phosgene is represented as: $CO(g) + Cl_2(g) \Leftrightarrow COCl_2(g)$

The reaction is carried out in a 500 ml flask. At equilibrium, 0.3 mol of phosgene, 0.1 mol of CO, and 0.1 mol of Cl, are present. The equilibrium constant of the reaction is

A. 30

B. 15

C. 5

D. 25

Answer: B

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20. For the reaction, $H_{2(g)} + CO_2(g) \Leftrightarrow CO(g) + H_2O(g),$ if the initial concentration of $[H_2] = [CO_2]$ and x molL^{-1} of $H_{,2}$ is consumed at equilibrium, the correct expression of K_P is:

A. $\dfrac{x^2}{(1-x)^2}$

B. $\dfrac{(1+x)^2}{(1-x)^2}$

C. $\dfrac{1+x^2}{(2+x)^2}$

D. $\dfrac{x^2}{1+x^2}$

Answer: A

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21. For the reaction : $2NO_2(g) \Leftrightarrow 2NO(g) + O_2(g), K_c = 1.8 \times 10^{-6} at 184^\circ C$ when K_P and K_c are compared at $184^\circ C,$ it is found that

A. K_P is greater than K_c

B. K_p is less than K_c

C. $K_p = K_c$

D. None of the above

Answer: A

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22. For the equilibrium $AB(g) \Leftrightarrow A(g) + B(g)$ at a given temperature, one-third of AB is dissociated. The equilibrium pressure of the system is

A. 8 times K_P

B. 16 times K_P

C. 4 times K_P

D. 9 times K_P

Answer: A

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23. The vapour density of the equilibrium mixture of the reaction: $SO_2Cl_2(g) \Leftrightarrow SO_2(g) + Cl_2(g) is 50.$ The percent dissociation of SO_2Cl_2 is

A. 33.00

B. 35.0

C. 30.0

D. 66.00

Answer: B

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24. In a 10 L vessel, HI was heated to attain equilibrium. At equilibrium 327.68 g HI, 406.4 g I_2 15.6g H_2 were present in the mixture. Calculate K_c if the mixture is transferred to 5L vessel.

A. 0.029

B. 0.059

C. 0.019

D. 0.91

Answer: C

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25. The heat of reaction at constant volume for an endothermic reaction in equilibrium is 1200 cal more than at constant pressure at:300 K, Calculate the ratio of equilibrium constants K_p (atm) and $K_c\left(molL^{-1}\right)$.

A. 2.846×10^{-3}

B. 6.481×10^{-3}

C. 1.856×10^{-3}

D. 1.648×10^{-3}

Answer: D

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26. On applying pressure to the equilibrium : Ice $\Leftrightarrow$ Water, which phenomenon will happen?

A. More ice will be formed

B. More water will be formed

C. Equilibrium will not be disturbed

D. Water will evaporate

Answer: B

Watch Video Solution

27. When $NaNO_3$ is heated in a closed vessel, oxygen is liberated and $NaNO_2$ is left behind. At equilibrium:

A. Addition of $NaNO_2$ favours reverse reaction

B. Addition of $NaNO_2$ favours forward reaction

C. Increasing temperatrature favours forward reaction

D. Decreasing pressure favoures reverse reaction

Answer: C

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28. The equilibrium constants for the reaction are:

$$H_3PO_4 \overset{K_1}{\Longleftrightarrow} H^+ + H_2PO_4^-, K_1$$

$$H_2PO_4^- \overset{K_2}{\Longleftrightarrow} H^+ + HPO_4^{2-}, K_2$$

$$HPO_4^{2-} \overset{K_3}{\Longleftrightarrow} H^+ + PO_4^{3-}, K_3$$

The equilibrium constant for $H_3PO_4 \Leftrightarrow 3H^+ + PO_4^{3-}$ will be:

A. K_1 / K_2K_3

B. $K_1 \times K_2 \times K_3$

C. K_2 / K_1K_3

D. $K_1 + K_2 + K_3$

Answer: B

Watch Video Solution

29. For the reaction, $PCl_{5(g)} \Leftrightarrow PCl_{3(g)}$ The forward reaction at constant temperature is favoured by: Introducing an inert gas at constant volume, Introducing chlorine gas at constant volume, Introducing ani inert gas at constant pressure, None of these

A. Introducing an inert gas at constant volume

B. Introducing chlorine gas at constant volume

C. Introducing an inert gas at constant pressure

D. None of these

Answer: C

Watch Video Solution

30. The equilibrium constant for, $H_{2(g)} + CO_{2(g)} \Leftrightarrow H_2O_{(g)} + CO_{(g)} is 1.80 at 1000^\circ C$. If 1.0 mole of H_2 and 1.0 mole of CO_2 are placed in one litre flask, the final equilibrium concentration of CO at $1000^\circ C$ will be: $0.573M, 0.385M, 5.73M, 0.295M$

A. 0.573 M

B. 0.385 M

C. 5.73 M

D. 0.295 M

Answer: A

Watch Video Solution

31. In the equilibrium, $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$ the partial pressure of SO_2, O_2 and SO_3 are 0.662,0.101 and 0.331 atm respectively. What should be the partial pressure of oxygen so that the equilibrium concentration of SO_2 and SO_3 are equal: $0.404 atm$, $1.01 atm$, $0.808 atm$, $0.2475 atm$

A. 0.404 atm

B. 1.01 atm

C. 0.808 atm

D. 0.2475 atm

Answer: A

Watch Video Solution

32. For the reaction, $A + B \Leftrightarrow C + D$, the initial concentration of A and B are equal, but the equilibrium concentration of Cis twice that of equilibrium concentration of A. The equilibrium constant is:

A. 4

B. 9

C. $1/4$

D. $1/9$

Answer: A

Watch Video Solution

33. The equilibrium constant for the reaction, $N_{2(g)} + O_{2(g)} \Leftrightarrow 2NO_{(g)}$ at temperature T is 25×10^{-4}. The value of K_c for the reaction. $NO_{(g)} \Leftrightarrow \frac{1}{2}N_{2(g)} + \frac{1}{2}O_{2(g)}$ at the same temperature is :

A. 20

B. 50

C. 4×10^{-4}

D. 2.5×10^{-2}

Answer: B

Watch Video Solution

34. Acetic acid undergoes dimerization in benzene solution. When the concentration of the reactant is increased, the position of equilibrium in the reaction $2CH_3COOH \Leftrightarrow (CH_3COOH)_2$ is shifted

A. to the right

B. to the left

C. neither to left nor to right

D. none of these

Answer: B

Watch Video Solution

35. Pure ammonia is placed in a vessel at a temperature where its dissociation constant (a) is appreciable at equilībrium,

A. K_p does not change with pressure

B. α does not change with pressure

C. concentration of NH_3 does not change with pressure

D. concentration of H_2 is less than that of N_2

Answer: A

Watch Video Solution

36. The following equilibrium exists in aqueous solution $CH_3COOH \Leftrightarrow CH_3COO^- + H^+$ If dil HCl is added without change in temperature, the

A. concentration of CH_3COO^- will increase

B. concentration of CH_3COO^- will decrease

C. the equilibrium constant will increase

D. the equilibrium constant will decrease.

Answer: B

Watch Video Solution

37. The partial pressures of CH_3OH, CO and H_3 in the equilibrium mixture for the reaction

$CO_{(g)} + 2H_{2(g)} \Leftrightarrow CH_3OH_{(g)}$

$at427^{\circ}$ are 2.0, 1.0 and.0.1 atm, respectively. The value of K_P for the decomposition of CH_3OH to CO and H_2 is

A. 1×10^2 atm

B. 4×10^2 atm

C. 5×10^{-3} atm

D. 5×10^3 atm

Answer: C

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38. At $25^{\circ}C$ the dissociation constant of HCN is $4.9 \times 10^{-10} M$. Calculate the degree of dissociation of HCN if the concentration is 0.1 M.

A. 7×10^{-5}

B. 5×10^{-5}

C. 6×10^{-5}

D. 8×10^{-5}

Answer: A

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39. What is the pH value of N/1000 KOH solution?

A. 10^{-11}

B. 3

C. 2

D. 11

Answer: D

Watch Video Solution

40. The solubility product ofa sparingly soluable salt AB at room temperature is 1.21×10^{-6}. Its molar solubility is

A. 1.21×10^{-6}

B. 1.21×10^{-3}

C. 1.1×10^{-4}

D. 1.1×10^{-3}

Answer: D

Watch Video Solution

41. A sample of HI was found to be 22% dissociated when equilibrium was reached. What will be the degree of dissociation if hydrogen is added in the proportion of mol for very mole of HI present originally ? Assume temperature and pressure to be constant.

A. 0.065

B. 0.085

C. 0.027

D. 0.052

Answer: C

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42. The pH of solution A is 3. It is mixed with an equal volume of another solution B having pH 2. What is the resultant pH of the solution?

A. 3.2

B. 2.26

C. 2.5

D. 3.5

Answer: B

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43. Vapour density of the equilibrium mixture of NO_2 and N_2O_4 is found to be 40 for the equilibrium: $N_2O_4(g) \Leftrightarrow 2NO_2(g)$. Calculate percentage of NO_2 in the mixture.

A. $26.08\ \%$

B. $21.52\ \%$

C. $19.24\ \%$

D. $24.62\ \%$

Answer: A

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44. Let the solubilities of AgCl in H_2O, 0.01 M $CaCl_2$, 0.01 M NaCl and 0.05 M $AgNO_3$ be S_1, S_2, S_3, S_4 respectively. What is the correct relationship between these quantities ?

A. $S_1 > S_2 > S_3 > S_4$

B. $S_1 > S_2 = S_3 > S_4$

C. $S_1 > S_3 > S_2 > S_4$

D. $S_4 > S_2 > S_3 > S_1$

Answer: C

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45. For a fairly concentrated solution of a weak electrolyte A_y, B_y the degree of dissociation is given by

A. $\alpha = \sqrt{\frac{K_{eq}xy}{C}}$

B. $\alpha = \sqrt{\frac{K_{eq}C}{xy}}$

C. $\alpha = \sqrt{\frac{K_{eq}C}{(x+y)}}$

D. $\alpha = \left(\frac{K_{eq}}{C^{x+y-1}x^x y^y}\right)^{1/(x+y)}$

Answer: D

Watch Video Solution

46. 25.0mL of0.1 M NaOH is titrated with 0.1 MHCl. Calculate pH when i) 20mL.

ii) 24 mL of acid is added

A. 12.0 , 11.30

B. 11.30, 12

C. 2.0, 2.70

D. 2.70, 2.0

Answer: A

Watch Video Solution

47. The number of $H^{\oplus}$ ions present in 1mL of solution having, pH=13 is

A. 6.02×10^{10}

B. 6.02×10^{7}

C. 6.02×10^{13}

D. 10^{13}

Answer: B

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48. For pure water,

A. Both pH and pOH decrease with increase in temperature

B. Both pH and pOH increase with decrease in temperature

C. pH decreases and pOH increases with increase in temperature

D. pH increases and pOH decreases with increase in temperature

Answer: A

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49. $2H_2O \Leftrightarrow H_3O^{\oplus} + \overset{\oplus}{O}H, K_w = 10^{=14} at 25^{\circ} C,$ hence K_a is

A. 10^{-7}

B. 5.55×10^{-13}

C. 10^{-14}

D. 18×10^{-17}

Answer: D

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50. The addition of NaH_2PO_4 to $0.1 M H_3PO_4$ will cause

A. No change in pH value

B. Increase in its pH value

C. Decrease in its pH value

D. Change in pH cannot be predicted

Answer: B

Watch Video Solution

51. The pH of a solution containing 0.1 mol of $CH_3COOH, 0.05$ mol of $NaOH$, and $0.2 mol of CH_3COONa$, in 1.L. $(pK_a of CH_3COOH = 4.74)$ is :

A. 5.44

B. 5.20

C. 5.04

D. 4.74

Answer: A

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52. The pH of blood is maintained by the balance between H_2CO_2 and $NaHCO_2$. If the amount of 'CO_(2)', in blood is increased, how will it affect the pH of blood?

A. pH will remain same

B. pH will be 7

C. pH will increase

D. pH will decrease

Answer: A

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53. The expression to calculate pH of sodium acetate solution at $25^\circ C$ is

A. $pH = 7 + \frac{1}{2} pK_b(CH_3COOH) - \frac{1}{2}$ log [salt]

B. $pH = 7 + \frac{1}{2} pK_a(CH_3COOH) - \frac{1}{2}$ log [salt]

C. $pH = 7 + \frac{1}{2} pK_b(CH_3COOH) + \frac{1}{2}$ log [salt]

D. $pH = 7 + \frac{1}{2} pK_a(CH_3COOH) + \frac{1}{2}$ log [salt]

Answer: D

Watch Video Solution

54. In which of the following acid-base titrations, pH is greater than 8 at the equivalence point?

A. Acetic acid vs ammonia

B. Acetic acid vs sodium hydroxide

C. Hydrochloric acid vs ammonia

D. Hydrochloric acid vs sodium hydroxide

Answer: B

Watch Video Solution

Level -II

1. For the following three reactions (i), (ii) and (iii), equilibrium constants are given:

i) $CO_{(g)} + H_2O_{(g)} \Leftrightarrow CO_{2(g)} + H_{2(g)}, K_1$

ii) $CH_{4(g)} + H_2O_{(g)} \Leftrightarrow CO_{(g)} + 3H_{2(g)}, K_2$

iii) $CH_{4(g)} + 2H_2O_{(g)} \Leftrightarrow CO_{2(g)} + 4H_{2(g)}, K_3$

Which of the following relation is correct?

A. $K_3K_2^3 = K_1^2$

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

C. $K_2K_3 = K_1$

D. $K_3 = K_1K_2$

Answer: D

Watch Video Solution

2. For the reaction, $H_{2(g)} + I_{2(g)} \Leftrightarrow 2HI_{(g)} K = 47.6,$ if the initial number of moles of each reactant and product is 1 mole, then at equilibrium:

A. $[I_2] = [H_2], [I_2] > [HI]$

B. $[I_2] < [H_2], [I_2] = [HI]$

C. $[I_2] = [H_2], [I_2] < [HI]$

D. $[I_2] > [H_2], [I_2] = [HI]$

Answer: C

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3. At equilibrium: $N_2O_4 \Leftrightarrow 2NO_{2(g)}$ the observed molecular weight of N_2O_4 is $80 gmol^{-1}$ at 350 K. The percentage dissociation of $N_2O_{4(g)}$ at 350 K is:

A. 10%

B. 15%

C. 20%

D. 18 %

Answer: B

Watch Video Solution

4. XY_2 dissociates as : $XY_{2(g)} \Leftrightarrow XY_{(g)} + Y_{(g)}$. Initial pressure of XY_2 is 600 mm Hg. The total pressure at equilibrium is 800 mm Hg. Assuming volume of system to remain constant, the value of K_p is :

A. 50

B. 100

C. 200

D. 400

Answer: B

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5. $NH_4COONH_{2(s)} \Leftrightarrow 2NH_{3(g)} + CO_{2(g)}$. If equilibrium pressure is 6 atm for the above reaction : K_p will be :

A. 32

B. 27

C. $4/27$

D. $1/27$

Answer: A

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6. The first and second dissociation constants of an acid, H_2A are 1.0×10^{-5} and 5.0×10^{-15} respectively. The overall dissociation constant of the acid will be :

A. 0.2×10^5

B. 5.0×10^{-5}

C. 5.0×10^{-20}

D. 5.0×10^{15}

Answer: C

Watch Video Solution

7. For which of the following sparingly soluble salt, the solubility (S) and solubility product (K_{sp}) are related by the expression : $S = \left[\frac{K_{sp}}{3}\right]^{1/2}$

A. $BaSO_4$

B. $Ca_3(PO_4)_2$

C. Hg_2Cl_2

D. Ag_3PO_4

Answer: C

Watch Video Solution

8. The pH of a solution obtained by mixing 100mL of 0.4HCl and 100 mL of 0.2 N NaOH is :

A. $-\log 2$

B. $-\log 0.2$

C. 1

D. 2

Answer: C

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9. Equal volumes of three acid solutions of pH 4, 5 and 6 are mixed in a vessel. What will be the H^{+} ion concentration in the mixture ?

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

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

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

D. $3.7 \times 10^{-5} M$

Answer: D

Watch Video Solution

10. The pH of a buffer solution prepared by adding 20 mL of 0.2 M CH_3COOH and 20 mL of 0.1 M sodium acetate will be : (given pK_a for $CH_3COOH = 4.74$)

A. 4.43

B. 3.04

C. 5.04

D. 3.05

Answer: C

Watch Video Solution

11. At $27^\circ C, K_p = 1.5 \times 10^{18}$ for the reaction, $3NO(g) \Leftrightarrow N_2O(g)$. If 0.03 mol of NO were placed in a 1L vessel and equilibirum were established, what would be the equilibrium concentration of NO ?

A. 0

B. $4 \times 10^{-8} M$

C. $1.2 \times 10^{-7} M$

D. $1.4 \times 10^{-8} M$

Answer: D

View Text Solution

12. At temperature T, a compound $AB_2(g)$ dissociates according to the reaction $2AB_2(g) \Leftrightarrow 2AB(g) + B_2(g)$ with degree of dissociation α, which is small compared with unity. The expression for K_p in terms of α and the total pressure p_T is

A. $\dfrac{p_T \alpha^3}{2}$

B. $\frac{p_T\alpha^2}{3}$

C. $\frac{p_T\alpha^2}{2}$

D. $\frac{p_T\alpha}{3}$

Answer: A

Watch Video Solution

13. Ascorbic acid (vitamin C) is a diprotic acid, $H_2C_6H_6O_6$. $[H^+]$, pH and $[C_6H_6O_6]^{2-}$ in a $0.10M$ solution of ascorbic acid will be respectively(Given $K_{a_1} = 6.8 \times 10^{-5}$ and $K_{a_2} = 2.7 \times 10^{-12}$ for ascorbic acid).

A. $3.6 \times 10^{-5}M, 2.58, 2.7 \times 10^{-12}M$

B. $2.6 \times 10^{-3}M, 5.18, 1.5 \times 10^{-10}M$

C. $2.6 \times 10^{-3}M, 2.58, 2.7 \times 10^{-12}M$

D. $1.5 \times 10^{-4}M, 3.67, 1.7 \times 10^{-14}M$

Answer: C

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14. The pH of a 0.1 M aqueous solution of Na_2CO_3 is adjusted to 12 using a strong base. What is the degree of hydrolysis of carbonate ions ? [Given : $K_{a1} = 4.5 \times 10^{-7}$ and $K_{a2} = 4.7 \times 10^{-11}$ for H_2CO_3]

A. 2.1×10^{-2}

B. 4.6×10^{-2}

C. 2.2×10^{-4}

D. 4.7×10^{-10}

Answer: A

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15. To which direction the equillibrium shifts when N_2 is added at equilibrium condition ? $N_2 + 3H_2 \Leftrightarrow 2NH_3$

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16. Ammonia under a pressure of 15 atm at $27^\circ C$ is heated to $347^\circ C$ in a closed vessel in the presence of catalyst. Under the conditions, NH_3 is partially decomposed according to the equation$2NH_3 \Leftrightarrow N_2 + 3H_2$. The vessel is such that the volume remains effectively constant, whereas pressure increases at 50 atm. Calculate the percentage of NH_3 actually decomposed.

A. 61.3%

B. 63.5%

C. 65.3%

D. 66.6%

Answer: A

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17. A mixture containing 8.07 mol of hydrogen and 9.08mol of iodine was heated at $448^{\circ}C$ till equilibrium was attained when 13.38 mol of hydrogen iodide was obtained. Calculate the percentage dissociation of hydrogen iodide at $448^{\circ}C$.

A. 13.2%

B. 19.8%

C. 18.9%

D. 21.4%

Answer: D

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18. The equilibrium constant K_C for the reaction $N_2O_4 \Leftrightarrow 2NO_2$ in chloroform at 291 Kis 1, 14. Calculate the free energy change of the reaction when the concentration of the two gases is 0.5 mol dm^{-3} each at the same temperature. ($R = 0.082 LatmK^{-1}$ ' mol^{-1})

A. $-54.95L$ atm

B. $-38.94L$ atm

C. $-27.2L$ atm

D. $-19.67L$ atm

Answer: D

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19. Suppose 20.85 g of $PCl_5(g)$ is introduced in vessel washed with a non-volatile solved (b.p. = 350 K, molar mass = $154 gmol^{-1}$). The equilibrium is established at 523 K when $PCl_3(g)$ is 523 dissociated and a total pressure was found to be 5.5 bar. If K_p fot the decomposition reaction $PCl_5 \Leftrightarrow PCl_3 + Cl_2$ is 1.78, calculate the weight of solvent left in the vessel during washing.

A. 2.188g

B. 1.128 g

C. 3.4188 g

D. 4.212 g

Answer: C

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20. The equilibrium constant of the reaction $A_2(g) + B_2(g) \Leftrightarrow 2AB(g) at 100^\circ C is 50$. If a one-litre flask containing one mole of A_2 is connected to a two litre flask conatining two moles of B_2 how many moles of AB will be formed at 373 K?

A. 1.86

B. 0.93

C. 2.32

D. 0.46

Answer: A

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21. A sample of air consisting of N_2 and O_2 was heated to 2500 K until the equilibrium.

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

was established with an equilibrium constant $K_c = 2.1 \times 10^{-3}$. At equilibrium the mole % of NO was 1.8. Estimate the initial composition of air in mole fraction of N_2 and O_2.

A. 0.68, 0.32

B. 0.46, 0.54

C. 0.79, 0.21

D. 0.83, 017

Answer: C

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22. At temperature T, a compound $AB_2(g)$ dissociates according to the reaction:

$2AB_2(g) \Leftrightarrow 2AB(g) + B_2(g)$ with a degree of dissociation 'x' which is small compared to unity. Deduce the expression for 'x' in terms of the equilibrium constant K_P and the total pressure P.

A. $\sqrt{\frac{2K_p}{P}}$

B. $\sqrt{\frac{3K_p}{P^2}}$

C. $3\sqrt{\frac{2K_p}{P}}$

D. $\frac{3K_p}{P^2}$

Answer: C

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23. An equilibrium mixture at 300 K contains N_2O_4 and NO_2, their partial pressures are 0.28 and 1.1 atmospheres respectively. If the volume of container is doubled, calculate the new equilibrium partial pressure of two gases.

A. 0.095 atm, 0.64 tm

B. 0.12 atm, 0.86 atm

C. 0.06 atm, 0.47 atm

D. 0.18 atm, 0.63 atm

Answer: A

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24. At 540K, 0.10 mole of PCI_5 are heated in a 8 litre flask. The pressure of the equilibrium mixture is found to be 1.0 atm. Calculate K_c and K_p for the reaction.

A. 2×10^{-2} mol litre^{-1}, 1.69 atm

B. 4×10^{-2} mol litre^{-1}, 1.77 atm

C. 2.5×10^{-2} mol litre^{-1}, 1.69 atm

D. 4×10^{-2} mol litre^{-1}, 2.63 atm

Answer: B

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25. The degree of dissociation is 0.4 at 400 K and 1.0 atm for the gaseous reaction. $PCl_5 \Leftrightarrow PCl_3 + Cl_2$. Assuming ideal behaviour of all the gases, calculate the density of equilibrium mixture at 400 K and 1.0 atmpshere. (Atomic mass of P = 31.0 and Cl = 35.5)

A. 7.39 g/L

B. 3.54 g/L

C. 6.92 g/L

D. 4.53 g/L

Answer: D

Watch Video Solution

26. A certain amount of $N_2O_4(g)$ is enclosed in a closed container at $127^\circ C$ when following equilibirum go setup at a total pressure of 10 atm,

$N_2O_4(g) \Leftrightarrow 2NO_2(g)$

If the concentration (moles) of $NO_2(g)$ in the equilibrium mixture be 8×10^5 ppm, the K_c (in mol L^{-1}) for the above reaction at $127^\circ C$ is equal to

A. 3.189

B. 2.051

C. 0.974

D. 1.842

Answer: C

View Text Solution

27. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$. The equilibrium, K_c for the dissociation of PCl_5 , is 4.0×10^{-2} at $250^\circ C$ in a 3.0L flask when equilibrium concentration of Cl_2 is 0.15 mol/L. What was the pressure of PCl_5 before any dissociation? $\left(R = 0.082L - atmK^{-1}mol^{-1}\right)$

A. 37.0 atm

B. 30.59 atm

C. 24.05 atm

D. 6.745 atm

Answer: B

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28. Assume that the decomposition of HNO_3 can be represented by the following equation

$4HNO_3(g) \Leftrightarrow 4NO_2(g) + 2H_2O(g) + O_2(g)$

And at the given temperature 400 K and pressure 30 atm the reaction approaches equilibrium. Atequilibrium partial pressure of HNO_3 is 2 atm. Find K_c in (mol/lit)

A. 30

B. 24

C. 18

D. 16

Answer: A

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29. 0.2M KCN and 0.06M $AgNO_2$ solutions are mixed in equal volumes. At $25^\circ C K_c$ for the reaction $Ag(CN)_2^- \Leftrightarrow Ag^+ + 2CN^- is 1.6 \times 10^{-19}$. The conc. of Ag^+ present in solution is

A. $1.5 \times 10^{-19} M$

B. $1.5 \times 10^{-18} M'$

C. $3 \times 10^{-19} M$

D. $3 \times 10^{-18} M$

Answer: B

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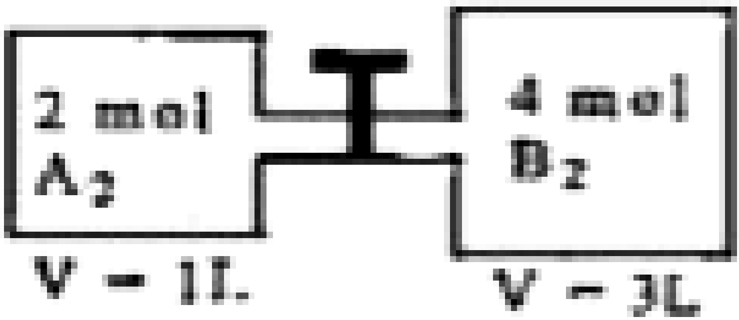

30. Gases are

present intwo containers at 300 K separated by a narrow tube of negligible volume having valve in between. On opening the valve the reaction $A_2(g) + B_2(g) \Leftrightarrow 2AB(g)$ attains equilibrium at 300 K. If $K_c = 4$ at 300 K, the concentration of AB at equilibirum is :

A. 1.33 M

B. 2.66 M

C. 1.66 M

D. 0.66 M

Answer: D

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31. At constant temperature, the equilibrium constant (K_P) for the decomposition reaction. $N_2O_4 \Leftrightarrow 2NO_2$ is expressed by $K_P = 4x^2 P / (1 - x^2)$ where, P is pressure, x is extent of decomposition. Which of the following statement is true?

A. K_p increases with increase of P

B. K_p increases with increase of x

C. K_p increases with decrease of x

D. K_p remains constant with change in P or x

Answer: D

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32. An acid-base indicator $(PK_a = 4.5271)$ has the acid form red and basic form blue. If we need 75% red to be converted into 75% blue form in solution, the change in pH of solution should be:

A. 4.05

B. 5.0

C. 0.95

D. 0.80

Answer: C

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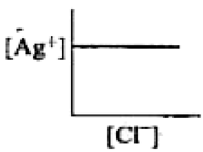
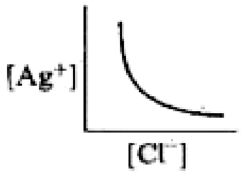
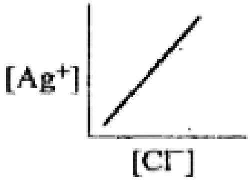
33. In a saturated solution of AgCl, addition of NaCl is made drop by drop in excess. Which graph correctly represents the change?

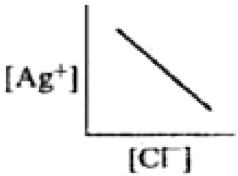
A. 



B.



C.



D.

Answer: B

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34. 0.1 M solution of H_3A being a weak triprotic acid having K_{a_1}, K_{a_2} and K_{a_3} as $10^{-5}, 10^{-9}$ and 10^{-13} respectively. If pX represents $-\log X$ and $X = \frac{[A^{3-}]}{[HA^{2-}]}$, then the value of pX is:

A. 7

B. 8

C. 10

D. 9

Answer: C

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35. When equal volumes of the following solutions are mixed, precipitation of AgCl $(K_{sp} = 1.8 \times 10^{-10})$ will occur only with:

A. $10^{-4}M(Ag^{+})$ and $10^{-4}M(Cl^{-})$

B. $10^{-5}M(Ag^{+})$ and $10^{-5}M(Cl^{-})$

C. $10^{-6}M(Ag^{+})$ and $10^{-6}M(Cl^{-})$

D. $10^{-10}M(Ag^{+})$ and $10^{-10}M(Cl^{-})$

Answer: A

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36. 2.5 mL of $\frac{2M}{5}$ weak monoacidic base $\left(K_b = 1 \times 10^{-12} at 25^\circ C\right)$ is titrated with $\frac{2}{15}$MHCl in water at $25^\circ C$. The concentration of that equivalence point is:

A. $3.7 \times 10^{-13} M$

B. $3.2 \times 10^{7} M$s

C. $3.2 \times 10^{-2} M$

D. $2.7 \times 10^{-2} M$

Answer: D

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37. The ionization constant of NH_4^+ in water is 5.6×10^{-10} at $25^\circ C$. The rate constant for the reaction of NH_4^+ and OH^- to form NH_3 and H_2O at $25^\circ C$ is $3.4 \times 10^{-10} Lmol^{-1} s^{-1}$. Calculate the rate constant for proton transfer from water of NH_3.

A. 8.23×10^5

B. 6.07×10^5

C. 12.14×10^4

D. 10.3×10^4

Answer: B

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38. The pH of blood stream is maintained by a proper balance of H_2CO_3 concentrations. What volume of $5 M NaHCO_3$ solution be mixed with 10 mL sample of blood which is $2M$ in H_2CO_3 in order to maintain a pH of $7.4 K_a$ for H_2CO_3in blood is 7.8×10^{-2}?

A. 41.86 mL

B. 83.2 mL

C. 78.36 mL

D. 52.43 mL

Answer: C

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39. The solubility of $Pb(OH)_2$ in water is $6.7 \times 10^{-6} M$ Calculate solubility of $Pb(OH)_2$ in a buffer of pH=8.

A. 12.03×10^{-2} mol/L

B. 1.203×10^{-3} mol/L

C. 3.102×10^{-3} mol/L

D. 3.102×10^{-2} mol/L

Answer: B

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40. The $K_{sp} of Ca(OH)_2 is 4.42 \times 10^{-4} at 25^{\circ} C. A 500 mL$ of saturated solution of$Ca(OH)_2$ is mixed with equal volume of 0.4 M NaOH. How much Ca$(OH)_2$ in mg is precipitated?

A. 527.3 mg

B. 638.4 mg

C. 218.3 mg

D. 758.2 mg

Answer: D

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41. An aqueous solution of a metal bromide $MBr_2(0.05M)$ is saturated with H_2S. What is the minimum pH at which MS will precipitate? K_p for $MS = 6.0 \times 10^{-21}$ concentration of saturated $H_2S = 0.1M$, $k_1 = 10^{-7}$ and $K_2 = 1.3 \times 10^{-13}$ for H_2S.

A. 0.9826

B. 1.3213

C. 2.6931

D. 2.1897

Answer: A

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42. What volume must $1Lof0.\ 5MCH_3COOH$solution should be diluted with water in order to double OH^(-) concentration? $K_a = 1.\ 8 \times 10^{-5}$

A. $3.7 \times 10^4 L$

B. $2.76 \times 10^3 L$

C. $3.10 \times 10^3 L$

D. $1.05 \times 10^4 L$

Answer: A

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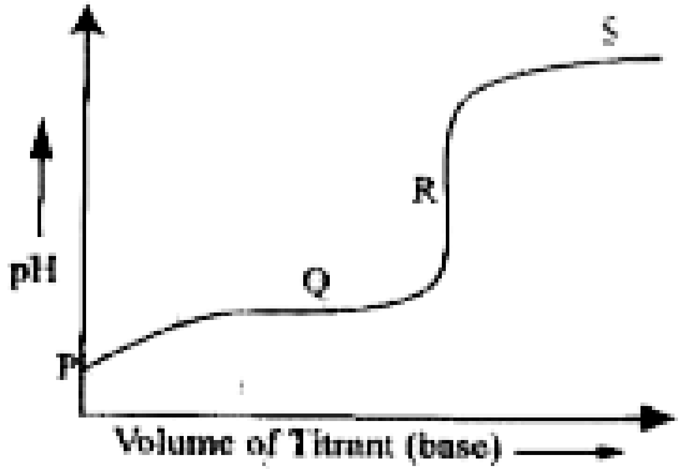
43. The pH curve the titration of weak acid with a strong base is given below :



Now choose the correct option among the following :

A. pH at point $P = \frac{1}{3} pK_a - \frac{1}{2} \log[A_0]$ where A_0 is the initial concentration of weak acid

B. pH at point $Q = pK_a - \frac{1}{2} \log \frac{[\text{weak acid}]}{[\text{salt}]}$

C. pH at point $R = \frac{1}{2} pK_w + \frac{1}{2} pK_a + \frac{1}{2} \log[\text{salt}]$

D. pH at point $S = \frac{1}{2} pK_w + \frac{1}{2} \log[\text{Base}]$

Answer: C

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44. H_2S is bubbled into 0.2 M NaCN solution which is 0.02 M in each $[Cd(CN)_4]^{2-}$ and $[Ag(CN_2)]^{-}$ H_2S produces $1 \times 10^{-9} M$ sulphide ion in the solution Given, $K_{ap}Ag_2S = 1 \times 10^{-50} M^3$, $K_{ap}Cds = 7.3 \times 10^{-18} M^2 K_{\text{iost}} [Ag(CN)_2]^1 =$

Identify the correct statement.

A. Ag_2S precipitates first from the solution

B. Ag_2S precipitates at a sulphide concentration $1 \times 10^{15} M$

C. CdS precipitates first from the solution

D. None of them precipitates under the given conditions

Answer: C

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45. For the equilibrium system $2HX(g) \Leftrightarrow H_2(g) + X_2(g)$ the equilibrium constant is 1.0×10^{-5}. What is the concentration of HX if the equilibrium concentration of H_2 and X_2 are $1.2 \times 10^{-3}M$, and $1.2x10^{-4}M$respectively?

A. $12 \times 10^{-4}M$

B. $12 \times 10^{-3}M$

C. $12 \times 10^{-2}M$

D. $12 \times 10^{-1}M$

Answer: C

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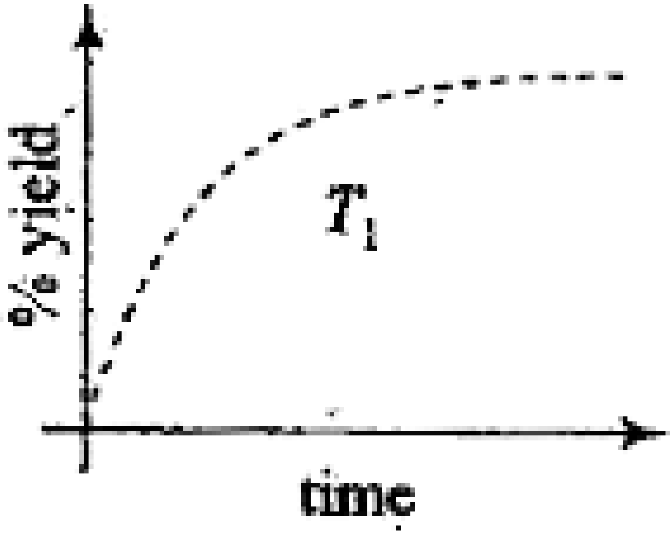
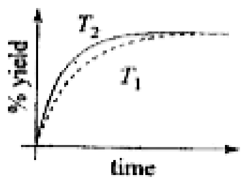
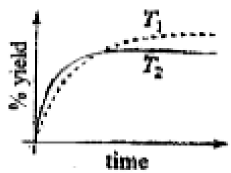
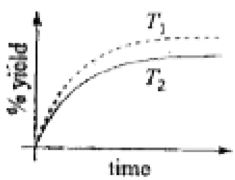
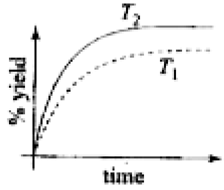
46. The %yield of ammonia as a function of time in the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g). \Delta H < 0at(p, T_1)$ is given below. If this reaction is conducted at (P_1T_2), with $T_2 > T_1$ the % yield of ammonia as a function of time is represented by



A. 

B. 

C. 

D. 

Answer: C

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47. For the reaction $N_2O_4(g) \Leftrightarrow 2NO_2(g)$, the value of K_p is $1.7 \times 10^3 at 500 K$ and $1.7 \times 10^4 at 600 K$. Which of the following is/are correct?

A. The proportions of NO_2 in the equilibrium mixture is increased by decrease in pressure.

B. The standard enthalpy change for the forward reaction is negative.

C. Units of K_p are atm^{-1}.

D. At 500 K the degree of dissociation of N_2O_4 decreases by 50% by increasing the pressure by 100%.

Answer: A

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48. 100 mL of a buffer solution contains 0.1 M each of weak acid HA and salt NaA. How many gram of NaOH should be added to the buffer so that it pH will be 6? $\left(K_a of \Delta A = 10^{-5}\right)$

A. 0.328

B. 0.458

C. 4.19

D. 1.32

Answer: A

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49. The solubility products of MA,MB,MC, and MD are $1.8 \times 10^{-10}, 4 \times 10^{-3}, 4 \times 10^{-8}$ and 6×10^{-5} respectively. Ifa 0.01 M solution of MX is added dropwise to a mixture containing $A^{\ominus}, B^{\ominus}, C^{\ominus}$ and $D^{\ominus}$ ions, then the one to be precipitated first will be

A. MA

B. MB

C. MC

D. MD

Answer: A

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50. $CaCO_3$ and $BaCO_3$ have solubility product values 1×10^{-8} and 5×10^{-9} respectively. If water is shaken up with both solids till equilibrium is reached, the concentration of CO_3^{2-} ion is

A. 1.5×10^{-8}

B. 1.225×10^{-4}

C. 2.25×10^{-9}

D. 2.5×10^{-8}

Answer: B

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51. A definite volume of a N/20 $CH_3COOH(pK_a = 4.7447)$ is titrated with a strong base (NaOH). It is found that 80 equal sized drops of NaOH, added from a burette effects the complete neutralisation. Find the pH, when the acid solution is neutralised to the extent of 20%

A. 4.14

B. 9.86

C. 5.34

D. 8.68

Answer: A

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52. Equilibrium constant K_P for $2H_2S_{(g)} \Leftrightarrow 2H_{2(g)} + S_{2(g)} is 0.0118 atm at 1065^\circ C$ and heat of dissociation is 42.4 kcal. Find equilibrium constant at $1132^\circ C$.

A. 0.025 atm

B. 0.052 atm

C. 0.52 atm

D. 0.075 atm

Answer: A

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Level - III

1. Starting with 1 mol of $O_2 : 2$ mol of SO_2, the equilibrium for the formation of $SO_3(g)$ was established a certain temperature. If V is the volume of the vessel and 2x is the number of moles of SO_3 present, equilibrium constant for the reaction $2SO_{2(g)} + O_{2(g)} \Leftrightarrow 2SO_{3(g)}$ would be :

A. $\frac{x^2 V}{(1-x)^3}$

B. $\frac{4x^2}{(2-x)(1-x)}$

C. $\frac{(1-x)^3}{2V}$

D. $\frac{x^2}{(2-x)(1-x)}$

Answer: A

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2. A 500 mL flask was charged with 1.0 mol of $COCl_2(g)$ and heated to some temperature (T) where decomposes partially as , $COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g), K_c(T) = 1.5M$

Now the above flask is connected to another flask containing some pure chlorine gas at the same temperature and pressure, by a narrow tube of negligible volume. When the equilibrium was restored, the concentration $COCl_2(g)$ was found to be 0.694 M. Determine the volume of $Cl_2(g)$ flask.

A. 200 mL

B. 100 mL

C. 150 mL

D. 120 mL

Answer: A

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3. 2.14 g of solid ammonium chloride was heated in a one-litre flask to $277^\circ C$. From the measurement pressure, it was found that 90% of ammonium chloride was dissociated. If to this flask 2.04 g of dry ammonia was added, what would be the percentage dissociation ?

A. $75\ \%$

B. $60\ \%$

C. $30\ \%$

D. $25\ \%$

Answer: D

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4. 0.2 mole of each $Cl_2(g)$ and $F_2(g)$ are introduced in a sealed flask and heated to 2000 K where following equilibirum established. $Cl_2(g) + F_2(g) \Leftrightarrow 2ClF(g)$, at equilibrium, moles of ClF = 0.267. At this stage 0.1 mole of Br_2 is added and equilibrium is re-established as : $Cl_2(g) + F_2(g) \Leftrightarrow 2ClF(g), Cl_2(g) + Br_2(g) \Leftrightarrow 2BrCl(g)$. Now moles of ClF is found to be 0.25. Calculate K_c for the second equilibrium reaction.

A. 1.32

B. 0.739

C. 0.528

D. 1.69

Answer: C

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5. Calculate the mass of $(NH_4)_2SO_4$ in g which must be added to 500 mL of $0.2 M NH_3$ to yield a solution of pH = 9.35 K_b for $NH_3 = 4.7$.

A. 5.248 g

B. 7.92 g

C. 6.973 g

D. 9.25 g

Answer: A

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6. The $\left[H^{+}\right]$ in 0.2 M solution of formic acid is 6.4×10^{-3} mol litre^{-1}. To this solution formate is added so as to adjust the conc. of sodium formate to one mol per litre. What will be pH of this solution ? K_a for HCOOH is 2.4×10^{-4} and degree of dissociation of HCOONa is 0.75. :

2.32, 6.29, 4.19, 1.57

A. 2.32

B. 6.29

C. 4.19

D. 1.57

Answer: C

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7. An acid type indicator HIn differs in colour from its conjugate base (In^{-}). The human eye is sensitive to colour differences only when the ratio (In^{-})/[Hin) is greater than 10 or smaller than 0.1. What should be the minimum change in the pH of the solution to observe a complete colour change $(K_a = 1.0 \times 10^{-5})$? : 3, 4, 1, 2

A. 3

B. 4

C. 1

D. 2

Answer: D

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8. K_{sp} for $SrF_2 = 2.8 \times 10^{-9}$ at $25^{\circ} C$. How much NaF should be added to 100 mL of solution having 0.016 M in Sr^{2+} ions to reduce its concentration to $2.5 \times 10^{-3} M$?

A. 0.3210 g

B. 0.1178 g

C. 0.2529 g

D. 0.4213 g

Answer: B

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9. 2M solution of Na_2CO_3 is boiled in a closed container with excess of CaF_2. Very little amount of $CaCO_3$ and NaF are formed. If the solubility product of $CaCO_3$ is x and molar solubility of CaF_2 is y, find the molar concentration of F^- in the resulting solution after equilibrium is attained.

A. $\sqrt{\frac{8y^3}{x}}$

B. $\sqrt{\frac{x}{y^3}}$

C. $\sqrt{\frac{2y}{x^3}}$

D. $\sqrt{\frac{4y^3}{x}}$

Answer: A

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10. Which of the following statements is correct?

A. Equilibrium constant of a reaction is doubled if the equilibirum concentration of the products become double

B. If a reaction mixture is compressed to half the volume, equilibrium constant is halved

C. Equilibrium constant may decrease or increases with increase of temperature

D. Equilibrium concentration always increase in the presence of a catalyst

Answer: A::B::C::D

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11. The equilibrium $SO_2Cl_{2(g)} \Leftrightarrow SO_{2(g)} + Cl_{2(g)}$ is attained at $25^\circ C$ in a closed container and inert gas helium is introduced. Which of the following statements are incorrect ?

A. Concentration of SO_2, Cl_2 and SO_2Cl_2 doesnot change

B. More chlorine is formed

C. Concentration of SO_2 is reduced

D. More SO_2Cl_2 is formed

Answer: B::C::D

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12. The thermal dissociation equilibrium of $CaCO_3(s)$ is studied under different conditions

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

For this equilibrium , the correct statements are : ΔH is dependent on T, K is dependent on the pressure of CO_2 at a given T, K is independent of the initial amount of $CaCO_3$, ΔH is independent of the catalyst, if any

A. ΔH is dependent on T

B. K is dependent on the pressure of CO_2 at a given T

C. K is independent of the initial amount of $CaCO_3$

D. ΔH is independent of the catalyst, if any

Answer: A::C::D

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13. For the reaction, $PCl_{5(g)} \Leftrightarrow PCl_{3(g)}$ The forward reaction at constant temperature is favoured by: Introducing an inert gas at constant volume, Introducing chlorine gas at constant volume, Introducing ani inert gas at constant pressure, None of these

A. introducing an inert gas at constant volume

B. introducing chlorine gas at constant volume

C. Introducing an inert gas at constant pressure

D. increasing the volume of the container

Answer: C::D

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14. For an equilibrium reaction, which of the following statements is/are correct ?

A. If the reaction quotient of a reaction is greater than K_{eq}, the reaction has a tendency to move in the backward direction.

B. If the reaction quotient of a reaction is greater than K_{eq}, the reaction has a tendency to the move in the forward direction.

C. The addition of an inert gas at constant volume does not affect the extent of reaction

D. The addition of an inert gas at constant pressure does not affect the extent of reaction.

Answer: A::C::D

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15. Which of the following expressions are not correct for a solution of sodium acetate in water ?

A. The pH of the solution is given by the expression $pH = pK_w^o + pK_a^o$ + log c

B. The degre of hydrolysis of acetate ions is given by log $\alpha = pK_a^o - pK_w^o$ - log c

C. The pOH of the solution decreases with increase in the concentration of sodium acetate.

D. The ionization constant of acetate is given by K_b (aceate) = K_w / K_b (acetic acid).

Answer: A::B::C

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16. Which of the following statements are correct ?

A. The levelling effect is not observed in nonaqueous medium

B. The strength of an acid having general formula $(HO)_m ZO_n$ increases with increase in the value of n.

C. In a given reaction, the position of equilibrium favours the formation of a weak Bronsted acid and a weak Bronsted base.

D. The reaction $HCN + OH^{-} \Leftrightarrow CN^{-} + H_2O$ is displaced to the right indicating that the acid strength of HCN is greater than water and the base strength CN^{-} is greater than that of OH^{-}.

Answer: B::C

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17. Which of the following statements are correct ?The pH of $1.0 \times 10^{-8} M$ solution of HCl is 8, The conjugate base of $H_2PO_4^{\ominus}$ is HPO_4^{2-}, The autoprotolysis constant of water increases with temperature, Whan a solution of a weak monoprotic acid is treated against a strong base, at half-neutralisation point, pH $= (1/2)pK_a$.

A. The pH of $1.0 \times 10^{-8} M$ solution of HCl is 8

B. The conjugate base of $H_2PO_4^{\ominus}$ is HPO_4^{2-}

C. The autoprotolysis constant of water increases with temperature

D. Whan a solution of a weak monoprotic acid is treated against a strong base, at half-neutralisation point, pH $= (1/2)pK_a$.

Answer: B::C

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18. A buffer solution can be prepared from a mixture of : Sodium acetate and acetic acid in water, Sodium acetate and HCl in water, Ammonia and ammonium chloride in water, Ammonia and Sodium hydroxide in water

A. Sodium acetate and acetic acid in water

B. Sodium acetate and HCl in water

C. Ammonia and ammonium chloride in water

D. Ammonia and Sodium hydroxide in water

Answer: A::C

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19. Aqueous solutions of HNO_3, KOH, CH_3COOH, and CH_3COONa of identical concentrations are provided. The pair (s) of solutions which form a buffer upon mixing is/are

A. HNO_3 and CH_3COOH

B. KOH and CH_3COONa

C. HNO_3 and CH_3COONa

D. CH_3COOH and CH_3COONa

Answer: C::D

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Level - III (Numerical type)

1. In an experiment starting with 1 mole of ethyl alcohol, 1 mole of acetic acid and 1 mole of water at $100^\circ C$, the equilibrium mixture on analysis shows that 54.3% of the acid is esterified. Calculate the equilibrium constant of this reaction.

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2. Calculate the percent dissociation of $H_2S_{(g)}$ if 0.1 mole of H_2S is kept in 0.4 litre vessel at 1000 K for the reaction, $2H_2S_{(g)} \Leftrightarrow 2H_{2(g)} + S_{2(g)}$ (The value of K_c is 1.0×10^{-6}).

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3. Calculate the pH at which $Mg(OH)_2$ begins to precipitate from a solution containing $0.10 M Mg^{2+}$ ions. (K_{sp} of $Mg(OH)_2 = 1.0 \times 10^{-11}$)

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4. The equilibrium constant for the reaction $A + B \Leftrightarrow AB$ is 0.5 at 200 K. The equilibrium constant for the reaction $AB \Leftrightarrow A + B$ would be

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5. One mole of ethanol is treated with one mole of ethanoic acid at $25^{\circ} C$. Half of the acid changes into ester at equilibrium. The equilibrium constant for the reaction will be

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6. The K_a of a substituted benzoic acid at 298 K is 1×10^{-4}. The pH of a 0.01 M aq. solution of its sodium salt at 298 K is

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7. Find the total number of diprotic acids among the following :

H_3PO_4, H_2SO_4, H_3PO_3, H_3CO_3, $H_2S_2O_4$, H_3BO_3, H_3PO_2, H_2SO_3

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8. In 1 L saturated solution of AgCl (K_{sp} of $AgCl = 1.6 \times 10^{-10}$), 0.1 mol of CuCl ($K_{sp}$ of $CuCl = 1.0 \times 10^{-6}$) is added. The resultant concentration of $Ag^{\oplus}$ in the solution is 1.6×10^{-x}. Calculate the value of x.

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Level - III (Matrix Match Type)

1. Match the reactions of the Column - I with the factors in Column-II

Column-I	Column-II
A) $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}; \Delta H = -46.2\ kJmol^{-1}$ (Exothermic)	p) Forward shift by rise in pressure
B) $2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}; \Delta H = -196\ kJmol^{-1}$ (Exothermic)	q) Unaffected by change in pressure
C) $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)}; \Delta H = +66.4\ kJmol^{-1}$ (Endothermic)	r) Forward shift by rise in temperature
D) $PCl_{3(g)} + Cl_{2(g)} \rightleftharpoons PCl_{5(g)}; \Delta H = +87.88\ kJmol^{-1}$ (Endothermic)	s) Forward shift by lowering the temperature

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2. Match the reactions of the Column - I with the factors in Column-II

Column-I	Column-II
A) $H_2(g)+I_2(g) \rightleftharpoons 2HI(g)$	p) $K_p = K_c(RT)$
B) $N_2(g)+3H_2(g) \rightleftharpoons 2NH_3(g)$	q) $K_p = K_c(RT)^2$
C) $PCl_5(g) \rightleftharpoons PCl_3(g)+Cl_2(g)$	r) $K_p = K_c(RT)^{-2}$
D) $NH_4HS(s) \rightleftharpoons NH_3(g)+H_2S(g)$	s) $K_p = K_c$

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3. Match the salts of the Column - I with the PH in Column-II

Column-I (Salt)	Column-II (pH)
A) Salt of strong acid and strong base	p) $\frac{1}{2}[pK_w + pK_a - pK_b]$
B) Salt of weak acid and strong base	q) $\frac{1}{2}[pK_w + pK_a + \log C]$
C) Salt of weak base and strong acid	r) $\frac{1}{2}[pK_w - pK_b - \log C]$
D) Salt of weak acid and weak base	s) $\frac{1}{2}pK_w$

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4. Match the Column - I with Column-II

Column-I (Salt)	Column-II (pH)
A) The limits of pH values of buffer solution	p) 5×10^{-12}
B) Concentration of $[H_3O^+]$ in 0.001M $Ba(OH)_2$	q) Equal
C) The buffer capacity of a solution is maximum when concentration of salt to that of acid is	r) 10^{-14}
D) Ionic product of water is	s) $pK_a \pm 1$

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5. Match the reactions of the Column - I with the factors in Column-II

Column-I (Salt)	Column-II (Degree of hydrolysis)
A) NH_4Cl	p) No hydrolysis
B) NaCl	q) $h=\sqrt{\frac{K_h}{C}}$
C) CH_3COONa	r) $h=\sqrt{\frac{K_w}{CK_b}}$
D) CH_3COONH_4	s) $h=\sqrt{K_h}$

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Level - III (Statement Type)

1. Assertion : Adding inert gas to dissociation equilibrium of N_2O_4 at constant pressure and temperature increases the dissociation.

Reason : Molar concentration of the reactants and products decrease.

A. Statement 1 is True, statement 2 is True, Statement 2 is correct explanation for Statement 1.

B. Statement 1 is True, statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, statement 2 is false.

D. Statement 1 is False, Statement 2 is True.

Answer: A

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2. Assertion: The equilibriurn constant is fixed and characteristic for any given chemical reactionata specified temperature.

Reason : The composition of the final equilibrium mixture at a particular temperature depends upon the starting amount of reactants.

A. Statement 1 is True, statement 2 is True, Statement 2 is correct explanation for Statement 1.

B. Statement 1 is True, statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, statement 2 is false.

D. Statement 1 is False, Statement 2 is True.

Answer: B

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3. Statement 1 : HF is weaker acid as compared to H_3BO_3.

Statement 2 : Higher the ionisation constant stronger is the acid. : Statement 1 is True, statement 2 is True, Statement 2 is correct explanation for Statement 1.; Statement 1 is True, statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.; Statement 1 is True, statement 2 is false.; Statement 1 is False, Statement 2 is True.

A. Statement 1 is True, statement 2 is True, Statement 2 is correct explanation for Statement 1.

B. Statement 1 is True, statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, statement 2 is false.

D. Statement 1 is False, Statement 2 is True.

Answer: D

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4. Assertion : The equilibrium constant for the reverse reaction is equal to the inverse of the equilibrium constant for the forward reaction.

Reason The value ofequilibrium constant is independent of initial concentrations of the reactants and products.

A. Statement 1 is True, statement 2 is True, Statement 2 is correct explanation for Statement 1.

B. Statement 1 is True, statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, statement 2 is false.

D. Statement 1 is False, Statement 2 is True.

Answer: B

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5. Assertion : In the dissociation of PCl_5 at constant pressure and temperature addition of helium at equilibrium increases the dissociation of PCI_3.

Reason : Helium reacts with Cl, and hence shifts the equilibrium in forward direction.

A. Statement 1 is True, statement 2 is True, Statement 2 is correct explanation for Statement 1.

B. Statement 1 is True, statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, statement 2 is false.

D. Statement 1 is False, Statement 2 is True.

Answer: C

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6. Statement 1: State of equilibrium of a system can not be changed by some external factors such as pressure, volume concentration.

Statement 2 : Any change in the state of equilibrium caused by external factors is nullified by the system. : Statement 1 is True, statement 2 is True, Statement 2 is correct explanation for Statement 1.; Statement 1 is True, statement 2 is True, Statement 2 is NOT a correct explanation for

Statement 1.; Statement 1 is True, statement 2 is false.; Statement 1 is False, Statement 2 is True.

A. Statement 1 is True, statement 2 is True, Statement 2 is correct explanation for Statement 1.

B. Statement 1 is True, statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, statement 2 is false.

D. Statement 1 is False, Statement 2 is True.

Answer: D

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Level - III (Linked Comprehension Type)

1. Aqueous solution of phosphoric acid with a density of $1gmL^{-1}$ containing 0.05% by weight of phosphoric acid is used to impart taste to many soft drinks.

What is the molarity of phosphoric acid used in soft drinks ?

A. 5.1×10^{-3}

B. 1.5×10^{-3}

C. 3.1×10^{-3}

D. 2.1×10^{-3}

Answer: A

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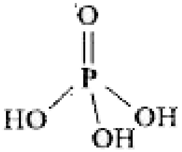
2. The dissociation of weak electrolyte (weak acid) is expressed in terms of Ostwald dilution law. Stronger is the acid, weaker is its conjugate base. The dissociation constants of an acid (K_a) and its conjugate base (K_b) are related by the given relation : $K_w = K_a \times K_b$

At $25^\circ C$, K_w (Ionic product of water) $= 10^{14}$. Phosphoric acid is a weak acid. it is used in fertilizer, food, detergent and toothpaste. Structure of phosphoric acid is :



$(pK_{a_1} = 2.12, pK_{a_2} = 7.21, pK_{a_3} = 12.32)$

$(pK_{a1} = 2.12, pK_2 = 7.21, pK_{a3} = 12.32)$

Aqueous solution of phosphoric acid with a density of $1 gmL^{-1}$ containing 0.05% by weight of phosphoric acid is used to impart taste to many soft drinks.

Phosphate ion is an interfering radical in qualitative analysis. It should be removed for analysis beyond third group of qualitative analysis.

Which among the following relations is correct ?

A. $K_{a1} < K_{a2} < K_{a3}$

B. $K_{a1} > K_{a2} > K_{a3}$

C. $K_{a1} = K_{a2} = K_{a3}$

D. $K_{a1} > K_{a3} > K_{a2}$

Answer: B

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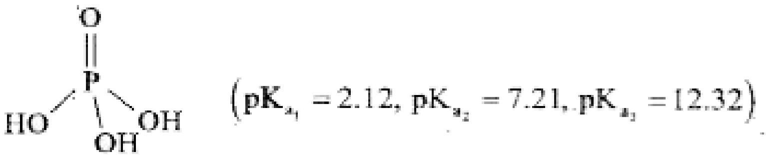
3. Structure of phosphoric acid is :



$(pK_{a1} = 2.12, pK_2 = 7.21, pK_{a3} = 12.32)$

First ionization of phosphoric acid is : $H_3PO_4 \Leftrightarrow H_3PO_4^- + H^+, pK_{a1} = 2.21$. The dissociation constant of conjugate base of $H_2PO_4^-$ will be :

A. 6.45×10^{-9}

B. 1.62×10^{-12}

C. 3.48×10^{-11}

D. 4.62×10^{-2}

Answer: B

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4. In Haber's process, ammonia is manufactured according to the following reaction

$N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}, \Delta H^\circ = -2.4kJ$

The pressure inside the chamber is maintained at 200 atm and temperature at $500^\circ C$. Generally this reaction is carried out in presence of Fe catalyst.

If K_p for the given reaction is 1.44×10^{-5}, then the value of K_c will be :

A. $\dfrac{1.44 \times 10^{-5}}{(0.082 \times 500)^{-2}} mol L^{-1}$

B. $\dfrac{1.44 \times 10^{-5}}{(8.314 \times 773)^{-2}} mol L^{-1}$

C. $\dfrac{1.44 \times 10^{-5}}{(0.082 \times 773)^{2}} mol L^{-1}$

D. $\dfrac{1.44 \times 10^{-5}}{(0.082 \times 773)^{-2}} mol L^{-1}$

Answer: D

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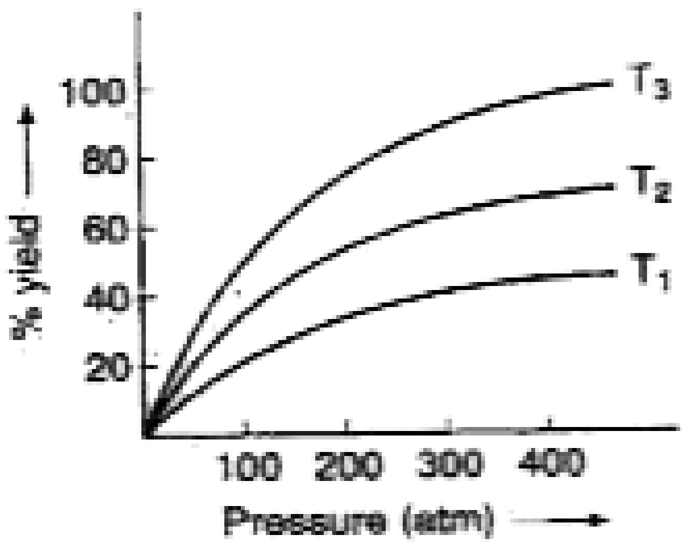
5. In Haber's process, ammonia is manufactured according to the following reaction

$N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}, \Delta H^\circ = -2.4kJ$

The pressure inside the chamber is maintained at 200 atm and temperature at $500^\circ C$. Generally this reaction is carried out in presence of Fe catalyst.

The preparation of ammonia by Haber's process is an exothermic reaction. If the preparation follows the following temperature pressure relationship for its % yield. Then for temperature T_1, T_2 and T_3, the correct option is :



A. $T_3 < T_2 < T_1$

B. $T_3 > T_2 > T_1$

C. $T_1 = T_2 = T_3$

D. $T_1 > T_2 < T_3$

Answer: B

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6. In Haber's process, ammonia is manufactured according to the following reaction

$N_{2(g)} + 3H_{2(g)} \Leftrightarrow 2NH_{3(g)}, \Delta H^\circ = -2.4kJ$

The pressure inside the chamber is maintained at 200 atm and temperature at $500^\circ C$. Generally this reaction is carried out in presence of Fe catalyst.

$500^\circ C$ is considered optimum temperature for Haber's process because : catalyst has maximum activity at this temperature, energy required is easily obtained at this temperature, yield is maximum at this temperature, rate is fast enough while the yield is also appreciable at this temperature

A. catalyst has maximum activity at this temperature

B. energy required is easily obtained at this temperature

C. yield is maximum at this temperature

D. rate is fast enough while the yield is also appreciable at this temperature

Answer: D

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7. 10 mole of NH_3 is heated at 15 atm from $27^{\circ C}$ to $347^{\circ} C$ assuming volume constant. The pressure at equilibrium is found to be 50 atm. The equilibrium constant for dissociation of NH_3 :

$2NH_3 \Leftrightarrow N_2 + 3H_2, \Delta H = 91.94kJ$ can be written as

$$K_p = \frac{p_{N_2} \times (p_{H_2})^2}{\left(P^2_{NH_3}\right)}(\text{atm})^2$$

The degree of dissociation of NH_3 is :

A. $61.3\ \%$

B. $20\ \%$

C. $48\ \%$

D. $50\ \%$

Answer: A

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8. 10 mole of NH_3 is heated at 15 atm from $27^{\circ C}$ to $347^{\circ} C$ assuming volume constant. The pressure at equilibrium is found to be 50 atm. The equilibrium constant for dissociation of NH_3 :

$2NH_3 \Leftrightarrow N_2 + 3H_2, \Delta H = 91.94 kJ$ can be written as

$$K_p = \frac{p_{N_2} \times (p_{H_2})^3}{\left(P^2_{NH_3}\right)}(\text{atm})^2$$

The equilibrium constant K_p for the reaction is :

A. 7.08×10^2

B. 3.06×10^2

C. 7.6×10^2

D. 1.53×10^3

Answer: D

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9. 10 mole of NH_3 is heated at 15 atm from $27^{\circ C}$ to $347^{\circ} C$ assuming volume constant. The pressure at equilibrium is found to be 50 atm. The equilibrium constant for dissociation of NH_3 :

$2NH_3 \Leftrightarrow N_2 + 3H_2, \Delta H = 91.94 kJ$ can be written as $K_p = \frac{p_{N_2} \times (p_{H_2})^2}{\left(P_{NH_3}^2\right)} (\text{atm})^2$

The increase in pressure and temperature on the reaction in equilibrium favours :

A. forward reaction in both cases

B. less dissociation of NH_3

C. backward reaction and forward reaction respectively

D. more formation of N_2 but less formation of H_2

Answer: C

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10. The degree of dissociation of weak electrolyte is inversely proportional to the same square root of concentration. What is called Ostwald's dilution law.

$\alpha = \sqrt{\frac{K_a}{c}}$ As the temperature increases, degree of dissociation will increase.

$\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{K_{a1}}{K_{a2}}}$ if concentration is same. $\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{c_2}{c_1}}$ if acid is same.

0.01 M CH_3COOH has 4.24% degree of dissociation, the degree of dissociation of 0.1 M CH_3COOH will be

A. $1.33\ \%$

B. 4.24%

C. 5.24%

D. 0.33%

Answer: A

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11. The degree of dissociation of weak electrolyte is inversely proportional to the same square root of concentration. What is called Ostwald's dilution law.

$\alpha = \sqrt{\frac{K_a}{c}}$ As the temperature increases, degree of dissociation will increase.

$\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{K_{a1}}{K_{a2}}}$ if concentration is same. $\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{c_2}{c_1}}$ if acid is sam.

pH of 0.005 M HCOOH $\left[K_a = 2 \times 10^{-4}\right]$ is equal to : 3, 2, 4, 5

A. 3

B. 2

C. 4

D. 5

Answer: A

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Level - III (Linked Comprehension Type Questions)

1. The degree of dissociation of weak electrolyte is inversely proportional to the same square root of concentration. What is called Ostwald's dilution law.

$\alpha = \sqrt{\dfrac{K_a}{c}}$ As the temperature increases, degree of dissociation will increase.

$\dfrac{\alpha_1}{\alpha_2} = \sqrt{\dfrac{K_{a1}}{K_{a2}}}$ if concentration is same. $\dfrac{\alpha_1}{\alpha_2} = \sqrt{\dfrac{c_2}{c_1}}$ if acid is sam.

For two monobasic acids HA_1 and HA_2 at the same concentration α_1 and α_2 are in ratio of 1:2. $K_{a1} = 2 \times 10^{-4}$. What will be K_{a2} ? 8×10^{-4}, $2 \times 10^{-4}, 4 \times 10^{-4}, 1 \times 10^{-4}$

A. 8×10^{-4}

B. 2×10^{-4}

C. 4×10^{-4}

D. 1×10^{-4}

Answer: A

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