CHEMISTRY

JEE MAIN AND ADVANCED

EQUILIBRIUM

Example

1. For $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$, write the expression of K_c

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2. For $2Hl(g) \Leftrightarrow H_2(g) + l_2(g)$, write the expression of K_c

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3. For $4NH_3(g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$, write the expression of K_c

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4. Write the unit of equlibrium constant $\left(K_c\right)$ for the given reaction.

$BaCO_3(s) \Leftrightarrow BaO(s) + CO_2(g)$

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5. Write the relation between K_p and K_c for the following reactions

(i) $N_2(g) + 3H_2(g) \Leftrightarrow 2H_2(g) + O_2(g)$

(ii) $2H_2O(g) \Leftrightarrow 2H_2(g) + O_2(g)$

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6. Two moles of PCl_5 were heated to $327^\circ C$ in a closed two-litre vessel, and when equilibrium was achieved, PCl_5 was found to be 40%

dissociated into PCl_3 and Cl_2. Calculate the equilibrium constant K_p and K_c for this reaction.

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7. In the reaction $A + B \Leftrightarrow C + D$ what will happen to the equlibrium if concentration of A is increased?

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8. What will be the affect of increased pressure in the following equlibrium reaction ?

(i) $H_2(g) + I_2(g) \Leftrightarrow 2Hl(g)$

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

(iii) $N_2O_4(g) \Leftrightarrow 2No_2(g)$

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9. Give the conjugate bases of (i) $H_2O(ii)HNO_3(iii)NH_4^+(Iv)HCO_3^{2-}$.

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10. Which concept can explain the acitic character of CO_2 ?

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11. The concentration of hydrogen ion in a sample of soft drink is $3.8 \times 10^{-3}M$. What is its pH?

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12. If hydrogen ion concentration in a solution is 1×10^{-5} moles/litre, calculate the concentration of OH ion in this solution $\left(K_w = 10^{-14}\text{moles}^2L^{-2}\right)$.

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13. If K_a of a weal acid is4×4^{-6} and its concentration is 0.1 M. Find pH of solution

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14. The dissociation constant of a base MOH is 4×10^{-6} then calculate the dissociation constant of its conjugate acid

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15. The dissociation constant of 0.01 M CH_3COOH is 1.2×10^{-5} then calculate the dissociation constant of its conjugate baze $\left(CH_3COO^-\right)$

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16. The dissociation constatn of 0.01 M CH_3COOH is 1.8×10^{-5} then calculate CH_3COO^- concentration of 0.1 M HCl solution.

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17. Calculate the degree of hydrolysis of 0.1 M solution of sodium acetate at $298K: K_a = 1.8 \times 10^{-5}$.

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18. Calculate the pH of 0.10 M solution of Nh_4Cl. The dissociation constant $\left(K_b\right)$ of NH_3 is 1.8×10^{-5}

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19. The pK_a of acetic acid and pK_b of ammonium hydroxide are 4.76 and 4.75 respectively. Calculate the pH of ammonium acetate solution.

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20. Calculate the percentage hydrolysis of decinormal solution of ammonium acetate given that

$k_a = 1.75 \times 10^{-5}, K_b = 1.80 \times 10^{-5}$ and $K_w = 1.0 \times 10^{-14}$

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21. The solubility of AgCl in water at 298 K is 1.06×10^{-5} mle per litre. Calculate its solubility product at this temperature.

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22. Calculate the solubility product of $PbCl_2$ at a certain temperature if the solubility of $PbCl_2$ is 4.4 g/L at the same temperature. $(Pb = 207, Cl = 35.5)$

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23. Calcualte the solubility of M_2X_3 in pure water, assuming that neither kind of ion reacts with H_2O. The solubility product of M_2X_3, $K_{sp} = 1.1 \times 10^{-23}$.

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24. Give reason why $BaSO_4$ will precipitate out when equal volumes of $2 \times 10^{-3} MBaCl_2$ solution and $2 \times 10^{-4} MNa_2SO_4$ solution are mixed. Given that the solubility product of $BaSO_4$ is 1×10^{-10}.

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25. What is the minimum concentration of Ba^{+2} ions required in order to initiate the precipitation of $BaSO_4$ from a solution containing 0.002 mole L^{-1} of So_4^{-2} ions?

(Given K_{sp} for $BaSO_4 = 1.4 \times 10^{-10}$)

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26. Two sparingly soluble salts AB and XYZ have the same soubility product. Which salt will be more soluble?

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27. Calculate solubility of AgCl in 0.1 M NaCl at $25^{\circ}C$ if its solubility proudct at same temperature is 2.0×10^{10}

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28. $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$. If 1 mole PCl_5 was put in a container of volume V litre and at equlibrium, x moles of it was decomposed, find its K_p and K_c at equlibrium pressure of P atm.

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29. In the following gaseous pjhase equlibrium at constant temperature the concentration of $\left[SO_2\right] = 3.0 \times 10^{-3}M.\ \left[O_2\right] = 3.5 \times 10^{-3}M.\ \left[SO_3\right] = 5.0 \times 10^{-2}M.$

Calculate equlibarium constant for both the directions.

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

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30. For the following reaction, $PCl_5 \Leftrightarrow PCl_3(g) + Cl_2(g)$

0.4 mole of $PCl_5$0.2 mole of PCl_3 and 0.6 mole of Cl_2 are taken in 1 litre flask if $K_c = 0.2$ then, predict the direction in which reaction proceeds.

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31. For the following reaction in equlibrium

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

Vapour density is found to be 100 when 1 mole of PCl_5 is taken in a 10

litre flask at $27^{\circ}C$ Calculate the equlibrium pressure. Also calculate percentage dissociation of PCl_3

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32. Calculate $\left[OH^{-}\right]$ and % dissociation of 0.01 M solution of ammonium hydroxide solution. The ionization constant for $NH_4OH\left(K_b\right) = 1.8 \times 10^{-5}$

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33. Find the concentration of $H^{\oplus}$, $HCO_3^{\ominus}$, and CO_3^{-2} in a $0.01M$ solution of carbonic acid if the pH of solution is 4.18.

$K_1 = 4.45 \times 10^{-7}, K_2 = 4.69 \times 10^{-11}$

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34. 1 M solution of CH_3COOH is diluted to x times so that pH of solution is doubled. Calculate x

Given $K_a = 1.8 \times 10^{-5}$

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35. Calculate the amount of NH_4C1 required to dissolve in $500mL$ of water to have a $pH = 4.5, K_b = 2.0 \times 10^{-5}$.

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36. Calculate the pH of each of the following solution

(i) 100 ml of 0.1 M CH_3COOH mixed with 100 ml of 0.1 M NaOH.

(ii) 100 ml of 0.1 M CH_3COOH mixed with 50 ml of 0.1 m NaOH

(iii) $50mlof0.1MCH_3COOH$ mixed with 100 ml of 0.1 M NaOH.

$K_a\left(CH_3COOH\right) = 1.8 \times 10^{-5}$

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37. If the solution $0.5MNH_3$ and stability constant for $A^+\left(NH_3\right)_2$ is

$$K_{stb} = \frac{\left[Ag\left(NH_3\right)_2\right]^+}{\left[Ag^+(aq)\right]\left[NH_3\right]^2} = 6.4 \times 10^7,$$

then find the solubility of AgCl in the above solution $K_{sp}ofAgCl = 2 \times 10^{-10}$

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38. The solubility proudct of AgCl at $25^\circ C$ is 1×10^{-10} A solution of Ag^+ at a concentration 4×10^{-3} M just fails to yield a prenciitate of AgCl with concentration of $1 \times 10^{-3}MCl^-$ when the concentration of NH_3 in the solution is $2 \times 10^{-2}M$. Calculate the equlibrium constant for $\left[Ag\left(NH_3\right)_2\right] \Leftrightarrow Ag^+ + 2NH_3$

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39. What is the molar solubility of AgCl(s) in 0.1 M $NH_3(aq)$? $K_{sp}(AgCl) = 1.8 \times 10^{-10}$, $K_f\left[Ag\left(NH_3\right)_2\right]^+ = 1.6 \times 10^7$.

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40. For $PCI_5(g) \Leftrightarrow PCI_3(g) + CI_2(g)$, write the expression of K_c .

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41. For $2HI(g) \Leftrightarrow H_2(g) + I_2(g)$ write the expression of k_c.

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42. For $4NH_3(g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$, write the expression of K_c

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45. Two moles of PCI_5 were heated to $327^\circ C$ in a closed two litre vessel and when equilibrium was achieved, PCI_5 was found to be 40% dissociated into PCI_3 and CI_2 calculate the equilibrium constant $\left(K_c\right)$ for the reaction.

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46. In the reaction $A + B \Leftrightarrow C + D$, What will happen to the equilibrium if concentration of A is increased ?

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47. What will be the effect of increased pressure in the following equilibrium reactions ?

$(i)H_2(g) + I_2(g) \Leftrightarrow 2HI(g)(ii)N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)(Iii)N_2O_4(g) \Leftrightarrow 2NO_2(g)$

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48. Give the conjugate bases of

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56. Calculate the degree of hydrolysis of 0.1 M solution of acetate at 298 k.

Given : $K_a = 1.8 \times 10^{-5}$

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62. Calculate the solubility of A_2X_3 is pure water, assuming that neither kind of ion racts with water. The solubility product of $A_2X_3, K_{sp} = 1.1 \times 10^{-23}$

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63. Give reason why $BaSO_4$ will precipitate out when equal volumes of $2 \times 10^{-3} M BaCl_2$ solution and $2 \times 10^{-4} M Na_2SO_4$ solution are mixed. Given that the solubility product of $BaSO_4$ is 1×10^{-10}.

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64. What is the minimum concentration of Ba^{+2} ions required in order to initiate the precipitation of $BaSO_4$ from a solution containing 0.002 mole L^{-1} of So_4^{-2} ions?

(Given K_{sp} for $BaSO_4 = 1.4 \times 10^{-10}$)

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66. Calculate solubility of AgCI in 0.1 M NaCI at $25^{\circ}C$ if its solubility product at same temperature is 2.0×10^{-10}.

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Try Yourself

1. Give the mathematical expression for the equlib rium constant K_c for the reaction.

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

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2. The following concentrations were obtained for the formation of NH_3 from N_2 and H_2 at equilibrium at $500K$. $\left[N_2\right] = 1.5 \times 10^{-2}M$, $\left[H_2\right] = 3.0 \times 10^{-2}M$, and $\left[NH_3\right] = 1.2 \times 10^{-2}M$. Calculate the equilibrium constant.

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3. The value of the equilibrium constant for the reaction :

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

at 720 K is 48. What is the value of the equilibrium constant for the reaction :

$1/2H_2(g) + 1/2I_2(g) \Leftrightarrow HI(g)$

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4. For the reaction, $A(g) + B(s) \Leftrightarrow C(g) + D(g). K_c = 49 mol L^{-1} at 127^\circ C.$ Calculate k_p.

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5. The value of $K_c = 4.24$ at 800 K for the reaction

$CO(g) + H_2O(g) \Leftrightarrow CO_2(g) + H_2(g)$

Calculate equlibrium concentrations of CO_2H_2, CO and H_2O at 800 K, if only CO and H_2O are present initially at concentration of 0.10 M each?

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6. 3.2 moles of HI (g) were heated in a sealed bulb at $444^\circ C$ till the equlibrium was reached its degree of dissociation was found to be $20\,\%$ Calculate the number of moles of hydrogen iodide, hydrogen and iodine present at eth equlibrium point and determine the value of equlibrium constnat for the reaction $2Hl(g) \Leftrightarrow H_2(g) + I_2(g)$. Considering the volume of the container 1 L.

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7. The value of $\Delta G^\ominus$ for the phosphorylation of glycose in glycolysis is $13.8 kJmol^{-1}$. Find the value of K_c at $298K$

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8. Hydrolysis of sucrose gives

$\text{Sucrose} + H_2O \Leftrightarrow \text{Glucose} + \text{Fructose}$

Equilibrium constant K_c for the reaction is 2×10^{13} at $300K$. Calculate $\Delta G^{\ominus}$ at $300K$.

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9. A system at equilibrium is described by the equation

$SO_2Cl_2 \Leftrightarrow SO_2 + Cl_2, \Delta H = +ve.$

When Cl_2 is added to the equilibrium mixture at constant volume, the temperture of the system

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10. Mention atleast three ways by which the concentration of $SO_2(g)$ be increased in the following reaction in a state of equilibrium :

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

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14. 13.5 g of an acid HA of molecular mass 135 was dissolved in 10 litres of aqueous solution Calculate the pH of the solution assuming the acid to

be completely dissociated.

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15. Calculate t the H^+ ion concentration in 0.10 M acetic acid solution. Given that the dissociation constant of acetic acid in water is 1.8×10^{-5}

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16. When 0.1 mole of NH_3 is dissolved in water to make 1.0 L of solution, the $\left[OH^-\right]$of solution is $1.30 \times 10^{-3}M$. Calculate K_b for NH_3.

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17. If ionisation constant of an acid (HA) at equlibrium is 1.0×10^{-8} then colculte the value of pK_a and pK_b (for its conjugate base)

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18. Calcuate the degree of ionisation and pH of 0.05 M solution of a weak base having the ionization constant $\left(K_b\right)$ is 1.77×10^{-5}. Also calculate the ionisation constnat of the conjugate acid of this base.

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19. The ionization constnt of $\left(C_2H_5\right)_3N$ is 6.4×10^{-5}. Calculate its degree of dissociation in its 0.1 M solution when it is mixed with 0.01 M NaOH solution.

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20. Calculate the pH of 0.033 M ammonia solution if $0.033MNH_4Cl$ is introduced in this solution at the same temperature $\left(K_b\right.$ for $NH_3 = 1.77 \times 10^{-5}$)

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21. Calculate the pH of 0.01 M solution of NH_4CN. The dissociation constants K_a for $HCN = 6.2 \times 10^{-10}$ and K_b for $NH_3 = 1.6 \times 10^{-5}$.

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22. One litre of 0.05 M HCl was completely neutralized by NaOH. Calcuate the pH of resulting solution

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23. The solubilty of barium sulphate at 298 K is $1.1 \times 10^{-5} \text{mol } L^{-1}$. Calculate the solubilty product of barium sulphate at the same temerature.

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24. $20mL$ of 1.5×10^{-5} M barium chloride solution is mixed with 40 mL of 0.9×10^{-5} sodium sulphate . Will a precipitate get formed ? $\left(K_{sp} \text{ for } BaSO_4 = 1 \times 10^{-10}\right)$

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25. Calculate solubility product of Hg_2Cl_2 if its solubility at room temperature is $2.0 \times 10^{-3} molL^{-1}$

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26. NaCl solution is added to a saturated solution of $PbCl_2$. What will happen to the concentration of Pb^{+2} ions?

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27. Given the mathematical expression for the equilibrium constant K_c for the reaction.

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28. The following concentration were obtained for the formation of NH_3 from N_2 and H_2 at equilibrium for the reaction

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Calculate equilibrium constant.

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49. The solubility of barium sulphate at 298 K is $1.1 \times 10^{-5} molL^{-1}$. Calculate the solubility product of barium sulphate at the same temperature .

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50. 20 ml of $1.5 \times 10^{-5} MBaCI_2$ solution is mixed with 40 ml of 0.9×10^{-5} M sodium sulphate solution , will a precipitate of $BaSO_4$ get formed ? $\left(K_{sp} \text{for} BaSO_4 = 1.2 \times 10^{-10}\right)$.

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51. Calculate solubility product of Hg_2Cl_2 if its solubility at room temperature is $2.0 \times 10^{-3} molL^{-1}$

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52. NaCI solution is added to a saturated solution of $PbCI_2$. What will happen to the concentration of Pb^{+2} ions ?

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Assignment Section A Subjective Type Questions One Option Is Correct

1. The equilibrium constant for the reaction $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$ is 4.0×10^{-4} at $2000K$. In the presence of a catalyst, the equilibrium is attained 10 times faster. Therefore, the equilibrium constant in presence of the catalyst at $2000K$ is

A. 40×10^{-4}

B. 4×10^{-4}

C. 4×10^{-2}

D. The data is insufficient

Answer: B

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2. For the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

the equilibrium constant K_p changes with

A. Catalyst

B. Temperatue

C. Amounts of H_2 and I_2

D. Amount of HI

Answer: B

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3. For a gaseous reaction

$xA + yB \Leftrightarrow lC + mD$

A. $K_p = K_c$

B. $K_p = K_c$

C. $K_p = K_c(RT)^{(I+m)-(x+y)}$

D. $K_p = \frac{1}{K_c}$

Answer: C

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4. Which of the following will not change the concentration of ammonia in the equilibrium

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g), \Delta H = -xkJ$

A. Increase of pressure

B. Increase of temperature

C. Decrease of volume

D. Addition of catalyst

Answer: D

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5. In which of the following reaction $K_p > K_c$

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

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

C. $PCl_{93}\rangle(g) + Cl_2(g) \Leftrightarrow PCl_2(g)$

D. $2SO_3(g) \Leftrightarrow PCl_{95}\rangle(g)$

Answer: D

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6. For the reaction

$PCl_3(g) + Cl_2(g) \Leftrightarrow PCl_5(g)$ the value of K_p at $250\,^\circ C$ is $0.61 atm^{-1}$ The value of K_c at this temperature will be

A. $15.19\left(molL^{-1}\right)$

B. $26.19\left(molL^{-1}\right)$

C. $35.19\left(molL^{-1}\right)$

D. $52.19\left(molL^{-1}\right)$

Answer: B

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7. An equilibrium mixture for the reaction

$2H_2S(g) \Leftrightarrow 2H_2(g) + S_2(g)$

had 1 mole of H_2S, 0.2 mole of H_2 and 0.8 mole of S_2 in a 2 litre flask. The value of K_c in mol L^{-1} is

A. 0.004

B. 0.08

C. 0.016

D. 0.016

Answer: C

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8. On the basis of Le- Chatelier's principle, predict which of the following conditions would be unfavourable for the formation of SO_3 ? Given that

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

A. Low temperature

B. High temperatue

C. High temperatuer

D. High concentration of SO_2

Answer: C

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9. For the reaction $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ the forward reaction at constant temperature is favoured by

A. Introducing an inert gas at constatn volume

B. Introducing $PCl_3(g)$ gas at constnt volume

C. Introducing $PCl_5(g)$ gas at constant volume

D. Introducing $Cl_2(g)$ gas at constant volume

Answer: C

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10. $CaCO_3 \Leftrightarrow CaO + CO_2$ reaction in a lime kiln goes to completion because

A. CaO does not react with CO_2 to give $CaCO_3$

B. Backward reaction is very slow

C. CO_2 formed escapes out

D. All of these

Answer: C

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11. The following reaction takes place in the body

$CO_2 + H_2O \Leftrightarrow H_2CO_3 \Leftrightarrow H^+ + HCO_3^-$. If CO_2 escapes from the system

A. pH will decrease

B. $\left[H^{+}\right]$ will diminish

C. $\left[H_2CO_3\right]$ will remain unchanged

D. The forward reaction will be favoured

Answer: B

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12. The equilibrium constant for the reaction

$N_2(g) + 3H_2(g) \Leftrightarrow NH_3(g)$ is K'

K and K' will be related to each other as

A. $K = K'$

B. $K = \sqrt{K}$

C. $K = \sqrt{K'}$

D. $K \times K' = 1$

Answer: B

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13. In which of the following sysems at equlibrium and room temperature doubling the volume will shift the equlibrium to the right?

A. $K_2 + Cl_2 \Leftrightarrow 2HCl$

B. $2CO + O_2 \Leftrightarrow 2CO_2$

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

D. $PCl_5 \Leftrightarrow pCl_3 + Cl_2$

Answer: D

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14. The melting of ice is favoured by ..... pressure and ..... temperature.

A. Low T and P

B. High T and P

C. Low T high P

D. Low P high T

Answer: B

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15. 1.1 mole of A mixed with 2.2 mole of B and the mixture is kept in a 1 litre at the equilibrium 0.2 mole of C is formed, then the value of K_c will be:

A. 0.001

B. 0.002

C. 0.003

D. 0.004

Answer: A

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16. The equilibrium constant for the reaction $CaSO_4.H_2O(s) \Leftrightarrow CaSO_4.3H_2O(s) + 2H_2O(g)$ is equal to

A. $\frac{[CuSO_4.5H_2O][H_2O]^2}{[CuSO_4.5H_2O]}$

B. $\frac{[CuSO_4.3H_2O]}{[CuSO_4.5H_2O]}$

C. $[H_2O]^2$

D. $[H_2O]$

Answer: C

Watch Video Solution

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

given equilibrium?

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

A. 2

B. 4

C. 6

D. 8

Answer: B

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18. The following equilibria are given by :

$N_2 + 3H_2 \Leftrightarrow 2NH_3, K_1$

$N_2 + O_2 \Leftrightarrow 2NO, K_2$

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

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

B. $K_1K_2K_3$

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

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

Answer: A

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19. What is the approximate OH^- ion concentration of a $0.150MNH_3$ solution? $\left(K_b = 1.75 \times 10^{-5}\right)$

A. 2.62×10^{-6}

B. 4.6×10^{-6}

C. 1.62×10^{-3}

D. 3.6×10^{-3}

Answer: C

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20. For the equilibrium, $N_2O_4 \Leftrightarrow 2NO_2$, $\left(G^{\circ}_{N_2O_4}\right)_{298} = 100kJ/mol$ and $\left(G^{\circ}_{NO_2}\right)_{298} = 50kJ/mol.$

(*a*) When $5mo\frac{l}{l}itre$ of each is taken, calculate the value of ΔG for the reaction at $298K.$

(*b*) Find the direction of reaction.

A. Forward

B. Backward

C. Equlibrium state

D. Unpredictable

Answer: A

Watch Video Solution

21. The exothermic formation of ClF_3 is represented by thr equation:

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

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

A. Increassing the temperature

B. Removing Cl_2

C. Increasing the volume of the container

D. Adding F_2

Answer: D

Watch Video Solution

22. For the reaction $2NO_2(g) \Leftrightarrow 2NO(g) + O_2(g)$

$K_c = 1.8 \times 10^{-6}$ at $184^\circ C, R = 0.00831kJ/$ (mol.K) when K_p and K_c are compared at $184^\circ C$, it is found

A. K_p is greater than K_c

B. K_p is less than K_c

C. $K_p = K_c$

D. none of these

Answer: A

Watch Video Solution

23. The following equilibrium exists in a closed vessel in $1L$ capacity

$A(g) + 3B(g) \Leftrightarrow 4C(g)$

initial cocentration of $A(g)$ is equal to that $B(g)$. The equilibrium concentration of $A(g)$ and $C(g)$ are equal. K_c for the reaction is

A. 0.08

B. 0.8

C. 8

D. 80

Answer: C

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24. For the reaction, $H_2 + I_2 \Leftrightarrow 2HI, K = 47.6$. If the initial number of moles of each reactant and product is 1 mole then at equilibrium

A. $\left[1_2\right] = \left[H_2\right], \left[l_2\right] > [Hl]$

B. $\left[1_2\right] < \left[H_2\right], \left[l_2\right] = [Hl]$

C. $\left[1_2\right] = \left[H_2\right], \left[l_2\right] < [Hl]$

D. $\left[1_2\right] > \left[H_2\right], \left[l_2\right] = [Hl]$

Answer: C

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25. If pressure is increased on the equlibrium $N_2 + O_2 \Leftrightarrow 2NO$ the equlibrium will

A. Shift in the forward direction

B. Shift in the backward direction

C. Remain undistrubed

D. None of these

Answer: C

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26. If K_1 and K_2 are respective equilibrium constants for two reactions :

$XeF_6(g) + H_2O \Leftrightarrow XeOF_4(g) + 2HF_g$

$XeO_4(g) + XeF_6(g) \Leftrightarrow XeOF_4(g) + XeO_3F_2(g)$

Then equilibrium constant for the reaction

$XeO_4(g) + 2HF(g) \Leftrightarrow XeO_3F_2(g) + H_2O(g)$ will be

A. $\frac{K_1}{K_2^2}$

B. K_1K_2

C. $\frac{K_1}{K_2}$

D. $\frac{K_2}{K_1}$

Answer: D

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27. For the reaction

$CO(g) + \frac{1}{2}O_2(g) \Leftrightarrow CO_2(g), K_p/K_c$ is

A. 1

B. RT

C. $\frac{1}{\sqrt{RT}}$

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

Answer: C

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28. 500 ml vessel contains 1.5 M each of A, B, C and D at equlibrium. If 0.5 M each of C and D are taken out, the value of K_c for $A + B \Leftrightarrow C + D$ will be

A. 1.0

B. $\frac{1}{9}$

C. $\frac{4}{9}$

D. $\frac{8}{9}$

Answer: A

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29. 9.2 grams of $N_2O_{4(g)}$ is taken in a closed one litre vessel and heated till the following equilibrium is reached $N_2O_{4(g)} \Leftrightarrow 2NO_{2(g)}$. At equilibrium, $50\,\%\, N_2O_{4(g)}$ is dissociated. What is the equilibrium constant (in mol $litre^{-1}$) (Molecular weight of $N_2O_4 = 92$) ?

A. 0.1

B. 0.2

C. 0.4

D. 2

Answer: B

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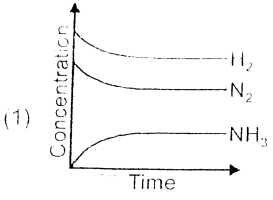
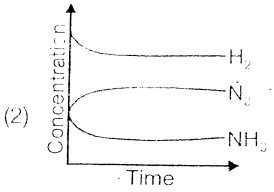
30. For the synthesis of ammonia by the reaction $N_2 + 3H_2 \Leftrightarrow 2NH_3$ in the Haber's process ,the attainment of equilibrium is correctly predicated bt the curve

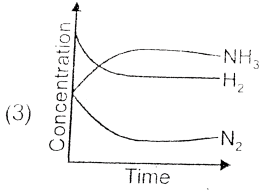
A.



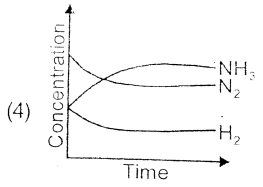
B.



C.



D.



Answer: A

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31. The equilibrium:

$P_4(g) + 6Cl_2(g) \Leftrightarrow 4PCl_3(g)$

is attained by mixing equal moles of P_4 and Cl_2 in an evacuated vessel.

Then at equilibrium:

A. $\left[Cl_2\right] > \left[PCl_3\right]$

B. $\left[CL_2\right] > \left[P_4\right]$

C. $\left[P_4\right] > \left[Cl_2\right]$

D. $\left[PCl_3\right] > \left[P_4\right]$

Answer: C

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32. For the hypothetical reactions, the equilibrium constant (K) value are given

$A \Leftrightarrow B, K_1 = 2, B \Leftrightarrow C, K_2 = 4,$

$C \Leftrightarrow D, K_3 = 3$

The equilibrium constant (K) for the reaction

$A \Leftrightarrow D$ is

A. 48

B. 6

C. 2.7

D. 24

Answer: D

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33. Partial pressure of O_2 in the reaction

$2Ag_2O(s) \Leftrightarrow 4Ag(s) + O_2(g)$ is

A. K_ρ

B. $\sqrt{K\rho}$

C. $3\sqrt{K_\rho}$

D. $2K_\rho$

Answer: A

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34. For the following gases equilibrium, $N_2O_4(g) \Leftrightarrow 2NO_2(g)$

K_p is found to be equal to K_c. This is attained when:

A. 0 K

B. 273 K

C. 1 K

D. 12.18 K

Answer: D

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35. $NH_4COONH_2(s) \Leftrightarrow 2NH_3(g) + CO_2(g)$ If equilibrium pressure is 3 atm for the above reaction, then K_p for the reaction is

A. 4

B. 27

C. $\frac{4}{27}$

D. $\frac{1}{27}$

Answer: A

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36. The following two reactions:

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

(ii) $COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

are simultaneously in equilibrium in a container at constant volume. A few moles of $CO(g)$ are later introduced into the vessel. After some time, the new equilibrium concentration of

A. PCl_5 will increases

B. PCl_5 will decreases

C. PCl_5 will remain unsffected

D. Cl_2 will increases

Answer: B

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37. When hydrogen molecules decompose into its atoms, which conditions give the maximum yield of hydrogen atoms ?

A. High temperatue and low pressure

B. Low temperatuer and high pressure

C. High temperatuer and high pressure

D. Low temperature and low pressure

Answer: A

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38. Equilivalent amounts of H_2 and I_2 are heated in a closed vessel till equilibrium is obtained. If $80\,\%$ of the hydrogen is converted to HI, the K_c at this temperature is

A. 64

B. 16

C. 0.25

D. 14

Answer: A

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39. The dissociation constants for acetic acid and HCN at $25^\circ C$ are 1.5×10^{-5} and 4.5×10^{-10}, respectively. The equilibrium constant for the equilibirum $CN^- + CH_3COOH \Leftrightarrow HCN + CH_3COO^-$ would be

A. 3.3×10^{-5}

B. 3.3×10^{-4}

C. 3.3×10^{4}

D. 3.3×10^{5}

Answer: C

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40. $Hg_2Cl_2(g)$ in saturated aqeous solution has equilibrium constant equal to :

A. $\left[Hg^+\right]\left[Cl^-\right]$

B. $\left[hg^+\right]^2\left[Cl^-\right]^2$

C. $\left[Hg_2^{+2}\right]\left[Cl^-\right]^2$

D. $2\left[Hg^+\right] \times 2\left[Cl^-\right]$

Answer: C

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41. K_p for the following reaction will be equal to

$3Fe(s) + 4H_2O(g) \Leftrightarrow Fe_3O_4(s) + 4H_2(g)$

A. $\left(P_{H_2}\right)^4\left(P_{Fe_3O_4}\right)$

B. $\frac{P_{H_2}}{P_{H_2O}}$

C. $\frac{\left(P_{H_2}\right)^4}{\left(P_{H_{2O}}\right)^4}$

D. $\frac{\left(P_{H_2}\right) \times P_{Fe_3O_4}}{P_{Fe}}$

Answer: C

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42. Which of the following factors will favour the reverse reaction in a chemical equilibrium?

A. Increasing the concentration of one of the reactants

B. Removal of at least one of the products at regular intervals

C. Increasing the concentration of one or more of the products

D. none of these

Answer: C

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43. The pH of $10^{-8}M$ solution of HCl in water is

A. 8

B. 6

C. Between 6 and 7

D. Between 7 and 8

Answer: C

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44. The pH of 0.05 M solution of a strong dibasic acid is

A. 0.0

B. 1

C. 2

D. 5

Answer: B

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45. Among the following the one which does not represent a conjugate acid-base pair is

A. HCl and Cl^-

B. HOH and OH^-

C. SO_2 and H_2SO_4

D. NH_4^+ and NH_3

Answer: C

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Assignment Section B Objective Type Questions One Option Is Correct

1. In which of the following does the reaction go almost to completion ?

A. $A + B \Leftrightarrow C, \quad K = 10^4$

B. $X + Y \Leftrightarrow Z, \quad K = 10^{-3}$

C. $P + Q \Leftrightarrow R, \quad K = 1$

D. $M + N \Leftrightarrow O + P, K = 10^{-1}$

Answer: A

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2. At constant pressure, the addition of argon in Haber's process

A. Reduces the formation of ammonia from N_2 and H_2

B. Increases the formation of ammonia from N_2 and H_2

C. Does not affect the equlibrium of the reaction in which ammonia is formed from N_2 and H_2

D. Reduces the dissociation of ammonia

Answer: A

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3. Consider the general hypothetical reaction

$A(s) \Leftrightarrow 2B(g) + 3C(g)$

If the concentration of C at equlibrium is doubled then after the equlibrium is re-established the concentration of B will be

A. Twice of its original value

B. Half of its original value

C. $2\sqrt{2}$ times of original value

D. $\frac{1}{2\sqrt{2}}$ time of original value

Answer: D

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4. Pure ammonia is placed in a vessel at a temperature where its dissociation constant (α) is appreciable. At equilibrium,

A. K_p does not change significantly with pressure

B. Concentration of N_2 does not change with pressure

C. Concentration of NH_3 does not change with pressure

D. K_p changes with pressure but α does not change

Answer: A

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5. Which of the following is correct if reaction quotient $(Q) = 1$?

A. $\Delta G = 0$

B. $\Delta G^\circ = 0$

C. $\Delta G gt \Delta G^\circ$

D. $\Delta G = \Delta G^{\circ}$

Answer: D

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6. For the equlibrium

$CO + H_2O \Leftrightarrow CO_2 + H_2$

The relation between K_p and $K_c at 25^{\circ} C$ and at $100^{\circ} C$ are

A. $K_p = K_c, K_p = K_c$

B. $K_p = K_c(RT)^{-1}, K_p = K_c$

C. $K_p = K_c(RT), K_p = K_c(RT)$

D. $K_p = K_c(RT), K_p = K_c$

Answer: D

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7. What is the vapour density of mixture of PCL_5 at $250\,^\circ C$ when it has dissociated to the extent of $80\,\%$?

A. 58

B. 41.7

C. 52.25

D. 83.6

Answer: A

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8. The equlibrium constnt $\left(K_\rho\right)$ for the reaction,

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ at 1000K is $3.5atm^{-1}$ then find out equlibrium constnt $\left(K_\rho\right)$ for the reaction,

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

A. 0.35 atm

B. 3.5atm

C. 2.85 atm

D. 0.285 atm

Answer: D

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9. For the equlibrium $H_2O(s) \Leftrightarrow H_2O(l)$ which of the following statements is true?

A. The pressrue changes do not effect the equlibrium

B. More of ice melts, if pressrue on the system in increased

C. More of liquid freezes, if pressure on the system is increased

D. Less of ice melts, if pressrue on the system is increased

Answer: B

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10. Conjugate acid of PO_4^{-3} is

A. H_3PO_4

B. $H_3PO_4^-$

C. HPO_4^{-2}

D. HPO_3^-

Answer: C

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11. The dissociation constant of monobasic acids A.B and C are $10^{-4}, 10^{-6}$ and $10?^{-10}$ respectively, The concentration of each monobasic acid is 0.1 M Which of the following has been arranged in inc reasing order of pH ?

A. $C < B < A$

B. $A < B < C$

C. $B < C < A$

D. $B < A < C$

Answer: B

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12. Among the following, which causes the greatest change in pH on addition to 50 ml of 0.2 M oxalic acid solution?

A. Addition of 25 ml of 0.02 M oxalic acid

B. Addition of 25 ml of 1 M NaOH solution

C. Addition of 2 ml of 0.02 M NH_4OH solution

D. Addition of 50 ml of 0.2 M acetic acid solution

Answer: B

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13. What will be the H^+ concentration in a solution prepared by mixing 50.0 ml of 0.20 m NaCl, 25 ml of 0.10 M NaOH and 25.0 ml of 0.30 M HCl?

A. 0.5 M

B. 0.05 M

C. 0.02 M

D. 0.10 M

Answer: B

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14. To 250.0 ml of $M/50 H_2SO_4$, 4.0 g of solid NaOH is added and the resulting solution is

A. 12.0

B. 11.25

C. 11.95

D. 12.95

Answer: D

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15. One "mole" of $N_2O_4(g)$ at $300K$ is kept in a closed container under 1 atm. It is heated to $600K$, when $20\ \%$ by mass of $N_2O_4(g)$ decomposes to $NO_2(g)$. The resultant pressure is

A. 1.2 atm

B. 2.4 atm

C. 2.0 atm

D. 1.0 atm

Answer: B

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16. For the equlibrium $SO_3(g) \Leftrightarrow SO_2(g) + \frac{1}{2}O(2)(g)$ the molar mass at equlibrium was observed to be 60. then the degree of dissociation of SO_3 would be

A. 0.33

B. 0.66

C. 0.25

D. 0.50

Answer: B

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17. When a solution of benzoic acid was titrated with $NaOH$ the pH of the solution when half the acid neutralized was 4.2. Dissociation constant of the acid is

A. 6.31×10^{-5}

B. 3.2×10^{-5}

C. 8.7×10^{-8}

D. 6.42×10^{-4}

Answer: A

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18. If an aqueous solution at $25^{\circ} C$ has twice as many OH^{-} as pure water its pOH will be

A. 6.7

B. 7.3

C. 7

D. 6.98

Answer: A

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19. Let the solubilities of $AgCI$ in H_2O, and in $0.01MCaCI_2$, $0.01MNaCI$, and $0.05MAgNO_3$ be S_1, S_2, S_3, S_4, respectively. What is the correct relationship between these quantites.

A. $S_1 < S_2 < S_3 < S_4$

B. $S_1 > S_3 > S_2 > S_4$

C. $S_1 > S_2 = S_3 > S_4$

D. $S_1 > S_3 > S_4 > S_2$

Answer: B

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20. pH of saturated solution of $Ba(OH)_2$ is 12. The value of solubility product $\left(K_{sp}\right)$ of $Ba(OH)_2$ is

A. $10^{-6}M^3$

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

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

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

Answer: C

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Assignment Section C Objective Type Questions More Than One Option Are Correct

1. The following reaction attains equlibrium at high temperature

$N_2(g) + 2H_2O(g) + heat \Leftrightarrow 2NO(g) + 2H_2(g)$

The concentration of NO(g)is affected by

A. Increasing the nitrogen concentration

B. Decreasing the hydrogen concentration

C. Compression the reaction mixture

D. Addition of catalyst

Answer: A::B::C

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2. For the reaction $PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$ the forward reaction at constant temperature is favoured by

A. Introducing an inert gas at constant volume

B. Introducing $Cl_2(g)$ at constant volume

C. Increasing the volume of the container

D. Introducing PCl_5 at constant volume

Answer: C::D

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3. If the concentration of two monobasic acids are same, their relative strength can be compared by

A. $\frac{\alpha_1}{\alpha_2}$

B. $\frac{K_1}{K_2}$

C. $\frac{\left[H^+\right]_1}{\left[H^+\right]_2}$

D. $\sqrt{\frac{K_1}{K_2}}$

Answer: A::C::D

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4. Which of the following solution will have no effect on Ph on dilution ?

A. $0.1MNH_4OH + 0.1MNH_4Cl$

B. $0.5MH_2CO_3 + 0.5MNaHCO_3$

C. $1MCH_3COOHN_4$

D. $0.1MCH_3COONH_4$

Answer: A::B::C

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5. Which of the following is correct about the equlibrium ?

A. Cayalyst has no effect on equlibrium state

B. K_{aq} changes with temperatue

C. Value of K_{eq} changes by increasing concentration of equilibrium

D. $\Delta G = 0$

Answer: A::B::D

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6. Which of the following statements are correct ?

A. The pH of 1.0×10^{-8} M solution of HCl is 8

B. The conjugate base of $H_2PO_4^{-2}$

C. Auto-protolysis constant of water increases with temperature

D. neutralization point $pH = \left(\frac{1}{2}\right)pK_a$

Answer: B::C

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7. Equal volumes of following solutions are mixed. In which case the pH of resulting solution will be average value of pH of two solutions?

A. $pH = 2(HCl)$ and $pH = 12(NaOH)$

B. $pH = 2(HCl)$ and $pH = 4(HCl)$

C. $pH = 2(HCN)$ and $pH = 12(NaOH)\left(K_a ofHCN = 10^{-10}\right)$

D. $pH = 5\left(CH_3COOH\right)$ and $pH = 9\left(NH_3\right)(aq)\left(K_a ofHCN = 10^{-10}\right)$

Answer: A::D

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8. A weak base (BOH) with $K_b = 10^{-5}$ is titrated with a strong acid (HCl), At $3/4$ th of the equivalence point, pH of the solution is:

A. $5 + \log^{30}$

B. $5 - \log^{3}$

C. $9 - \log^{3}$

D. 8.523

Answer: C::D

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9. What is the difference in pH for $1/3$ and $2/3$ stages of neutralization of $0.1MCH_3COOH$ with $0.1MNaOH$?

A. $2\log\frac{1}{4}$

B. $2\log 3$

C. 0.9542

D. 0.3010

Answer: B::C

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10. Which of the following solution will have pH close to 7?

A. $100mlof\frac{M}{10}HCl + 100mlof\frac{M}{10}NaOH$

B. 1M solution of $CH_3COONH_4\left(K_a = K_b\right)$

C. $1Mmlof\frac{M}{10}H_2SO_4 + 100mlof\frac{M}{10}NaOH$

D. $100 mlof \frac{M}{10} HCl + 100 mlof \frac{M}{10} Ca(OH)_2$

Answer: A::B

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Assignment Section D Linked Comprehension Type Questions

1. Degree of dissociation (α)

α are the number of moles which are dissociating from 1 mole of given reactants and gas density measurements can be used to determine the degree of dissociatin. Let us take a general case where one molecule of a substance A splits up into n molecules of A(g) on heating i.e.,

$A_n(g) \Leftrightarrow nA(g)$

$t = 0 a$

$t = t_{eq} a - xnx \quad \alpha = \frac{x}{a} \Rightarrow x = a\alpha$

$a - a\alpha na\alpha$

Total number of Moles $= a - a\alpha + na\alpha$

$= [1 + (n - 1)\alpha]a$

Observed molecular weight of molar mass of the mixture

$M_{\text{mixture}} = \dfrac{M_{A_n}}{[1 + (n - 1)\alpha]}, M_{A_n} =$ Molar mass of A_n

A sample of mixture A(g), B(g)and C(g) under equlibrium has a mean molecular weight (observed) of 80.

The equlibrium is

$A(g) \Leftrightarrow B(g) + C(g)$

(Mol wt =100) (Mol. wt=60) (Mol. wt=40) Calculate the Degree of dissociation for given reaction.

A. 0.25

B. 0.5

C. 0.75

D. 0.8

Answer: A

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2. Degree of dissociation (α)

α are the number of moles which are dissociating from 1 mole of given reactants and gas density measurements can be used to determine the degree of dissociatin. Let us take a general case where one molecule of a substance A splits up into n molecules of A(g) on heating i.e.,

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$a - a\alpha na\alpha$

Total number of Moles $= a - a\alpha + na\alpha$

$= [1 + (n - 1)\alpha]a$

Observed molecular weight of molar mass of the mixture

$M_{\text{mixture}} = \frac{M_{A_n}}{[1 + (n - 1)\alpha]}, M_{A_n} =$ Molar mass of A_n

If the t otal mass of the mixture in question (1) is 300 gm, then moles of C(g) present are

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

B. $\frac{4}{3}$

C. $\frac{3}{4}$

D. $\frac{1}{2}$

Answer: C

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3. Pure water is netural in nature $\left[H^{+}\right] = \left[OH^{-}\right]$. When this condition is disturbed by changing the concentration of H^{+} or OH^{-}, the natural solution changes to acidic $\left\{\left[H^{+}\right] > \left[OH^{-}\right]\right\}$ or basic $\left\{\left[H^{+}\right] < \left[OH^{-}\right]\right\}$. This change occurs during salt hydrolysis. pH of salt solution can be calculate using the following relation

(i) Salt of weak acid and strong base

$$pH = \frac{1}{2}\left[pK_w + pK_a + \log C\right]$$

(ii) Salt of weak base and strong acid

$$pH = \frac{1}{2}\left[pK_w - pK_b - \log C\right]$$

(iii) For salt of weak base and strong acid

$$pH = \frac{1}{2}\left[pK_w + pK_a - pK_b\right]$$

The pH of buffer can be calculated using t he following formula

$$pH = pK_a + \log\frac{[\text{Salt}]}{[\text{Acid}]}$$

$$pOH = pK_b = \log\frac{[\text{Salt}]}{[\text{Base}]}$$

Answer t he following questions when

$pK_a = 4.7447$

$pK_b = 4.75$ lt rgt $pK_w = 14$

When 50 ml of 0.1 M NH_4OH is added to 50 ml of 0.05 M HCl solution, the pH is nearly

A. 1.60

B. 12.40

C. 4.75

D. 9.25

Answer: D

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4. Pure water is netural in nature $\left[H^+\right] = \left[OH^-\right]$. When this condition is disturbed by changing the concentration of H^+ or OH^-, the natural solution changes to acidic $\left\{\left[H^+\right] > \left[OH^-\right]\right\}$ or basic $\left\{\left[H^+\right] < \left[OH^-\right]\right\}$. This change occurs during salt hydrolysis. pH of salt solution can be calculate using the following relation

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$$pOH = pK_b = \log\frac{[\text{Salt}]}{[\text{Base}]}$$

Answer t he following questions when

$pK_a = 4.7447$

$pK_b = 4.7447$ ltb rgt $pK_w = 14$

When 50 ml of 0.1 m NaOH is added of 50 ml of $0.1MCH_3COOH$ solution the pH will be

A. 4.7447

B. 9.2553

C. 8.7218

D. 1.6020

Answer: C

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5. Pure water is netural in nature $\left[H^+\right] = \left[OH^-\right]$. When this condition is disturbed by changing the concentration of H^+ or OH^-, the natural solution changes to acidic $\left\{\left[H^+\right] > \left[OH^-\right]\right\}$ or basic $\left\{\left[H^+\right] < \left[OH^-\right]\right\}$. This change occurs during salt hydrolysis. pH of salt solution can be calculate using the following relation

(i) Salt of weak acid and strong base

$$pH = \frac{1}{2}\left[pK_w + pK_a + \log C\right]$$

(ii) Salt of weak base and strong acid

$$pH = \frac{1}{2}\left[pK_w - pK_b - \log C\right]$$

(iii) For salt of weak base and strong acid

$$pH = \frac{1}{2}\left[pK_w + pK_a - pK_b\right]$$

The pH of buffer can be calculated using t he following formula

$$pH = pK_a + \log\frac{[\text{Salt}]}{[\text{Acid}]}$$

$$pOH = pK_b = \log\frac{[\text{Salt}]}{[\text{Base}]}$$

Answer t he following questions when

$pK_a = 4.7447$

$pK_b = 4.7447$ ltb rgt $pK_w = 14$

1 mole of CH_3COOH is dessolved in water to from 1 litre aqueous solution. The pH of resulting solution will be

A. 9.2253

B. 2.3723

C. 14

D. 7

Answer: B

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6. pH is the negative logarithm of H^+

$pH = \log\left[H^+\right]$

$HCl < H^+ + Cl^-$

$H_2O \Leftrightarrow H^+ + OH^-$

$K_W = \left[H^+\right]\left[OH^-\right]$

K_W depend on the temperatue. With rise in temperature K_W increases.

At 298 K, pH of pure water = 7

At 373 K, pH of the pure water is

A. 7

B. > 7

C. < 7

D. Cannot be stated

Answer: C

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7. pH is the negative logarithm of H^+

$pH = \log\left[H^+\right]$

$HCl < H^+ + Cl^-$

$H_2O \Leftrightarrow H^+ + OH^-$

$K_W = \left[H^+\right]\left[OH^-\right]$

K_W depend on the temperatue. With rise in temperature K_W increases.

At 298 K, pH of pure water = 7

The exact concentration of H^+ in 10^{-6} M HCl given by

A. $10^{-6} + 10^{-8}$

B. $10^{-6} + 10^{-7}$

C. 10^{-6}

D. $10^{-6} - 10^{-7}$

Answer: B

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8. pH is the negative logarithm of H^+

$pH = \log\left[H^+\right]$

$HCl < H^+ + Cl^-$

$H_2O \Leftrightarrow H^+ + OH^-$

$K_W = \left[H^+\right]\left[OH^-\right]$

K_W depend on the temperatue. With rise in temperature K_W increases.

At 298 K, pH of pure water = 7

The pH at first equivalance of H_3PO_4 vs NaOH will be

A. 7

B. > 7

C. < 7

D. Depend on the concentration of titrant

Answer: C

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Assignment Section E Assertion Reason Type Questions

1. STATEMENT-1: For a given reaction at fixed temperatures, equlibrium constants K_p and K_c are realated as $K_p = K_c(RT)^{\Delta n}$

STATEMENT-2: $\Delta n = N \odot$ of moles of product - No of moles of reactants.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a 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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2. STATEMENT-1: Equlibrium constant does not depend upon concentration of various reactants, presence of catalyst, direction from which equilibrium is reached.

STATEMENT-2 : Equlibrium constant is only dependent upon the temperature.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-2

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-2

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. Assertion (A): pK_a of a weak acid become equal of the pH of the solution at the mid-point of titration.

Reason (R) : The molar concentration of the proton donor an proton acceptor beomes equal at the mid-point.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-3

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-3

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

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4. STATEMENT-1 : When a small amount of strong acid is added to a buffer solution, its pH value does not change signific antly

STATEMENT-2 : Buffer action of the buffer sloution resist the changee in pH when small amount of acid is added to it

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-4

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-4

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

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5. STATEMENT-1: pH of water decreases with increase in temperature.

STATEMENT-2 : K_w of water decreases with increase in temperature.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-5

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-5

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-2: It is difficult to distinguish between the strenghts of the strong acids like HCl, HNO_3, $HClO_4$ etc. in dilute aqueous solution.

STATEMENT-2 : In dilute aqueous solution, all strong acids donate a

proton to water and are essentially $100\ \%$ ionised to produce a solution containing H_3O^+ ions plus t he anions of strong acid.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-6

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-6

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: A

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7. STATEMENT-1: Solubility of $BaSO_4$ in 0.1 M $Na_2SO_4 is 10^{-9}$ M hence its K_{sp} is 10^{-18}.

STATEMENT-2: In aqueous solution, solubility product of $BaSO_4 = S^2$. (Where S is solubility of $BaSO_4$)

A. Statement-1 is True, Statement-2 is True, Statement-2 is a 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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8. STATEMENT-1: $CaCo_3(s) \Leftrightarrow CaO(s) + CO_2(g)$, for given equlibrium $K_p = pCO_2$.

STATEMENT-2: If we add $CaCO_3$, equlibrium will shift in forward direction

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-8

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-8

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: C

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9. STATEMENT-1: For $H_2O(l) \Leftrightarrow H_2O(g)$ vapour pressure if P atm then K_ρ is equal to vapour pressure

STATEMENT-2: K _ (ρ) can be changed by adding more H_2O vapour from our side

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-9

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-9

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: C

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10. STATEMENT-1: For a hypotherical equlibrium, $AB_2(g) \Leftrightarrow AB(g), K_\rho$ is always greater than K_c.

STATEMENT-2: Relation of K_ρ and K_c will be $K_\rho = K_c(RT)\Delta_{ng}$.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-10

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-10

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: D

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11. STATEMENT-1: Buffer capacity is maximum when concentrtion of salt is equal concentrtion of acid.

STATEMEN T-2: pH of the buffer is given by pH=$pK_a + \log\frac{[\text{salt}]}{[\text{acid}]}$.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-11

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-11

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: B

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12. STATEMENT-1: HCl is a strong acid and true electrolyte.

STATEMENT-2: Liquid HCl is bad conductor of electricity.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-12

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-12

C. Statement-1 is True, Statement-2 is False

D. Statement-1 is False, Statement-2 is True

Answer: D

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Assignment Section F Matrix Match Type Questions

1. Match Column-I with Columnn-II

Column-I	Column-II
(A) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$	(p) $\Delta n_g > 0$
(B) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$	(q) $K_p < K_c$
(C) $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$	(r) K_p not defined
(D) $CH_3COOC_2H_5(l) + H_2O(l) \rightleftharpoons CH_3COOH(l) + C_2H_5OH(l)$ (assume temperature = 25°C)	(s) $K_p > K_c$

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Assignment Section G Integer Answer Type Questions

1. Equal volumes of solution of $pH = 6$ and $pH = 8$ are mixed. What will be the pH of resulting mixture?

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2. In Homogeneous gaseous equlibrium, $M(h) + 3N(g) \Leftrightarrow 4P(g)$. Initial concentration of M is equal to that of N is equlibrium concentration of

M and P are equal then what will be the value of K_c?

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3. K_a for a monobasic organic acid is 2×10^{-5} wiat is pH of 0.2 M aqueous solution of its salt formed with KOH?

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4. $NH_4COONH_2(s) \Leftrightarrow 2NH_3(g) + CO_2(g)$ If equilibrium pressure is 3 atm for the above reaction, then K_p for the reaction is

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5. Find the pH of a buffer solution having equal volumes of $0.2MNH_4OH$ and $0.2MNH_4Cl\left(K_b \text{ for base } = 1.0 \times 10^{-5}\right)$

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Assignment Section H Multiple True False Type Questions

1. STATEMENT-1 : pH of water at $25^{\circ} C$ is less than the pH at $4^{\circ} C$.

STATEMENT-2: Water is more ac idic at $25^{\circ} C$ then at $4^{\circ} C$.

STATEMENT-3: Water is netureal at all temperatures

A. T F T

B. F F T

C. F T T

D. T T F

Answer: A

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2. STATEMENT-1: Autoprotolysis constant of water increases with the increase in temperature.

STATEMENT-2: When a solution of a weak monobasic acid is titrated wita

a strong base, at half neutralization point $pH = pK_a + 1$.

STATEMENT-3: The pH of 10^{-8} m HCl is 8.

A. F F T

B. T F F

C. F T T

D. T T T

Answer: B

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3. STATEMENT-1 Net reaction can occur only if a system is in equlibrium.

STATEMENT-2: All reactin tends to be in a state of equlibrium.

STATEMENT-3: At equlibrium, ΔG is zero.

A. T T F

B. F T T

C. T T T

D. F T F

Answer: C

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4. STATEMENT-1: Catalyst change the activation energy.

STATEMENT-2: Catalyst can change equlibrium.

STATEMENT-3: K_p is temperature dependent.

A. T F T

B. F T T

C. F F T

D. T T T

Answer: A

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Assignment Section I Subjective Type Questions

1. One "mole" of $N_2O_4(g)$ at $300K$ is kept in a closed container under 1 atm. It is heated to $600K$, when $20\,\%$ by mass of $N_2O_4(g)$ decomposes to $NO_2(g)$. The resultant pressure is

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2. Density of equilibrium mixture of N_2O_4 and NO_2 at $1atm$ and $384K$ is $1.84gdm^{-3}$. Calculate the equilibrium constant of the reaction.

$N_2O_4 \Leftrightarrow 2NO_2$

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3. 15 g sample of BaO_2 is heated to $794^\circ C$ in a closed evacuated vessel of 5 litre capacity. How many g of peroxide are converted to $BoO(s)$?

$2BaO_2(s) \Leftrightarrow 2BaO(s) + O_2(g), K_p = 0.5$ atm

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4. Calculate the pH at the equivalence point during the titration of $0.1M, 25mL CH_3COOH$ with $0.05M NaOH$ solution. $\left[K_a\left(CH_3COOH\right) = 1.8 \times 10^{-5}\right]$

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5. Calculate the change in pH of 1 litre buffer solution containing 0.1 mole each of NH_3 and NH_4CI upon addition of:

(i) 0.02 mole of dissolved gasous HCI.

(ii) 0.02 mole of dissolved of NaOH.

Assume no change in volume. $K_{NH_3} = 1.8 \times 10^{-5}$

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6. Two solid compounds A and B dissociate into gaseous products at $20^{\circ} C$ as

a. $A(s) \Leftrightarrow A'(s) + H_2S(g)$

b. $B(s) \Leftrightarrow B'(g) + H_2S(g)$

At $20^{\circ} C$ pressure over excess solid A is 50 mm and that over excess solid B is 68 mm. Find:

a. The dissociation constant of A and B

b. Relative number of moles of A' and B' in the vapour phase over a mixture of the solids A and B.

c. Show that the total pressure of gas over the solid mixture would be 84.4 mm.

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7. The $K_{SP} of Ca(OH)_2 is 4.42 \times 10^{-5} at 25^{\circ} C$. A 500 mL of saturated solution of $Ca(OH)_2$ is mixed with equal volume of $0.4 MNaOH$. How much $Ca(OH)_2$ in mg is preciptated ?

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8. The pH of blood stream is maintained by a proper balance of H_2CO_3 and $NaHCO_3$ concentrations. What volume of 5 M $NaHCO_3$ solution, shnould be mixed with 10 mL sample of blood, which is 2 M in H_2CO_3 in order to maintain a pH of 7.4$\left(K_af \text{ or } H_2CO_3\text{in blood} = 7.8 \times 10^{-7}\right)$

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9. The solubility product of $BaSO_4$ and $BaCrO_4$ at $25^\circ C$ are 1×10^{-10} respectively. Calculate the simultaneous solubilities of $BaSO_4$ and $BaCrO_4$.

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Assignment Section J Aakash Challengers Questions

1. The exact concentration of H^+ ion in 10^{-3} molar HCl aq solution at 298 K is

A. $10^{-3} + 10^{-7}$

B. $10^{-3} + \frac{K_w}{\left[H^+\right]}$

C. $10^{-3} + \frac{K_w}{\left[OH^-\right]}$

D. 10^{-3}

Answer: B

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2. In ammonia formation process, due t o increase in pressure, equlibrium will shift in

A. Forward direction

B. Backward direction

C. No effect

D. May be forward or in backward direction.

Answer: B

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3. 4 mole of N_2O_4 is taken in container of unit volume at any temperature. After some time, equlibrium is attained and vapour density of mixture is 34.5. The value of ΔG will be

A. Zero

B. 9.2 Kcal

C. 50 Kcal

D. Data is insufficient to colculate

Answer: A

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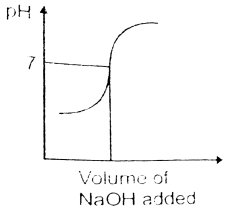
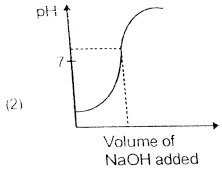
4. Which of the following pH curve represent the titration of weak acid and strong base (dotted line show equivalence point)?

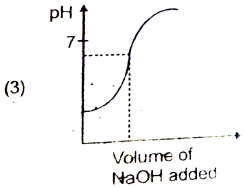
A.



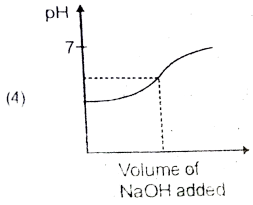
B.



C.



D.



Answer: B

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5. Which of the followig equilibrium will shift in forward direction on increase of pressure?

A. $S_{\text{solid}} \Leftrightarrow S_{\text{liquid}}$

B. $H_2O_{ice} \Leftrightarrow H_2O(l)$

C. $Ga_s \Leftrightarrow Ga_{(\text{liquid})}$

D. Both 2 & 3

Answer: D

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6. The equilibrium constant of given reaciton will be

$HCO_3^- + H_2O \Leftrightarrow H_2CO_3 + OH^-$

A. $\sqrt{K_w}$

B. $\left(\frac{K_w}{K_{a_1}}\right)$

C. $\frac{K_w}{K_{a_2}}$

D. $K_w K_{a_1}$

Answer: B

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Exercise

1. In a closed system : $A(s) \Leftrightarrow 2B(g) + 3C$, if the partial pressure of C is doubled, then partial pressure of B will be

A. Twice the orignal pressure

B. Halfof its original pressure

C. $\frac{1}{2\sqrt{2}}$ times the original pressure

D. $2\sqrt{2}$ times its original pressure

Answer: C

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2. Sulphide ion reacts with solid sulphur

$S_{(aq)}^{2-} + S_{(s)} \Leftrightarrow S_{2(aq)}^{2-}, k_1 = 10$

$S_{(aq)}^{2-} + 2S_{(s)} \Leftrightarrow S_{3(aq)}^{2-} k_2 = 130$

The equilibrium constant for the formation of $S_3^{2-}(aq)$ from $S_2^{2-}(aq)$ and sulphur is

A. 10

B. 13

C. 130

D. 1300

Answer: B

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3. For the reaction $CaCO_{3(s)} \Leftrightarrow CaO_{(s)} + CO_{2(g)} k_p$ is equal to

A. K_c

B. $K_c RT$

C. $K_c (RT)^2$

D. $K_C (RT)^{-1}$

Answer: B

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4. The active mass of 7.0 g of nitrogen in a 2.0 L container would be

A. 0.25

B. 0.125

C. 0.5

D. 14.0

Answer: B

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5. For the system $3A + 2B \Leftrightarrow$ C, the expression for equilibrium constant is

A. $\frac{[3A] \times [2B]}{[C]}$

B. $\frac{[A]^3 \times [B]}{[C]}$

C. $\frac{[C]}{[A]^3 \times [B]^2}$

D. $\frac{[C]}{[3A] \times [2B]}$

Answer: C

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6. A state of equilibrium is reached when

A. The rate of forward reaction is greater than the the rate of the reverse reaction

B. The concentration of the products and reactants are equal

C. More product is present than reactant

D. The concentration of the products and reactants have reached constant value

Answer: D

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7. In which of the following does the reaction go almost to completion ?

A. $A \Leftrightarrow B\left(K = 10^{3}\right)$

B. $P \Leftrightarrow Q\left(K = 10^{-2}\right)$

C. $A + B \Leftrightarrow C + D(K = 10)$

D. $X + Y \Leftrightarrow XY_{2}\left(K = 10^{-1}\right)$

Answer: A

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8. K_p/K_c for the reaction

$CO(g) + \frac{1}{2}O_2(g) \Leftrightarrow CO_2(g)$ is

A. $\frac{R}{T}$

B. RT

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

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

Answer: D

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9. For the reaction $A + 3B \Leftrightarrow 2C + D$ initial mole of A is twice that of B . If at equilibrium moles of B and C are equal , then percent of B reacted is

A. 0.1

B. 0.2

C. 0.4

D. 0.6

Answer: D

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10. The equilibrium $A(g) + 4B(g) \Leftrightarrow AB_4(g)$ is attained by mixing equal moles of A and B in a one litre vessel Then at equilibrium

A. [A]=[B]

B. $[A] > [B]$

C. $[A] < [B]$

D. $\left[AB_4\right] > [A]$

Answer: B

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11. The numerical value of equilibrium constant depends on

A. Temperature

B. pressure

C. Concentration of reactants

D. All of these

Answer: A

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12. The favourable conditions for melting of ice is

A. Low pressure

B. High pressure

C. low temperature

D. Absence of catalyst

Answer: B

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13. The oxidation of SO_2 to SO_3 is an exothermic reaction. The yield of SO_3 will be maximum if :

A. Temperature and pressure both are increased

B. Temperature decreased , pressure increased

C. Temperature increased , pressure constant

D. Temperature and pressure both decreased

Answer: B

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14. K_c for $A + B \Leftrightarrow C + D$ is 10 at $25^\circ C$. If a container contains 1, 2, 3, 4 $mol/litre$ of A, B, C and D respectively at $25^\circ C$, the reaction shell proceed:

A. From left to right

B. From right to left

C. Reaction is at equilibrium

D. Unpredictable

Answer: A

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15. For the reaction $CO(g) + 2H_2(g) \Leftrightarrow CH\_3OH(g)$. If active mass of CO is kept constant and active mass of H_2 is tripled, the rate of of forward reaction will become

A. Three times

B. Six times

C. Eight times

D. Nine times

Answer: D

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16. The equilibrium constant for the reaction $H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$ is 32 at a given temperature. The equilibrium concentration of I_2 and HI are 0.5×10^{-3} and $8 \times 10^{-3} M$ respectively. The equilibrium concentration of H_2 is

A. $1 \times 10^{-3} M$

B. 0.5×10^{-3} M

C. 2×10^{-3} M

D. 4×10^{-3} M

Answer: D

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17. For the reaction is equilibrium :

$2NOBr_{(g)} \Leftrightarrow 2NO_{(g)} + Br_{2(g)}$

If P_{Br_2} is $\frac{P}{9}$ at equilibrium and P is total pressure, prove that $\frac{K_p}{P}$ is equal to $\frac{1}{81}$.

A. $\frac{1}{9}$

B. $\frac{1}{81}$

C. $\frac{1}{27}$

D. $\frac{1}{3}$

Answer: B

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18. When 20 g of $CaCO_3$ were put into 10 litre flask and heated to $800^\circ C, 30\%$ of $CaCO_3$ remained unreacted at equilibrium K_p for decomposition of $CaCO_3$ will be

A. 1.145 atm

B. 1.231 atm

C. 2.146 atm

D. 3.145 atm

Answer: B

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19. At temperature T k PCI_5 is 50% dissociated at an equilibrium pressure of 4 atm. At what pressure it would dissociate to the extent of 80% at the same temperature ?

A. 0.05 atm

B. 0.60 atm

C. 0.75 atm

D. 2.50 atm

Answer: C

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20. For the equilibrium

$CH_3CH_2CH_2CH_{3(g)} \Leftrightarrow CH_3 - CH \mid CH_3$ iso-butane $- CH_{3(g)}$

If the value of K_c is 3.0 the percentage by mass of iso-butane in the equilibrium mixture would be

A. 0.75

B. 0.9

C. 0.3

D. 0.6

Answer: A

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21. $2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g), \Delta H = -92.2$ kJ. Which of the following condition will shift the equilibrium in the forward direction ?

A. CO is removed

B. CH_3OH is added

C. The pressure of the system is increased

D. Temperature of the system is increased

Answer: C

Watch Video Solution

22. In the manufacture of NH_3 by Haber's process involving the reaction

$$N_2(g) + 3H_2(g) \xrightleftharpoons{[F_{o_2}O_2]} 2NH_3(g)$$

$\Delta H = -22.08$ kcal . The fovourable conditions are

A. High pressure and low temperature

B. Low pressure and low temperature

C. High pressure and high temperature

D. Low pressure and high temperature

Answer: A

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23. Ice and water are placed in a closed container at a pressure of 1 atm and 273.15 K temperature . If pressure of the system is increased by 2 atm keeping temperature constant the correct observation would be

A. The liquid phase disappears completely

B. The amount of ice increases

C. The solid phase (ice) disappears completely

D. Volume of the system increases

Answer: C

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24. In the system $Fe(OH)_{3(s)} \Leftrightarrow Fe_{(aq)}{}^{3+} + 3OH^{-}_{(aq)}$, decreasing the conc. Of OH^{-} ions $\frac{1}{3}$ times cause the equilibrium conc. Of Fe^{3+} to increase ..... Times

A. 3

B. 9

C. 18

D. 27

Answer: D

Watch Video Solution

25. A cylinder filled with a movable piston contains liquid water in equilibrium with water vapour at $25^{\circ}C$. Which one of the following operations results in a decrease in the equilibrium vapour pressure ?

A. Moving 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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26. Which of the following changes the value of the equilibrium constant ?

A. Change in concentration of reactant

B. Change in amount of catalyst

C. Change in pressure

D. Change in temperature

Answer: D

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27. Choose the correct statement

A. Catalyst increases the rate of reaction

B. Catalyst decreases the time of attainment of equilibrium

C. Catalyst decreases the activation energy

D. All of correct

Answer: D

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28. In which of the following equilibrium , change in pressure will not affect the equilibrium ?

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

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

C. $PCI_5(g) \Leftrightarrow PCI_3(g) + CI_2(g)$

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

Answer: B

Watch Video Solution

29. If K_1 is the equilibrium constant at temperature T_1 and K_2 is the equilibrium constant at temperature T_2 and If $T_2 > T_1$ and reaction is endothermic then

A. $K_2 < K_1$

B. $K_2 = K_1$

C. $K_2 > K_1$

D. All of these

Answer: C

Watch Video Solution

30. If Ar is added to the equilibrium $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3$ at constant volume , the equilibrium will

A. Shift in forward direction

B. Shift in reverse direction

C. Not shift in any direction

D. All are incorrect

Answer: C

Watch Video Solution

31. In which of the following case pH is greater than 7 ?

A. 50 ml of 0.1 M HCI+50 ml of 0.1 M NaCI

B. 50 ml of 0.1 M H_2SO_4 +50 ml of 0.2 M NaOH

C. 50 ml of 0.1 M CH_3COOH +50 mol of 0.1 M KOH

D. 50 ml of 0.1 M HNO_3 +50 ml of 0.1 NH_3

Answer: C

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32. The compound that is not a Lewis acid

A. $AICI_3$

B. BF_3

C. NF_3

D. $SnCI_4$

Answer: C

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33. The pH of a solution obtained by mixing 100 ml of 0.2 M CH_3COOH with 100 ml of 0.2 N NaOH will be

$\left(pK_a \text{for } CH_3COOH = 4.74 \text{ and } \log 2 = 0.301\right)$

A. 4.74

B. 8.87

C. 9.1

D. 8.57

Answer: B

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34. With increases in temperature pH of pure water

A. increases

B. Decreases

C. Remains constant

D. May increase or decrease

Answer: B

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35. The pH of a solution increased from 3 to 6. Its $\left[H^{\oplus}\right]$ will be

A. Reduced to half

B. Doubled

C. Reduced by 1000 times

D. Increased by 1000 times

Answer: C

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36. Which pair will show common ion effect ?

A. $BaCI_2 + Ba\left(NO_3\right)_2$

B. $NaCI + HCI$

C. $NH_4OH + NH_4CI$

D. $NaCN + KCN$

Answer: C

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37. The pH of solution at $25^\circ C$ which has twice as many hydroxide ion as in pure water at $25^\circ C$, will be

A. 14

B. 9

C. 6.699

D. 7.301

Answer: D

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38. Fear or exitement, generally cause one to breathe rapidaly and it results in the decrease of concentration of CO_2 in blood. In what way it will change pH of blood ?

A. pH will decreases

B. pH will increases

C. pH will adjust to 7

D. pH will remain unchanged

Answer: D

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39. Which of the following can act as a lewis acid ?

A. H_2O

B. $B(OH)_3$

C. BF_3

D. Both (2) & (3)

Answer: D

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40. Which of the following is an Arrhenius base ?

A. H_2SO_4

B. $NaOH$

C. H_3PO_4

D. All of these

Answer: B

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41. For a MX_2 type salt if K_{sp} is solubility product, then solubility will be

A. $S = \sqrt{\frac{K_{sp}}{2}}$

B. $S = \sqrt[3]{\frac{K_{sp}}{4}}$

C. $S = \sqrt[3]{\frac{K_{sp}}{6}}$

D. $S = \sqrt[3]{\frac{K_{sp}}{8}}$

Answer: B

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42. The compound whose $0.1M$ solution is basic is

A. Ammonium acetate

B. Ammonium chloride

C. Ammonium sulphate

D. sodium acetate

Answer: D

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43. The correct order of increasing solubility of AgCI in

(A) water (B) 0.1 M NaCI

(C) 0.1 M $BaCI_2$ (D) 0.1 M NH_3 is

A. $A < B < C < D$

B. $B < C < A < D$

C. $C < B < D < A$

D. $C < B < A < D$

Answer: D

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44. The solubility of AgCI is

A. $\sqrt{K_{sp}}$

B. $\left(K_{sp}\right)^{1/3}$

C. $\left(\frac{K_{sp}}{4}\right)^{1/3}$

D. $\left(8K_{sp}\right)^{1/2}$

Answer: A

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45. If the K_b value in the hydrolysis reaction

$B^+ + H_2O \Leftrightarrow BOH + H^+$

is 1.0×10^{-6}, then the hydrolysis contant of the salt would be

A. 1×10^{-6}

B. 1×10^{-7}

C. 1×10^{-8}

D. 1×10^{-9}

Answer: C

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46. Which of the following increasing order of pH of 0.1 M solution of the compound

(A) $HCOONH_4$

(B) CH_3COONH_4

(C) CH_3COONa

(D) NH_4CI is correct ?

A. $A < D < B < C$

B. $D < A < C < B$

C. $A < D < C < B$

D. $D < A < B < C$

Answer: D

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47. The dissociation constant of a weak acid HA and weak base BOH are 2×10^{-5} and 5×10^{-6} respectively.

The equilibrium constant for the neutralization reaction of the two is (ignnore hydrolysis of resulting salt)

A. 1.0×10^{-4}

B. 1.0×10^{-10}

C. 2.5×10^{-1}

D. 1.0×10^{4}

Answer: B

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48. K_{sp} of $Mg(OH)_2$ is 4.0×10^{-12}. The number of moles of moles of Mg^{2+} ions in one litre of its saturated solution in 0.1 M NaOH is

A. 4.0×10^{-10}

B. 1.0×10^{-4}

C. 2.0×10^{-6}

D. 8.0×10^{-6}

Answer: A

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49. If the solubility of $AI_2\left(SO_4\right)$ is S , then its solubility product is

A. $27S^3$

B. $54S^4$

C. $108S^5$

D. $64S^3$

Answer: C

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50. Which of the following is correct for the solution of the salt of weak acid & weak base ?

A. $pH = \frac{1}{2}\left[pK_w + pK_a - pK_b\right]$

B. $pH = \frac{1}{2}\left[pK_w - pK_a - pK_b\right]$

C. $pH = \frac{1}{2}\left[pK_w + pK_a + pK_b\right]$

D. $pH = \frac{1}{2}\left[pK_w \times pK_a \times pK_b\right]$

Answer: A

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Assignment Section A

1. The K_c for given reaction will be $A_2(g) + 2B(g) \Leftrightarrow C(g) + 2D(s)$

A. $K = \dfrac{[C][D]^2}{[A_2][B]^2}$

B. $K = \dfrac{[C]}{[A_2][B]^2}$

C. $K = \dfrac{[A_2][B]^2}{[C][D]^2}$

D. $K = \dfrac{[A_2][B]^2}{[C]}$

Answer: B

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2. For which of the following reaction the degree of dissociation (α) and equilibrium constant $\left(K_p\right)$ are related as $K_p = \dfrac{4\alpha^2 P}{\left(1 - \alpha^2\right)}$?

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

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

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

D. $PCI_3(g) + CI_2(g) \Leftrightarrow PCI_5(g)$

Answer: A

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3. In which of the following does the reaction go almost to completion ?

A. $K_c = 10^3$

B. $K_{=}c = 10^2$

C. $K_c = 10^{-2}$

D. $K_c = 10^{-3}$

Answer: A

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4. In a chemical equilibrium, the rate constant for the backward reaction is 7.5×10^{-4} and the equilibrium constant is 1.5 the rate constant for the forward reaction is:

A. 2×10^{-3}

B. 15×10^{-4}

C. 1.125×10^{-3}

D. 9.0×10^{-4}

Answer: C

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5. K_p is how many times equal to K_c for the given reaction ?

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

A. $\frac{1}{R^2T^2}$

B. R^2T^2

C. $\frac{R}{T}$

D. RT

Answer: A

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6. $4gH_2, 32gO_2, 14gN_2$ and 11_gCO_2 are taken in a bulb of 500 ml. Which one of these has maximum active mass ?

A. H_2

B. O_2

C. N_2

D. CO_2

Answer: A

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7. For reaction $2A + B \Leftrightarrow 2C, K = x$

Equilibrium constant for $C \Leftrightarrow A + 1/2B$ will be

A. x

B. $\frac{x}{2}$

C. $\frac{1}{\sqrt{x}}$

D. $\sqrt{x}$

Answer: C

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8. XY_2 dissociates as

$XY_2(g) \Leftrightarrow XY(g) + Y(g)$

Initial pressure XY_2 is 600 mm Hg. The total pressure at equilibrium is 800 mm Hg. Assuming volume of system to remain cosntant ,the value of K_p is

A. 50

B. 100

C. 20

D. 400

Answer: B

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9. The initial pressure of $COCI_2$ is 1000 torr. The total pressure of the system becomes 1500 torr, when the equilibrium

$COCI_2(g) \Leftrightarrow CO(g) + CI_2(g)$ is attained at constant temperature . The value of K_p of a reaction.

A. 1500

B. 1000

C. 2500

D. 500

Answer: D

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10. Hydrogen (a moles) and iodine (b moles) react to give 2x moles of the HI at equilibrium . The total number of moles at equilibrium is

A. a+b+2x

B. (a-b)+(b-2x)

C. (a+b)

D. a+b-x

Answer: C

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11. When ethanol and acetic acid are mixed together in equimolar proportions, equilibrium is attained when $2/3rd$ of acid and alcohol are consumed. The equilibrium constant for the reaction is

A. 0.4

B. 4

C. 40

D. 0.04

Answer: B

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12. Two moles of N_2 and two moles of H_2 are taken in a closed vessel of 5 litres capacity and suitable conditions are provided for the reaction. When the equilibrium is reached ,it is found that a half mole of N_2 is used up. The equilibrium concentration of NH_3 is

A. 0.3

B. 0.4

C. 0.2

D. 0.1

Answer: C

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13. 1 moles of NO_2 and 2 moles of CO are enclosed in a one litre vessel to attain the following equilibrium $NO_2 + CO \Leftrightarrow NO + CO_2$. It was estimated that at the equilibrium , 25% of initial amount of CO is consumed. The equilibrium constant K_p is

A. 1

B. $1/2$

C. $1/4$

D. $1/3$

Answer: D

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14. Two moles of NH_3 gas are introduced into a previously evacuated one litre vesel in which it partially dissociates at high temperature as $2NH_3(g) \Leftrightarrow N_2(g) + 3H_2(g)$ .at equilibrium , one mole of $NH_3(g)$ remain . The value of K_c is

A. 3

B. $27/16$

C. $3/2$

D. $27/64$

Answer: B

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15. 4.0 moles of PCI_5 dissociated at 760 K in a 2 litre flask $PCI_5(g) \Leftrightarrow PCI_3(g) + CI_2(g)$ at equilibrium .

0.8 mole of CI_2 was present in the flask .The equilibrium constant would be

A. 1.0×10^{-1}

B. 1.0×10^{-4}

C. 1.0×10^{-2}

D. 1.0×10^{-3}

Answer: A

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16. When 3.00 mole of A and 1.00 mole of B are mixed in a 1,00 litre vessel , the following reaction takes place

$A(g) + B(g) \Leftrightarrow 2C(g)$

the equilibrium mixture contains 0.5 mole of C. What is the value of equilibrium constant for the reaction ?

A. 0.12

B. 6

C. 1.5

D. 3

Answer: A

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17. At 700 K, the equilibrium constant, K_p for the reaction $2SO_3(g) \Leftrightarrow 2SO_2(g) + O_2(g)$ is 1.8×10^{-3} atm. The value of K_c for the above reaction at the same temperature in moles per litre would be

A. 1.1×10^{-7}

B. 3.1×10^{-5}

C. 6.2×10^{-7}

D. 9.3×10^{-7}

Answer: B

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18. Which one of the following equilibrium moves backward when pressure is applied ?

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

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

C. water $\Leftrightarrow$ Ice

D. $I_2(g) \Leftrightarrow I_2(s)$

Answer: C

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19. In melting of ice , which one of the conditions will be more favourable ?

A. High temp. and high pressure

B. Low temp. and low pressure

C. Low temp. and high pressure

D. High temp. and low pressure

Answer: A

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20. Given reaction is $2X_{(gas)} + Y_{(gas)} \Leftrightarrow 2Z_{(gas)} + 80$ Kcal

Which combination of pressure and temperature gives the highest yield of Z at equilibrium ?

A. 1000 atm and $500^\circ C$

B. $500\text{atm and } 500^\circ C$

C. 1000 atm and $100^\circ C$

D. 500 atm and $100^\circ C$

Answer: C

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21. Calculate the percentage ionization of 0.01 M acetic acid in 0.1 M HCI

K_a of acetic acid is 1.8×10^{-5}

A. 0.0018

B. 0.0001

C. 0.018

D. 0.18

Answer: B

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22. 0.2 M solution of formic acid is ionized 3.2 % . Its ionization constant is

A. 9.6×10^{-3}

B. 2.1×10^{-4}

C. 1.25×10^{-6}

D. 2.1×10^{-8}

Answer: B

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23. At $100\ ^\circ C, K_w = 10^{-12}$. PH of pure water at $100\ ^\circ C$ will be

A. 7.0

B. 6.0

C. 8.0

D. 12.0

Answer: B

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24. A monoprotic acid in a 0.1 M solution ionizes to 0.001%. Its ionisation constant is

A. 1.0×10^{-3}

B. 1.0×10^{-6}

C. 1.0×10^{-8}

D. 1.0×10^{-11}

Answer: D

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25. when 0.2 mole of ammonia is dissolved in sufficient water to make 1 litre of solution. The solution is found to have a hydroxide ion concentration of 1.34×10^{-3}. The dissociation constant of ammonia is

A. 1.8×10^{-5}

B. 1.6×10^{-6}

C. 1.34×10^{-3}

D. 1.8×10^{-4}

Answer: A

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26. A solution of NaOH contain 0.04 gm of NaOH per litre. Its pH is

A. 10

B. 9

C. 11

D. 12

Answer: C

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27. 1 c.c of 0.1 N HCI is added to 1 litre solution of sodium chloride. The pH of the resulting solution will be

A. 7

B. 0

C. 10

D. 4

Answer: D

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28. 100 c.c of N/10 NaOH solution is mixed with 100 c.c of N/5 HCI solution and the whole volume is made to 1 litre . The pH of the resulting solution will be

A. 1

B. 2

C. 3

D. 4

Answer: B

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29. The pH of a solution is zero. The solution is

A. Neutral

B. Normal acid

C. Decinormal acid

D. Strongly alkaline

Answer: B

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30. 100 ml of 0.1 N NaOH is mixed with 50 ml of 0.1 N H_2SO_4 . The pH of the resulting solution is

A. < 7

B. > 7

C. $= 7$

D. Cannont be predicted

Answer: C

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31. The pH of 0.016 M NaOH solution is

A. 1.796

B. 12.204

C. 11

D. None of these

Answer: B

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32. pH of 1 M HCl is

A. zero

B. -2

C. 7

D. 14

Answer: A

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33. For a acid 'A' pH =2 and for acid 'B' pH is 4. Then

A. A is more basic than B

B. B is more acidic than A

C. A is more acidic than B

D. B is more basic than A

Answer: C

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34. The addition of solid sodium carbonates to pure water causes

A. An increases in the hydronium ion concentration

B. An increase in pH

C. No change in pH

D. A decreases in the hydroxide ion concentration.

Answer: B

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35. A buffer solution can be prepared from a mixture of

1. Sodium acetate and acetic acid in water

2. Excess sodium acetate and hydrochloric acid in water

3. Ammonia and ammonia chloride in water

4. Ammonia and sodium hydroxide in water.

A. 1,3,4

B. 2,3,4

C. 1,2,4

D. 1,3

Answer: D

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36. A salt of strong acid and weak base is dissolved in water. Its hydrolysis in solution is

A. Unaffected on heating

B. increased by adding strong acid

C. Suppressed by diluting

D. Suppressed by adding strong acid

Answer: D

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37. The following reaction takes place in the body

$CO_2 + H_2O \Leftrightarrow H_2CO_3 \Leftrightarrow H^+ + HCO_3^-$. If CO_2 escapes from the system

A. pH will decrease

B. Hydrogen ion concentration will diminish

C. H_2CO_2 concentration will be promoted

D. The forward reaction will be promoted

Answer: B

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38. Which of the following salts undergoes hydrolysis ?

A. CH_3COONa

B. KNO_3

C. $NaCI$

D. K_2SO_4

Answer: A

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39. Which will undergo cationic hydrolysis ?

A. NaCl

B. CH_3COONa

C. $\left(NH_4\right)_2SO_4$

D. Na_2CO_3

Answer: C

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40. A 0.1 N solution of sodium bicarbonate has a pH value of

A. 5.6

B. 7.0

C. 8.4

D. 4.0

Answer: C

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41. Degree hydrolysis (h) of a salt of weak acid and a strong base is given by

A. $h = \sqrt{\frac{K_h}{c}}$

B. $h = \sqrt{K_h}$

C. $h = \sqrt{\frac{c}{K_h}}$

D. $h = \sqrt{\frac{K_w}{K_b}}$

Answer: A

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42. pH of a salt of a strong base with weak acid

A. $pH = \frac{1}{2}pK_w + \frac{1}{2}pK_a + \frac{1}{2}\log C$

B. $pH = \frac{1}{2}pK_w - \frac{1}{2}pK_a - \frac{1}{2}\log C$

C. $pH = \frac{1}{2}pK_w + \frac{1}{2}pK_a - \frac{1}{2}\log C$

D. None of these

Answer: A

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43. Which relation is correct for NH_4 CI ?

A. $K_h = K_w / K_a$

B. $K_h = K_w / K_b$

C. $K_h = K_w / K_a . K_b$

D. $K_h = K_w . K_a$

Answer: B

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44. Solubility product principle can be applied when

A. A solid is insoluble in a liquid

B. A liquid is insoluble in another liquid

C. Any ionic compoound is sparingly soluble in a liquid

D. Substance is ionic

Answer: C

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45. The solubility product of AgCI is K_{sp}. Then the solubility of AgCI in xM KCI is

A. $K_{sp} \times X^2$

B. $\frac{x}{K_{sp}}$

C. $\frac{K_{sp}}{X^2}$

D. $\frac{K_{sp}}{X}$

Answer: D

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46. The correct representation for the K_{sp} of SnS_2 is

A. $\left[Sn^{2+}\right]\left[S^{2-}\right]^2$

B. $\left[Sn^{4+}\right]\left[S^{-2}\right]^2$

C. $\left[Sn^{2+}\right]\left[2S^{-2}\right]^2$

D. $\left[Sn^{4+}\right]\left[2S^{2-}\right]^2$

Answer: B

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47. The K_{sp} for a sparingly soluble Ag_2CrO_4 is 4×10^{-12}. The molar solubility of the salt is

A. $2.0 \times 10^{-6} molL^{-1}$

B. $1.0 \times 10^{-4} molL^{-1}$

C. $2.0 \times 10^{-12} molL^{-1}$

D. $1.0 \times 10^{-15} molL^{-1}$

Answer: B

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48. The precipitation occurs if ionic concentration is

A. Equals K_{sp}

B. Exceeds K_{sp}

C. Less than K_{sp}

D. is very small

Answer: B

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49. The precipitate of $CaF_2\left(K_{sp} = 1.7 \times 10^{-10}\right)$ is obtained when equal volumes of the following are mixed

A. $10^{-4}MCa^{2+} + 10^{-4}MF^-$

B. $10^{-2}MCa^{2+} + 10^{-3}MF^-$

C. $10^{-4}MCa^{2+} + 10^{-3}MF^-$

D. $10^{-3}MCa^{2+} + 10^{-5}MF^-$

Answer: B

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50. An example of a salt dissolved in water to give acidic solution is

A. Ammonium chloride

B. Sodium acetate

C. Potassium nitrate

D. Barium bromide

Answer: A

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Assignment Section B

1. The equilibrium constant K_c for the following reaction will be

$$K_2CO_3(aq) + BaSO_4(s) \Leftrightarrow BaCO_3(s) + K_2SO_4(aq)$$

A. $\frac{\left[CO_3^{2-}\right]}{\left[SO_4^{2-}\right]}$

B. $\frac{[K_2CO_3]}{[K_2SO_4]}$

C. $\frac{[BaSO_4]}{[CO_3^{2-}]}$

D. $\frac{[SO_4^{2-}]}{[CO_3^{2-}]}$

Answer: D

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2. 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. $\frac{Px^3}{2}$

B. $\frac{Px^2}{3}$

C. $\frac{Px^3}{3}$

D. $\frac{Px^2}{2}$

Answer: A

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3. Solid Ammonium carbamate dissociates as:

$NH_2COONH_4(s) \Leftrightarrow 2NH_3(g) + CO_2(g)$.

In a closed vessel, solid ammonium carbonate is in equilibrium with its dissociation products. At equilibrium, ammonia is added such that the partial pressure of NH_3 at new equilibrium now equals the original total pressure. Calculate the ratio of total pressure at new equilibrium to that of original total pressure. Also find the partial pressure of ammonia gas added.

A. $\frac{27}{31}$

B. $\frac{31}{27}$

C. $\frac{4}{9}$

D. $\frac{5P}{9}$

Answer: B

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4. When 1 mole of N_2 and 1 mole of H_2 is enclosed in 3L vessel and the reaction is allowed to attain equilibrium , it is found that at equilibrium there is 'x' mole of H_2 . The number of moles of NH_3 formed would be

A. $\frac{2x}{3}$

B. $\frac{2(1+x)}{3}$

C. $\frac{2(1-x)}{3}$

D. $\frac{(1-x)}{2}$

Answer: C

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5. 1 mole of 'A' 1.5 mole of 'B' and 2 mole of 'C' are taken in a vessel of volume one litre. At equilibrium concentration of C is 0.5 mole /L .Equilibrium constant for the reaction , $A_{(g)} + B_{(g)} \Leftrightarrow C_{(g)}$ is

A. 0.66

B. 0.066

C. 66

D. 6.6

Answer: B

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6. The number of hydrogen ions in 10 ml of a solution with pH=13 is

A. 10^{13}

B. 6.023×10^{8}

C. 6.023×10^{10}

D. 6.023×10^{13}

Answer: B

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7. $N_2 + 3H_2 \Leftrightarrow 2NH_3, K_c = 1.2$

At the start of a reaction, there are 0.249 mol N_2, $3.21 \times 10^{-2} molH_2$ and $6.42 \times 10^{-4} molNH_3$ in a 3.50 L reaction vessel at $375^\circ C$. Hence reaction will proceed in

A. forward direction

B. Backward direction

C. At equilibrium

D. stops

Answer: A

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8. Solid ammonium carbamate dissociated according to the given reaction

$NH_2COONH_4(s) \Leftrightarrow 2NH_3(g) + CO(g)$

Total pressure of the gases in equilibrium is 5 atm. Hence K_p.

A. 18.5

B. 16.4

C. $1/5$

D. 12.5

Answer: A

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9. 1.1 mole of A is mixed with 1.2 mol of B and the mixture is kept in a 1 L flask till the equilibrium $A + 2B \Leftrightarrow 2C + D$ is reached. At equilibrium 0.1

mol of D is formed . The K_c of the reaction

A. 0.002

B. 0.004

C. 0.001

D. 0.003

Answer: B

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10. In the following reaction $HC_2O_4^-(aq) + PO_4^{3-}(aq) \Leftrightarrow HPO_4^{2-}(aq) + C_2O_4^{2-}(aq)$, which are the two Bronsted bases ?

A. $HC_2O_4^-$ and PO_4^{3-}

B. HPO_4^{2-} and $C_2O_4^{2-}$

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

D. PO_4^{3-} and $C_2O_4^{2-}$

Answer: D

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11. $C(s) + H_2O(g) \Leftrightarrow CO(g) + H_2(g), \Delta H < 0$

the above equilibrium will proceed in forward direction when

A. it is subjected to high pressure

B. it is subjected to high temperature

C. Inert gas (Argon) is added at constant pressure

D. Carbon (solid) is added

Answer: C

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12. In the equilibrium $SO_2CI(g) \Leftrightarrow SO_2(g) + CI_2(g)$

at 2000 k and 10 atm pressure , $\%\, CI_2 = \%\, SO_2 = 40$ (by volume) then

A. $K_c = 0.1 mol\text{It}^{-1}$

B. $\frac{n\left(SO_2CI_2\right)}{n\left(SO_2\right)} = \frac{1}{4}$ at equilibrium

C. $n\left(SO_2CI_2\right) = n\left(SO_2\right) = n\left(CI_2\right)$

D. $K_p = 8$ atm

Answer: D

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13. Le Chatelier's principle is not applicable to

A. $Fe(s) + S(s) \Leftrightarrow FeS(s)$

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

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

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

Answer: A

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14. For the reaction, $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

Equilibrium constant $k_c = 2$

Degree of association is

A. $\frac{1}{1 - \sqrt{2}}$

B. $\frac{1}{1 + \sqrt{2}}$

C. $\frac{2}{1 + \sqrt{2}}$

D. $\frac{2}{1 - \sqrt{2}}$

Answer: B

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15. At $30^{\circ} C$ the solubility of $Ag_2CO_3\left(K_{SP} = 8 \times 10^{-12}\right)$ would be gretest in one litre of:

A. $0.05MNa_2CO_3$

B. $0.05MAgNO_3$

C. Pure water

D. $0.05MNH_3$

Answer: D

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16. Which of the following solutions will have pH close to 1.0 ?

A. $100ml, \frac{M}{5}HCI +_{100}ml, \frac{M}{5}NaOH$

B. $55ml, \frac{M}{10}HCI + 45ml, \frac{M}{10}NaOH$

C. $10ml, \frac{M}{10}HCI + 90ml, \frac{M}{10}NaOH$

D. $75ml, \frac{M}{5}HCI + 25ml, \frac{M}{5}NaOH$

Answer: D

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17. Silver nitrate solution is gradually added to an aqueous solution containing $0.01M$ each of chloride, bromide and iodide ions. The correct sequence in which the halides will be precipitated is:

A. Br^-, CI^-, I^-

B. I^-, CI^-, Br^-

C. I^-, Br^-, CI^-

D. CI^-, Br^-, I^-

Answer: C

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18. if ionic product of water is $K_w = 10^{-16}$ at $4^\circ C$, then a solution with pH =7.5 at $4^\circ C$ will

A. Turn blue litmus red

B. Turn red litmus blue

C. Be neutral to litmus

D. Be alkaline

Answer: A

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19. When a small amount of HCI is added to a buffer solution of acetic acid and sodium acetate

A. pH increases

B. $\left[H^+\right]$ decreases

C. Dissociation of acetic acid decreases

D. $\left[CH_3COO^-\right]$ increases

Answer: C

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20. The pH of 10^{-11} M HCl at $25\ ^\circ C$ is

A. 11

B. 3

C. Slightly greater than 7

D. Slightly less than 7

Answer: D

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21. When equal volumes of pH =4 and pH=6 are mixed together then th ph of the resulting solution will be [log 5 =0.7]

A. 4.3

B. 4.7

C. 5

D. 5.3

Answer: A

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22. Which causes the change in the value of equilibrium constant of any equilibria ?

A. Adding of inert gas at constant pressure

B. Increasing the pressure

C. Adding of inert gas at constant volume

D. Decreasing the temperature

Answer: D

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23. The value of K_p for the reaction,

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ is 5

what will be the partial pressure of O_2 at equilibrium when equal moles of SO_2 and SO_3 are present at equilibrium ?

A. 0.5

B. 0.3

C. 0.2

D. 0.1

Answer: C

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24. The solubility product of AgBr is 4.9×10^{-9} . The solubility of AgBr will be

A. 7×10^{-4} mole /litre

B. 7×10^{-5} g / litre

C. 1.316×10^{-2} g/litre

D. 1×10^{-3} mole /litre

Answer: C

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25. In which of the following solution, AgCl has minimum solubility ?

A. $0.05MAgNO_3$

B. $0.01MCaCI_2$

C. $0.01MNaCI$

D. $0.01 MNH_4OH$

Answer: A

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26. The pH of $\frac{M}{100} Ca(OH)_2$ is

A. 1.699

B. 12

C. 12.301

D. 12.699

Answer: C

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27. The pH of a mixture of 100 ml 1M H_2SO_4 and 200 ml 1 N NaOH at $25\,^{\circ}C$ is

A. More than 7

B. Less than 7

C. Equal to 7

D. Can't predict

Answer: A

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28. The solubility product of $BaSO_4$ is 4×10^{-10}. The solubility of $BaSO_4$ in presence of 0.02 NH_2SO_4 will be

A. 4×10^{-8} M

B. 2×10^{-8} M

C. 2×10^{-5}M

D. 2×10^{-4} M

Answer: A

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29. The pH of a mixture of 0.01 M HCI and 0.1 M CH_3COOH is approximately

A. 1

B. 2

C. 4

D. 7

Answer: B

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30. The equilibrium constants for $A_2(g) \Leftrightarrow 2A(g)$ at 400 k and 600 k are 1×10^{-8} and 1×10^{-2} respectively . The reaction is

A. Exothermic

B. Endothermic

C. May be exodhermic or endothermic

D. No heat is evolved or abosorbed

Answer: B

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31. Two samples of CH_3COOH each of 10 g were taken separately in two vessels containing water of 6 litre and 12 litre respectively at $27^\circ C$. The degree of dissociation of CH_3COOH will be

A. More in 12 litre vessel

B. More in 6 litre vessel

C. Equal in both vessels

D. Half in 6 litre vessel than in 12 litre vessel

Answer: A

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32. Following three gaseous equilibrium reactions are occuring at $27^\circ C$

A, $2CO + O_2 \Leftrightarrow 2CO_2$

B, $PCI_5 \Leftrightarrow PCI_3 + CI_2$

C, $2HI \Leftrightarrow H_2 + I_2$

The correct order of $\frac{K_p}{K_c}$ for the following reactions is

A. $A < C < B$

B. $A < B < C$

C. $C < B < A$

D. $B < C < A$

Answer: A

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33. Solubility product of the salt A_xB_y will be represented most suitably, if the solubility is represented by S

A. $K_{sp} = X^y Y^x (S)^{Xxy}$

B. $K_{sp} = X^y + Y^x + S^{x+y}$

C. $K_{sp} = X^x y^y (s)^{x+y}$

D. $K_{sp} = X \cdot S^{x+y} \cdot Y$

Answer: C

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34. Which is incorrect ?

A. Conjugate acid of H_2O is H_3O^+

B. Conjugate base of HCO_3 - is CO_3^{2-}

C. Conjugate base of NH_3 is NH_2^{Θ}

D. Conjugate base of HOCI is CI^-

Answer: D

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35. A buffer solution can be obtained from

A. HCN and KCN

B. CH_3COONH_4

C. NH_4CI and NH_4OH

D. All of these

Answer: D

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Assignment Section C

1. A 20 litre container at $400K$ contains $CO_2(g)$ at pressure $0.4atm$ and an excess of SrO (neglect the volume of solid SrO). The volume of the container, when pressure of CO_2 attains its maximum value, will be:

(Given that: $SrCO_3(s) \Leftrightarrow SrO(s) + CO_2(g) K_p = 1.6atm$)

A. 5 litre

B. 10 litre

C. 4 litre

D. 2 litre

Answer: A

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2. The equilibrium constant of the following are reactions

$N_2 + 3H_2 \Leftrightarrow 2NH_3 K_1$

$N_2 + O_2 \Leftrightarrow 2NOK_2$

$H_2 + \frac{1}{2}O_2 \rightarrow H_2OK_3$

The equilibrium constant (K) of the reaction $NH_3 + \frac{5}{2}O_2 \overset{K}{\leftrightarrow} 2NO + 3H_2O$, will be

A. $K_1K_3^3/K_2$

B. $K_2K_3^3/K_1$

C. K_2K_3/K_1

D. $K_2^3K_3/K_1$

Answer: B

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3. Concentration of the Ag^+ ions in a saturated solution of $Ag_2CO_2O_4$ is $2.2 \times 10^{-4} molL^{-1}$ Solubility product of $Ag_2C_2O_4$ is:

A. 2.42×10^{-8}

B. 2.66×10^{-12}

C. 4.5×10^{-11}

D. 5.3×10^{-12}

Answer: D

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4. The percentage of pyridine $\left(C_5H_5N\right)$ that forms pyridinium ion $\left(C_5H_5N^+H\right)$ in a 0.10 M aqueous pyridine solution (K_b for $C_5H_5N = 1.7 \times 10^{-9}$) is

A. 0.0060 %

B. 0.013 %

C. 0.77 %

D. 1.6 %

Answer: B

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5. The pH of a solution of AgCI(s) with solubility product 1.6×10^{-10} in 0.1 M Nacl solution would be :

A. 1.26×10^{-5} M

B. 1.6×10^{-9} M

C. 1.6×10^{-11}M

D. zero

Answer: B

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6. Boric acid is an acid because its molecule

A. Contains replaceable H^+ ion

B. Gives up a proton

C. Accepts OH^- from water releasing proton

D. Combines with proton from water molecule

Answer: C

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7. Which of the of the following fluoro -compouds is most likely to beahve as a Lewis base?

A. BF_3

B. PF_3

C. CF_4

D. SiF_4

Answer: B

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8. MY and NY_3 two nearly insoluble salts, have the same K_{sp} values of 6.2×10^{-13} at room temperature. Which statement would be true in rearged to MY and NY_3 ?

A. The addition of the salt of KY to solution of MY and NY_3 will have no effect on their solubilities

B. The molar solubilities of MY and NY_3 in water are identical

C. The molar solubility of MY in water is less than that of NY_3

D. The salts MY and NY_3 are more soluble in 0.5 M KY than in pure water

Answer: C

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9. Consider the following liquid-vapour equilibrium.

$\text{Liquid} \Leftrightarrow \text{Vapour}$

Which of the following relations is correct?

A. $\frac{d\text{In}P}{dT} = \frac{\Delta H_v}{RT^2}$

B. $\frac{d\text{In}G}{dT^2} = \frac{\Delta H_v}{RT^2}$

C. $\frac{d\text{In}P}{dT} = \frac{-\Delta H_v}{RT}$

D. $\frac{d\text{In}P}{dT^2} = \frac{-\Delta H_v}{RT^2}$

Answer: A

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10. If the equilibrium constant for

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

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

A. K

B. K^2

C. $K^{1/2}$

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

Answer: C

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11. Which one of the following pairs of solution is not an acidic buffer?

A. H_2CO_3 and Na_2CO_3

B. H_3PO_4 and Na_3PP_4

C. $HClO_4$ and $NaClO_4$

D. CH_3COOH and CH_3COONa

Answer: C

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12. What is the pH of the resulting solution when equal volumes of 0.1 M NaOH and 0.01 M HCI are mixed ?

A. 7.0

B. 1.04

C. 12.65

D. 2.0

Answer: C

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13. Which of the following statements is correct for a reversible process in a state of equilibrium ?

A. $\Delta G^{\circ} = 2.30RT\log K$

B. $\Delta G = -2.30RT\log K$

C. $\Delta G = 2.30RT\log K$

D. $\Delta G^{\circ} = -2.30RT\log K$

Answer: D

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14. The K_{sp} of $Ag_2CrO_4, AgCl, AgBr$ and AgI are respectively, $1.1 \times 10^{-12}, 1.8 \times 10^{-10}, 5.0 \times 10^{-13}, 8.3 \times 10^{-17}$. Which one of the following salts will precipitate last if $AgNO_3$ solution is added to the solution containing equal moles of NaCl,NaBr,NaI and Na_2CrO_4 ?

A. $AgCrO_4$

B. AgI

C. $AgCI$

D. $AgBr$

Answer: A

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15. If the value of equilibrium constant for a particular reaction is 1.6×10^{12}, then art equilibrium the system will contain

A. Similar amounts of reactants and products

B. All reactants

C. Mostly reactants

D. Mostly products

Answer: D

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16. Which of the following salts will give highest pH in water ?

A. KCl

B. NaCl

C. Na_2CO_3

D. $CuSO_4$

Answer: C

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17. For a given exothermic reaction , K_p and k'_p are the equilibrium constants at temperatures T_1 and 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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18. Using the Gibbs energy change, $\Delta G^{\circ} = +63.3kJ$, for the following reaction,

$Ag_2CO_3 \Leftrightarrow 2Ag^{+}(aq) + CO_3^{2-}$

the K_{sp} of $Ag_2CO_3(s)$ in water at $25^{\circ}C$ is

$\left(R = 8.314JK^{-1}mol^{-1}\right)$

A. 3.2×10^{-26}

B. 8.0×10^{-12}

C. 2.9×10^{-3}

D. 7.9×10^{-2}

Answer: B

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19. For the reversible reaction

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

The equilibrium shifts in forward direction

A. By increasing the concentration of $NH_3(g)$

B. By decreasing the pressure

C. By decreasing the concentration of $N_2(g)$ and $H_2(g)$

D. By increasing pressure and decreasing temperature

Answer: D

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20. Indentify the correct order of solubility in aqueous medium

A. $ZnS > Na_2S > CuS$

B. $Na_2S > CuS > ZnS$

C. $Na_2S > ZnS > CuS$

D. $CuS > ZnS > Na_2S$

Answer: B

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21. $KMnO_4$ can be prepared fromK_2MnO_4 as per the reaction: 

The reaction can go the completion by removing $OH^{\ominus}$ ions by adding.

A. KOH

B. CO_2

C. SO_2

D. HCI

Answer: B

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22. Buffer solutions have constant acidity and alkalinity because

A. They have large excess of H^+ or OH^- ion

B. They have fixed value of pH

C. These give unionised acid or base on reaction with added acid or alkali

D. Acids and alkalies in these solutions are shieded from attack by other ions

Answer: C

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23. pH of saturated solution of $Ba(OH)_2$ is 12. The value of solubility product $\left(K_{sp}\right)$ of $Ba(OH)_2$ is

A. 4.0×10^{-6}

B. 5.0×10^{-6}

C. 3.3×10^{-7}

D. 5.0×10^{-7}

Answer: D

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24. Given that equilibrium constant for the reaction $2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ has a value of 278 at a particular temperature. What is the value of the equilibrium constant for the following reaction at the same temperature ? $SO_3(g) \Leftrightarrow SO_2(g) + \frac{1}{2}O_2(g)$

A. 1.8×10^{-3}

B. 3.6×10^{-3}

C. 6.0×10^{-2}

D. 1.3×10^{-5}

Answer: C

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25. Given the reaction between 2 gases represented by A_2 and B_2 to given the compound AB(g). $A_2(g) + B_2(g) \Leftrightarrow 2AB(g)$

At equilibrium, the concentrtation

of $A_2 = 3.0 \times 10^{-3} M$

of $B_2 = 4.2 \times 10^{-3} M$

of $AB = 2.8 \times 10^{-3} M$

If the reaction takes place in a sealed vessel at $527^\circ C$. then the value of K_c will be

A. 2.0

B. 1.9

C. 0.62

D. 4.5

Answer: C

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26. A buffer solution is prepared in which the concentration of NH_3 is $0.30M$ and the concentration of NH_4^+ is $0.20M$. If the equilibrium constant, K_b for NH_3 equals 1.8×10^{-5}, what is the pH of this solution? ($\log 2.7 = 0.43$)

A. 8.73

B. 9.08

C. 9.43

D. 11.72

Answer: C

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27. For the reaction $N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$, the equilibrium constant is K_1. The equilibrium constant is K_2 for the reaction

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

What is K for the reaction

$NO_2(g) \Leftrightarrow \frac{1}{2}N_2(g) + O_2(g)$?

A. $\frac{1}{(K_1K_2)}$

B. $\frac{1}{(2K_1K_2)}$

C. $\frac{1}{(4K_1K_2)}$

D. $\left[\frac{1}{(K_1K_2)}\right]^{1/2}$

Answer: D

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28. In qualitative analysis, the metals of group I can be separated from other ions by precipitating them as chloride salts. A solution initially contains Ag^+ and Pb^+ at a concentration of 0.10M. Aqueous HCl is added to this solution until be Cl^- concentration is 0.10M. What will be concentration of Ag^+ and Pb^{2+} be at equilibrium ?

(K_{sp} for AgCl $= 1.8 \times 10^{-10}$

K_{sp} for $PbCl_2 = 1.7 \times 10^{-5}$)

A. $\left[Ag^+\right] = 1.8 \times 10^{-9}M \left[Pb^{2+}\right] = 1.7 \times 10^{-3}M$

B. $\left[Ag^+\right] = 1.8 \times 10^{-11}M \left[Pb^{2+}\right] = 1.7 \times 10^{-4}M$

C. $\left[Ag^+\right] = 1.8 \times 10^{-6}M \left[Pb^{2+}\right] = 1.7 \times 10^{-11}M$

D. $\left[Ag^+\right] = 1.8 \times 10^{-11}M \left[Pb^{2+}\right] = 8.5 \times 10^{-5}M$

Answer: A

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29. The value of ΔH for the reaction

$X_2(g) + 4Y_2(g) \Leftrightarrow 2XY_4(g)$

is less than zero. Formation of $XY_4(g)$ will be favoured at

A. High pressure and low temperature

B. High temperature and high pressure

C. low pressure and low temperature

D. High temperature and low pressure

Answer: A

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30. In which of the following equilibrium K_c and K_p are not equal ?

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

B. $SO_2(g) + NO_2(g) \Leftrightarrow SO_3(g) + NO(g)$

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

D. $2C(s) + O_2(g) \Leftrightarrow 2CO_2(g)$

Answer: D

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31. What is $\left[H^+\right]$ in mol/L of a solution that is $0.20M$ in CH_3COONa and $0.1M$ in CH_3COOH? K_a for CH_3COOH is 1.8×10^{-5}?

A. 3.5×10^{-4}

B. 1.1×10^{-5}

C. 1.8×10^{-5}

D. 9.0×10^{-6}

Answer: D

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32. In a buffer solution containing equal concentration of B^- and HB, the K_b for B^- is 10^{-10}. The pH of buffer solution is

A. 10

B. 7

C. 6

D. 4

Answer: D

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33. The reaction,

$2A(g) + B(g) \Leftrightarrow 3C(g) + D(g)$

is begun with the concentration of A and B both at an intial value of 1.00 M. When equilibrium is reached, the concentration of D is measured and found to be 0.25 M. The value for the equilibrium constant for this reaction is given by the expression:

A. $\left[(0.75)^3(0.25)\right] \div \left[(1.00)^2(1.00)\right]$

B. $\left[(0.75)^3(0.25)\right] \div \left[(0.50)^2(0.75)\right]$

C. $\left[(0.75)^3(0.25)\right] \div \left[(0.50)^2(0.25)\right]$

D. $\left[(0.75)^3(0.25)\right] \div \left[(0.75)^2(0.25)\right]$

Answer: B

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34. The dissociation constants for acetic acid and HCN at $25^\circ C$ are 1.5×10^{-5} and 4.5×10^{-10}, respectively. The equilibrium constant for the equilibirum $CN^- + CH_3COOH \Leftrightarrow HCN + CH_3COO^-$ would be

A. 3.0×10^{-5}

B. 3.0×10^{-4}

C. 3.0×10^{4}

D. 3.0×10^{5}

Answer: C

Watch Video Solution

35. The ionization constant of ammonium hydroxide is 1.77×10^{-5} at $298K$. Hydrolysis constant of ammonium chloride is

A. 6.50×10^{-12}

B. 5.65×10^{-13}

C. 5.65×10^{-12}

D. 5.65×10^{-10}

Answer: D

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36. What is the $\left[OH^{-}\right]$ in the final solution prepared by mixing $20.0mL$ of $0.050MHCl$ with $30.0mL$ of $0.10MBa(OH)_2$?

A. 0.40 M

B. 0.0050 M

C. 0.12 M

D. 0.10 M

Answer: D

Watch Video Solution

37. the value of equilibrium constant for the reaction

$HI(g) \Leftrightarrow 1/2H_2(g) + 1/2I_2(g)$ is 8.0

The equilibrium constant for the reaction

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

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

B. $\frac{1}{16}$

C. $\frac{1}{64}$

D. 16

Answer: C

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

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

B. 1.11×10^{-4} M

C. 3.7×10^{-4} M

D. 3.7×10^{-3} M

Answer: C

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39. The values of K_{p_1} and K_{p_2} for the reactions

$X \Leftrightarrow Y + Z$ ....(i)

and $A \Leftrightarrow 2B$ ...(ii)

are in ratio of 9 : 1. If degree of dissociation of X and A be equal, then total presure at equilibrium (i) and (ii) are in the ratio.

A. $1:1$

B. $3:1$

C. $1:9$

D. $36:1$

Answer: D

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40. If the concentration of OH^- ions in the reaction

$Fe(OH)_3(s) \Leftrightarrow Fe^{3+}(aq.) + 3OH^-(aq.)$

is decreased by $1/4$ times, then the equilibrium concentration of Fe^{3+} will increase by

A. 4 times

B. 8 times

C. 16 times

D. 64 times

Answer: D

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41. The dissociation equilibrium of a gas AB_2 can be represented as, $2AB_2(g) \Leftrightarrow 2AB(g) + B_2(g)$. The degree of disssociation is 'x' and is small compared to 1. The expression relating the degree of dissociation (x) with equilibrium constant k_p and total pressure P is

A. $\left(\frac{K_p}{P}\right)$

B. $\left(\frac{2k_p}{P}\right)$

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

D. $\left(\frac{2K_p}{P}\right)^{1/2}$

Answer: C

Watch Video Solution

42. Equimolar solutions of the following were prepared in water separately. Which one of the solutions will record the highest pH ?

A. $CaCI_2$

B. $SrCI_2$

C. $BaCI_2$

D. $MgCI_2$

Answer: C

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43. The following equilibrium constants are given

$N_2 + 3H_2 \leftrightarrow 2NH_3, K_1$

$N_2 + O_2 \leftrightarrow 2NO, K_2$

$H_2 + \frac{1}{2}O_2 \leftrightarrow H_2O, K_3$

The equlibrium constant for the oxidation of NH_3 by oxygen to given NO is

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

B. $K_2K_3^3/K_1$

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

D. $\frac{K_2^2K_3}{K_1}$

Answer: B

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44. Calculate the pOH of solution at $25\,^{\circ}C$ that contains $1 \times 10^{-10} M$ of hydronium ions, i.e., H_3O^+

A. 1.000

B. 7.000

C. 4.000

D. 9.000

Answer: C

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45. A weak acid, HA, has a K_a of 1.00×10^{-5}. If 0.100 mol of the acid is dissolved in 1 L of water, the percentage of the acid dissociated at equilibrium is the closed to

A. 0.100 %

B. 99.0 %

C. 1.00 %

D. 99.9 %

Answer: C

Watch Video Solution

46. Which one of the following ionic species has the greatest proton affinity to form stable compound ?

A. I^-

B. HS^-

C. NH_2^-

D. F^-

Answer: C

Watch Video Solution

47. For the reaction

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

$$\Delta_r H = -170.8 kJmol^{-1}$$

Which of the following statements is not true ?

A. At equilibrium , the concentration of $CO_2(g)$ and $H_2O(I)$ are not equal

B. The equilibrium constant for the reaction is given by $K_p = \frac{[CO_2]}{[CH_4][O_2]}$

C. Addition of $CH_4(g)$ or $O_2(g)$ at equilibrium will cause a shift to the right

D. The reaction is exothermic

Answer: B

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48. Which of the following pairs consitutes buffer?

A. HNO_2 and $NaNO_2$

B. $NaOH$ and $NaCI$

C. HNO_3 and NH_4NO_3

D. HCI and KCI

Answer: A

Watch Video Solution

49. The hydrogen ion concentration of a $10^{-8}MHCl$ aqueous soultion at $298K\left(K_w = 10^{-14}\right)$ is

A. 1.0×10^{-6}M

B. 1.0525×10^{-7} M

C. 9.525×10^{-8} M

D. 1.0×10^{-8} M

Answer: B

Watch Video Solution

50. At $25\ ^\circ C$, the dissociation constant of a base. BOH is 1.0×10^{-12}. The concentration of hydroxyl ions in 0.01M aqueous solution of the base would be

A. $2.0 \times 10^{-6} molL^{-1}$

B. $1.0 \times 10^{-5} molL^{-1}$

C. $1.0 \times 10^{-6} molL^{-1}$

D. $1.0 \times 10^{-7} molL^{-1}$

Answer: D

Watch Video Solution

51. Equilibrium constants K_1 and K_2 for the following equilibria

$NO(g) + 1/2O_2(g) \overset{K_1}{\Leftrightarrow} NO_2(g)$ and 2NO_(2)(g) overset(K_(2)) (hArr)2NO(g)+O_(2)(g)`

are related as

A. $K_2 = \frac{1}{K_1}$

B. $K_2 = K_1^2$

C. $K_2 = \frac{K_1}{2}$

D. $K_2 = \frac{1}{K_1^2}$

Answer: D

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52. H_2S gas when passed through a solution of cations containing HCl precipitates the cations of second group in qualitative analysis but not those belonging to the fourth group. It is because

A. presence of HCI decreases the sulphide ion concentration

B. Presence of HCI increases the sulphide ion concentration

C. Solubility of group II sulphides is more than that of group IV sulphides

D. Sulphides of group IV cations are unstable in HCI

Answer: A

Watch Video Solution

53. The dissociation constant of a weak acid is 1×10^{-4}. In order of prepare a buffer solution with a pH =5 the [Salt]/[Acid] ratio should be

A. $1:10$

B. $4:5$

C. $10:1$

D. $5:4$

Answer: C

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54. Which one of the following is not acid-base conjugate pair ?

A. $HONO, NO_2^-$

B. $CH_3NH_3^+, CH_3NH_2$

C. $C_6H_5 - COOH, C_6H - 5COO^-$

D. H_3O^+, OH^-

Answer: D

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55. For the reaction,

$I_2(aq) \Leftrightarrow I_2$ (oil), Equilibrium constant is K_1.

I_2(oil) $\Leftrightarrow I_2$(ether), Equilibrium constant is K_2.

$I_2(aq) \Leftrightarrow I_2(\text{ether})$, Equilibrium constant is K_3.

The reaction between K_1, K_2, K_3 is

A. $K_3 = K_1 + K_2$

B. $K_3 = K_1 K_2$

C. $K_3 = K_1 / K_2$

D. $K_3 = K_2 / K_1$

Answer: B

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56. Given exothermic reaction

$$CoCl_4^{2-}(aq) + 6H_2O(l) \Leftrightarrow \left[Co\left(H_2O\right)_6\right]^{2+} + 4Cl^-$$

Which one of the following will decrease the equilibrium concentration of $CoCl_4^{2-}$?

A. Addition of HCl

B. Addition of $Co\left(NO_3\right)_2$

C. The solution is diluted with water

D. The temperature is increased

Answer: C

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57. For preparing a buffer solution of pH = 7.0 which buffer system you will choose?

A. $H_3PO_4, H_2PO_4^-$

B. $H_2PO_4^-, HPO_4^{2-}$

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

D. H_3PO_4, PO_4^{3-}

Answer: B

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58. For a chemical reaction of the type $A \Leftrightarrow B, K = 2.0$ and $B \Leftrightarrow C, K = 0.01$. Equilibrium constant for the reaction $2C \Leftrightarrow 2A$ is

A. 25

B. 50

C. 2500

D. 4×10^{-4}

Answer: C

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59. A solution is 0.10 M in Ag^{+}, Ca^{2+}, Mg^{2+} and Al^{3+} ions. Which compound will precipitate at the lowest $\left[PO_4^{3-}\right]$ when a solution of Na_3PO_4 is added ?

A. $Ag_3PO_4\left(K_{sp} = 1 \times 10^{-6}\right)$

B. $Ca_3(PO)4)_2\left(K_{sp} = 1 \times 10^{-33}\right)$

C. $Mg_3\left(PO_4\right)_2\left(K_{sp} = 1 \times 10^{-24}\right)$

D. $AIPO_4\left(K_{sp} = 1 \times 10^{-20}\right)$

Answer: D

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60. Which one of the following species acts only as a base ?

A. H_2S

B. HS^-

C. S^{2-}

D. H_2O

Answer: C

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61. At $100^{\circ}C$ the K_w of water is 55 times its value at $25^{\circ}C$. What will be the pH of neutral solution ?

(log 55=1.74)

A. 6.13

B. 7.00

C. 7.87

D. 5.13

Answer: A

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62. Whhich one of the following is most soluble ?

A. $Bi_2S_3\left(K_{sp} = 1 \times 10^{-70}\right)$

B. $Ag_2S\left(K_{sp} = 6 \times 10^{-51}\right)$

C. $CuS\left(K_{sp} = 8 \times 10^{-37}\right)$

D. $MnS\left(K_{sp} = 7 \times 10^{-16}\right)$

Answer: D

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63. At $80\,^{\circ}C$ distilled water has $\left[H_3O^{+}\right]$ concentration equal $\left[OH^{-}\right] 1 \times 10^{-6}\text{mole}/litre$. The value of K_w at this temperature will be

A. 1×10^{-12}

B. 1×10^{-15}

C. 1×10^{-6}

D. 1×10^{-9}

Answer: A

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64. The pH value of blood does not change appreciably by a small addition of an acid or base, because the blood

A. Can be easily coagulated

B. Contains iron as a part of the molecule

C. is a body fluid

D. Contains serum protein which acts as buffer

Answer: D

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65. The pH value of 10^{-7} M solution HCI is

A. Equal to 1

B. Equal to 2

C. Less than 7

D. Equal to 0

Answer: C

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66. The standard state Gibbs's energy change for the isomerisation reaction cis - 2 - $pentence \Leftrightarrow trans$ - 2 - $pentence$ is $-3.67 kJmol^{-1}$ at $400K$. If more $trans$ - 2 - $pentence$ is added to the reaction vessel, then:

A. Equilibrium remains unaffected

B. Equilibrium is shifted in the forward direction

C. More cis-2-pentene is formed

D. Additional trans-2- pentene is formed

Answer: C

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67. The equilibrium constant for the reaction

$N_2 + 3H_2 \Leftrightarrow 2NH_3$ is K , then the equilibrium constant for the equilibrium $2NH_3 \Leftrightarrow N_2 + 3H_2$ is

A. $\sqrt{k}$

B. $\sqrt{\frac{1}{k}}$

C. $\frac{1}{k}$

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

Answer: C

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68. The ionic product of water at $25\ ^\circ C$ is 10^{-14} its ionic product at $90\ ^\circ C$ will be

A. 1×10^{-14}

B. 1×10^{-16}

C. 1×10^{-20}

D. 1×10^{-12}

Answer: D

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69. If α is degree of dissociation, then the total number of moles for the reaction starting with 1 mole of HI $2HI = H_2 + I_2$ will be

A. 1

B. $1 - \alpha$

C. 2

D. $2 - \alpha$

Answer: A

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70. Which of the following is not a Lewis acid ?

A. SiF_4

B. C_2H_4

C. BF_3

D. $FeCI_3$

Answer: B

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71. The solubility product of CuS, Ag_2S and HgS are $10^{-31}, 10^{-44}, 10^{-54}$ respectively. The solubilities of these sulphides are in the order

A. $HgS > Ag_2S > CuS$

B. $CuS > Ag_2S > HgS$

C. $Ag_2S > CuS > HgS$

D. $AgS > HgS > CuS$

Answer: C

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72. If K_1 and K_2 are respective equilibrium constants for two reactions :

$XeF_6(g) + H_2O \Leftrightarrow XeOF_4(g) + 2HF_g$

$XeO_4(g) + XeF_6(g) \Leftrightarrow XeOF_4(g) + XeO_3F_2(g)$

Then equilibrium constant for the reaction

$XeO_4(g) + 2HF(g) \Leftrightarrow XeO_3F_2(g) + H_2O(g)$ will be

A. $\frac{K_1}{K_2}$

B. $K_1 \cdot K_2$

C. $\frac{K_1}{(K_2)^2}$

D. $\frac{K_2}{K_1}$

Answer: D

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73. The concentration of $\left[H^{+}\right]$ and concentration of $\left[OH^{-}\right]$ of a 0.1 aqueous solution of $2\,\%$ ionised weak acid is [Ionic product of water $= 1 \times 10^{-14}$]

A. $2 \times 10^{-3} M$ and $5 \times 10^{-12} M$

B. $1 \times 10^{-3} M$ and $3 \times 10^{-11} M$

C. $0.02 \times 10^{-3} M$ and $5 \times 10^{-11} M$

D. $3 \times 10^{-2} M$ and $4 \times 10^{-13} M$

Answer: A

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74. The K_a value of $CaCO_3$ and CaC_2O_4 in water are 4.7×10^{-9} and 1.3×10^{-9}, respectively, at $25\,^{\circ} C$. If a miaxture of two is washed with H_2O, what is Ca^{2+} ion concentration in water?

A. $7.746 \times 10^{-5} M$

B. $5.831 \times 10^{-5} M$

C. $6.856 \times 10^{-5} M$

D. $3.606 \times 10^{-5} M$

Answer: A

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75. The solubility of a saturated solution of calcium fluoride is 2×10^{-4} mol/L. Its solubility product is

A. 22×10^{-11}

B. 14×10^{-4}

C. 2×10^{-2}

D. 32×10^{-12}

Answer: D

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76. Equilibrium constant Kp for following reaction:

$MgCO_3(s) \Leftrightarrow MgO(s) + CO_2(g)$

A. $K_p = P_{CO_2}$

B. $K_p = P_{CO_2} \times \frac{P_{CO_2} \times P_{MgO}}{P_{MgCO_3}}$

C. $K_p = \frac{P_{CO_2} \times P_{MgO}}{P_{MgCO_3}}$

D. $K_p = \frac{P_{MgCO_3}}{P_{CO_2} \times P_{Mgo}}$

Answer: A

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77. Correct relation between dissociation constants of a di-basic acid

A. $K_{a_1} = K_{a_2}$

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

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

D. $K_{a_1} = \frac{1}{K_{a_2}}$

Answer: B

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78. The conjugate acid of NH_2^- is

A. NH_4OH

B. NH_4^+

C. NH^{2-}

D. NH_3

Answer: D

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79. Which statements is wrong about pH ?

A. pH of pure water is not zero

B. Adding 1 N solution CH_3COOH and $1N$ NaOH pH will be seven

C. pH of dilute and hot H_2SO_4 is less then 7

D. Mixing solution of CH_3COOH and HCI pH will be less than 7

Answer: B

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80. In $HS^-, I^-, R\text{-}NH_2, NH_3$ order of proton accepting tendency will be

A. $I^- > NH_3 > R\text{-}NH_2 > HS^-$

B. $NH_3 > R\text{-}NH_2 > HS^- > I^-$

C. $R\text{-}NH_2 > NH_3 > HS^- > I^-$

D. $HS^- > R\text{-}NH_2 > NH_3 > I^-$

Answer: C

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81. Ionisation constant of CH_3COOH is 1.7×10^{-5} and concentration of $H^+ ions$ is 3.4×10^{-4}. Then, find out initial concentration of CH_3COOH molecules.

A. 3.4×10^{-4}

B. 3.4×10^{-3}

C. 6.8×10^{-4}

D. 6.8×10^{-3}

Answer: D

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82. Solution of 0.1 N NH_4OH and $0.1NNH_4CI$ has pH 9.25 . Then find out pK_bofNH_4OH

A. `9.25

B. 4.75

C. 3.75

D. 8.25

Answer: B

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83. Which one of the following compounds is not a protoric acid?

A. $B(OH)_3$

B. $PO(OH)_3$

C. $SO(OH)_2$

D. $SO_2(OH)_2$

Answer: A

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84. The reaction quotient (Q) for the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ is given by $Q = \frac{[NH_3]^2}{[N_2][H_2]^3}$. The reaction will proceed from right to left if

A. $Q = K_c$

B. $Q < K_c$

C. $Q > K_c$

D. $Q = 0$

Answer: C

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85. The solubility product of AgI at $25^{\circ}C$ is $1.0 \times 10^{-16} mol^2 L^{-2}$. The solubility of AgI in 10^{-4} M solution of KI at $25^{\circ}C$ is approximately (in mol L^{-1})

A. 1.0×10^{-16}

B. 1.0×10^{-12}

C. 1.0×10^{-10}

D. 1.0×10^{-8} M

Answer: B

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86. The solubility product of a sparingly soluble salt AX_2 is 3.2×10^{-11}. Its solubility (in mo/L) is

A. 5.6×10^{-6}

B. 3.1×10^{-4}

C. 2×10^{-4}

D. 4×10^{-4}

Answer: C

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87. The rapid change of pH near the stoichiometric point of an acid-base titration is the basic of indicator detection. pH of the solution is related to the ratio of the concentration of conjugate acid $(H \in)$ and base $\left(In^{-}\right)$ forms of the indicator by the expression

A. $\log \frac{\left[In^{-}\right]}{[HIn]} = pK_{In} - pH$

B. $\log \frac{[HIn]}{\left[In^{-}\right]} = pK_{In} + pH$

C. $\log \frac{[HIn]}{\left[In^{-}\right]} = pH - pK_{In}$

D. $\log \frac{\left[\mathrm{In}^{-}\right]}{[\mathrm{HIn}]} = pH - pK_{\mathrm{In}}$

Answer: D

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88. What is the correct relationship between the pH of isomolar solutions of sodium oxide $\left(pH_1\right)$, sodium sulphide $\left(pH_2\right)$, sodium selenide $\left(pH_3\right)$, and sodium telluride $\left(pH_4\right)$?

A. $pH_1 > pH_2 > pH_3 > pH_4$

B. $pH_1 > pH_2 \approx pH_3 > pH_4$

C. $pH_1 < pH_2 < pH_3 < pH_4$

D. $pH_1 < pH_2 < pH_3 \approx pH_4$

Answer: A

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89. Which of the following molecules acts as a Lewis acid?

A. $\left(CH_3\right)_3N$

B. $\left(CH_3\right)_3B$

C. $\left(CH_3\right)_2O$

D. $\left(CH_3\right)_3P$

Answer: B

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Assignment Section D

1. A : At higher temperature , K_w of water remains unaltered.

R: k_w is a constant.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: D

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2. A : HCI, HNO_3 and H_2SO_4 are equalty strong acids in water

R : Water is a stronger acid than alcohols

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: B

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3. A : Increasing the concentration of H_2 will increases magnitude of equilibrium constant of the reaction

$H_2 + I_2 \Leftrightarrow 2HI$

R: Value of K_c depends upon the concentration of reactants and products taken.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: D

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4. A : Increasing the temperature , increases $\left[H^{+}\right]$ concentration in water

R: Water is acidic at higher temperature

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: C

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5. A : Solution of CH_3COONH_4 is a buffer solution

R: H^+ ion added will be consumed by CH_3COO^- ion and OH^- ion added will be consumed by NH_4^+ ion.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: A

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6. A : K_{sp} is a constant value for any salt at particular temperature

R: Solubility of any salt is constant at a particular temperature.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: A

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7. A : H_3O^+ ion from water is also taken in consideration while calculating the pH of very dilute solution (say concentration = 10^{-9} M) of acid

R: $\left[H_3O^+\right]$ from water is only available in very dilute solution of acid.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: C

Watch Video Solution

8. A : pH of 10^{-8} M HCI solution is approx 6.9

R : HCI is a strong acid.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: B

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9. A : For equilibrium ice $\Leftrightarrow$ water on increasing temperature and pressure more of water will form.

R: Forward reaction is endothermic and volume decreases on product side.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: A

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10. A : At equilibrium concentration of the reactant and product does not change with time for a chemical reaction.

R : The rate of reaction is zero at equilibrium

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: C

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11. A : pH of 0.1 M HCI solution is less than 0.1 M HCN solution

R : In equimolar solutions , the number of ionisable H^+ present in HCI is less than present in HCN solution .

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: C

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12. A : A catalyst does not alter the equilibrium constant of a reaction

R : A catalyst does not alter the position of chemical equilibrium .

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: B

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13. A : pH of equimolar solution of NH_4CI and NH_4OH does not change when small amount of HCI is added to it .

R : pOH of above solution is equal to pK_b of the buffer.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: B

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14. A: The reaction $2NO(g) + O_2(g) \Leftrightarrow 2NO_2(g)$ is favoured in the forward direction with increase of pressure.

R : The above reaction is exothermic .

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: B

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15. A : pH of 1 M NaCI solution is 7 at $25^{\circ}C$.

R : pH of this solution decreases when it is diluted 100 times

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: C

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16. A : CO_2 is a Lewis acid.

R : H_2SO_4 is Arrhenius acid as well as Bronsted acid.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: B

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17. A : For $H_2CO_3 K_{a_1} < K_{a_2}$.

R : H_2CO_3 is weaker acid than HCO_3^-

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: D

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18. A : pH of mixture of 0.1 M HCN and 0.05 M NaOH is less than 7 .

R : HCN is a weak -acid and NaOH is a strong base.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: B

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19. A: Solubility of AgCI is more in NH_3 than in pure water.

R : Common ion effect decreases the concentration of CI^- when NH_3 is added to 0.1 m AgCI solution.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: C

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20. A : Precipitates formation takes place when

$K_{ip} > K_{sp}$.

R : $K_{ip} = K_{sp}$ for a saturated solution.

A. If both Assertion & Reason are true and the reason in the corret explanation of the assertion, then mark

B. If both assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark

C. If Assertion is true statement but Reason is false then mark

D. If both Assertion and Reason are false statements , then mark

Answer: B