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| Division | 11th |
| Subject | Chemistry |
| Chapter | Equilibrium |
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| Category | 3 |

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| The dissociation constants for acetic acid and at are and ,  respectively. The equilibrium constant for the equilibrium,  would be  (2009) |
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| 3.0×104 |
| D |
| The equilibrium constant for a reaction can be calculated using the equilibrium constants of the individual dissociation reactions involved |
| ,    (ii)  For  ?  On subtracting Eq. (ii) from Eq. (i), we get |
| Equilibrium in physical processes |

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| If and are the respective equilibrium constants for the two reactions,      The equilibrium constant of the reaction,    will be  (2011) |
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| D |
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| ...i  ...(ii)  For the reaction,    By dividing eq. (ii) by (i) we get, |
| Equilibrium in physical processes |

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| If is the fraction of HI dissociated at equilibrium in the reaction, starting with the 2 moles of , then the total number of moles of reactants and products at equilibrium are  (2005) |
|  |
| 2 |
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|  |
| b |
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| Equilibrium in chemical processes |

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| The rate constants for forward and backward reaction of hydrolysis of ester are and per minute. Equilibrium constant for the reaction, is  (2012) |
| 4.33 |
| 5.33 |
| 6.33 |
| 7.33 |
| d |
| Equilibrium constant k |
| Equilibrium constant k |
| Equilibrium in chemical processes |

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| and are equilibrium constant for reactions (i) and (ii)  Then,  (2014) |
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|  |
| A |
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| Consider reaction (i),  Now, consider reaction (ii),  K1= ]2 |
| Dynamic nature of equilibrium |

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| is introduced in evacuated flask at of the solid decomposed to and as gases. The of the reaction at is , molar mass of , molar mass of )  (2019) |
|  |
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| b |
| Number of moles of introduced in the vessel |
| Molar mass of  Number of moles of introduced in the vessel |
| Law of mass action |

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| An aqueous solution contains and . If the equilibrium constants for the formation of from is and that of from ions is then the concentration of ions in aqueous solution is  (2017) |
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| b |
|  |
| Given  So,  It means for,  Now [according to the final equation] |
| Law of mass action |

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| The equilibrium constant at for a reaction, is 100 . If the initial concentrations of all the four species were each, then equilibrium concentration of (in ) will b  (2018) |
| 0.818 |
| 1.818 |
| 1.182 |
| 0.182 |
| b |
|  |
| At equilibrium  Or or  Or |
| Equilibrium constant |

|  |
| --- |
| The standard Gibbs energy change at for the reaction, is 2494. 2 J. At a given time, the composition of the reaction mixture is and . The reaction proceeds in the  (2015) |
| forward direction because |
| reverse direction because |
| forward direction because |
| reverse direction because |
| b |
|  |
| Given,  We know,  =28747.27  Also, we have  If is positive,  Therefore, reaction shifts in reverse direction. |
| Factors affecting equilibrium |

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| For the chemical reaction,  the amount of at equilibrium is affected by  (2004) |
| temperature and pressure |
| temperature only |
| pressure only |
| temperature, pressure and catalyst |
| a |
| Factors affecting equilibrium |
| Both temperature and pressure will change the equilibrium amount of . Temperature changes the value of equilibrium constant. when a system at equilibrium is subjected to a change in temperature, the system will adjust in a way that counteracts the effect of the temperature change. For an exothermic reaction (a reaction that releases heat), increasing the temperature will shift the equilibrium towards the left. For an endothermic reaction (a reaction that absorbs heat), the effects are reversed. Increasing the temperature will shift the equilibrium towards the right.  The effect of pressure on the equilibrium constant depends on whether the reaction involves gaseous species. If the reaction does involve gases, a change in pressure can affect the equilibrium position. |
| Factors affecting equilibrium |

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| For the reaction, the forward reaction at constant temperature is favoured by  (2011) |
| introducing an inert gas at constant volume |
| introducing an inert gas at constant pressure |
| increasing the volume of the container |
| introducing at constant volume |
| c |
| Inert gases, such as helium or argon, do not participate in the chemical reaction. |
| If inert gas is introduced at constant pressure, volume of container will have to be increased and this will favour the forward reaction. Also adding at constant volume will favour forward reaction because is a reactant.  Inert gases, such as helium or argon, do not participate in the chemical reaction and do not affect the equilibrium constant. They simply occupy additional space within the container. By increasing the volume, the total pressure remains constant while the partial pressures of the reactants and products stay the same. |
| Postulates of Le Chatelier’s principle |

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| For the gas phase reaction,  carried out in a vessel, the equilibrium concentration of can be increased by  (2015) |
| increasing the temperature |
| decreasing the pressure |
| removing some |
| adding some |
| d |
| Increasing temperature will favour backward reaction, will increase the amount of |
| The above reaction is exothermic, increasing temperature will favour backward reaction, will increase the amount of . Decreasing pressure will favour reaction in direction containing more molecules (reactant side in the present case). Therefore, decreasing pressure will increase amount of .  Removing , which is a reactant, will favour reaction in backward direction, more will be formed.  Adding will favour backward reaction and some of the will be dehydrogenated to . |
| Postulates of Le Chatelier’s principle |

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| The percentage of pyridine that forms pyridinium ion in a aqueous pyridine solution for is  (2016) |
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|  |
| 0.81 |
| b |
| To find the percentage of pyridine that forms the pyridinium ion in a 0.10 M aqueous pyridine solution, use the equilibrium expression for the base dissociation of pyridine:  C5H5N + H2O ⇌ C5H5NH+ + OH- |
| As pyridinium is a weak base so degree of dissociation is    The aqueous pyridine solution is 1.3×10-4 or 0.013% |
| Ionic equilibrium |

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| At , the dissociation constant of a base, is . The concentration of hydroxyl ions in aqueous solution of the base would be  (2020) |
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|  |
| d |
| At equilibrium |
| Base, is dissociated as follows  So, the dissociation constant of  base  At equilibrium  Given that  and  Thus, |
| Ionic equilibrium |

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| --- |
| The of a solution will be [Given and  (2011) |
| 4.65 |
| 2.65 |
| 5.35 |
| 4.35 |
| c |
|  |
| Given,  concentration of salt solution  Now,  On substituting the given values in above equation, we get |
| Differences between strong and weak electrolytes |

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| Which of the following salts is the most basic in aqueous solution  (2017) |
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| b |
| Rest are acidic in nature. |
| Among the given salts  is acidic in nature i.e., have acidic solution as it is the salt of weak base and strong acid.  and are the salts of weak acid and weak base.  is the salt of strong base and weak acid.  Hence, the solution of will be most basic because of the following reaction. |
| Differences between strong and weak electrolytes |

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| of a weak acid and of a weak base (BOH) are 3.2 and 3.4, respectively. The of their salt solution is  (2021) |
| 7.2 |
| 6.9 |
| 7.0 |
| 1.0 |
| b |
|  |
| For a salt of weak acid and weak base  Given, |
| Degree of ionization |

|  |
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| mole, is added to 0.08 mole of and the solution is diluted to one litre, resulting hydrogen ion concentration is  (2004) |
|  |
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|  |
|  |
| b |
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|  |
| Degree of ionization |

|  |
| --- |
| How many litres of water must be added to of an aqueous solution of with a of 1 to create an aqueous solution with of 2 ?  (2013) |
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|  |
| D |
| M1V1=M2V2 |
|  |
| Ionization of poly basic acids |

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| If of is , the molar solubility of in is  (2018) |
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| c |
| The solubility of is . Now, of is added to this solution after which let the solubility of becomes .  and |
| Let the solubility of is . Now, of is added to this solution after which let the solubility of becomes .  and  Given,  is very small, we neglect against in Eq. (i)  or  or  Thus, molar solubility of in  is . |
| Ionization of poly basic acids |

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| --- |
| How many litres of water must be added to of an aqueous solution of with a of 1 to create an aqueous solution with of 2?  (2013) |
|  |
|  |
|  |
|  |
| b |
| For dilution of |
| For dilution of  V=10L  Volume of water to be added |
| Acid strength |

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| Consider the following statements.  I. The of a mixture containing of and of will be approximately 1.3 .  II. Ionic product of water is temperature dependent.  III. A monobasic acid with has a . The degree of dissociation of this acid is .  IV. The Le-Chatelier's principle is not applicable to common-ion effect.  The correct statements are  (2021) |
| I, II and IV |
| II and III |
| I and II |
| I, II and III |
| d |
|  |
| The explanation of given statements are as follows:  In statement (I), millimoles of  Millimoles of (Limiting reagent)  Millimoles of left  Hence, Statement (I), is correct.  In statement (II), ionic product of is temperature dependent.  With increase in temperature, dissociation of units into and ions will also increase. As a result, the value of ionic product, will be increased. e.g    Hence, the statement (II), is correct.  In statement (III), for a weak monobasic acid  of the solution is 5 , i.e.  Hence, statement (III), is correct. In statement (IV), Le-Chatelier's principle is applicable to common ion effect. Because, in presence of common ion (given) by strong electrolyte , the product of the concentration terms in RHS increases. For the weaker electrolyte, (say) the equilibrium shifts to the LHS,  As a result dissociation of gets suppressed. Hence, statement IV is incorrect |
| Acid strength |

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| An acidic buffer solution can be prepared by mixing the solution of  (2007) |
| acetate and acetic acid |
| ammonium chloride and ammonium hydroxide |
| sulphuric acid and sodium sulphate |
| sodium chloride and sodium hydroxide |
| a |
| Form a conjugate acid-base pair that helps maintain a relatively constant pH when small amounts of acid or base are added to the solution. |
| Acidic buffer is prepared by mixing weak acid with salt of its conjugate base. Therefore, acetic acid and sodium acetate can be used to prepare acidic buffer. By adjusting the ratio of acetic acid to sodium acetate, we can control the pH of the buffer solution.  CH3COOH ⇌ H+ + CH3COO-  CH3COONa ⇌ Na+ + CH3COO- |
| Concept of pH |

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| Of the given anions, the strongest base is  (2001) |
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| D |
| The increase in the number of oxygen atoms in the oxyacid, along with the electronegativity of the central chlorine atom, leads to an increasing order of acidity |
| The order of acidic strength of conjugate acids is  Reverse is the order of basic strength of their conjugate base, i.e. is the strongest base.  The acidity of oxyacids increases as the number of oxygen atoms bonded to the central chlorine atom increases. The more oxygen atoms there are, the stronger the acid becomes. This is because the oxygen atoms have an electron-withdrawing effect |
| Concept of pH |

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| At , pure water has as . What is the value of at ?  (2005) |
|  |
|  |
|  |
|  |
| b |
| kw |
| kw |
| Hydrolysis of salts |

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| Following solutions were prepared by mixing different volumes of and of different  concentrations:  I.  II.  III.  IV.  of which one of them will be equal to 1?  (2018) |
| 1 |
| II |
| III |
| IV |
| c |
|  |
| Milliequivalent of  Milliequivalent of  of  Milliequivalent of left unused  Volume of solution  Molarity of in the resulting mixture |
| Buffer solution |

|  |
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| What is the in the final solution prepared by mixing 20.0 of with of ?  (2010) |
|  |
|  |
|  |
|  |
| a |
| Milliequivalents of |
| Number of milliequivalents of  Number of milliequivalents of  of final solution  Milliequivalents of |
| Buffer solution |

|  |
| --- |
| Which will make basic buffer?  (2020) |
| of of |
| of of |
| of of |
| of of |
| b |
| buffer solution having more than 7 is known as basic buffer. It is obtained by mixing weak base and its salt with strong acid in a fixed proportion |
| Calculate the moles of HCl and NH4OH in their respective solutions  Moles of HCl = (Volume of HCl in liters) x (Concentration of HCl)  HCl NH4OH NH4Cl+ + H20  100 Ml ×0.1 M= 10 mmol 200mL×0.1M= 20mmol 0  0 10 10 mmoL  This is basic buffer. It is basic solution. of of |
| Buffer solution |

|  |
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| Calculate the of a solution at that contains M of hydronium ion.  (2012) |
| 7.00 |
| 4.00 |
| 9.00 |
| 1.00 |
| B |
|  |
| from eq. (i) and (ii), we get |
| Henderson Equation |

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| If the ion concentration product (Q) of a substance is greater than its Ksp, what will happen?  (2006) |
| A precipitate will form. |
| The solution will become more dilute. |
| The solubility of the substance will increase. |
| The solution will turn acidic. |
| a |
| When Q is greater than Ksp, the solution is supersaturated. |
| When Q is greater than Ksp, the solution is supersaturated. In this state, the excess ions cannot remain dissolved in the solution and will tend to come together and form solid particles or a precipitate. This process is a result of the solution trying to return to a state of equilibrium. |
| Solubility product |

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| Which of the following pairs constitutes a buffer?  (2015) |
| and |
| and |
| and |
| and |
| A |
| Solubility product |
| A pair constituent with and because is weak acid and is a salt of weak acid with strong base ( . Hence it is an example of acidic buffer solution. |
| Solubility product |

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| The value of a solution of is  (2009) |
| less than 0 |
| equal to 0 |
| equal to 1 |
| equal to 2 |
| A |
|  |
|  |
| Common ion effect |

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| The value of blood does not change appreciably by a small addition of an acid or base, because the blood  (2013) |
| is a body fluid |
| can be easily coagulated |
| contains iron as a part of the molecule |
| contains serum protein that acts as buffer |
| d |
| Blood contains serum protein |
| Blood is an example of buffer solution, which contains serum protein, so its does not change appreciably by adding small amount of an acid or a base to it. |
| Common ion effect |