



# CHEMISTRY

## BOOKS - SAI CHEMISTRY (TELUGU ENGLISH)

### CHEMICAL EQUILIBRIUM AND ACIDES- BASES

Mcq

1. On increasing temperature, the equilibrium constant of exothermic and endothermic reactions, respectively

A. Increases and decreases

B. Decreases and increases

C. Increases and increases

D. Decreases and decreases

**Answer: B**



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2. What is the pH of the NaOH solution when 0.04 g of it is dissolved in water and made to 100 ml solution?

A. 2

B. 1

C. 13

D. 12

**Answer: D**



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3. When one mole of A and one mole of B were heated in a one litre flask at T(K), 0.5 moles of C were formed at equilibrium



The equilibrium constant  $K_C$  is

A. 0.25

B. 0.5

C. 1

D. 2

**Answer: C**



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4. If the solubility of  $Ca_3(PO_4)_2$  in water is 'X' mol  $L^{-1}$ , its solubility product in  $mol^5 L^{-5}$  is

A.  $6X^5$

B.  $36X^5$

C.  $64X^5$

D.  $108X^5$

**Answer: D**



5. In a reaction,  $A + B \rightleftharpoons C + D$  40% of B has reacted at equilibrium, when 1 mole of A was heated with 1 mole of B in a 10 L closed vessel. The value of  $K_C$  is

A. 0.44

B. 0.18

C. 0.22

D. 0.36

**Answer: A**



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6. If the ionic product of  $Ni(OH)_2$  is  $1.9 \times 10^{-15}$ , the molar solubility of  $Ni(OH)_2$ , in 1.0 M NaOH is

A.  $1.9 \times 10^{-18} \text{ M}$

B.  $1.9 \times 10^{-13} \text{ M}$

C.  $1.9 \times 10^{-15} \text{ M}$

D.  $1.9 \times 10^{-14} \text{ M}$

**Answer: C**



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7. The degree of ionization of 0.10 M lactic acid is 4.0%

The value of  $K_C$  is



A.  $1.66 \times 10^{-5}$

B.  $1.66 \times 10^{-4}$

C.  $1.66 \times 10^{-3}$



D.  $1.66 \times 10^{-2}$

**Answer: B**



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8. The pH of a buffer solution made by mixing 25 mL of 0.02 M  $NH_4OH$  and 25 mL of 0.2 M  $NH_4Cl$  at  $25^\circ$  is ( $p^{K_b}$  of  $NH_4OH = 4.8$ )

A. 5.8

B. 8.2

C. 4.8

D. 3.8

**Answer: B**



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9. The  $pK_a$  values of four carboxylic acids are given below.

Identify the weakest carboxylic acid.

A. 4.89

B. 1.28

C. 4.76

D. 2.56

**Answer: A**



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**10.** Which one of the following statements is not correct?

- A. The pH of  $1.0 \times 10^{-8}$  M HCl is less than 7
- B. The ionic product of water at  $25^\circ\text{C}$  is  $1.0 \times 10^{-14} \text{ mol}^2 \text{ L}^{-2}$
- C.  $\text{Cl}^-$  is Lewis acid
- D. Bronsted Lowry theory cannot explain the acidic character of  $\text{AlCl}_3$

**Answer: C**



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11. If the equilibrium constant for the reaction  $2AB \rightleftharpoons A_2 + B_2$  is 49 what is the value of equilibrium constant for  $AB \rightleftharpoons \frac{1}{2}A_2 + \frac{1}{2}B_2$  ?

A. 7

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

C. 24.5

D. 49

**Answer: A**



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12. The pH of 0.05 M acetic acid is  
( $K_a = 2 \times 10^{-5}$ )

A. 2

B. 11

C.  $10^{-3}$

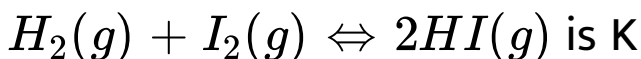
D. 3

**Answer: D**

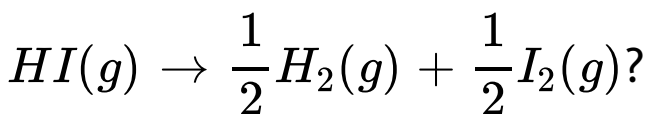


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13. If the equilibrium constant for the reaction,



What is the equilibrium constant of



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

B.  $\sqrt{K}$

C.  $K$

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

**Answer: D**



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14. The pH of 0.01 M solution of acetic acid is 5.0. What are the values of  $[H^+]$  and  $K_a$  respectively?

A.  $1 \times 10^{-5} M, 1 \times 10^{-8}$

B.  $1 \times 10^{-5} M, 1 \times 10^{-9}$

C.  $1 \times 10^{-4} M, 1 \times 10^{-8}$

D.  $1 \times 10^{-3} M, 1 \times 10^{-8}$

**Answer: A**





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15. pH of a buffer solution decreases by 0.02 units when 0.12 g of acetic acid is added to 250 mL of a buffer solution of acetic acid and potassium acetate at  $27^{\circ}C$ . The buffer capacity of the solution is

A. 0.1

B. 10

C. 1

D. 0.4

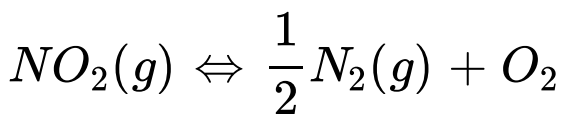
**Answer: D**



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**16.** The equilibrium constant for the given reaction is 100.

$N_2(g) + 2O_2(g) \rightleftharpoons 2NO_2(g)$  What is the equilibrium constant for the reaction given below?



A. 10

B. 1

C. 0.1

D. 0.01

**Answer: C**



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**17.** 20 mL of 0.1 M acetic acid is mixed with 50 mL of potassium acetate.  $K_a$  of acetic acid =  $1.8 \times 10^{-5}$  at  $27^\circ C$ . Calculate concentration

of potassium acetate if pH of the mixture is 4.8.

A. 0.1M

B. 0.04M

C. 0.4M

D. 0.02M

**Answer: B**



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18. 50 ml of  $H_2O$  is added to  $1 \times 10^{-3}M$  barium hydroxide solution. What is the pH of the resulting solution?

A. 3

B. 3.3

C. 11

D. 11.7

**Answer: C**



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**19.** Assertion (A): The aqueous solution of  $CH_3COONa$  is alkaline in nature.

Reason (R): Acetate ion undergoes anionic hydrolysis.

The correct answer is

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true but (R) is not the correct explanation of (A)

C. (A) is the true but (R) is not true

D. (A) is not true but (R) is true

**Answer: A**



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20. In a 500 mL flask, the degree of dissociation of  $PCl_5$  at equilibrium is 40% and the initial amount is 5 moles. The value of equilibrium constant in  $molL^{-1}$  for the decomposition of  $PCl_5$  is

A. 2.33

B. 2.66

C. 5.32

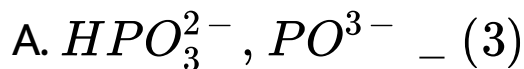
D. 4.66

**Answer: B**

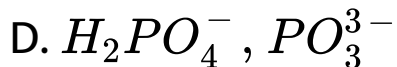
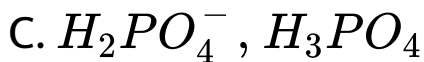
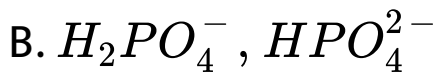


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21. Which of the following is not a conjugate acid base pair?







**Answer: D**



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22. Which of the following salts gives an acidic solution in water?



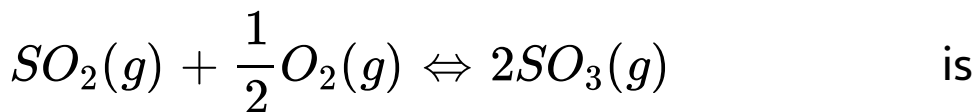


**Answer: B**



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**23.** The equilibrium constant of the reaction,



$5 \times 10^{-2} atm$ . The equilibrium constant of the



A. 100 atm

B. 200 atm

C.  $4 \times 10^2 \text{ atm}$

D.  $6.25 \times 10^4 \text{ atm}$

**Answer: C**



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**24.** At  $T(K)$ , 100 L of dry oxygen is present in a sealed container. It is subjected to silent electrical discharge till the volumes of oxygen

and ozone become equal What is the volume  
(in L) of ozone formed at T(K)?

A. 50

B. 60

C. 30

D. 40

**Answer: D**



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25. Which of the following is not a characteristic property of chemical equilibrium?

A. Rate of forward reaction is equal to rate of backward reaction at equilibrium

B. After reaching the chemical equilibrium, the concentrations of reactants and products remain unchanged with time

C. For  $A(g) = B(g)$ ,  $K_C$  is  $10^{-2}$ , if this reaction is carried out in the presence of

catalyst, the value of  $K_C$  decreases

D. After reaching the equilibrium, both forward and backward reactions continue to take place.

**Answer: C**



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**26.** The concentration of oxalic acid is 'x' mol  $L^{-1}$  40 mL of this solution reacts with 16 mL of 0.05M acidified  $KMNO_4$ . What is the pH of 'x'

M oxalic acid solution?

(Assume that oxalic acid dissociates completely.)

A. 1.3

B. 1.699

C. 1

D. 2

**Answer: A**



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27. Assertion (A): The pH of a buffer solution containing equal moles of acetic acid and sodium acetate is 4.8 ( $pK_a$  of acetic acid is 4.8).

Reasons (R): The ionic product of water at  $25^\circ C$  is  $10^{-14} mol^2 L^{-2}$ .

The correct answer is

- A. Both (A) and (R) are true and (R) is the correct explanation of (A)
- B. Both (A) and (R) are true and (R) is not the correct explanation of (A)



C. (A) is true but (R) is not true

D. (A) is not true but (R) is true

**Answer: B**



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**28.** At 550 K, the K for the following reaction is  $10^4 \text{ molL}^{-1}$ .

$X(g) + Y(g) \rightleftharpoons Z(g)$  At equilibrium, it was observed that  $[X] = \frac{1}{2}[Y] = \frac{1}{2}[Z]$  What is the value of  $[Z]$  (in  $\text{molL}^{-1}$ ) at equilibrium?

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

B.  $10^{-4}$

C.  $2 \times 10^4$

D.  $10^4$

**Answer: A**



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**29.** The pH of a solution of  $H_2O_2$  is 6.0. Some chlorine gas is bubbled into this solution. Which of the following is correct?

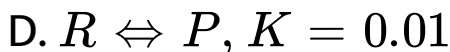
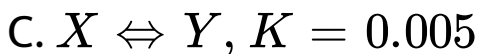
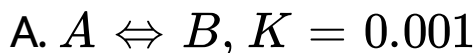
- A. The pH of resulting solution becomes 8.0
- B. Hydrogen gas is liberated from resultant solution
- C. The pH of resultant solution becomes less than 6.0 and oxygen gas is liberated
- D.  $Cl_2O$  is formed in the resultant solution

**Answer: C**



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30. In which of the following reactions, the concentration of product is higher than the concentration of reactant at equilibrium? ( $K$  = equilibrium constant)



**Answer: B**



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31. Study the following table

Which of the two sets of buffer solutions have least pH?



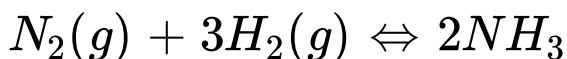
- A. I and II
- B. I and III
- C. II and III
- D. II and IV

**Answer: B**



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**32.** Consider the following reaction equilibrium



Initially, 1 mole of  $N_2$  and 3 moles of  $H_2$  are taken in a 2 L flask. At equilibrium state, if the number of moles of  $N_2$  is 0.6, what is the total number of moles of all gases present in the flask?

A. 0.8

B. 1.6

C. 3.2

D. 6.4

**Answer: C**



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**33.** If the ionic product of water ( $K_w$ ) is  $1.96 \times 10^{-14}$  at  $35^\circ C$  what is its value at  $10^\circ C$ ?

A.  $1.96 \times 10^{-14}$

B.  $3.92 \times 10^{-14}$

C.  $2.95 \times 10^{-15}$

D.  $1.96 \times 10^{-13}$

**Answer: C**



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**34.** 75 mL of 0.2 M HCl is mixed with 25 mL of 1 M HCl. To this solution, 300 mL of distilled



water is added. What is the pH of the resultant solution?

A. 1

B. 2

C. 4

D. 0.2

**Answer: A**



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35. Which one of the following statements is correct?

A. Bronsted-Lowry theory could not explain the acidic nature of  $BCl_3$

B. The pH of 0.01 M NaOH solution is 2

C. The ionic product of water at  $25^\circ C$  is  $10^{-10} mol^2 L^{-2}$

D. The pH of a solution can be calculated using the equation,  $pH = -\log[H^+]$

**Answer: A**



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**36.** 250 mL of a sodium carbonate solution contains 2.65 g  $Na_2CO_3$ . If 10 mL of this solution is diluted to one litre, what is the concentration of resultant solution?

A. 0.1 M

B. 0.001 M

C. 0.01 M

D.  $10^{-4} M$

**Answer: B**



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**37.** The  $pK_a$  of a weak acid is 4,8. What should be the ratio  $\frac{Acid}{Salt}$  if a buffer of pH= 5.8 is required?

A. 0.1

B. 10

C. 1

D. 2

**Answer: A**



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**38.** Which of the following would produce a buffer solution when mixed in equal volumes?

A.  $1MCH_3COOH$  and  $0.5MNaOH$

B.  $1MCH_3COOH$  and  $0.5MHCl$

C.  $1MNH_4OH$  and  $0.5MNaOH$

D.  $1MNH_4OH$  and  $0.5MHCl$

**Answer: A**



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**39.** The equilibrium constant for the reaction,  $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$  is 64 at a certain temperature. The equilibrium concentrations of  $H_2$  and HI are  $2mol/L$  and  $16mol/L$

respectively. What is the equilibrium concentration (in  $\text{mol} / \text{L}$ ) of  $\text{I}_2$  ?

A. 16

B. 4

C. 8

D. 2

**Answer: D**



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40. Which of the following is correct for acid buiter? [salt = S, acid = A]

A.  $pK_a = pH + \log \frac{S}{A}$

B.  $pH = pK_a + \log \frac{S}{A}$

C.  $pK_a = pH - \frac{A}{S}$

D.  $pH = pK_a + \log \frac{A}{S}$

**Answer: B**



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41. The pH of an aqueous solution of a salt is

10. The salt

A. NaCl

B.  $NH_4Cl$

C.  $CH_3COON$

D.  $(NH_4)_2SO_4$

**Answer: C**



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42. The following reaction is known to occur in the body, If  $CO_2$  escapes from the system



- A.  $H^+$  ion concentration increases
- B.  $H^+$  ion concentration decreases
- C.  $H_2CO_3$  concentration does not change
- D. The forward reaction will be promoted

**Answer: B**



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43.  $\Delta x = (\text{hydration energy}) - (\text{lattice energy})$ ,

for a salt  $\Delta x$  is found to be  $-500 \text{ kcal mol}^{-1}$

Then, on increasing the temperature, its solubility in water

A. Increases

B. Decreases

C. Remains same

D. Increase initially and then decreases

**Answer: A**



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44. The pH of 1 L solution is 2. It is diluted with water till its becomes 4. How many litres of water are added?

A. 99

B. 9

C. 999

D. 9.9

**Answer: A**



45. At  $90^\circ C$ , the concentration of  $H_3O^+$  in pure water is  $10^{-6} molL^{-1}$ . What is the value of  $K_w$  at this temperature?

A.  $10^{-6}$

B.  $10^{-8}$

C.  $10^{-14}$

D.  $10^{-12}$

**Answer: D**



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46. The pH of a solution is increased from 3 to 6. Its H<sup>+</sup> ion concentration will be

A. Reduced to half

B. Doubled

C. Reduced by 1000 times

D. Increased by 1000 times

**Answer: C**



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47. The conjugate base of  $NH_2^-$  is

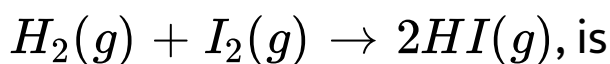


**Answer: B**



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**48.** 4.5 moles, each of hydrogen and iodine was heated in a sealed 10 L vessel. At equilibrium, 3 moles of HI were found. The equilibrium constant for



A. 1

B. 10

C. 5

D. 0.33

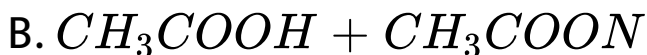
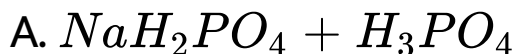
**Answer: A**





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49. Which of the following solutions cannot act as a buffer?

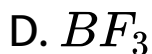
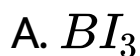


Answer: C



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50. Which of the following is the strongest Lewis acid?



**Answer: A**



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51. If the equilibrium constant for the reaction  $2AB \rightleftharpoons A_2 + B_2$  is 49 what is the value of equilibrium constant for  $AB \rightleftharpoons \frac{1}{2}A_2 + \frac{1}{2}B_2$  ?

A. 49

B. 2401

C. 7

D. 0.02

**Answer: C**



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52. The value of  $K_p$  for the reaction  $2H_2S(g) \rightleftharpoons 2H_2(g) + S_2(g)$  is  $1.2 \times 10^{-2}$  at  $1065^\circ C$ . The value of  $K$ , for this reaction is

A.  $1.2 \times 10^{-2}$

B.  $< 1.2 \times 10^{-2}$

C. 82

D.  $> 1.2 \times 10^{-2}$

**Answer: B**



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53. The pH of the aqueous solution containing 0.49 g  $H_2SO_4$  in one litre is

A. 2

B. 1

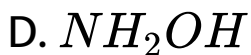
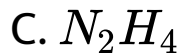
C. 1.7

D. 0.3

**Answer: A**



54. The conjugate acid of  $NH_2^-$  ion is



**Answer: A**



55. Which of the following compounds is Lewis acid?

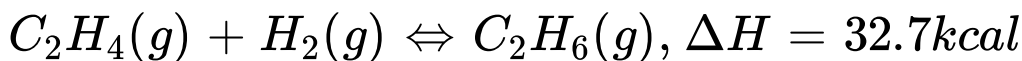


**Answer: B**



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56. The equilibrium concentration of  $C_2H_4$  in the following gas phase reaction can be increased by



- A. Removal of  $C_2H_6$
- B. Removal  $H_2$  of
- C. Increase in temperature
- D. Increase in pressure

**Answer: B**



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57. Urine normally has a pH of 6. If a patient eliminates 1.3 L of urine per day, how many moles of  $H^+$  ions does he urinate?

A.  $1.3 \times 10^{-3}$

B.  $1.3 \times 10^{-6}$

C.  $1.3 \times 10^{-7}$

D.  $1.3 \times 10^6$

**Answer: B**



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

(i)  $HCO_3^-$  (ii)  $NH_3$  (iii)  $O^{2-}$  (iv)  $HCl$

A. (i) and (ii)

B. (ii) and (iii)

C. None of the above

D. All of the above

**Answer: A**



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59. Which of the following is least likely to act as a Lewis base?

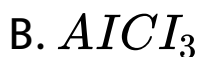
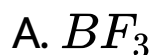


**Answer: D**



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60. Which of the following is not a Lewis acid?



**Answer: C**



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61. The equilibrium constant ( $K_C$ ) for the reaction  $HA + B \rightleftharpoons BH^+ + A$  is 100. If the rate constant for the forward reaction is  $10^5$ , rate constant for the reverse reaction is

A.  $10^{-3}$

B.  $10^{-5}$

C.  $10^7$

D.  $10^3$

**Answer: D**



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62. In the equilibrium reaction,  $A(g) + 2B(g) +$   
 $(g)$ , the equilibrium constant,  $K_c$  is given by  
the expression

A.  $K_c = \frac{[C][D]}{[A][B]}$

B.  $K_c = \frac{[C][D]^2}{[A][B]}$

C.  $K_c = \frac{[A][B]^2}{[C][D]}$

D.  $K_c = \frac{[C][D]}{[A][B]^2}$

**Answer: D**



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63. The ionic product of water is  $10^{-14}$ . What is the hydrogen ion concentration of a 0.1 M NaOH solution?

A.  $10^{-14}$

B. 14 M

C. 13 M

D.  $10^{-13}$  M

**Answer: D**



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64. The pH of a 0.05 M solution of  $H_2SO_4$  is

A. 5

B. 1

C. 3

D. 0.1

**Answer: B**



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**65.** The pH of a 0.001 M aqueous solution of sodium hydroxide will be

A. 5

B. 7.5

C. 9

D. 11

**Answer: D**



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**66.** The nature of 0.1 M solution of sodium bisulphate is

A. Acidic

B. Basic

C. Neutral

D. Can't predict

**Answer: C**



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67. The ionic product of water  $[H^+][OH^-]$

is

A.  $10^{-11}$

B.  $10^{-12}$

C.  $10^{-5}$

D.  $10^{-14}$

**Answer: D**



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**68.** The solution which tends to keep the concentration of hydrogen ions constant even when small amount of strong acid or strong base are added to them, is known as

- A. Acidic solution
- B. Alkaline solution
- C. Buffer solution
- D. Ideal solution

**Answer: C**



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69. In the reaction  
$$H_2(g) + Cl_2(g) \rightarrow 2HCl(g),$$
the relation  
between  $K_p$  and  $K_c$  is

A.  $K_p = K_c$

B.  $K_p \neq K_c$

C.  $K_p \geq K_c$

D.  $K_p < K_c$

**Answer: A**





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70. If in 100 mL of an aqueous HCl of pH 10, 900 mL of distilled water is added, the pH of the resultant solution will be

A. 1

B. 2

C. 4

D. 7

**Answer: B**



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71. The degree of dissociation of an acid HA in 0.1 M solution is 0.1%. Its dissociation constant is

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

B.  $1 \times 10^{-7}$

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

D.  $1 \times 10^{-14}$

**Answer: B**



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72. The pH of  $10^{-2}$  M NaOH solution is,

- A. 2
- B. 12
- C. 10
- D. 4

**Answer: B**



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73. The solution that is made by mixing appropriate amount of a weak acid and salt is called

- A. Basic buffer
- B. Acidic buffer
- C. Neutral buffer
- D. Both (a) and (b)

**Answer: B**



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74. The  $pK_a$  of a certain weak acid is 4.0. What should be the [salt] to [acid] ratio, if we have to prepare a buffer with a pH= 5 using the acid and one of its salts?

A. 4: 5

B. 5: 4

C. 10: 1

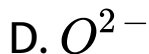
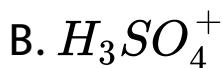
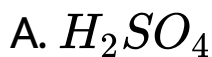
D. 1: 10

**Answer: C**



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75. The conjugate base of  $HSO_4^-$  ion is .....



**Answer: C**



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76. Aqueous solution of  $FeCl_3$  is acidic because of

- A. Hydrolysis
- B. Anionic hydrolysis
- C. Cationic hydrolysis
- D. Dissociation

**Answer: C**



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77. 0.1 M HCl solution is diluted by 100 times.

The pH of the solution so formed is.....

A. 4

B. 1

C. 2

D. 3

**Answer: D**



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