

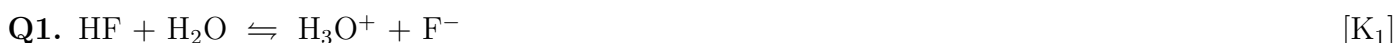


DPP-5 [Conjugate Acid–Base and Acidic strength]

Chapter: Ionic Equilibrium

“Success is no accident. It is hard work, perseverance, learning, studying, sacrifice and most of all, love of what you are doing.”

GROUP–A: K_a , K_b , K_w & Conjugate Relations

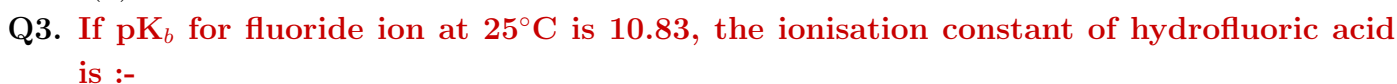


For the above two reactions which of the given relation is correct? [NCERT Pg. 223]

- (1) $K_2 = K_w$
- (2) $K_2 = \frac{1}{K_w}$
- (3) $K_w = K_1 K_2$
- (4) $K_w = \frac{K_1}{K_2}$



- (a) 1×10^{-6}
- (b) 1×10^8
- (c) 1×10^{-8}
- (d) 1×10^6



- (a) 1.74×10^{-5}
- (b) 3.52×10^{-3}
- (c) 6.75×10^{-4}
- (d) 5.38×10^{-2}



- (1) 4.0×10^{-20}
- (2) 2.5×10^{-9}
- (3) 1.0×10^{-6}
- (4) 2.5×10^{-5}



- (1) 5.6×10^{-10}
- (2) 1.8×10^{-5}
- (3) 1.0×10^{-14}
- (4) 3.2×10^{-7}

- Q6. What is the ionisation constant of HOCl, if K_b of $\text{OCl}^- = 4 \times 10^{-10}$?**
- (1) 4.6×10^{-2}
 - (2) 1.0×10^{-10}
 - (3) 2.5×10^{-5}
 - (4) 6.0×10^{-7}
- Q7. The percentage of pyridine ($\text{C}_5\text{H}_5\text{N}$) that forms pyridinium ion ($\text{C}_5\text{H}_5\text{NH}^+$) in a 0.10 M aqueous pyridine solution ($K_b = 1.7 \times 10^{-9}$) is :-**
- (1) 0.77%
 - (2) 1.6%
 - (3) 0.0060%
 - (4) 0.013%
- Q8. Which of the following is incorrect?**
- (a) K_a (weak acid), K_b (conjugate weak base) = K_w
 - (b) K_a (strong acid), K_b (conjugate weak base) = K_w
 - (c) K_a (weak acid), K_b (weak base) = K_w
 - (d) K_a (weak acid), K_b (conjugate strong base) = K_w

GROUP-B: Conjugate Acid-Base Identification

- Q1. The conjugated acid of O^{2-} ion's is :-**
- (1) O_2^+
 - (2) H^+
 - (3) H_3O^+
 - (4) OH^-
- Q2. The conjugated base of $(\text{CH}_3)_2\text{NH}_2^+$ is :-**
- (1) CH_3NH_2
 - (2) $(\text{CH}_3)_2\text{N}^+$
 - (3) $(\text{CH}_3)_2\text{N}$
 - (4) $(\text{CH}_3)_2\text{NH}$
- Q3. Conjugate acid of $\text{Zn}(\text{OH})_2$ is :-**
- (1) $\text{Zn}(\text{OH})^+$
 - (2) $\text{Zn}(\text{OH})_3^-$
 - (3) Zn^{2+}
 - (4) None
- Q4. In the reaction $\text{HNO}_3 + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{NO}_3^-$, the conjugate base of HNO_3 is :-**
- (1) H_2O
 - (2) H_3O^+
 - (3) NO_3^-
 - (4) H_3O^+ and NO_3^-
- Q5. Ammonium ion is :-**
- (1) A conjugate acid
 - (2) A conjugate base
 - (3) Neither an acid nor a basic
 - (4) Both an acid and a base

Q6. Which is incorrect?

- (1) Conjugate acid of H_2O is H_3O^+
- (2) Conjugate base of HCO_3^- is CO_3^{2-}
- (3) Conjugate base of NH_3 is NH_2^-
- (4) Conjugate base of HOCl is Cl^-

Q7. Which one of the following is not acid–base conjugate pair?

- (1) HONO , NO_2^-
- (2) CH_3NH_3^+ , CH_3NH_2
- (3) $\text{C}_6\text{H}_5\text{-COOH}$, $\text{C}_6\text{H}_5\text{COO}^-$
- (4) H_3O^+ , OH^-

Q8. Conjugate acid of NH_2^- is :-

- (1) NH_4OH
- (2) NH_4^+
- (3) NH_2^-
- (4) NH_2

Q9. When HF is dissolved in formic acid, the equilibrium is :-



The true pair of conjugate acid–base is :-

- (1) $(\text{HF}, \text{HCOOH})$ and $(\text{HCOOH}_2^+, \text{F}^-)$
- (2) $(\text{HF}, \text{HCOOH}_2^+)$ and $(\text{HCOOH}, \text{F}^-)$
- (3) $(\text{HCOOH}_2^+, \text{HF})$ and $(\text{F}^-, \text{HCOOH})$
- (4) (HF, F^-) and $(\text{HCOOH}_2^+, \text{HCOOH})$

Q10. The conjugate base of H_2PO_4^- is :-

- (1) PO_4^{3-}
- (2) P_2O_5
- (3) H_3PO_4
- (4) HPO_4^{2-}

Q11. What is the conjugate base of OH^- ?

- (1) O_2
- (2) H_2O
- (3) O^{2-}
- (4) O_2^-

Q12. The conjugate base of hydrazoic acid is :-

- (1) N_3^-
- (2) N_3^{2-}
- (3) N_2^-
- (4) HN_3^-

Q13. In the reaction $\text{HNO}_3 + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{NO}_3^-$, the conjugate base of HNO_3 is :-

- (a) H_2O
- (b) H_3O^+
- (c) NO_3^-
- (d) H_3O^+ and NO_3^-

Q14. Out of the following, amphiprotic species in aqueous medium are : I : HPO_4^{2-} II : OH^- III : H_2PO_4^- IV : HCO_3^-

- (a) I, III, IV
- (b) I and III
- (c) III and IV
- (d) All

Q15. The conjugate acid of NH_2^- is :-

- (a) NH_3
- (b) NH_2OH
- (c) NH_4^+
- (d) N_2H_4

Q16. The following equilibrium is established when HClO_4 is dissolved in weak acid HF solvent :



Which of the following is correct set of conjugate acid–base pair ?

- (a) HF and HClO_4
- (b) HF and ClO_4^-
- (c) HF and H_2F^+
- (d) HClO_4 and H_2F^+

Q17. Select Polyprotic Arrhenius acids from the following : H_3PO_2 , H_3PO_3 , H_3BO_3 , HCOOH , $(\text{COOH})_2$

(b) Write conjugate acids of SO_4^{2-} , RNH_2 , NH_2^- , $\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$, F^-

(c) Write conjugate base of HNO_2 , OH^- , H_2CO_3 , HClO_4

(d) Write conjugate acid and conjugate base of following amphoteric species : HS^- , NH_3 , $\text{C}_2\text{H}_5\text{OH}$, H_2O

(e) Classify the following into Lewis acid & Lewis base : H^+ , FeCl_3 , $(\text{CH}_3)_3\text{N}$, F^- , CH_2

GROUP–C: Acid Strength, pK_a , pK_b & Relative Strength

Q1. Which of the following is the weakest acid ?

- (1) Phenol ($K_a = 1.3 \times 10^{-10}$)
- (2) Hydrocyanic acid ($K_a = 4.9 \times 10^{-10}$)
- (3) Acetic acid ($K_a = 1.8 \times 10^{-5}$)
- (4) Benzoic acid ($K_a = 6.5 \times 10^{-5}$)

Q2. Which of the following is the strongest base ?

- (1) $\text{C}_6\text{H}_5\text{NH}_2$ ($\text{pK}_b = 9.42$)
- (2) $\text{C}_6\text{H}_5\text{NHCH}_3$ ($\text{pK}_b = 9.15$)
- (3) $\text{C}_6\text{H}_5\text{N}(\text{CH}_3)_2$ ($\text{pK}_b = 8.94$)
- (4) $\text{C}_6\text{H}_5\text{NHC}_2\text{H}_5$ ($\text{pK}_b = 8.89$)

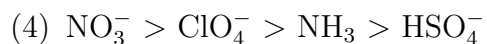
Q3. Value of dissociation constant of acetic acid is 10^{-6} , where as dissociation constant of formic acid is 10^{-5} . Which of the following will be the value of $\text{pK}_a(\text{acetic acid}) - \text{pK}_a(\text{formic acid})$?

- (1) 10
- (2) +1

(3) 10^{-1}

(4) -1

- Q4. For two monobasic acids A and B, $pK_{a1} = 1.2$, $pK_{a2} = 2.8$ respectively in value, then which is true:**
- (a) A & B both have equal acidic strength
 - (b) A is stronger than B
 - (c) B is stronger than A
 - (d) If both acids have same concentration than A is more acid than B
- Q5. Ionization constant of AOH and BOH base are K_{b1} and K_{b2} . Their relation is $pK_{b1} < pK_{b2}$. Conjugate of following base, does not show maximum pH :**
- (1) AOH
 - (2) BOH
 - (3) Both of them
 - (4) NOT
- Q6. K_a for formic acid and acetic acid are 1.8×10^{-4} and 1.8×10^{-5} respectively. The relative strength of acids is :**
- (a) 10 : 1
 - (b) 1 : 10
 - (c) 1 : $\sqrt{10}$
 - (d) $\sqrt{10}$: 1
- Q7. The strongest conjugate base is :-**
- (1) NO_3^-
 - (2) Cl^-
 - (3) SO_4^{2-}
 - (4) CH_3COO^-
- Q8. CH_3COO^- ion is a :-**
- (1) Weak conjugate base
 - (2) Strong conjugate base
 - (3) Weak conjugate acid
 - (4) Strong conjugate acid
- Q9. Which of the following is strongest conjugate base :-**
- (1) ClO_4^-
 - (2) HCO_3^-
 - (3) F^-
 - (4) HSO_4^-
- Q10. The decreasing order of strength of following bases NH_3 , CH_3COO^- and Cl^- is :-**
- (1) Cl^- , CH_3COO^- , NH_3
 - (2) CH_3COO^- , NH_3 , Cl^-
 - (3) CH_3COO^- , Cl^- , NH_3
 - (4) NH_3 , CH_3COO^- , Cl^-
- Q11. Correct basic strength order will be :-**
- (1) $\text{HSO}_4^- < \text{ClO}_4^- < \text{NO}_3^- < \text{NH}_3$
 - (2) $\text{ClO}_4^- < \text{HSO}_4^- < \text{NO}_3^- < \text{NH}_3$
 - (3) $\text{ClO}_4^- > \text{HSO}_4^- > \text{NO}_3^- > \text{NH}_3$



Q12. The conjugate base of the weak acid in the reaction $\text{HBr} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{Br}^-$ is :-

- (1) HBr
- (2) H_2O
- (3) Br^-
- (4) H_3O^+

Q13. The pH of 0.1 M monobasic acid is 4.50. The acidity constant (K_a) of the monobasic acid is-

- (1) 1.0×10^{-7}
- (2) 1.0×10^{-5}
- (3) 1.0×10^{-4}
- (4) 1.0×10^{-8}

Q14. If an acid-base reaction $\text{HA}(\text{aq}) + \text{B}^-(\text{aq}) \rightleftharpoons \text{HB}(\text{aq}) + \text{A}^-(\text{aq})$ has $K_{eq} = 10^{-4}$, how many of the following statements are true ?

- (i) HB is stronger acid than HA
 - (ii) HA is stronger acid than HB
 - (iii) HA and HB have the same acidic strength
 - (iv) B^- is stronger base than A^-
 - (v) A^- is stronger base than B^-
 - (vi) B^- and HB are conjugate acid-base pair
 - (vii) A^- is the conjugate base of acid HA
 - (viii) HA can be HSO_4^- and HB can be HCOOH
 - (ix) A^- can be F^- and B^- can be CN^-
- (1) 4 (i, v, vi, vii)