DPP–6 SOLUTIONS (Polyprotic Acids, Ostwald's Law, Common Ion Effect)

Chapter: Ionic Equilibrium

"Hard work compounds faster than interest — revise daily."

GROUP–A: Polyprotic Acids – STNMJC Solutions

Q1. In the dissociation of H_2A, which is correct?

Polyprotic acids ka simple rule: pehla proton sabse easy nikalta hai. Isliye K_1 ¿ K_2 hota hi hota hai.

H_2A neutral hota hai → pehla H^+ remove karna easy. HA^- negative ion hota hai → second H^+ remove karna tough. Therefore:

$$K_1 > K_2$$

Correct option: (3)

Q2. Which of the following is right for diprotic acid?

Diprotic acids me first dissociation ¿ second dissociation. Isliye K_{a1} ¿ K_{a2}.

Neutral → first H^+ remove easy Negative → second H^+ remove difficult

$$K_{a1} > K_{a2}$$

Correct option: (4)

Q3. Overall dissociation constant of H_2A?

Overall $K = K_1 \times K_2$. Bas multiply.

$$K_1 = 10^{-5}, \quad K_2 = 5 \times 10^{-10}$$

$$K = 5 \times 10^{-15}$$

Correct option: (1)

Q4. 10% dissociation of 5×10^{-3} M H_2CO_3 → $[H^+]$?

Alpha = 0.1 diya hai. Polyprotic acid first step dominates.

$$[H^+] = C\alpha = 5 \times 10^{-3} \times 0.1 = 5 \times 10^{-4}$$

Closest = 10^{-2}

Correct option: (2)

Q5. pH of 0.0025 M $M(OH)_4$ (50% ionised)?

$M(OH)_4 \rightarrow 4\ OH^-$. $OH^- = 4C$.

$$[OH^-] = 4(0.0025)(0.5) = 0.005$$

pOH = –log(0.005) = 2.3 pH = 11.7

Correct option: (4)

Q6. Concentrations in 0.1 M oxalic acid ($K_1 = 10^{-2}$, $K_2 = 10^{-5}$)?

K1 large → first dissociation strong. K2 small → second weak.

Best matching distribution: option (1)

Correct option: (1)

Q7. pH of H_3X (1st = 100%, 2nd = 50%)?

Total H^+ = first + half of second.

$$H^+ = 2 \times 10^{-4} + 1 \times 10^{-4} = 3 \times 10^{-4}$$

pH = 3.52

Correct option: (3)

Q8. Correct Kb values for phosphate ions?

$$K_b = \frac{K_w}{K_a}$$

Smaller Ka → larger Kb.

$$K_b(\mathrm{HPO_4^{2-}}) = 10^{-6}$$

$$K_b(\mathrm{PO_4^{3-}}) = 10^{-2}$$

Order matches option (1)

Correct option: (1)

GROUP–B: Ostwald's Dilution Law – STNMJC Solutions

Q9. Max ionisation (NH_3 different concentrations)?

Weak base → more dilute → more ionised.

Smallest concentration = 0.0001 M → highest .

Correct option: (4)

Q10. Ratio / after 100× dilution?

$$\alpha = \sqrt{\frac{K_a}{C}}$$

So increases by 100 = 10.

$$\frac{\alpha_2}{\alpha_1} = 10$$

Correct option: (1)

Q11. What happens after dilution of weak acid?

Dilution always increases ionisation for weak acids.

Only (a) correct.

Correct option: (1)

Q12. Ionisation increases when...

More water → more ionisation.

Correct = option (3)

Correct option: (3)

Q13. Relation if both acids give same $[H^+]$?

Weak acids: Ka·V constant hota hai.

$$K_{a1}V_1 = K_{a2}V_2$$

Correct option: (1)

Q14. Why Ostwald fails for strong electrolytes?

Strong electrolytes already 100

1 → formula meaningless.

Correct option: (1)

Q15. Which vessel gives more for acetic acid?

Zyada volume = zyada dilution = zyada .

12 L ¿ 6 L

Correct option: (1)

Q16. Dilution law applicable for?

Only weak electrolytes follow Ostwald.

CHCOONa = WASB salt → weak electrolyte.

Correct option: (3)

GROUP–C: Common Ion Effect – STNMJC Solutions

Q17. Assertion–Reason (NaCl + HCl)?

Common ion effect weak electrolyte me hota hai. Yahaan dono strong hain.

Assertion true. Reason true. Reason explains assertion.

Correct option: A

Q18. Which pair shows common ion effect?

Weak electrolyte + common ion from strong electrolyte.

NHOH (weak) + NHCl (strong salt with same ion).

Correct option: (3)

Q19. Adding HCl to acetic acid solution... what happens?

Extra H^+ aane se equilibrium left shift hota hai $\rightarrow$ acetate kam hota hai.

$$CH_3COOH \leftrightarrow H^+ + CH_3COO^-$$

$H^+ \uparrow \rightarrow$ backward shift $\rightarrow$ CHCOO decreases.

Correct option: (1)