

21. (b) Fourteen

Explanation

At 25°C , water ionizes as:

$$K_w = [\text{H}^+] \times [\text{OH}^-] = 1 \times 10^{-14}$$

Taking negative logarithm:

$$\text{pH} + \text{pOH} = 14$$

This is a **fixed relation at 25°C .**

22. (c) It is a strong acid and they lose proton in a solution.

23. (a) $[\text{OH}^-] = 10^{-2} \text{M}$; $\text{pOH} = 2$

$$\text{pH} + \text{pOH} = 14; \text{pH} = 14 - \text{pOH}$$

$$\text{pH} = 14 - 2 = 12$$

24. (d) Order of acidic strength is $\text{H}_2\text{Te} > \text{H}_2\text{Se} > \text{H}_2\text{S} > \text{H}_2\text{O}$

Na_2O is a salt of NaOH and H_2O and H_2O is least acidic among given acids hence pH in

this case will be max^m .

25. (b) pH of the solution A = 3

$$[\text{H}^+]_A = 10^{-3} \text{M}.$$

pH of the solution B = 2

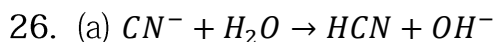
$$[\text{H}^+]_B = 10^{-2} \text{M}$$

$$[\text{H}^+] = 10^{-3} + 10^{-2} = 10^{-3} + 10 \times 10^{-3} = 11 \times 10^{-3}.$$



$$pH = -\log(11 \times 10^{-3}) = 3 - \log 11$$

$$= 3 - 1.04 = 1.95$$



Because OH^- concentration is increased.

27. (a) On dilution the pH of acid A increases while pH of base B decreases.

28. (d) CH_3COONa is a salt of weak acid, (CH_3COOH) and strong base ($NaOH$).

29. (b) The equilibrium will shift in the backward direction.

30. (b) $K_a = 10^{-5}$; $pH = 6$

$$pH = -\log K_a + \log \frac{[Salt]}{[Acid]};$$

$$6 = -\log 10^{-5} + \log \frac{[Salt]}{[Acid]}$$

$$6 = 5 \log 10 + \log \frac{[Salt]}{[Acid]}; 6 = 5 + \log \frac{[Salt]}{[Acid]}$$

$$\log \frac{[Salt]}{[Acid]} = 6 - 5 = 1; \frac{[Salt]}{[Acid]} = \frac{10}{1}$$

31. (d) All are true – (a) is true for acid buffer, (b) for basic buffer, (c) is called buffer solution.

32. (b) $\frac{N}{100} = 0.01 NHCl; [H^+] = 10^{-2} M; pH = 2$

$$[OH] = 10^{-2} M \text{ for } NaOH$$

$$pH + pOH = 14; pH = 14 - 2; pH = 12$$





33. (a) Slightly lower than that of rainwater without thunderstorm

Explanation (Easy to Understand):

During a thunderstorm, large amounts of electric discharge occur.

This causes nitrogen and oxygen in the air to react and form oxides of nitrogen (e.g., NO and NO₂).

These oxides dissolve in rainwater and form nitric acid (HNO₃).

As a result, the rainwater becomes slightly more acidic, meaning pH decreases.

So, thunderstorm rain = more nitric acid formation → lower pH.

34. (a) It is a buffer solution of strong acid and its weak conjugate base.

35. (c) $HA \rightleftharpoons H^+ + A^-$

$$[H^+] = 0.1M; [H^+]^2 = K_a \times C$$

$$[H^+] = \sqrt{K_a \times C} = \sqrt{1 \times 10^{-5} \times 0.1} = \sqrt{10^{-6}}$$

$$[H^+] = 10^{-3}M; pH = 3$$

36. (c) As the solution is acidic, $pH < 7$. This is because $[H^+]$ from H_2O cannot be neglected in comparison to 10^{-8} .

37. (c) Human body contain buffer solution. Its $pH = 6.8$

38. (a) It is a neutral solution and its $pH = 7$

39. (a) $pH = 5$, means $[H^+] = 10^{-5}M$.

$$\text{After dilution } [H^+] = 10^{-5}/100 = 10^{-7}M$$

$[H^+]$ from H_2O cannot be neglected.

$$\text{Total } [H^+] = 10^{-7} + 10^{-7} = 2 \times 10^{-7}$$



$$pH = 7 - 0.3010 = 6.6990 = 7 \text{ (neutral).}$$

$$40. \text{ (d) } [H^+] = \alpha \cdot C = \frac{2}{100} \times .02; [H^+] = 4 \times 10^{-4} M$$

$$pH = -\log [H^+] = 4 - \log 4; pH = 3.3979$$

