

21. (b) Fourteen

### Explanation

At **25°C**, water ionizes as:

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

Taking negative logarithm:

$$pH + pOH = 14$$

This is a **fixed relation at 25°C**.

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

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

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

$$pH = 14 - 2 = 12$$

24. (d) Order of acidic strength is  $H_2Te > H_2Se > H_2S > H_2O$

$Na_2O$  is a salt of  $NaOH + H_2O$  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

$$[H^]_A = 10^{-3} M$$

$pH$  of the solution B = 2

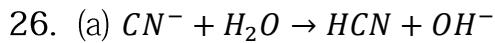
$$[H^]_B = 10^{-2} M$$

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



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

$$= 3 - 1.04 = 1.95$$



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)  $K_a = 10^{-5}$ ;  $pH = 6$

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

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

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

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

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 NO<sub>2</sub>).

These oxides dissolve in rainwater and form nitric acid (HNO<sub>3</sub>).

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  $[H^+] = 10^{-5}M$ .

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

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

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





IONIC EQUILIBRIUM

## IIT-JEE CHEMISTRY

$pH = 7 - 0.3010 = 6.6990 = 7$  (neutral).

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

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

