YAKEEN NEET 2.0

2026

Ionic Equilibrium

Physical Chemistry | Lecture -04

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Topics to be covered

MEDICS Test.

1. Revision of Last Class
2. Ph of strong base and on its dilution
3. Ph of mixtures of acids or bases
4. Magarmach Practice questions, Home work from modules

Rule to Attend Class

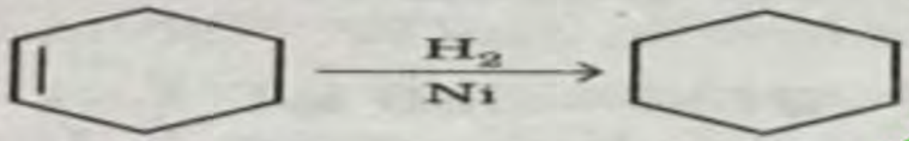
1. Always sit in a peaceful environment with headphone and be ready with your copy and pen.
2. Never ever attend a class from in between or don't join a live class in the middle of the chapter.
3. Make sure to revise the last class before attending the next class & always complete your home work along with DPP.
4. Never ever engage in chat whether live or recorded on the topic which is not being discussed in current class as by doing so u can be blocked by the admin team or your subscription can be cancelled.

Rule to Attend Class

5. Try to make maximum notes during the class if something is left then u can use the notes pdf after the class to complete the remaining class.
6. Always ask your doubts in doubt section to get answer from faculty. Before asking any doubt please check whether same doubt has been asked by someone or not.
7. Don’t watch the videos in high speed if you want to understand better.

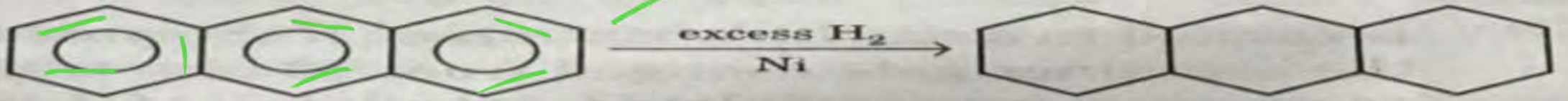

There is one big flaw in your Preparation that's name is Backlog ? What do we say to Backlog ?
NOT TODAY !!!

. Use the following data to answer the question below :



$\Delta H = -28.6$ kcal mol^{-1};

$\Delta H = 7x - 28.6 = -200.2$



$\Delta H = -116.2$ kcal mol^{-1}

Calculate the resonance energy of anthracene,

R.E. = $\Delta H_{\text{jo aana chahiye}} - \Delta H_{\text{jo aaya hai}}$

$= -200.2 - (-116.2)$

$= -84$ KCal/mol.

Which of the following process is/are always exothermic?

(a) Enthalpy of combustion

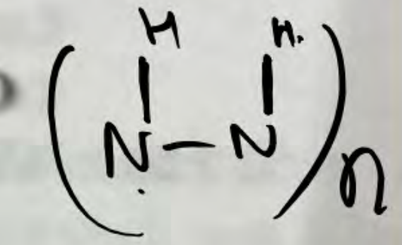
(b) Enthalpy of neutralisation

(c) Enthalpy of atomisation

(d) Enthalpy of formation

Determine enthalpy change for the following polymerization reaction per mole of $N_2(g)$ consumed

$$n N_2(g) + n H_2(g) \longrightarrow (NH{-}NH)_n\ (g)$$



Given :

Bond enthalpy :

N≡N = 942 kJ/mole;

N—N = 163 kJ/mole

H—H = 436 kJ/mole

N—H = 390 kJ/mole

$$\Delta H = \frac{n \times 942 + n \times 436 - n \times 163 + 2n \times 390)}{n}$$

$$\Delta H = 1378 - 943$$

$$= 435$$

780
163
94 3

(a) 272 kJ/mole (b) 140 kJ/mole

(c) −110 kJ/mole (d) −400 kJ/mole

Which of these conversions has a positive $\Delta S°$?

(P) combustion of charcoal $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$

(Q) condensation of $Br_2(g) \longrightarrow Br_{2(l)}$

(R) precipitation of $AgCl(s) \rightarrow AgCl \downarrow$

(a) P only

(b) Q only

(c) R only

(d) Q and R only

Given these reactions :

eq ① − eq ③ + 2 eq ②

$A \longrightarrow 2B$ ① $\Delta H = 40$ kJ

$B \longrightarrow C$ ② $\Delta H = -50$ kJ

$2C \longrightarrow D$ ③ $\Delta H = -20$ kJ

$\Delta H = 40 + 20 + 2 \times -50$

$= 60 - 100 = -40$

Calculate ΔH for the reaction : $D + A \longrightarrow 4C$

(a) −100 kJ

(b) −60 kJ

(c) −40 kJ ✓

(d) 100 kJ

Medics test → Faraday → Chem eq. → Lec-1 to Lec-4.

Revision of Last Class

$K_w = [H^+][OH^-]$

✓ $K_w \propto T$ ✓

at 298 K $\Rightarrow K_w = 10^{-14} \Rightarrow pK_w = 14$

$\downarrow$

$[H^+] = [OH^-] = 10^{-7}$ M

$$[OH^-] = \frac{K_w}{[H^+]}$$

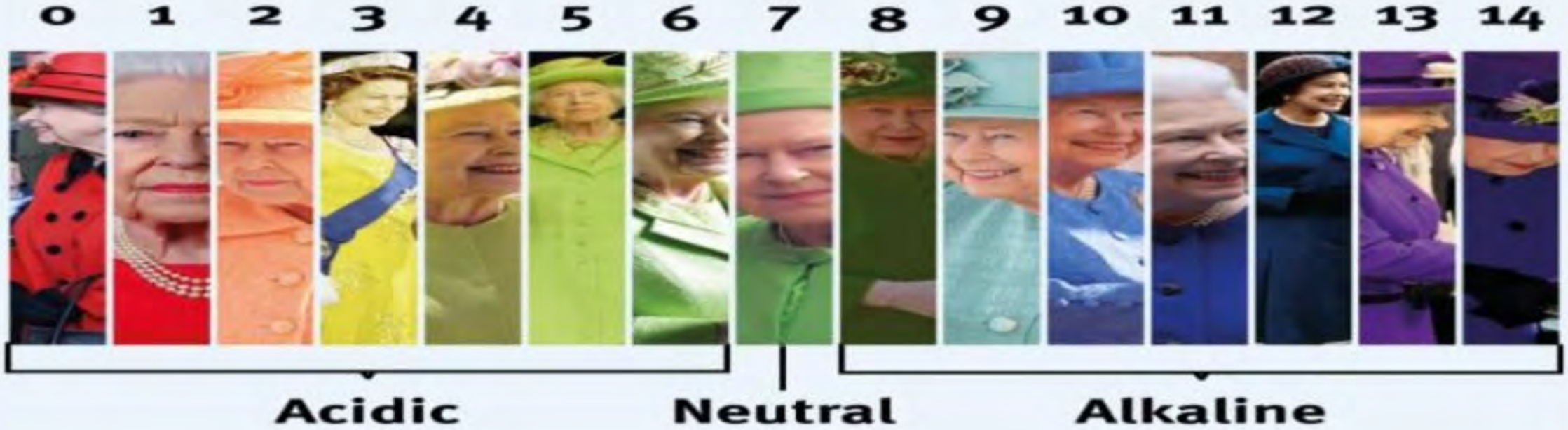
$$[H^+] = \frac{K_w}{[OH^-]}$$

pH

$pH = -\log[H^+]$


Today we're discussing pH
Ma'am, pH is just number stuff na? Boring AF
ROAST BATTLE
Welcome túo pH Roast Battle! Let's see who's more—savage—Acid ya
I'm so low, I make lemons cry. pH 1, baby!
Main toh so basic, I clean toilets. pH 13, clean AND mean!
Stop the drama, I'm pH 7. Chill like Gangajal.

Her Royal pH Scale



QUESTION

25° $K_w = 10^{-14}$ pH = 7

100°C $pH = -\log[H^+]$

At 100° C the K_w of water is 55 times its value at 25°C. What will be the pH of neutral solution (log 55 = 1.74):

A. 7.00

B. 7.87

C. 5.13

D. 6.13 ✓

$(K_w)_{100^\circ C} = 55 \times (K_w)_{25^\circ C}$

$(K_w)_{100^\circ C} = 55 \times 10^{-14} = [H^+]^2$

$[H^+] = (55 \times 10^{-14})^{1/2}$

$pH = \frac{1}{2} - \log 55 \times 10^{-14}$

$pH = \frac{1}{2}[14 - 1.74]$

$= \frac{12.26}{2} = 6.13$

at $T \uparrow$ $K_w \uparrow$ $[H^+] \uparrow$ $pH \downarrow$

QUESTION

1000ml → 0.016

100ml → $\frac{0.016}{1000} \times 100$ $= 16 \times 10^{-4}$ moles HCl

$[HCl] = 16 \times 10^{-4}$

The $[OH^-]$ in 100 ml of 0.016 M HCl (aq) is:

A 5×10^{-12} M

B 3×10^{-10} M

C 6.2×10^{-13} M

D 2×10^{-9} M

$[H^+] = 16 \times 10^{-4}$ M

$[OH^-] = \frac{10^{-14}}{16 \times 10^{-4}} = \frac{10^{-10}}{16} = \frac{100}{16} \times 10^{-12}$

$= \frac{100 \times 10^{-10}}{16 \times 100}$

QUESTION – (AIIMS 2008)

What is the pH value of 1 M H_2SO_4?

- (A) 0
- (B) –0.213
- (C) –2
- (D) –0.3010

$1\,H_2SO_4 + H_2O \rightarrow 2H^+ + 1\,SO_4^{2-}$

1 M → 2 M

$[H^+] > 1M$

$pH = -\log[H^+]$

$pH = -\log 2$

$= -0.3010$

QUESTION – (AIIMS 2001)

The pH value of N/10 NaOH is:

$n_f = 1$

$N = M \times n_f$

$\frac{1}{10} = M \times 1$

$M = \frac{1}{10} M = 10^{-1} M$

$NaOH + H_2O \rightarrow Na^+ + OH^-$

$10^{-1} M \qquad\qquad 10^{-1} M$

$pOH = -\log 10^{-1}$

$= 1$

$pH = 14 - pOH$

$= 14 - 1 = 13$

A. 9

B. 10

C. 12

D. 13 ✓

QUESTION – (NEET Odisha 2019)

The pH of 0.01 M NaOH (aq.) solution will be

A. 9

B. 7.01

C. 2

D. 12

pH of Diluted Acid or Diluted Base

Dilution eqⁿ :-
Conc. dilute.

$$M_1V_1 = M_2V_2$$

$$\therefore M_2 = \frac{M_1V_1}{V_2}$$

QUESTION

$M = \frac{n}{V_l}$

0.3

Find pH when 50 ml of 1 M HCl is diluted to 100 ml.

Ans

$M_1V_1 = M_2V_2$

$1 \times 50 = M_2 \times 100$

$M_2 = [HCl] = \frac{1}{2} M = 0.5 M$

$HCl + H_2O \rightarrow H^+ + Cl^-$

$0.5 \qquad\qquad 0.5$

$pH = -\log 5 \times 10^{-1}$

$= 1 - \log 5 = 1 - 0.7 = 0.3$

MIT

$[H^+]$ 10 times ↓ pH inc. by 1

$[H^+]$ 10 times ↑ pH dec. by 1

$\downarrow pH = -\log [H^+] \uparrow$

$= -\log 10^{-1}$

$pH_1 = 1$

$pH_2 = -\log 10^{-2}$

$pH_2 = 2$

QUESTION

How many litres of water must be added to 1 L of an aqueous solution of HCl with a pH of 1 to create an aqueous solution with pH of 2

$\downarrow C = \frac{n}{V\uparrow}$

$V_1 = 1\ L$

$V_2 = 10\ L$

Vol. of H_2O add $= 10 - 1 = 9\ L$

A 0.1 L

B 0.9 L

C 2.0 L

D 9.0 L ✓

QUESTION

Find pH when 10 ml of 0.1 M NaOH is diluted to 100 ml.

Ans (12)

$M_1V_1 = M_2V_2$

$0.1 \times 10 = M_2 \times 100$

$M_2 = \frac{0.1}{10} = 10^{-2}$ M NaOH

$1\,NaOH \xrightarrow{+H_2O} 1\,OH^-$

10^{-2} M $\quad$ 10^{-9} M

$[OH^-] = 10^{-2}$ M

$pOH = 2$

$pH = 14 - 2 = 12$

QUESTION

If $[H^+] < 10^{-6}$ M in Acid or $[OH^-] < 10^{-6}$ in Base

$[H^+]_{H_2O}$ Can't be neglected ≈ MIT

$HCl + H_2O \longrightarrow H^+ + Cl^-$

$< 10^{-6}$ M $+ 10^{-7}$ M

Same for base → $[OH^-] < 10^{-6}$ M (base)

$[OH^-]_{Total} = [OH^-]_{base} + [OH^-]_{water}$

$= q_{tn.} + 10^{-7}$

$pOH = -\log[OH^-]_{Total}$

Same for acid → $[H^+] < 10^{-6}$ M. (acid)

$[H^+]_{Total} = [H^+]_{acid} + [H^+]_{water}$

$= q_{tn} + 10^{-7}$

$pH = -\log[H^+]_{Total}$

QUESTION

$[H^+] = 10^{-8}$ ~~$pH = 8$~~

Find pH of 10^{-8} M HCl at 25° C.

$$HCl_{(aq)} + H_2O_{(l)} \rightarrow H^+_{(aq.)} + Cl^-_{(aq.)}$$

10^{-8} M $\qquad$ 10^{-8} M

$$[H^+]_{Total} = 10^{-8} + 10^{-7}$$

$$= 10^{-7}\left(\frac{1}{10} + 1\right)$$

$$= \frac{11}{10} \times 10^{-7}$$

$$= 11 \times 10^{-8}\ M$$

$$pH = 8 - \log 11$$

$$= 8 - 1.04 = 6.96$$

Q: find pH of 10^{-7} M NaOH at 25°C ?

A: 7.3

$$1\,NaOH + 1\,H_2O \rightarrow 1\,Na^+ + 1\,OH^-$$

10^{-7} M $\qquad\qquad$ 10^{-7} M

$$[OH^-]_{Total} = 10^{-7} + 10^{-7}$$

$$= 2 \times 10^{-7}\ M$$

$$pOH = 7 - \log 2 = 7 - 0.3 = 6.7$$

$$pH = 14 - 6.7 = 7.3$$

pH of Weak Acid or Weak Base

#MIT

Ostwald's Dilution Law:-

Weak Acid.

$[H^+] = C\alpha$

If $\alpha = \sqrt{\frac{K_a}{C}}$ $\left(\alpha \le 0.05 \text{ or } \frac{K_a}{C} \le 25 \times 10^{-4}\right]$

$[H^+] = C\sqrt{\frac{K_a}{C}} = \sqrt{\frac{K_a C^2}{C}}$

$pH = \frac{1}{2} \log K_a C$

$= -\frac{1}{2}[\log K_a + \log C]$

If $\alpha > 0.05$ or $\frac{K_a}{C} > 25 \times 10^{-4}$

$[H^+] = C\alpha$

$\downarrow$

$pH = -\log[H^+]$

For any weak base:

$[H^+] \rightarrow [OH^-]$

$pH \rightarrow pOH$

$K_a \rightarrow K_b$

QUESTION

Find pH, α, $[H^+]$, $[OH^-]$ after 0.1 M CH_3COOH. ($K_a = 36 \times 10^{-7}$)

$\frac{K_a}{C} = \frac{36 \times 10^{-7}}{10^{-1}} = 36 \times 10^{-6} < 25 \times 10^{-4}$

$\alpha = \sqrt{\frac{K_a}{C}} = \sqrt{\frac{36 \times 10^{-7}}{10^{-1}}} = \sqrt{36 \times 10^{-6}} = 6 \times 10^{-3}$

$[H^+] = 6 \times 10^{-4}$

$[OH^-] = \frac{K_w}{[H^+]} = \frac{10^{-14}}{6 \times 10^{-4}}$

$pH = 4 - \log 6$

$= 4 - 0.78$

$= 3.22$

QUESTION

The pH of a 0.1 molar solution of the acid HQ is 3. The value of ionisation constant. K_a of the acid is:

A. 3×10^{-1}

B. 1×10^{-3}

C. 1×10^{-5}

D. 1×10^{-7}

$C = 0.1\ M$

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

$[H^+] = 10^{-3} = 10^{-1}\alpha$

$\alpha = 10^{-2} = 0.01$

$K_a = C\alpha^2$

$= 10^{-1} \times (10^{-2})^2$

$= 10^{-5}$

QUESTION

An acid HA ionises as $HA \rightleftharpoons H^+ + A^-$. The pH of 1.0 M solution is 5. It's dissociation constant would be:

$K_a = C\alpha^2$

$= 1(10^{-5})^2$

$= 10^{-10}$

$\alpha = 10^{-5}$

(A) 1×10^{-10}

(B) 5

(C) 5×10^{-8}

(D) 1×10^{-5}

QUESTION

$\rightarrow 1H^+$

A monobasic weak acid solution has molarity of 0.005 and pH of 5. What is the percentage ionisation in this solution?

% age $\alpha = \alpha \times 100$

$= 2 \times 10^{-3} \times 100 = 0.2$ %

(A) 2.0

(B) 0.2

(C) 0.5

(D) 0.25

$C = 0.005\,M = 5 \times 10^{-3}\,M$

$pH = 5 \Rightarrow [H^+] = 10^{-5} = C\alpha$

$10^{-2} \cdot 10^{-3} = 5 \times 10^{-3}\,\alpha$

$\frac{0.2 \times 10^{-2}}{2 \times 10^{-3}} = \frac{1}{5} \times 10^{-2} = \alpha$

QUESTION

Find pH, α, %age distance, $[H^+]$, $[OH^-]$ for 0.1 M NH_4OH is $K_b = 36 \times 10^{-7}$.

$\frac{K_b}{C} = \frac{36 \times 10^{-7}}{10^{-1}} = 36 \times 10^{-6}$

Ans $[H^+] = \frac{10^{-14}}{6 \times 10^{-4}}$

$[OH^-] = \sqrt{K_b C} = 6 \times 10^{-4}$

$pH = 10.78$

$pOH = 4 - \log 6 = 4 - 0.78 = 3.22$

$\alpha = 6 \times 10^{-3}$

%age $\alpha = 6 \times 10^{-1}$

QUESTION – (NEET 2016-II)

$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$

$C - C\alpha \quad C\alpha \quad C\alpha$

The percentage of pyridine (C_5H_5N) that forms pyrimidine ion ($C_5H_5N^+H$) in a 0.10 M aqueous pyridine solution (K_b for $C_5H_5N = 1.7 \times 10^{-9}$) is:

$\frac{17 \times 10^{-9}}{10^{-1}} \quad 10^{-10}$

$C_5H_5N + H_2O \rightarrow C_5H_5NH^+ + OH^-$

0.1

$C = 0.1\,M$

$[C_5H_5NH^+] = C\alpha = \sqrt{\frac{K_b}{C}}C\alpha$

$= \sqrt{K_b C}$

$= \sqrt{17 \times 10^{-10} \times 10^{-1}}$

$= \sqrt{17 \times 10^{-11}}$

(A) 0.77%

(B) 1.6%

(C) 0.0060%

(D) 0.013%

pH of Mixture of Strong Acids or Strong Base

#MIT

$$[H^+]_{Total} = \frac{\sum \text{g-eq. of all S.A.}}{\text{Total Vol(L)}}$$

$$pH = -\log [H^+]_{Total}$$

$$[OH^-]_{Total} = \frac{\sum \text{g eq of all S.B.}}{\text{Total Vol (L)}}$$

$$pOH = -\log [OH^-]_{Total}$$

QUESTION

If 100 ml of 1 M HCl is mixture with 500 ml of 2 M HCl then $[H_3O^+]$ is:

↑ $[H^+]$

$[H^+]_{Total} = \frac{100 \times 1 \times 1 + 500 \times 2 \times 1}{600} = \frac{1100}{600} = \frac{11}{6} = 1.8$ M.

(A) 10.1 M

(B) 1.8 M

(C) 1.33 M

(D) 3 M

$pH = -\log 1.8$

$pH = -\log[H^+]$

QUESTION

Equal volume of three strong acid solution of pH 3, 4 and 5 are mixed in vessel. What will be $[H^+]$ ion in the mixture.

$[H^+] = 10^{-3}, 10^{-4}, 10^{-5}$

V V V

10^{-3} M 10^{-4} M 10^{-5} M

$$[H^+] = \frac{V\times10^{-3}\times1 + V\times10^{-4}\times1 + V\times10^{-5}\times1}{3V}$$

$$\frac{10^{-3}+10^{-4}+10^{-5}}{3}$$

$$10^{-3}\left(\frac{1+\frac{1}{10}+\frac{1}{100}}{3}\right)$$

$$\frac{111\times10^{-3}}{100\times3}$$

$$\frac{111}{3}\times10^{-5} = 37\times10^{-5} = 3.7\times10^{-4}\ M$$

(A) 3.7×10^{-3} M

(B) 1.11×10^{-3} M

(C) 1.11×10^{-4} M

(D) 3.7×10^{-4} M ✓

$[H^+] = 37 \times 10^{-5}$

$pH = 5 - \log 37$

$\approx 5 - \log 6^2$

$\approx 5 - 2 \times 0.78$

≈ 3.44

QUESTION

$V(L) \times N$

$\frac{0.3V}{3V} = \frac{0.1}{10^{-1}}$

What is the pH of solution made by mixing equal volumes of 0.1 N H_2SO_4, 0.1 N HNO_3 and 0.1 N HCl?

$[H^+]_{Total} = \frac{0.1 \times V + 0.1 \times V + 0.1 \times V}{3V} = \frac{0.3}{3} = 0.1 = 10^{-1} M$

A 1

B 2

C 3

D 4

QUESTION

$\frac{2}{40} = \frac{1}{20} = 0.05$

$= 5 \times 10^{-2}$

$14 - 0.7 = 13$

Find pH when 10 ml of 0.1 N KOH is mixed with 10 ml of 0.1 N NaOH and solution is diluted to 40 ml.

pH = 12.7

Ans $[OH^-]_{Total} = \frac{10 \times 0.1 + 10 \times 0.1}{40} = \frac{2}{40} = \frac{1}{20} = 0.05 = 5 \times 10^{-2}$

$pOH = 2 - \log 5$

$= 2 - 0.7$

$= 1.3$

$pH = 14 - 1.3$

$= 12.7$

pH of Mixture of Strong Acids and Strong Base

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QUESTION – (NEET 2015 Re)

What is the pH of the resulting solution when equal volumes of 0.1 M NaOH and 0.01 M HCl are mixed?

A 2.0

B 7.0

C 1.04

D 4

QUESTION

Following solution were prepared by mixing different volumes of NaOH and HCl of different concentrations:

(1) 60 mL $\frac{M}{10}$ HCl + 40 mL $\frac{M}{10}$ NaOH

(2) 55 mL $\frac{M}{10}$ HCl + 45 mL $\frac{M}{10}$ NaOH

(3) 75 mL $\frac{M}{10}$HCl + 25 mL $\frac{M}{10}$ NaOH

(4) 100 mL $\frac{M}{10}$ HCl + 100 mL $\frac{M}{10}$NaOH

pH of which of solution is equal to:

A 2

B 1

C 4

D 3

QUESTION

Three solutions of strong electrolytes, 25 ml of 0.1 M HX, 25 ml of 0.1 M H_2Y and 50 ml of 0.1 N $Z(OH)_2$ are mixed, the pOH of the resulting solution is:

A 1.6

B 7.0

C 12.4

D 11.6

pH of Mixture of Strong Base and Weak Base

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QUESTION

Find pH, $[H^+]$, $[HCOO^-]$, $[OH^-]$ and α of solution containing 0.1 M HCOOH ($K_a = 10^{-5}$) and 0.1 M HNO_3?

QUESTION

What is the $HCOO^-$ in the solution that contains 0.015 M HCOOH and 0.02 N HCl is Ka HCOOH = 1.8×10^{-4}

A 1.8×10^{-4}

B 1.35×10^{-4}

C 1.8×10^{-2}

D 8×10^{-3}

Home work from modules

Prarambh numericals of PH of S.A. & S.B.

Magarmach Practice Questions (MPQ)

QUESTION

Find pH of 10^{-7} M NaOH solution.

QUESTION – (NCERT Exemplar)

A solution having hydrogen ion concentration 0.0005 g eqvt./litre, its pOH is:

A. Equal to 7.0

B. Greater than 7.0

C. Less than 7.0

D. Equal to zero

QUESTION – (NCERT Exemplar)

What will be the value of pH of 0.01 mol dm^{-3} CH_3COOH ($K_a = 1.74 \times 10^{-5}$)?

A 3.4

B 3.6

C 3.9

D 3.0

QUESTION – (NCERT Exemplar)

Assertion (A): **The ionisation of hydrogen Sulphide in water is low in the presence of hydrochloric acid.**

Reason (R): **Hydrogen Sulphide is a weak acid.**

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

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

(C) A is true but R is false.

(D) Both A and R are false.

QUESTION – (AIPMT 2007)

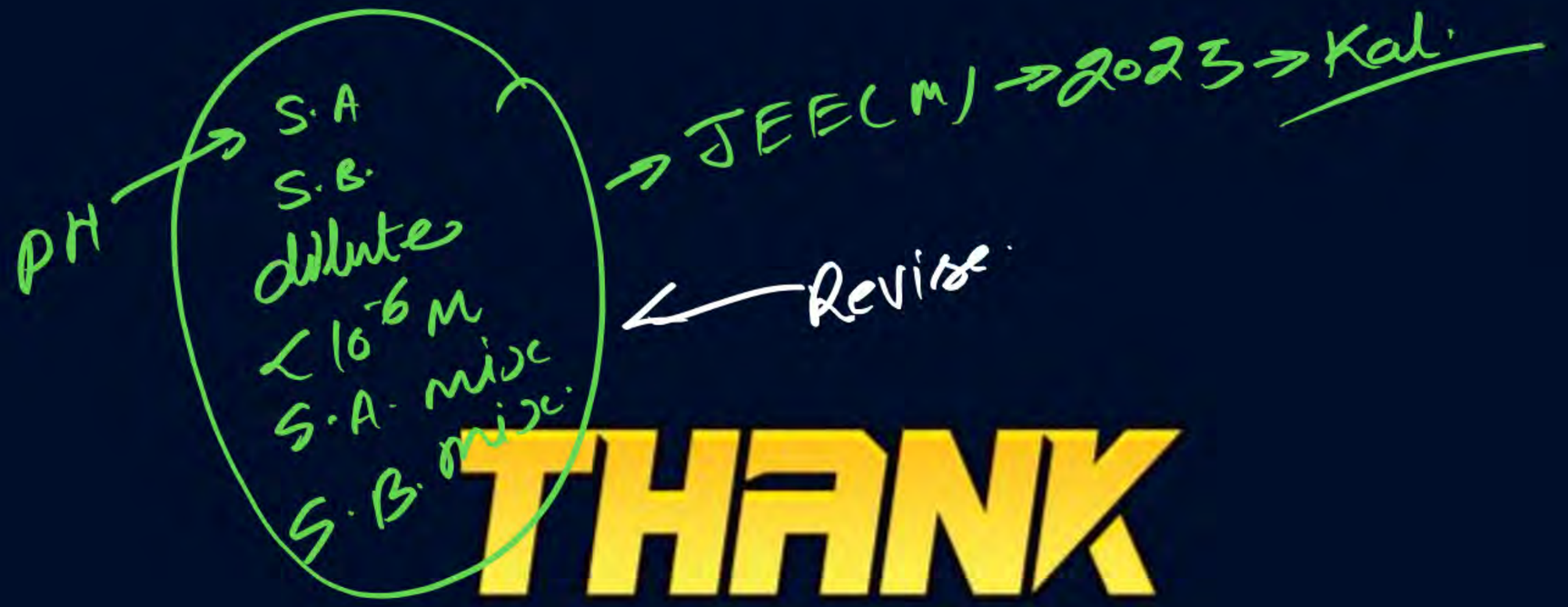
Calculate the pOH of a solution at 25°C that contains 1×10^{-10} M of hydronium ions, i.e. H_3O^+.

A 4.0

B 9.0

C 1.0

D 7.0



THANK YOU