

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

pH and pOH Worksheet $K_w = 1.0 \times 10^{-14}$

Name: Key
Date: _____

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Answer each question as completely as possible showing all work and units!

1) The concentration of either H^+ ion or the OH^- ion is given for three aqueous solutions at 298K. For each solution, calculate $[H^+]$ or $[OH^-]$. State whether the solution is acidic, basic or neutral.

a. $[H^+] = 1.0 \times 10^{-13} M$ $1.0 \times 10^{-14} = 1.0 \times 10^{-13} \cdot [OH^-]$
Basic ① $[OH^-] = \boxed{1.0 \times 10^{-1} M}$ ①

b. $[OH^-] = 1.0 \times 10^{-7} M$ $1.0 \times 10^{-14} = [H^+] \cdot 1.0 \times 10^{-7}$
Neutral ① $[H^+] = \boxed{1.0 \times 10^{-7} M}$ ①

c. $[OH^-] = 1.0 \times 10^{-3} M$ $1.0 \times 10^{-14} = [H^+] \cdot 1.0 \times 10^{-3}$
Basic ① $[H^+] = \boxed{1.0 \times 10^{-11} M}$ ①

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2) Calculate the pH of solutions having the following ion concentrations at 298K:

a. $[H^+] = 1.0 \times 10^{-2} M$ $pH = -\log(1 \times 10^{-2}) = \boxed{2}$ ①

b. $[H^+] = 3.0 \times 10^{-6} M$ $pH = -\log(3 \times 10^{-6}) = \boxed{5.52}$ ①

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c. $[OH^-] = 8.2 \times 10^{-6} M$ $pOH = -\log(8.2 \times 10^{-6}) = 5.09$
 $pH = 14 - 5.09 = \boxed{8.91}$ ①

3) Calculate the pH and pOH of aqueous solutions having the following ion concentrations:

a. $[OH^-] = 1.0 \times 10^{-6} M$ $pOH = -\log(1 \times 10^{-6}) = 6$
 $pH = 14 - 6 = 8$
 $\boxed{pOH = 6}$ ① $\boxed{pH = 8}$ ①

b. $[OH^-] = 6.5 \times 10^{-4} M$ $pOH = -\log(6.5 \times 10^{-4}) = 3.19$
 $pH = 14 - 3.19 = 10.81$
 $\boxed{pOH = 3.19}$ ① $\boxed{pH = 10.81}$ ①

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c. $[H^+] = 3.6 \times 10^{-9} M$ $pH = -\log(3.6 \times 10^{-9}) = 8.44$
 $pOH = 14 - 8.44 = 5.56$
 $\boxed{pH = 8.44}$ ① $\boxed{pOH = 5.56}$ ①

d. $[H^+] = 0.025 M$ $pH = -\log(0.025) = 1.60$
 $pOH = 14 - 1.60 = 12.40$
 $\boxed{pH = 1.60}$ ① $\boxed{pOH = 12.40}$ ①

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4) Fill in the remaining boxes in the table showing all work!

[H ⁺]	pH	pOH	[OH ⁻]	Acid, Base or Neutral?
1.02×10^{-9}	8.99	5.01	9.8×10^{-6}	Base
1.15×10^{-9}	8.94	5.06	8.71×10^{-6}	Base
$7.28 \times 10^{-3} \text{ M}$	2.14	11.86	1.38×10^{-12}	Acid
0.331	0.48	13.52	$2.99 \times 10^{-14} \text{ M}$	Acid
1.62×10^{-8}	7.79	6.21	$6.23 \times 10^{-7} \text{ M}$	Base
2.75×10^{-11}	10.56	3.44	3.63×10^{-4}	Base
$4.61 \times 10^{-5} \text{ M}$	4.34	9.66	2.19×10^{-10}	Acid
0.022	1.65	12.35	4.47×10^{-13}	Acid