ACID SOLUTIONS WORKSHEET

Name Answer key

Date_____

1) What is the pH and pOH of a 1.2×10^{-3} M HBr solution?

$H^+ = 1.2 \times 10^{-3}$

$pH = -\log[1.2 \times 10^{-3}] = 2.9$ $\quad pOH = 14 - pH = 11.1$

2) What is the pH and pOH of a 2.34×10^{-5} M NaOH solution?

$pH + pOH = 14$

$OH^- = 2.34 \times 10^{-5}$ $\quad pOH = -\log[2.34 \times 10^{-5}] = \boxed{4.6}$ pOH

$pH = 14 - 4.6 = \boxed{9.4}$ pH

3) Fill in the following table

Solution	pH=5.5	pH=9.9	pH=6.6	pH=1	pH=7.4
pOH	$14-5.5=8.5$	$14-9.9=4.1$	$14-6.6=7.4$	$14-1=13$	$14-7.4=6.6$
$[H^+] = 10^{-pH}$	3.2×10^{-6}	1.3×10^{-10}	2.5×10^{-7}	0.1	4.0×10^{-8}
$[OH^-] = 10^{-pOH}$	3.2×10^{-9}	7.9×10^{-5}	4.0×10^{-8}	1×10^{-13}	2.5×10^{-7}
Acidic	✓		✓	✓	
Basic		✓			✓
Neutral			✓		✓

4) What is the $[H^+]$ of a 2.3 pH solution? $H^+ = 10^{-pH} = 10^{-2.3} = \boxed{0.0050\ M}$

Is this acidic or basic? acidic

If the pH increases is it becoming more acidic or alkaline? alkaline

5) What is the pH and pOH of a solution made by adding water to 15 grams of hydroiodic acid (HI) until the volume of the solution is 2500 mL?

$15\ g\ HI \times \frac{1\ mol}{127.55\ g} \times \frac{1}{2.5\ L} = 0.047\ M$ $\quad pH = -\log(0.047)$

$pH = 1.3$

$pOH = 12.7$

6) What is the pH and pOH of a solution that was made by adding 400 mL of water to 350 mL of 5.0×10^{-3} M NaOH solution?

$C_1V_1 = C_2V_2$

$5 \times 10^{-3}(350) = C_2(750)$

$5 \times 10^{-3}\left(\frac{350}{750}\right) = 0.00233\ M\ OH^-$

$pOH = -\log(0.00233) = \boxed{2.6}$ pOH

$pH = 14 - 2.6 = \boxed{11.4}$ pH

7) Calculate the molar concentration and the pH of a 12 L solution that contains 1 mole of hydrochloric acid. HCl

$\frac{1\ mol}{12\ L} = 0.083\ M$ $\quad pH = -\log[0.083]$

$\boxed{pH = 1.1}$

8) *How many grams of HCl are needed to make* 2 L of 6 M HCl? *(molar mass = 36.46 g) What is the pH of this solution?*

$2\ L \times \frac{6\ mol}{1\ L} = 12\ mol \times \frac{36.46\ g}{1\ mol} =$ **438 g HCl**

$pH = -\log[6] =$ **−.8 pH**

9) *How many grams of NaOH are needed to make* 1.5 L of 2 M NaOH? *(molar mass = 40.00 g). What is the pH of this solution? Is it acidic or alkaline?*

$1.5\ L \times \frac{2\ mol}{1} = 3\ mol\ NaOH \times 40.00\ g/mol =$ **120 g NaOH**

pOH = −.3 $pOH = -\log[2]$

pH = 14.3 $pH = 14 - (-.3) =$

10) What is the pH and pOH of a solution with a volume of 5.4 L that contains 15 grams of hydrochloric acid and 25 grams of nitric acid? [HCl] and [HNO_3]

$15\ g\ HCl \times \frac{1\ mol}{36.46\ g} = 0.41\ mol\ HCl$

$25\ g\ HNO_3 \times \frac{1\ mol}{63.02\ g} = 0.40\ mol\ HNO_3$

total mol $H^+ = 0.81$ mol

$M = \frac{.81\ mol}{5.4\ L} = 0.15\ M$

pH = 0.83 **pOH = 13.17**

11) A swimming pool has a volume of one million liters. How many grams of HCl would need to be added to that swimming pool to bring the pH down from 7 to 4? (Assume the volume of the HCl is negligible)

pH 7 = $1 \times 10^{-7}\ M \times 10^6 = 0.1$ mol HCl

pH 4 = $1 \times 10^{-4}\ \frac{mol}{L} \times 10^6 = 100$ mol HCl.

$100 - .1 =$

99.9 mol HCl to add

$99.9\ mol \times \frac{36.46\ g}{1\ mol} =$ **3650 g HCl to add**

OR $C_1V_1 = C_2V_2$