

**Agriculture
pH Worksheet**

Name _____

The pH scale ranges from 0 to 14. A pH of 7 is neutral, while greater than 7 is basic and less than 7 is acidic. Complete the table below to determine if the following foods are acid or base.

$pH = -\log H^+$

	Food	H^+	pH	Acid or Base
1.	Apple juice	3.2×10^{-4}	3.5	Acid
2.	Buttermilk	2.5×10^{-5}	4.6	Acid
3.	Ketchup	1.3×10^{-4}	3.9	Acid
4.	Mustard	2.5×10^{-4}	3.6	Acid
5.	Peas	1.0×10^{-6}	6.0	Acid

The pH of each food is given, find the concentration of hydrogen ions $[H^+]$.

6. maple syrup pH = 5.2

$$\begin{aligned} pH &= -\log H^+ \\ 5.2 &= -\log H^+ \\ -5.2 &= \log H^+ \\ 10^{-5.2} &= 10^{\log H^+} \end{aligned}$$

$$H^+ = 6.3 \times 10^{-6}$$

7. cider vinegar pH = 3.1

$$\begin{aligned} 3.1 &= -\log H^+ \\ -3.1 &= \log H^+ \\ 10^{-3.1} &= 10^{\log H^+} \end{aligned}$$

$$H^+ = 7.9 \times 10^{-4}$$

8. Tomato juice pH = 4.0

$$\begin{aligned} 4.0 &= -\log H^+ \\ -4.0 &= \log H^+ \\ 10^{-4.0} &= 10^{\log H^+} \end{aligned}$$

$$H^+ = 1.0 \times 10^{-4}$$

9. watermelon pH = 5.4

$$\begin{aligned} 5.4 &= -\log H^+ \\ -5.4 &= \log H^+ \\ 10^{-5.4} &= 10^{\log H^+} \end{aligned}$$

$$H^+ = 4.0 \times 10^{-6}$$

10. Condensed milk pH = 6.3

$$\begin{aligned} 6.3 &= -\log H^+ \\ -6.3 &= \log H^+ \\ 10^{-6.3} &= 10^{\log H^+} \end{aligned}$$

$$H^+ = 5.0 \times 10^{-7}$$

11. Lime juice pH = 2.2

$$\begin{aligned} 2.2 &= -\log H^+ \\ -2.2 &= \log H^+ \\ 10^{-2.2} &= 10^{\log H^+} \end{aligned}$$

$$H^+ = 0.006 \text{ or } 6.0 \times 10^{-3}$$

* Students might notice a pattern to the 6-10 problems

$$H^+ = 10^{-pH}$$

Solve the following exponential or logarithmic equations.

$$12. 4^x = 18$$

$$\log_4 18 = x$$

$$\boxed{x = 2.08}$$

$$13. \begin{array}{r} 5 + 3^x = 44 \\ -5 \quad -5 \end{array}$$

$$3^x = 39$$

$$\log_3 39 = x$$

$$\boxed{x = 3.33}$$

$$14. 15^{2x+1} = 37$$

$$\log_{15} 27 = 2x+1$$

$$\begin{array}{r} 1.22 = 2x+1 \\ -1 \end{array}$$

$$\frac{0.22}{2} = \frac{2x}{2}$$

$$\boxed{x = 0.11}$$

$$15. \log 2x = 3$$

$$\log_{10} 2x = 3$$

$$10^3 = 2x$$

$$\frac{1000}{2} = \frac{2x}{2}$$

$$\boxed{x = 500}$$

$$16. \log_3 x = 8$$

$$3^8 = x$$

$$\boxed{x = 6561}$$

OR

$$3^{\log_3 x} = 3^8$$

$$x = 3^8 = 6561$$

$$17. \frac{2 \log(x+1)}{2} = \frac{8}{2}$$

$$\log_{10} (x+1) = 4$$

$$10^4 = x+1$$

$$10000 = x+1$$

$$\boxed{x = 9999}$$

OR $\log_{10} x+1 = 10^4$
 $x+1 = 10^4$
 $x = 9999$

OR $\log_{10} 2x = 3$

$$2x = 1000 \rightarrow x = 500$$

$$18. \log_4 2x = 3$$

$$4^3 = 2x$$

$$\frac{64}{2} = \frac{2x}{2}$$

$$\boxed{x = 32}$$

$$19. \begin{array}{r} 5 - 2^x = -10 \\ -5 \quad -5 \end{array}$$

$$\frac{-2^x}{-1} = \frac{-15}{-1}$$

$$2^x = 15$$

$$\log_2 15 = x$$

$$\boxed{x = 3.91}$$

Isolate
1st

$$20. \log(2x+1) = 4$$

$$\log_{10} 2x+1 = 4$$

$$10^4 = 2x+1$$

$$10000 = 2x+1$$

$$\frac{9999}{2} = \frac{2x}{2}$$

$$\boxed{x = 4999.5}$$