5.4

APPLICATIONS OF COMMON LOGARITHMS

The **pH**, or hydrogen potential, of a solution is defined by

$$\text{pH} = -\log_{10}[\text{H}^+] \tag{1}$$

where $[\text{H}^+]$ is the concentration of hydrogen ions in an aqueous solution in moles per liter. When $0 < \text{pH} < 7$ the solution is said to be *acid*; for $\text{pH} > 7$ the solution is *base* or *alkaline*; for $\text{pH} = 7$ the solution is *neutral* (for example, water). A strongly acid solution such as lemon juice has a pH in the range $\text{pH} \leq 3$. Human urine averages around $\text{pH} = 6$. Note that (1) can also be written $\text{pH} = \log_{10} 1/[\text{H}^+]$.

In a healthy person it is found that the concentration of hydrogen ions in blood is $[\text{H}^+] = 3.98 \times 10^{-8}$ moles/liter. Determine the pH of blood.

From (1) we find that the pH of blood is given by

$$\begin{aligned}
\text{pH} &= -\log_{10} 3.98 \times 10^{-8} \\
&= -[\log_{10} 3.98 + \log_{10} 10^{-8}] \\
&= -[\log_{10} 3.98 - 8] \\
&= -[0.5999 - 8] \\
&\approx 7.4.
\end{aligned}$$

Severe illness, or even death, could result when a person's blood pH falls outside the narrow limits $7.2 \leq \text{pH} \leq 7.6$. We note that values of pH are usually given to the nearest tenth of a unit.

Source : College Mathematics by Dennis Zill , 2nd Edition