

**Table 41-2** Lepton Numbers

|                  | $L_e$ | $L_\mu$ | $L_\tau$ |
|------------------|-------|---------|----------|
| $e^-$            | +1    | 0       | 0        |
| $\nu_e$          | +1    | 0       | 0        |
| $e^+$            | -1    | 0       | 0        |
| $\bar{\nu}_e$    | -1    | 0       | 0        |
| $\mu^-$          | 0     | +1      | 0        |
| $\nu_\mu$        | 0     | +1      | 0        |
| $\mu^+$          | 0     | -1      | 0        |
| $\bar{\nu}_\mu$  | 0     | -1      | 0        |
| $\tau^-$         | 0     | 0       | +1       |
| $\nu_\tau$       | 0     | 0       | +1       |
| $\tau^+$         | 0     | 0       | -1       |
| $\bar{\nu}_\tau$ | 0     | 0       | -1       |

**Table 41-3** Properties of Quarks and Antiquarks

| Flavor            | Spin               | Charge          | Baryon Number  | Strangeness | Charm | Topness | Bottomness |
|-------------------|--------------------|-----------------|----------------|-------------|-------|---------|------------|
| <b>Quarks</b>     |                    |                 |                |             |       |         |            |
| $u$ (up)          | $\frac{1}{2}\hbar$ | $+\frac{2}{3}e$ | $+\frac{1}{3}$ | 0           | 0     | 0       | 0          |
| $d$ (down)        | $\frac{1}{2}\hbar$ | $-\frac{1}{3}e$ | $+\frac{1}{3}$ | 0           | 0     | 0       | 0          |
| $s$ (strange)     | $\frac{1}{2}\hbar$ | $-\frac{1}{3}e$ | $+\frac{1}{3}$ | -1          | 0     | 0       | 0          |
| $c$ (charmed)     | $\frac{1}{2}\hbar$ | $+\frac{2}{3}e$ | $+\frac{1}{3}$ | 0           | +1    | 0       | 0          |
| $t$ (top)         | $\frac{1}{2}\hbar$ | $+\frac{2}{3}e$ | $+\frac{1}{3}$ | 0           | 0     | +1      | 0          |
| $b$ (bottom)      | $\frac{1}{2}\hbar$ | $-\frac{1}{3}e$ | $+\frac{1}{3}$ | 0           | 0     | 0       | +1         |
| <b>Antiquarks</b> |                    |                 |                |             |       |         |            |
| $\bar{u}$         | $\frac{1}{2}\hbar$ | $-\frac{2}{3}e$ | $-\frac{1}{3}$ | 0           | 0     | 0       | 0          |
| $\bar{d}$         | $\frac{1}{2}\hbar$ | $+\frac{1}{3}e$ | $-\frac{1}{3}$ | 0           | 0     | 0       | 0          |
| $\bar{s}$         | $\frac{1}{2}\hbar$ | $+\frac{1}{3}e$ | $-\frac{1}{3}$ | +1          | 0     | 0       | 0          |
| $\bar{c}$         | $\frac{1}{2}\hbar$ | $-\frac{2}{3}e$ | $-\frac{1}{3}$ | 0           | -1    | 0       | 0          |
| $\bar{t}$         | $\frac{1}{2}\hbar$ | $-\frac{2}{3}e$ | $-\frac{1}{3}$ | 0           | 0     | -1      | 0          |
| $\bar{b}$         | $\frac{1}{2}\hbar$ | $+\frac{1}{3}e$ | $-\frac{1}{3}$ | 0           | 0     | 0       | -1         |