24.38. **Model:** The allowed energies of a particle of mass m in a two-dimensional square box of side L are

$$E_{nm} = \frac{h^2}{8mL^2}\left(n^2 + m^2\right)$$

Solve: **(a)** The minimum energy for a particle is for $n = m = 1$:

$$E_{min} = E_{11} = \frac{h^2}{8mL^2}\left(1^2 + 1^2\right) = \frac{h^2}{4mL^2}$$

(b) The five lowest allowed energies are E_{min}, $\frac{5}{2}E_{min}$ (for $n = 1$, $m = 2$ and $n = 2$, $m = 1$), $4E_{min}$ (for $n = 2$, $m = 2$), $5E_{min}$ (for $n = 1$, $m = 3$ and $n = 3$, $m = 1$), and $\frac{13}{2}E_{min}$ (for $n = 2$, $m = 3$ and $n = 3$, $m = 2$).