66. The speed of each particle of mass m upon impact with the scale is found from mechanical energy conservation (or simply using Eq. 2-16 with $\vec{a} = g$ downward): $v = \sqrt{2gh}$, where $h = 3.5\,\text{m}$. With $+y$ upward, the change in momentum for the particle is therefore

$$\Delta\vec{p} = m\Delta\vec{v} = 2mv = 2m\sqrt{2gh}\ .$$

During a time interval Δt, the number of collisions is $N = R\Delta t$ where $R = 42\,\text{s}^{-1}$. Thus, using the impulse-momentum theorem and Eq. 10-8, the average force is

$$\begin{aligned}
\vec{F}_{\text{avg}} &= \frac{N\Delta\vec{p}}{\Delta t} \\
&= 2mR\sqrt{2gh} \\
&= 2(0.110)(42)\sqrt{2(9.8)(3.5)} \\
&= 77\ \text{N}
\end{aligned}$$

which corresponds to a mass reading of $77/9.8 = 7.8\,\text{kg}$.