11. We use Eq. 8-18, representing the conservation of mechanical energy (which neglects friction and other dissipative effects).

    (a) In the solution to exercise 5 (to which this problem refers), we found $\Delta U = mgL$ as it goes to the highest point. Thus, we have

    $$\begin{aligned} \Delta K + \Delta U &= 0 \\ K_{\text{top}} - K_0 + mgL &= 0 \end{aligned}$$

    which, upon requiring $K_{\text{top}} = 0$, gives $K_0 = mgL$ and thus leads to

    $$v_0 = \sqrt{\frac{2K_0}{m}} = \sqrt{2gL}\ .$$

    (b) We also found in the solution to exercise 5 that the potential energy change is $\Delta U = -mgL$ in going from the initial point to the lowest point (the bottom). Thus,

    $$\begin{aligned} \Delta K + \Delta U &= 0 \\ K_{\text{bottom}} - K_0 - mgL &= 0 \end{aligned}$$

    which, with $K_0 = mgL$, leads to $K_{\text{bottom}} = 2mgL$. Therefore,

    $$v_{\text{bottom}} = \sqrt{\frac{2K_{\text{bottom}}}{m}} = \sqrt{4gL}$$

    which simplifies to $2\sqrt{gL}$.

    (c) Since there is no change in height (going from initial point to the rightmost point), then $\Delta U = 0$, which implies $\Delta K = 0$. Consequently, the speed is the same as what it was initially ($\sqrt{2gL}$).

    (d) It is evident from the above manipulations that the results do not depend on mass. Thus, a different mass for the ball must lead to the same results.