Problem 1 in homework.

Frequency of spring system is proportional to inverse of square root of mass. Increasing mass by 4 decreases frequency by $\frac{1}{2}$.

Problem 2 in homework.

Period and frequency of a pendulum are independent of mass so don’t change.

Problem 3 in homework.

$v$ is proportional to the square root of tension so to double $v$, the tension must be increased by factor of 4.

13.64 Observe in the sketch at the right that $2d + L/2 = D$, or

$$d = \frac{D - L/2}{2} = \frac{2.00 \text{ m} - 1.50 \text{ m}}{2} = 0.250 \text{ m}$$

Thus,

$$\theta = \cos^{-1} \left( \frac{d}{L/4} \right) = \cos^{-1} \left( \frac{0.250 \text{ m}}{0.750 \text{ m}} \right) = 70.5^\circ$$

Now, consider a free body diagram of point A:

$$\sum F_x = 0 \Rightarrow F = T_2 \cos(70.5^\circ),$$

and

$$\sum F_y = 0 \Rightarrow T_2 \sin(70.5^\circ) = 19.6 \text{ N}$$
Hence, the tension in the section between A and B is

\[ F = \frac{19.6 \text{ N}}{\tan(70.5^\circ)} = 6.93 \text{ N} \]

The mass per unit length of the string is

\[ \mu = \frac{10.0 \times 10^{-3} \text{ kg}}{3.00 \text{ m}} = 3.33 \times 10^{-3} \text{ kg/m}, \]

so the speed of transverse waves in the string between points A and B is

\[ v = \sqrt{\frac{F}{\mu}} = \sqrt{\frac{6.93 \text{ N}}{3.33 \times 10^{-3} \text{ kg/m}}} = 45.6 \text{ m/s} \]

The time for the pulse to travel from A to B is

\[ t = \frac{L/2}{v} = \frac{1.50 \text{ m}}{45.6 \text{ m/s}} = 3.29 \times 10^{-2} \text{ s} = 32.9 \text{ ms} \]