a. **Calculate the velocity that a satellite shot from Newton's cannon must have to orbit Earth, 150 km above its surface.**
b. **How long would it take for the satellite to return to the cannon in seconds and minutes?**

The second Newton's law for satellite:

$$Ma = G\frac{M_e M}{(R+h)^2}$$

$$a = G\frac{M_e}{(R+h)^2}$$

Where a is the centripetal acceleration:

$$\frac{v^2}{R+h} = G\frac{M_e}{(R+h)^2}$$

So, satellite's speed:

$$v = \sqrt{G\frac{M_e}{R+h}}$$

Using $g = G\frac{M_e}{R^2} \rightarrow GM_e = gR^2$

$$v = R\sqrt{\frac{g}{R+h}}$$

$$v = 6.4 * 10^6 m \sqrt{\frac{10 m/s^2}{6.4 * 10^6 m + 0.15 * 10^6 m}} = 7.91 * 10^3 m/s$$

Time to return to the cannon:

$$T = \frac{2\pi(R+h)}{v}$$

$$T = \frac{2 * 3.14 * (6.4 * 10^6 m + 0.15 * 10^6 m)}{7.91 * 10^3 m/s} = 5.20 * 10^3 s$$

Answer: $v = 7.91 * 10^3 m/s, T = 5.20 * 10^3 s$