

2. A toy rocket of mass 0.50 kg starts from rest on the ground and is launched upward, experiencing a vertical net force. The rocket's upward acceleration a for the first 6 seconds is given by the equation $a = K - Lt^2$, where $K = 9.0 \text{ m/s}^2$, $L = 0.25 \text{ m/s}^4$, and t is the time in seconds. At $t = 6.0 \text{ s}$, the fuel is exhausted and the rocket is under the influence of gravity alone. Assume air resistance and the rocket's change in mass are negligible.
- (a) Calculate the magnitude of the net impulse exerted on the rocket from $t = 0$ to $t = 6.0 \text{ s}$.
- (b) Calculate the speed of the rocket at $t = 6.0 \text{ s}$.
- (c)
- Calculate the kinetic energy of the rocket at $t = 6.0 \text{ s}$.
 - Calculate the change in gravitational potential energy of the rocket-Earth system from $t = 0$ to $t = 6.0 \text{ s}$.
- (d) Calculate the maximum height reached by the rocket relative to its launching point.
- (e) On the axes below, assuming the upward direction to be positive, sketch a graph of the velocity v of the rocket as a function of time t from the time the rocket is launched to the time it returns to the ground. T_{top} represents the time the rocket reaches its maximum height. Explicitly label the maxima with numerical values or algebraic expressions, as appropriate.

