

27. Taking the  $y$  axis to be upward and placing the origin at the firing point, the  $y$  coordinate is given by  $y = v_0 t \sin \theta_0 - \frac{1}{2} g t^2$  and the  $y$  component of the velocity is given by  $v_y = v_0 \sin \theta_0 - g t$ . The maximum height occurs when  $v_y = 0$ . Thus,  $t = (v_0/g) \sin \theta_0$  and

$$y = v_0 \left( \frac{v_0}{g} \right) \sin \theta_0 \sin \theta_0 - \frac{1}{2} \frac{g(v_0 \sin \theta_0)^2}{g^2} = \frac{(v_0 \sin \theta_0)^2}{2g} .$$