Solution

FIRST MIDTERM

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

(a) A rock falls from rest 150 m in 6.00 min on another planet. Calculate \( g \) in m/s².
\[
\begin{align*}
\text{\( v_0 = 0, y_0 = 0, y_f = 150 \text{ m} \)} & \quad \text{\( t = 6.00 \text{ min} = 360.0 \text{ s} \)} \\
\text{\( y = \frac{1}{2}gt^2 \Rightarrow g = \frac{2y}{t^2} = \frac{2(150 \text{ m})}{(360.0 \text{ s})^2} = 2.31 \times 10^{-3} \text{ m/s}^2 \)}
\end{align*}
\]

(b) If \( g \) on a large planet is 100 m/s², what is this in ft/s²?
\[
\text{\( g = 100 \frac{\text{m}}{\text{s}^2} \times \frac{3.28 \text{ ft}}{1 \text{ m}} = 328 \text{ ft/s}^2 \)}
\]

(c) Convert 165 mi/hr to m/sec.
\[
\text{\( \frac{165 \text{ mi}}{\text{hr}} \times \frac{1 \text{ hr}}{3600 \text{ s}} \times \frac{1 \text{ m}}{3.28 \text{ ft}} = 73.8 \text{ m/s} \)}
\]

(d) The stopping distance for a car at 30.0 mi/hr is measured to be 50.0 ft. All other things being the same, what is the stopping distance for the car at 50.0 mi/hr?
\[
\begin{align*}
\text{\( V_f = 50.0 \text{ ft/s} \)} & \quad \text{\( x_o = 0 \)} & \quad \text{\( V_o = 30 \text{ mi/hr} = 2.64 \times 10^2 \text{ ft/hr} \)} \\
\text{\( \frac{x_f}{V_f^2} = \frac{1}{2a} \)} & \quad \text{\( V_o = 50 \text{ mi/hr} = 2.24 \times 10^2 \text{ ft/hr} \)} & \quad \text{\( V_o = 50 \text{ mi/hr} = 2.24 \times 10^2 \text{ ft/hr} \)} \\
\text{\( a = \frac{-V^2}{2x_f} = -2.509 \times 10^8 \text{ ft/hr} \)} & \quad \text{\( x_f = \frac{-V^2}{2a} = \frac{-2.24 \times 10^2 \text{ ft/hr}^2}{2 \times 2.509 \times 10^8 \text{ ft/hr}^2} = 138.9 \text{ ft} \)}
\end{align*}
\]

(e) A rock is thrown upward on the moon with an initial speed of 20.0 m/s. Calculate its maximum height from the point of release.
\[
\text{\( V_o = 20 \text{ m/s} \)} & \quad \text{\( v_f = 0 \)} & \quad \text{\( g_{\text{moon}} = -1.62 \text{ m/s}^2 \)} \\
\text{\( y_f = 7. \text{ m} \)} & \quad \text{\( y_o = 0 \)}
\]
\[
\begin{align*}
\text{\( x_f = v_o^2 + 2a(y - y_o) \)} & \quad \text{or} \quad \text{\( 0 = \frac{v_o^2}{2g} \)} \\
\text{\( \frac{v_f^2}{2g} = \frac{(20 \text{ m/s})^2}{2(-1.62 \text{ m/s}^2)} = 119.8 \text{ m} \)} & \quad \text{or} \quad \text{\( 120 \text{ m} \)}
\end{align*}
\]