Lesson 6—Law of Conservation of Mechanical Energy

PRACTICE EXERCISES ANSWERS AND SOLUTIONS

1.
$$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m(v^2 - v_0^2) = -mg\Delta h$$
$$\frac{1}{2}(v^2 - v_0^2) = -(9.81\ \text{m/s}^2)(\Delta h)$$
$$\Delta h = \frac{\frac{1}{2}(3.2\ \text{m/s})^2}{-9.81\ \text{m/s}^2}$$
$$= -0.52\ \text{m}$$

$\therefore$ the object is dropped from a height of 0.52 m.

2.
$$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m(v^2 - v_0^2) = -mg\Delta h$$
$$\frac{1}{2}(v^2 - v_0^2) = -g\Delta h$$
$$\frac{1}{2}(v^2 - 0) = (9.81\ \text{m/s}^2)(-8.00\ \text{m})$$
$$v = \sqrt{2(-9.81\ \text{m/s}^2)(-8.0\ \text{m})}$$
$$= 12.5\ \text{m/s}$$

3.
$$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m(v^2 - v_0^2) = -mg\Delta h$$
$$\frac{1}{2}(v^2 - v_0^2) = -g\Delta h$$
$$\frac{1}{2}((37.0\ \text{m/s})^2 - 0) = (9.81\ \text{m/s}^2)(\Delta h)$$
$$\Delta h = \frac{\frac{1}{2}(37.0\ \text{m/s})^2}{-9.81\ \text{m/s}^2}$$
$$= -69.8\ \text{m}$$

$\therefore$ The building was 69.8 m tall.

4.
$$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m(v^2 - v_0^2) = -mg\Delta h$$
$$\frac{1}{2}(v^2 - v_0^2) = -g\Delta h$$
$$\frac{1}{2}(v^2 - (11.0\ \text{m/s})^2) = -(9.81\ \text{m/s}^2)(-1.3\times10^2\ \text{m})$$
$$v = \sqrt{2(9.81\ \text{m/s}^2)(1.3\times10^2\ \text{m}) + (11.0\ \text{m/s})^2}$$
$$= 52\ \text{m/s}$$

5.
$$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m(v^2 - v_0^2) = -mg\Delta h$$
$$\frac{1}{2}(v^2 - v_0^2) = -g\Delta h$$
$$\frac{1}{2}(v^2 - 0) = -(9.81\ \text{m/s}^2)(-4.0\ \text{m})$$
$$v = \sqrt{2(9.81\ \text{m/s}^2)(4.0\ \text{m})}$$
$$= 8.9\ \text{m/s}$$

6.
$$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m(v^2 - v_0^2) = -mg\Delta h$$
$$\frac{1}{2}(v^2 - v_0^2) = -g\Delta h$$
$$\frac{1}{2}(v^2 - 0) = -(9.81\ \text{m/s}^2)(-0.25\ \text{m})$$
$$v = \sqrt{2(-9.81\ \text{m/s}^2)(-0.25\ \text{m})}$$
$$= 2.2\ \text{m/s}$$

7. Find Δh first:
$$\sin 30.0° = \frac{\Delta h}{12.0\ \text{m}}$$
$$\Delta h = 6.0\ \text{m}$$

$$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m(v^2 - v_0^2) = -mg\Delta h$$
$$\frac{1}{2}(v^2 - v_0^2) = -g\Delta h$$
$$\frac{1}{2}(v^2 - 0) = -(9.81\ \text{m/s}^2)(-6.0\ \text{m})$$
$$v = \sqrt{2(9.81\ \text{m/s}^2)(6.0\ \text{m})}$$
$$= 10.8\ \text{m/s}$$