$(1.24 \times 10^3\ \text{J/°C})t_f = 3.39 \times 10^4\ \text{J}$

$$t_f = \frac{3.39\times10^4\ \text{J}}{1.24\times10^3\ \text{J/¡C}} = 27.3\text{°C}$$

7. heat gained by water + heat lost by metal = 0

$\Delta Q_W + \Delta Q_M = 0$

$m_W\Delta t_W c_W + m_M\Delta t_M c_M = 0$

$(0.265\ \text{kg})(33.0\text{°C} - 26.0\text{°C})(4.18 \times 10^3\ \text{J/kg•°C}) + (0.352\ \text{kg})(33.0\text{°C} - 215\text{°C})c = 0$

$7.75 \times 10^3\ \text{J} = (64.1\ \text{kg•°C})c$

$$c = \frac{7.75\times10^3\ \text{J}}{64.1\ \text{kg•¡C}} = 1.21 \times 10^2\ \text{J/kg•°C}$$

8. $$E_k = \frac{1}{2}mv^2 = \frac{1}{2}(0.101\ \text{kg})(40.0\ \text{m/s})^2 = 80.8\ \text{J}$$

$\Delta E_h = m\Delta tc$

$$\Delta t = \frac{\Delta E_h}{mc} = \frac{80.8\ \text{J}}{(0.101\ \text{kg})(4.18\times10^3\ \text{J/kg•C})} = 0.191\text{°C}$$

9. heat gained by cold liquid + heat lost by warm liquid = 0

$\Delta E_{hC} + \Delta E_{hW} = 0$

$m_C\Delta t_C c_C + m_W\Delta t_W c_W = 0$

$(20.0\ \text{g})(t_f - 10.0\text{°C})c_C + (29.0\ \text{g})(t_f - 52.0\text{°C})c_W = 0$

Can divide both sides by c.

$\therefore\ (20.0\ \text{g})(t_f - 10.0\text{°C}) + (29.0\ \text{g})(t_f - 52.0\text{°C}) = 0$

$(20.0\ \text{g})t_f - 200.0\ \text{g•°C} + (29.0)t_f - 1.51 \times 10^3\ \text{g•°C} = 0$

$(49.0\ \text{g})t_f = 1.71 \times 10^3\ \text{g•°C}$

$$t_f = \frac{1.71\times10^3\ \text{g}\cdot\text{°C}}{49.0\ \text{g}} = 34.9\text{°C}$$

Note: We did not need to change the mass to kilograms.

Lesson 5–Law of Conservation of Mechanical Energy

1. $$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m\left(v_f^2 - v_0^2\right) = -mg\Delta h$$
$$\frac{1}{2}\left(v_f^2 - v_0^2\right) = -g\Delta h$$
$$\frac{1}{2}\left((3.2\ \text{m/s})^2 - 0\right) = -(9.80\ \text{m/s}^2)(\Delta h)$$
$$\Delta h = \frac{\frac{1}{2}(3.2\ \text{m/s})^2}{-9.80\ \text{m/s}^2} = -0.52\ \text{m}$$

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

2. $$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m\left(v_f^2 - v_0^2\right) = -mg\Delta h$$
$$\frac{1}{2}\left(v_f^2 - v_0^2\right) = -g\Delta h$$
$$\frac{1}{2}\left(v_f^2 - 0\right) = -(9.80\ \text{m/s}^2)(-8.0\ \text{m})$$
$$v_f = \sqrt{2(-9.80\ \text{m/s}^2)(-8.0\ \text{m})} = 13\ \text{m/s}$$

3. $$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m\left(v_f^2 - v_0^2\right) = -mg\Delta h$$
$$\frac{1}{2}\left(v_f^2 - v_0^2\right) = -g\Delta h$$
$$\frac{1}{2}\left((37.0\ \text{m/s})^2 - 0\right) = -(9.80\ \text{m/s}^2)(\square h)$$
$$\Delta h = \frac{\frac{1}{2}(37.0\ \text{m/s})^2}{-9.80\ \text{m/s}^2} = -69.8\ \text{m}$$

$\therefore$ building was 69.8 m tall

4. $$\Delta E_k + \Delta E_p = 0$$
$$\Delta E_k = -\Delta E_p$$
$$\frac{1}{2}m\left(v_f^2 - v_0^2\right) = -mg\Delta h$$
$$\frac{1}{2}\left(v_f^2 - v_0^2\right) = -g\Delta h$$

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