p 405 21, 23, 25, 29, 32

(21) $Q = mc\Delta T + mL_f$

$c_{Ag} = 230\ J kg^{-1} C^{o-1}$

$L_{f_{Ag}} = 88\ kJ\ kg^{-1}$

Ag melting point = 961 °C

$Q = (16.5\ kg)(230\ J kg^{-1} C^{o-1})(961 - 20°C) + (16.5\ kg)(88 \times 10^3\ J kg^{-1})$

$= \underline{5.0 \times 10^6\ J}$

(23) $Q = mL$ $\quad L_v = 210\ kJ kg^{-1}$

$m = \frac{Q}{L} = \frac{2.8 \times 10^5\ J}{210 \times 10^3\ J kg^{-1}}$

$= \underline{1.3\ kg}$

(25) $Q_{loss} = Q_{gain}$

$m_{Al} c_{Al} \Delta T_{Al} + m_w c_w \Delta T_w = m_{ice} c_{ice} \Delta T_{ice} + m_{ice} L_{f_{ice}} + m_{ice} c_w \Delta T_{iw}$

$m_{Al} c_{Al} \Delta T_{Al}$: calorimeter; $m_w c_w \Delta T_w$: water in calorimeter; $m_{ice} c_{ice} \Delta T_{ice}$: ice cube; $m_{ice} L_{f_{ice}}$: melting ice; $m_{ice} c_w \Delta T_{iw}$: water from melted ice

$$m_{ice} = \frac{m_{Al} c_{Al} \Delta T_{Al} + m_w c_w \Delta T_w}{c_{ice} \Delta T_{ice} + L_{f_{ice}} + c_w T_{iw}}$$

$c_{Al} = 900\ J kg^{-1} C^{o-1}$

$c_w = 4186\ J kg^{-1} C^{o-1}$

$c_{ice} = 2100\ J kg^{-1} C^{o-1}$

$L_f = 333\ kJ kg^{-1}$

$$m_{ice} = \frac{(.095\ kg)(900\ J kg^{-1} C^{-1})(20 - 17°C) + (.310\ kg)(4186\ J kg^{-1} C^{o-1})(20 - 17°C)}{(2100\ J kg^{-1} C^{o-1})(0 - -8.5°C) + 333 \times 10^3\ J kg^{-1} + (4186\ J kg^{-1} C^{o-1})(17 - 0°C)}$$

$m_{ice} = \underline{9.8 \times 10^{-3}\ kg}$

(29) $m_{Al} c_{Al} \Delta T_{Al} + m_w c_w \Delta T_w = m_{Hg} L_v + m_{Hg} c_{Hg} \Delta T_{Hg}$

$$L_v = \frac{m_{Al} c_{Al} \Delta T_{Al} + m_w c_w \Delta T_w - m_{Hg} c_{Hg} \Delta T_{Hg}}{m_{Hg}}$$

$$= \frac{(.62)(900)(12.8 - 5.06) + (.4)(4186)(12.8 - 5.06) - (1)(138)(5.06 - -39)}{1 kg}$$

$$L_v = 1.12 \times 10^4 \ J kg^{-1}$$

(32) $Q = mc\Delta T + mL_f$

$= (.082 kg)(130)(327 - 20) + .082(25 \times 10^3)$

$= 5322.62 J$

$c_{lead} = 130 \ J kg^{-1} C^{0-1}$

$L_f = 25 \ kJ kg^{-1}$

melting point $= 327°C$

The bullet must have had that much energy.

$E_k = \frac{1}{2} m v^2 = 5322.62 J$

$$v = \sqrt{\frac{2(5322.62 \ J)}{(.082 kg)}} = 360 \ ms^{-1}$$