CONCEPTUAL PHYSICS
SOLUTIONS TO REVIEW PACKET, CH. 21-23

① $Q = mL$ $\quad 5.0 \times \frac{10^3 g}{1 kg} \times \frac{80 cal}{g} = \boxed{4.0 \times 10^5 cal}$

② $Q = mL$ $\quad 2.5 g \times \frac{540 cal}{g} = 1350 cal$ or $\boxed{1.4 \times 10^3 cal}$

③ melting: $Q = mL$ $\quad 3.0 g \times \frac{80 cal}{g} = 240 cal$
warming: $Q = mC\Delta T$ $\quad 3.0 g \times \frac{1.00 cal}{g \cdot °C} \times (20°C - 0°C) = 60 cal$
Total $= \boxed{300 cal}$

④ heating ice: $Q = mC\Delta T$ $\quad (50.0 g)\left(\frac{.5 cal}{g °C}\right)(30°C) = 750 cal$
melting: $Q = mL$ $\quad (50.0 g) \times \left(\frac{80 cal}{g}\right) = 4000 cal$
heating water: $mC\Delta T = (50.0 g)\left(\frac{1.00 cal}{g \cdot °C}\right)(100°C) = 5000 cal$
vaporization: $mL = (50.0 g)\left(\frac{540 cal}{g}\right) = 27000 cal$
heating steam: $mC\Delta T = (50.0 g)\left(\frac{.5 cal}{g}\right)(140-100) = 1000 cal$
Total $37750 cal$
or $\boxed{3.8 \times 10^4 cal}$

⑤ freezing: $mL = 25.0 g \times \frac{80 cal}{g} = 2000 cal$ or $2.0 \times 10^3 cal$
cooling: $mC\Delta T = (25.0 g)\left(\frac{.5 cal}{g \cdot °C}\right)(15°C) = 187.5$ or $188 cal$
Total released: $\boxed{2188 cal \text{ or } 2.2 \times 10^3 cal}$

⑥ a) energy released while cooling: $Q = mC\Delta T$
$Q = \left(10.0 mL \times \frac{1.0 g}{mL}\right)\left(\frac{1.00 cal}{g \cdot °C}\right)(80°C) = 800 cal$ released

b) melting ice: $Q = mL$ $\quad (800 cal) = m\left(\frac{80 cal}{g}\right)$
$\boxed{m = 10 g}$

⑦ If you touch a hot iron with a wet finger, the heat from the iron will vaporize the moisture on your finger first, removing a lot of heat and not burning your finger — if you are quick!

(8) If the specific heat of A is larger than the specific heat of B, then more heat will be required to raise the temp of A 1°C than the temp. of B by 1°C, so A will take longer.

(9) Conduction: the handle of your spoon gets hot when the bowl of the spoon is in hot soup.

Convection: The Gulf Stream carries warm water from the Gulf of Mexico to the North Atlantic.

Radiation: radiation from the sun travels through space to earth where it may warm us and burn our skin

(10) $Q = mC\Delta T$, so $C = \frac{Q}{m\Delta T}$ $\quad C = \frac{47.0\,J}{(35.4\,g)(3.45°C)} = \boxed{.389 \frac{J}{g \cdot °C}}$

(11) a) $Q = mC\Delta T$ $\quad Q = (361\,g)\left(\frac{1.00\,cal}{g\,°C}\right)(23.0°C) = 8303\,cal$ lost by OJ $\rightarrow \boxed{8.30 \times 10^3\,cal}$

b) $Q = mL$ $\quad m = Q/L = \frac{8303\,cal}{80\,cal/g} = \boxed{104\,g}$

c) $152\,g - 104\,g = \boxed{48\,g \text{ of ice remaining}}$

(12) heat released by water: $Q = mC\Delta T$ $\quad \left(187\,mL \times \frac{1\,g}{mL}\right)\left(\frac{4.184\,J}{g\,°C}\right)(-4°C) = \underline{-3130\,cal}$

$C = \frac{1.00\,cal}{g\,°C}$ or $\frac{4.184\,J}{g\,°C}$

heat absorbed by iron bar $= 3130\,cal$

so $Q = mC\Delta T$ $\quad \Delta T = \frac{Q}{mC}$ $\quad \frac{3130\,cal}{(283\,g)\left(\frac{.45\,J}{g\,°C}\right)} = 24.6°C$

$\Delta T = T_f - T_i$

$T_i = T_f - \Delta T$ $\quad 16.0°C - 24.6°C = \boxed{-8.6°C}$