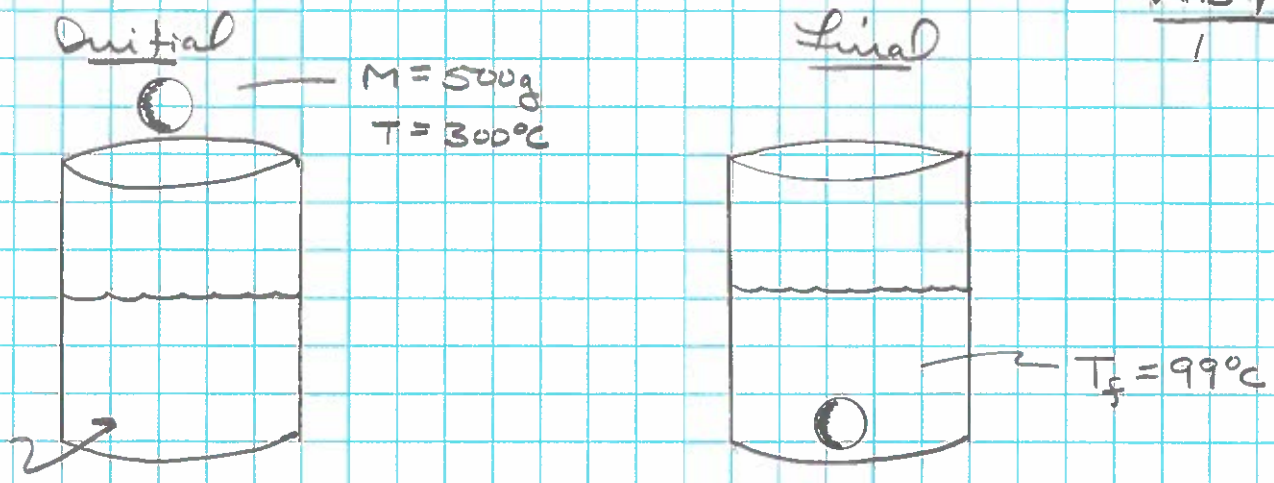

Mercury: $V = 300\,cm^3$
$= 300\times10^{-6}\,m^3$

@ $T_m = 20°C$

$M_m = \rho_m V = 4.08\,kg$

$\rho_m = 13600\ \frac{kg}{m^3}$ (from chap 18)

Q_{net} = Heat to Mercury + Heat from sphere = 0

So

$$0 = M_m c_m \Delta T_m + Mc\Delta T_s$$

$$= M_m c_m (T_f - T_m) + Mc(T_f - T)$$

So

$$c = \frac{-M_m c_m (T_f - T_m)}{M(T_f - T)} = 449.0\ \frac{J}{kg\,K}$$

$c_m = 140\ \frac{J}{kg\,K}$

Comparing to table 19.2, this is Iron.