A 500 g block of copper ($C_{P,m} = 24.4\ J\ K^{-1}\ mol^{-1}$) at 100°C and a 500 g block of silver ($C_{P,m} = 32.9\ J\ K^{-1}\ mol^{-1}$) at 0°C are brought into contact. What is the final temperature of the system?

- It is tempting to ~~[illegible]~~ say 50°C, but remember we must work in units of mols and K

$n(Cu) = \frac{500\,g}{63.5\,g/mol} = 7.87\,mol$

$n(Ag) = \frac{500\,g}{108\,g/mol} = 4.63\,mol$

$T_i(Cu) = 373\,K$

$T_i(Ag) = 273\,K$

$q_p(\text{lost, Cu}) = -q_p(\text{gained, Ag})$

$n(Cu)C_{p,m}(Cu)(T_f - T_i(Cu)) = -n(Ag)C_{p,m}(Ag)(T_f - T_i(Ag))$

$T_f(n(Cu)C_{p,m}(Cu)) - T_i(Cu)n(Cu)C_{p,m}(Cu) = -T_f(n(Ag)C_{p,m}(Ag)) + T_i(Ag)n(Ag)C_{p,m}(Ag)$

$$T_f = \frac{T_i(Ag)n(Ag)C_{p,m}(Ag) + T_i(Cu)n(Cu)C_{p,m}(Cu)}{n(Cu)C_{p,m}(Cu) + n(Ag)C_{p,m}(Ag)}$$

$$T_f = \frac{(273\,K)(4.63\,mol)(32.9\,J/K\,mol) + (373\,K)(7.87\,mol)(24.4\,J/K\,mol)}{(7.87\,mol)(24.4\,J/K\,mol) + (4.63\,mol)(32.9\,J/K\,mol)}$$

$\boxed{T_f = 329\,K}$

Even though Ag has the higher heat capacity, Cu has almost 2x as many mols. So in this problem, intuition doesn't help you, have to actually crunch #'s