

# Coursework 1 – Transient Conduction

Adam Duncan

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## 1 *Part A: Using lumped capacitance*

### 1.1 Assumptions

- Internal temperature of the steel ball is uniform at any time  $t$ .
- No change in water temperature
- No heat transfer by radiation
- Material is standard carbon steel
- Material properties constant (taken at average temperature  $T = 469^\circ\text{C}$ )

### 1.2 Schematic

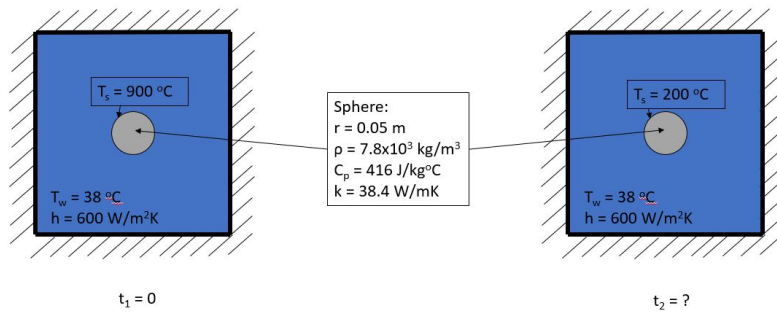


Figure 1: Part A schematic at initial and final state.

### 1.3 Analysis

Energy balance for closed system gives the following equation.

$$Bi = \frac{hL_c}{k} \quad (1)$$

Where  $h$  is conductivity [W/mK]

$$t = \frac{f_0 \rho C_p R^2}{k} \quad (2)$$

**2    *Part B: Lumped capacitance justification***

**3    *Part C: Transient conduction***

**4    *Part D: Non-infinite water bath***

**5    *Part E: Equilibrium temperature***