

Tutorial Sheet - Specific Heat Capacity (solid and liquid)

Take: specific heat capacity for water as $4.18 \text{ kJkg}^{-1} \text{ K}^{-1}$

1. A steel billet of mass 250 kg has its temperature increased from 288 K to 1123 K. Taking the specific capacity of steel as $0.503 \text{ kJkg}^{-1}\text{K}^{-1}$, determine the heat transferred.
(105 MJ)
2. A copper calorimeter of mass 1.0 kg contains 0.15 kg of water, 0.2 kg of iron and 0.4 kg of aluminium. The temperature of the calorimeter and its contents is raised from 290 K to 360 K. Determine the heat transfer. The specific heat capacities are: copper $0.377 \text{ kJkg}^{-1}\text{K}^{-1}$; iron $0.503 \text{ kJkg}^{-1}\text{K}^{-1}$; aluminium $0.88 \text{ kJkg}^{-1}\text{K}^{-1}$.
(102 MJ)
3. A calorimeter, of mass 0.15 kg and containing 0.236 kg of water at 280 K, is placed inside a larger insulated vessel. A piece of metal of mass 0.201 kg at a steady temperature of 311 K is dropped into the water. The final resulting temperature of the whole system is 285 K. Assuming the specific heat capacity of the calorimeter to be $0.47 \text{ kJkg}^{-1}\text{K}^{-1}$, determine the specific heat capacity of the metal.
($1.01 \text{ kJkg}^{-1} \text{ K}^{-1}$)
4. Using the calorimeter and metal referred to in the previous example (Q3) an experiment was carried out as follows. A quantity of oil, mass 0.307 kg at temperature 280 K, was placed in the calorimeter; then the metal, at temperature 311 K was dropped into the oil, the resulting steady temperature of the system was 286 K. Determine the specific heat capacity of the oil.
($2.53 \text{ kJkg}^{-1} \text{ K}^{-1}$)
5. In an experiment to determine the specific heat capacity of lead the following observations were made:

mass of copper calorimeter, empty	95 g
mass of copper calorimeter and water	152.5 g
mass of lead	67.5 g
initial temperature of lead before transfer to the calorimeter	100°C
initial temperature of water in the calorimeter	16°C
final temperature after transfer of the lead to the calorimeter	18.5°C.

If the specific heat capacity of the copper calorimeter is $0.419 \text{ kJ/kg}^{-1} \text{ K}^{-1}$, calculate the specific heat capacity of lead from the above data.
($0.128 \text{ kJkg}^{-1} \text{ K}^{-1}$)