EXERCISES
Specific heats of thermal physics

$T =$ $l =$ $m =$

$c =$ $\Delta =$ $E =$

1. A 3-metre iron rod at room temperature is heated until 1200 ℃.
    a. How much does the rod expand due to the temperature increase?

$\alpha =$ $l =$ $\Delta T =$

$\Delta l = \alpha \cdot l \cdot \Delta T =$

    b. How much energy does the increase require, given that the mass of the rod is 2 kg?

$m =$ $c =$ $\Delta T =$

$E = m \cdot c \cdot \Delta T =$

2. A copper stick at room temperature is submerged in boiling water. Beforehand, the length was observed to be 20 cm.
    a. Find the length of the rod after the expansion.

$\alpha =$ $l =$ $\Delta T =$

$\Delta l = \alpha \cdot l \cdot \Delta T =$
Therefore, the total length is $l + \Delta l =$

    b. How much energy does this expansion of a 500-gram rod require?

$m =$ $c =$ $\Delta T =$

$E = m \cdot c \cdot \Delta T =$

3. Mamie pours 2 dl $= 0{,}2$ kg of coffee at 90 ℃ out of a coffee pot.
    a. She adds 2 dl $= 0{,}2$ kg of refridgerator-cold milk at 10 ℃. Which point does the temperature stabilize to?

    b. The coffee-milk beverage is left to be until it achieves room temperature. Find the amount of energy it releases to its surroundings.

$m =$ $c =$ $\Delta T =$

$E = m \cdot c \cdot \Delta T =$

4. Can you lose weight by eating a popsicle? For simplicity, let us assume that you eat a 100-gram popsicle out of a $-10\ ^\circ\mathrm{C}$ freezer.
    a. How much energy is consumed during the temperature change $-10\ ^\circ\mathrm{C} \rightarrow 0\ ^\circ\mathrm{C}$?

$m = 0{,}1\ \mathrm{kg}$ $\quad c =$ $\quad \Delta T =$

$E = m \cdot c \cdot \Delta T =$

    b. How much energy is consumed when the popsicle thaws? The latent heat of water is $334\ 000\ \mathrm{J/kg}$.

$E =$

    c. How much energy is consumed during the temperature change $0\ ^\circ\mathrm{C} \rightarrow 36\ ^\circ\mathrm{C}$?

$m =$ $\quad c =$ $\quad \Delta T =$

$E = m \cdot c \cdot \Delta T =$

    d. Find the nutritional information of a popsicle. How much energy (kJ) does eating a popsicle release into your system?

    e. Which is higher: The amount of energy released (nutritional information) or consumed (calculations)?

5. As a common method, ice can be added to a beverage to cool the temperature of the drink.
    a. You add 100 grams of ice cubes to your soft drink. How much energy is released when the cubes melt? The latent heat of water is 334 000 J/kg

$E =$

    b. By how much does this amount of energy lower the temperature of $1{,}5$ litres of soda?

$$\_\_\_\_\_\ \mathrm{J} = 1{,}5\ \mathrm{kg} \cdot 4\ 190\ \frac{\mathrm{J}}{\mathrm{kg}\ ^\circ\mathrm{C}} \cdot \Delta T$$

subtance	**specific heat capacity**
lead	$130\ \frac{\mathrm{J}}{\mathrm{kg}\ ^\circ\mathrm{C}}$
copper	$390\ \frac{\mathrm{J}}{\mathrm{kg}\ ^\circ\mathrm{C}}$
iron	$450\ \frac{\mathrm{J}}{\mathrm{kg}\ ^\circ\mathrm{C}}$
ice	$2\ 090\ \frac{\mathrm{J}}{\mathrm{kg}\ ^\circ\mathrm{C}}$
water	$4\ 190\ \frac{\mathrm{J}}{\mathrm{kg}\ ^\circ\mathrm{C}}$

substance	**thermal coeff.**
carbon	$0{,}0000088\ \frac{1}{^\circ\mathrm{C}}$
copper	$0{,}0000170\ \frac{1}{^\circ\mathrm{C}}$
iron	$0{,}0000120\ \frac{1}{^\circ\mathrm{C}}$
aluminium	$0{,}0000232\ \frac{1}{^\circ\mathrm{C}}$
silver	$0{,}0000190\ \frac{1}{^\circ\mathrm{C}}$