

# The Carbon cycle – reflection



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a) Area = 1 hectare.

b) Domination kind of wood - Beech wood.

c) The estimated biomass (beech wood) per hectare is ca.  $500 \frac{m^3}{hectare}$

d) The density of beech wood with 64% of water is  $910 \frac{kg}{m^3}$

e) Assume that all the dry matter in the beech wood is cellulose – this is a pretty crude assumption that underestimates the carbon content in beech wood by 5%.

f) The energy content (i.e. heat of combustion) of carbohydrates is  $q_{carbohydrate} = 17 \frac{kJ}{g}$ .

The mass of the dry matter of the Beechwood according to the data above is

$$m_{dry} = 500 * 910 * 0.34 = 154700 kg$$

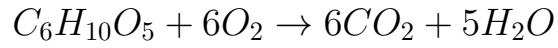
The mass of cellulose is equal to the mass of the dry matter.

$$m_{cellulose} = m_{dry}$$

The energy emitted into surroundings while burning can be estimated as follows:

$$E = m_{cellulose} * q_{carbohydrate} = 1547 * 10^5 * 17 = 2629900 MJ$$

$CO_2$  release:



$$n_{C_6H_{10}O_5} = \frac{m_{cellulose}}{M_{cellulose}} = \frac{154700000}{6 * 12 + 10 + 5 * 16} = 954938.27 \text{ mol}$$

$$n_{CO_2} = n_{C_6H_{10}O_5} * 6 = 954938.27 * 6 = 5729629.63 \text{ mol}$$

$$m_{CO_2} = n_{CO_2} * M_{CO_2} = 5729629.63 * 48 \approx 275000 \text{ kg}$$

According to the data<sup>1</sup> Denmark emits 5.05 tons of  $CO_2$  per capita.

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<sup>1</sup><https://www.statista.com/statistics/270508/co2-emissions-per-capita-by-country/>