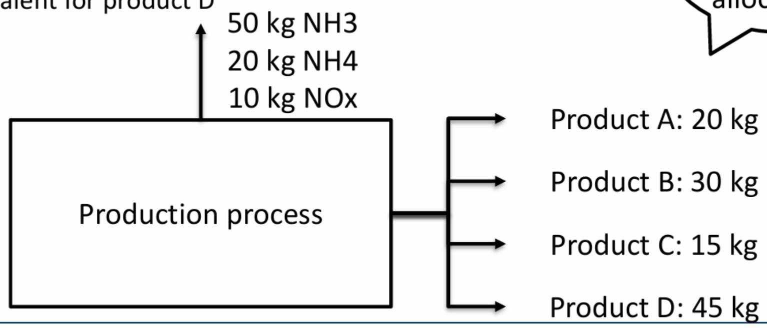
Practical part: LCA

The figure below shows a production process with four products, product A, product B, product C and product D and given emissions for this process. The characterization factor of NH_3 into N equivalent is 0.09, and of NH_4 into N equivalent is 0.78 and NO_x into N equivalent is 0.39. You should use mass-based allocation of marine eutrophication impact into the products. Which statement is true for the result of this?

a. 6.55 kg N equivalent for product A
b. 6.55 kg N equivalent for product B
c. 9.82 kg N equivalent for product C
d. 3.27 kg N equivalent for product D

What if it was asked energy allocation?



Solving

	CF	Emission (kg)	Marine eutrophication (kg N equivalent)
NH3	0.09	50	4.5
NH4	0.78	20	15.6
Nox	0.39	10	3.9
Total			24

	Mass (kg)	Mass allocation (%)	Allocated impacts
Product A	20	18%	4.36
Product B	30	27%	6.55
Product C	15	14%	3.27
Product D	45	41%	9.82
Total	110	1	24

Practical part: footprint and impact

A production process emits five different types of gases to the atmosphere: 50 kg of CO2, 30 kg of CO, 25 kg of NO_x, 35 kg of SO2, and 80 kg of CH4. What are the total impacts of this process? Use the characterization factors from the table below. Note that climate change unit is CO2 equivalent, human toxicity is kg 1.4-DB equivalent acidification is mol H+ equivalent.

a. Total impact: 2547 kg CO2 equivalent
b. Climate change: 2450 kg CO2 equivalent; Human toxicity: 44.3 kg 1,4 DB equivalent; Acidification: 52.5 mol H+ equivalent
c. Climate change: 44.3 kg CO2 equivalent; Human toxicity: 2450 kg 1,4 DB equivalent; Acidification: 52.5 mol H+ equivalent
d. Climate change: 2450 kg CO2 equivalent; Human toxicity: 52.5 kg 1,4 DB equivalent; Acidification: 44.3 mol H+ equivalent

	CHARACTERIZATION FACTOR		
Emission	Climate change	Human toxicity	Acidification
CO2	1	-	-
CO	-	0.012	-
NOx	-	0.078	0.7
SO2	-	1.2	1.0
CH4	30	-	-

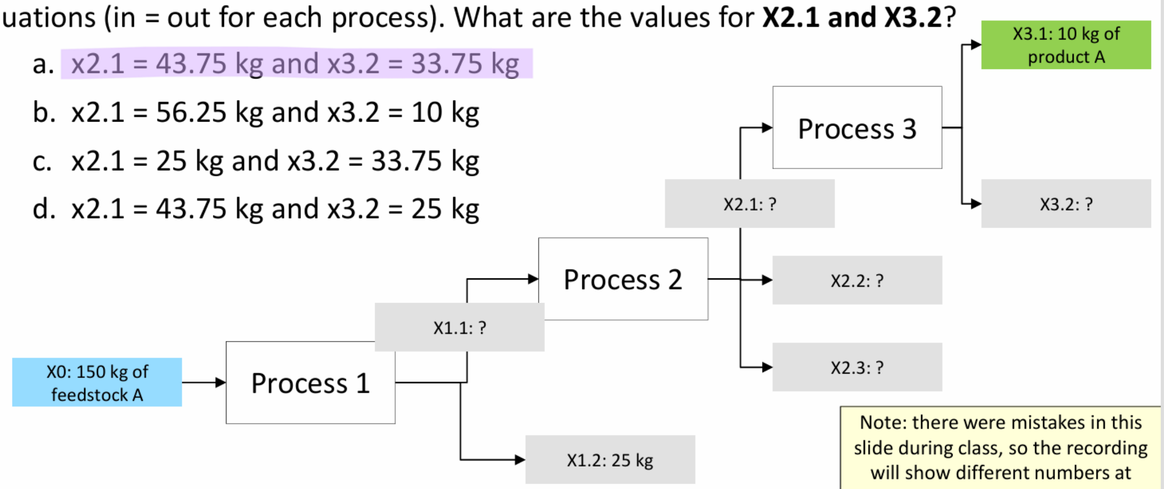
Solving

	CHARACTERIZATION FACTOR				IMPACT		
	Climate change	Human toxicity	Acidification	Emission (kg)	Climate change impact (kg CO2eq)	Human toxicit impact (kg 1,4 DB equivalent)	Acidification impact (mol H+ equivalent)
CO2	1	0	0	50	50	0	0
CO	0	0.012	0	30	0	0.36	0
Nox	0	0.078	0.7	25	0	1.95	17.5
SO2	0	1.200	1.0	35	0	42	35
CH4	30	0	0	80	2400	0	0
Total					**2450**	**44.31**	**52.5**

Practical part: MFA

The figure below shows a system to produce a product A from feedstock A. This system has four processes and a total of 8 flows ($x1.0$, $x1.1$, $x1.2$, $x2.1$, $x2.2$, $x2.3$, $x3.1$, $x3.2$). 35% of Process 2 output is x2.1, 20% is x2.2 and 45% is x2.3. Set up the balance equations (in = out for each process). What are the values for **X2.1 and X3.2**?

a. x2.1 = 43.75 kg and x3.2 = 33.75 kg
b. x2.1 = 56.25 kg and x3.2 = 10 kg
c. x2.1 = 25 kg and x3.2 = 33.75 kg
d. x2.1 = 43.75 kg and x3.2 = 25 kg



Note: there were mistakes in this slide during class, so the recording will show different numbers at first, I corrected them live.

Solving

Balancing process 1:
X1.1 = x0-x1.2
X1.1 = 150 kg – 25 kg = 125 kg
Balancing process 2
X2.1 = 125 kg * 0.35 = 43.75 kg
X2.2 = 125 kg * 0.2 = 25 kg
X2.3 = 125 kg * 0.45 = 56.25 kg
Balancing process 3
X3.2 = x2.1 – x3.1
X3.2 = 43.75 – 10 kg = 33.75 kg