GREEN THINKING

How much CO_2 can I save by…

Climate is changing. We can see the effects of climate change in our own lives. It is getting hotter and hotter, and we are experiencing more droughts, floods and storms. The main reason for this is that we are releasing too much greenhouse gases – such as CO2 – into the air. These gases trap heat from the sun and make the world warmer.
But we can all do something to reduce the CO2 emissions and help to protect our planet. What about simply leaving the car behind and walking or biking to work instead? Let's have a look at how much CO2 we can save by living an eco-friendlier lifestyle.

Overview "HOW MUCH CO_2 CAN I SAVE BY…"

What can I do to reduce CO_2 emissions?

Context
Everyday life
Health and care

Cognitive processes
Analysing situations
Processing information
Critical thinking

Target group (incl. necessary prior skills and competences)

Adults with basic mathematical and digital skills

Adults willing to reflect their everyday life behaviour in order to protect the environment

X1 /Y2

Content
Quantity and number
Using a calculator

Dispositions
Self-confidence
Motivation
Flexibility

Reflecting on the consequences of the learner's own behaviour on CO_2 emissions

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Main information

Content	Quantity and number (calculating with large numbers, calculation with digital numbers) Using digital skills (calculator/smartphone) for the calculation steps or for checking the results
Target group	Adults with basic arithmetic skills being able to use a calculator. Adults willing to reflect their own behaviour in environmental matters (means of transport, food).
Learning intention	What is the intention of adults to face this problem? – Numeracy for personal and private purposes – Numeracy to understand society
Duration	Approx. 4 lessons
Material and resources	Lists of activities, picture cards, various worksheets, graphs,…
Group size	Up to 10 learners
Problem statement	CO_2 emissions are primarily caused by burning fossil fuels. By applying mathematical calculations and understanding f. ex. the relationship between fuel consumption and CO_2 emissions, learners can make informed decisions to reduce their carbon footprint.
Working questions	Which human activities produce the highest CO_2 emissions? How can you compare the CO_2 emissions of different means of transport? How can you compare the CO_2 emissions of different dietary styles? How can you reduce your carbon footprint? How can we calculate with large numbers? How can we calculate with digital numbers? How can you verify results with a calculator?
Learning outcomes and results	The learners can calculate and compare CO_2 emissions associated with different means of transport and dietary styles. They understand the environmental impact of their choices in everyday life.
Reference to National Qualification Frame	Optional (country's decision)

Working plan

Time (lessons)	Description of content/activities	Material	Methodical and didactic information[1]
15 min	Activation The learners should understand that CO_2 emissions are primarily caused by burning fossil fuels, such as gasoline in vehicles and that by reducing fuel consumption, we can effectively reduce CO_2 emissions. First the learners collect human activities which are responsible for CO_2 emissions (f. ex. transportation, energy production, industrial processes, deforestation, livestock…)	Flipchart	HITS structuring lessons questioning cognitive activation
15 min	Estimation – ranking The learners work in small groups. They get a list of various means of transportation / different types of food and the estimated CO_2 emissions for each item. The learners rank the activities in order of CO_2 -emissions, starting with the activity that has the highest emission. The different groups can work together to discuss and justify their rankings.	List of means of transportation / food. List of CO_2 emissions The teachers choose the items from the list depending on their assessment. (Appendix 1) (Alternatively: picture cards)	HITS collaborative learning cognitive activation metacognitive strategies
45 min	Learning – revision If necessary, the learners reinforce their basics of arithmetic (addition, subtraction, multiplication) with large numbers and decimal numbers.	Worksheets (Appendix 2) Calculator, smartphone (optional)	HITS worked examples differentiated teaching

[1] for description and explanation of kinds of tasks, HITS and other background information please consult the teacher's/user's guide

45 min	Learning The learners calculate the CO_2 emissions for • different means of transport car – car car – bike plane – train – car … • different dietary styles • purchasing local or imported • …	Worksheets (Appendix 3) (Appendix 4)	HITS worked examples differentiated teaching
30 min	Transfer The learners are able to quantify and compare the CO_2 emissions associated with different modes of transportation and dietary styles. They understand the environmental impact of their choice. They reflect on their own behavior.	Online-tools (carbon footprint calculator) (Appendix 5)	HITS questioning feedback

Suggestions for the teacher/user

The example presented here should be considered as exemplary and inspirational material presenting a guideline with a high range of possibilities of adapting those suggestions to a specific group of learners or an individual learner with his or her very personal requirements.

In concrete terms, the example "HOW MUCH CO_2 CAN I SAVE BY …" could be adapted these ways:

- Duration: Depending on the prior knowledge of the learners, the duration of this example can vary. Especially the activation of the learners could require more time if they are not yet so familiar with the topic climate change and CO_2 emissions. It also could be useful to use visual aids such as graphs, diagrams or infographics to illustrate the concepts of CO_2 emissions and the calculations involved.
- Individualization: Depending on the learners' prior skills, the trainer should repeat and train the capacity of written addition, subtraction or multiplication. Therefore, additional material could be necessary.
- Level of difficulty: This example contains calculations with large numbers and digital numbers. It is necessary to adapt the examples to the learners' skills. Some learners can calculate the results without calculator and use it afterwards only to verify the answers. Others might use it to perform the calculation directly.

Our educational activities aim at numeracy skills being not only memorized, but first of all being practiced and functionally used by the learners in daily life or/and vocational situations. It is therefore recommended to implement the idea of HITS[2] (higher impacts of teaching skills) as far and often as possible: ...

- ... work with concrete and authentic material that learners will recognize from everyday life situations.
- ... ask the learners questions and let them raise questions themselves. It can be crucial to discuss numeracy themes, contexts and numbers. The learners can be engaged in group discussions where they can share their thoughts, ideas and questions. This allows peer-to-peer learning and promotes active participation.
- ... think of possible ways of transfer: These calculation examples should allow the learners to develop an understanding of the environmental impact of their own everyday life decisions. Once again, depending on the (digital) skills and the interest of the learners, the teachers can incorporate online tools such as an ecological footprint calculator.

[2] For general information and explanation on HITS please see the teacher's/user's guide.

Appendix 1

Transportation: What are the CO_2 emissions per passenger kilometre using the …

Car	147 g CO_2
Train	57 g CO_2
Bicycle	0 g CO_2
Bus	29 g CO_2
Plane	271 g CO_2
On foot	0 g CO_2

Source: CO2 durch Verkehrsmittel im Vergleich | Mein Klimaschutz (mein-klimaschutz.de) [24.06.2023]

Food: What is the CO2 emissions of 100 grams of…

Hamburger	3068 g CO_2
Fried fish	820 g CO_2
Grilled sausage	1568 g CO_2
Pasta	152 g CO_2
Green Salad	70 g CO_2
Vegetarian Schnitzel	592 g CO_2

Quelle: Climate impact of CO2 Potatoes (foodfootprint.nl)[24.06.2023]

Food: What is the CO2 emissions of 100 grams of…

French fries	615 g CO_2
Potatoes	92 g CO_2
Chicken	1087 g CO_2
Kiwi	70 g CO_2
Beefsteak	3134 g CO_2
Broccoli	134 g CO_2

Quelle: Climate impact of CO2 Potatoes (foodfootprint.nl)[24.06.2023]

Appendix 2

Calculating with large numbers.

Calculate and verify the results with the calculator.

a) 8745 + 5321 =

b) 9876 - 5432 =

c) 3562 + 8956 – 2187 =

*d) 345 * 6 =*

*e) 786 * 4 =*

*f) 234 * 6 =*

Results:

2070	*10331*	*14066*
1404	*4444*	*3144*

Calculating with decimal numbers.

Calculate the price for your shopping list. Verify the results using a calculator.

Apples	*2,50 €*
Bread	*1,80 €*
Milk	*1,29 €*
Cheese	*4,35 €*
Yogurt	*1,24 €*

The purchase costs ◯ 11,18 € ◯ 18,11 € ◯ 11, 81 €

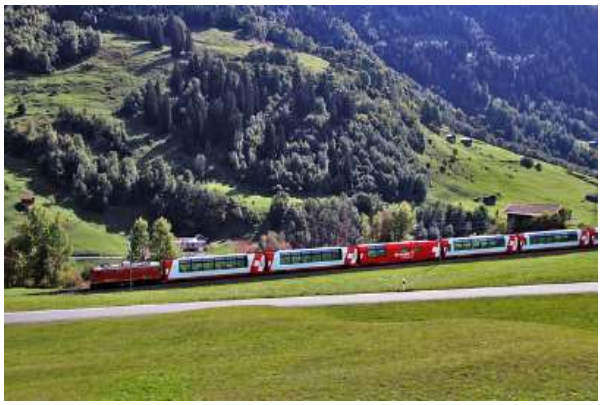
Appendix 3

The distance between Vienna and Munich is 400 kilometers. There are various modes of transportation available for a trip from Vienna to Munich:

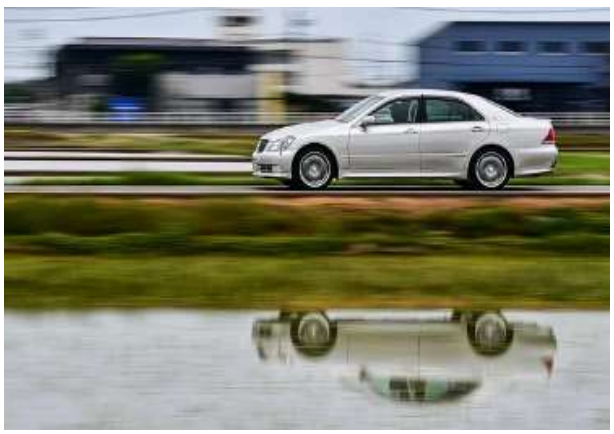
CO_2 emissions: 0,27 kg per kilometer

400 kilometer * 0,27 kg = **108 kg**

The airplane has a CO_2 emissions of 108 kilos.



CO_2 emissions: 0,06 kg per kilometer



CO_2 emissions: 0,15 kg per kilometer

[Fotos: www.pixabay.com]

How much CO_2 do the train and the car produce? Use the calculator.

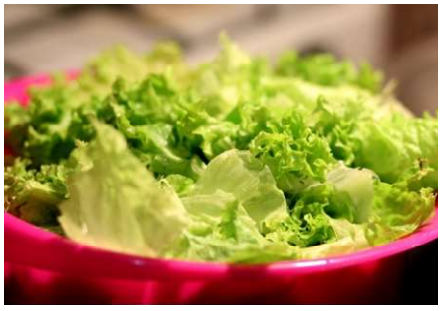
Appendix 4

Caculate: How much CO_2 do the two menus generate?

Menu 1:

Hamburger: 3086 grams CO_2

Frenchs fries: 615 grams CO_2

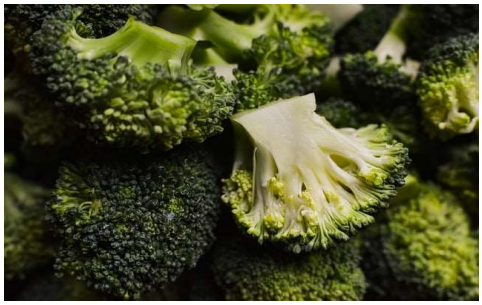


Salad: 70 grams CO_2

Menu 1: _____ grams CO_2

Menu 2:

Chicken: 1087 grams CO_2



Broccoli: 134 grams CO_2

Pasta: 152 grams CO_2

Menu 2: _____ grams CO_2

[Fotos: www.pixabay.com]

Appendix 5

Online carbon footprint calculator:

https://www.co2-rechner.at/ [26.06.2023]