

Maths

Is fashion a toxic trip?

RecyCOOL Lessons

Disclaimer

These lessons have been created for and tested with young people in Slovakia, the Czech republic, Germany, Hungary and Croatia. They are open-source and available for adaptation for different groups globally.

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Is fashion a toxic trip?

Description of the lesson

Students will firstly learn about the complexity of one shirt's journey. After reading the text they will have to calculate the distance that their piece of clothing covered, before it reached their closet. They will also calculate how many t-shirts one fully loaded truck can carry, and how to calculate how much fuel money is spent for each shirt in transport.

Objective

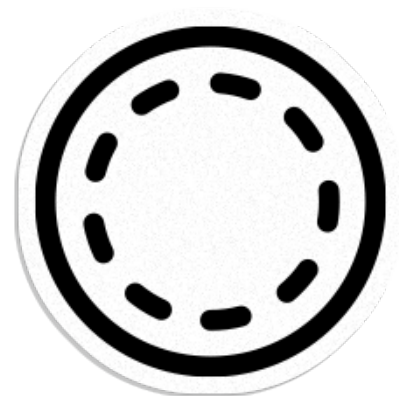
Objective of this lesson is to calculate basic data related to the transport of one t-shirt – recognise how far it travels, and the cost of transport, to calculate its impact on the environment.

After this lesson you will be able to

- name the problems of transportation, calculate the carbon footprint of one bought t-shirt
- explain what contributes to the carbon footprint of the t-shirt
- demonstrate how transportation is a critical link in the supply chain
- start to recognise more sustainable ways of managing the logistics and supply chains of the fashion industry

Tools and materials

calculator, paper, pencil



CARBON FOOTPRINT:

A carbon footprint corresponds to the whole amount of greenhouse gases (GHG) produced to, directly and indirectly, support a person's lifestyle and activities. Carbon footprints are usually measured in equivalent tons of CO₂, during the period of a year, and they can be associated with an individual, an organization, a product or an event, among others.



Have you ever thought about the environmental impact that your clothes made to get to you? Where did it come from and how was it transported? Was it shipped by large container vessel or put on a cargo plane? For at least some part of the journey, it was probably carried on a truck or a van to deliver it to the store.

All these modes of transportation emit a certain amount of CO₂ and other greenhouse gases into the atmosphere. In this lesson we will calculate the carbon footprint that these clothes are making on their journey around the world, from manufacturers to customers like you and me.

Most of your clothes' toxicity comes from its production, but certainly transportation has its share in carbon emissions that shouldn't be neglected.

Maybe some of your clothes are made locally but, generally, most of the world's clothes come from countries with cheaper labour and travel thousands of kilometres before they end up at your local fashion store.

Not to mention that the production of one single piece of clothing involves many different countries that aren't necessarily close to each other which highly increases the number of kilometres if taken into account.

And also to consider the natural resource extraction and processing and the energy used to power the factories making the clothes. These might be oil or coal powered factories.

Garments or clothing, similarly to other freight, is usually transported by four different modes of transportation: ships, planes, trucks and trains.

Clothing is mostly transported by ships and planes if it's a long distance trip, while rail and road transport are more suitable for shorter distances.

For example, your favourite T-Shirt was first put on a container vessel in China and shipped to a European port, from where it was carried by train to the warehouse, put on a truck and delivered to the fashion store in your town.

Data



TRY TO SOLVE THIS
MATH PROBLEM

T-Shirt weight: **0,2 kg = 0,0002T**

Average ContainerShip carbon footprint

25 CO² g/T/km = 0.000025T/km

Average carbon footprint of train: **65 CO² g/T/km**

Average distance travelled: **40 000 km** (included raw material, production)

From 40 000 km, let's say 30 000 km was travelled by ship and 10 000 km by train

Example:

How much carbon footprint is in 1 t-shirt which travelled 30000 km?

Calculation process:

1

We need to find out how many T-Shirts are in one tonne.

If one tonne is 1000 kg, and one Shirt weight is 0,2kg:

$$1000\text{kg} * 0,2 \text{ kg} = 5000 \text{ T-Shirts}$$

From this we can conclude that 5000 T-Shirts emit 25gCO²/T/ km since average carbon footprint per tonne of one container ship is 25gCO₂ KM/T

2

To calculate 1 T- Shirt's carbon footprint we need to divide 25gCO²/T with 5000 T-shirts.

$$25/5000 = 0,005\text{gCO}^2 /\text{km is carbon footprint of 1 T-shirt}$$

3

Now we will calculate the total carbon footprint for a T-Shirt travelled 30 000 km by ship.

$$\begin{aligned}\text{Total(CFship)} &= \text{Tshirt(CF)} * \text{travelled distance} \\ &= 0,005\text{g CO}^2/\text{km} * 30000 \text{ km} \\ &= 150\text{g CO}^2/\text{km}\end{aligned}$$



Total carbon footprint for this trip is 150g CO²/km .

And for distance travelled by train: $65/5000=0,013\text{g/CO}^2/\text{T/km}$

Total CF(train): 10000 km * 0,013g = 130g CO²/T/km

Total carbon footprint for transport is : Total CF(ship) + Total CF (train) 150+130 = 280g CO²/T/km

Yearly 2 billion T-shirts are produced in the world. Since 25% of world T-shirt export is from China, and 7% from Vietnam, we can say that T-shirts travelled around 40 000 km.

30% of 2 Bill is 600 million T-Shirts.

$$600 \text{ mil} * 0,00028\text{T CO}_2/\text{T/km} = 168 \text{ 000T CO}_2/\text{km}$$

168000T CO²/km is the total carbon footprint produced yearly for 30% of worldwide T-Shirt production. To compare – this is equal to the carbon footprint of 1000 cars.

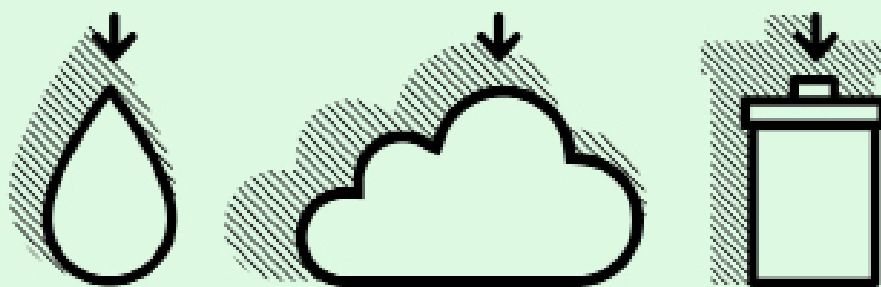
Task

Calculate carbon footprint for 1 T-Shirt that has travelled 40 000 km with a plane!

Follow the procedure above for help.

Don't forget to convert tons into kilograms before the calculation!

**EXTENDING THE LIFE OF CLOTHING
BY A FURTHER 9 MONTHS
WOULD REDUCE CARBON, WASTE
AND WATER FOOTPRINTS BY
AROUND 20-30% EACH**



#FASHIONREVOLUTION

Photo credit: [Fashion Revolution](#)

Reflection

Global carbon dioxide (CO²) emissions are one of the world's biggest problems, threatening the very survival of the planet Earth. Transport is responsible for 25% of CO² emissions, due to the use of fossil fuels.

With a simple mathematical example we showed how much fuel is spent on transporting one t-shirt.

But, in recent years, the online sale of clothing and footwear has brought many innovations to the transport and logistics sector – large and rapid growth has required a real small revolution in business.

Courier services also faced great challenges. Instead of the previous delivery of one shipment with several packages to retail stores, especially in shopping malls – i.e. delivery to one address, we now have a situation where each individual package from such a shipment is delivered directly to the end customer.

For the first time, online users are getting used to “bringing a changing room home”, i.e. buying several products, trying them out and returning those they do not want to keep. As a result, our T-shirt often travels much longer and its carbon footprint is at least doubled.

All the above facts lead us to the only right path, let us buy responsibly and be conscientious citizens of this world.

Resources

Chrobot, P., Faist, M., Gustavus, L., Martin, A., Stamm, A., & Zah, R. (2018). Measuring Fashion: Environmental Impact of the Global Apparel and Footwear Industries Study [Full Report and Methodological Considerations]. Quantis. Available online at: https://quantis.com/wp-content/uploads/2018/03/measuringfashion_globalimpactstudy_full-report_quantis_cwf_2018a.pdf



Authors

Sonja Tudor, Fashion Revolution Croatia

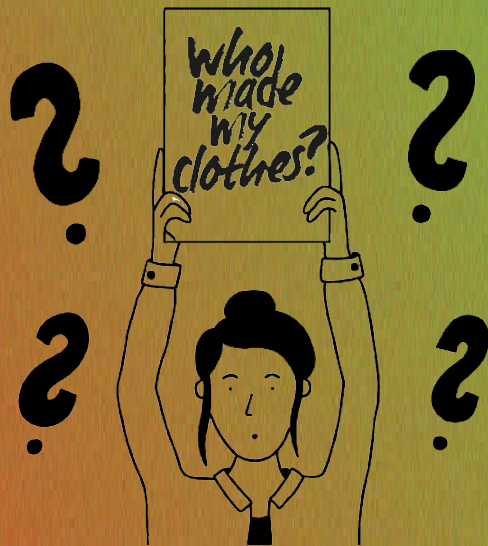
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