Teacher's Guide: Greenhouse Gases Around the World (with Answers)

Before the lesson: print cards with total emissions (p. 6-9) and per capita emissions (p. 10 -13).

1. Glossary (New Words to Learn!) - 5 min

Here are some concepts that your students need to understand for this lesson.

Greenhouse gas – A gas that traps heat in the air and makes the Earth warmer. (Example: Carbon dioxide from cars and factories.)

Greenhouse gas emissions – The total amount of pollution a country releases into the air.

Greenhouse gas emissions per person – The amount of pollution divided by all the people in a country.

You can now tell your students to form groups of 2-4 students.

2. Converting from Billion to Million and Vice Versa - 15 min

Introduce the concepts of million and billion to your students. 1 billion = 1,000 million.

Use the cards with total emission (set 1) to practice conversion with them. 5 of them are from million to billion and 5 are from billion to million.

You can do one conversion from million to billion and one from billion to million with them. Then, let them try to do the other conversions in their group.

Correction p.3

3. Who Pollutes the Most? - 15 min

Use the same cards (set 1) with countries' total emissions. The goal is to order them from the one who pollutes the least to the one that pollutes the most.

Explain to your students how to do so. They should look either at the number in billion or million and then look at the hundreds, dozens, and unities to determine which numbers are bigger.

Again, you can select two to do with them and then give them time to order the rest of the cards.

If you feel like 10 numbers are too many numbers, you can remove some cards.

Correction p.4

4. How Much Does Each Person Pollute? - 15 min

Now, let's look at how much pollution each person in these countries makes. Use the cards with per capita emissions (set 2). Ask your students to put them in order from the country where each person pollutes the least to the country where each person pollutes the most.

Correction p.5

5. Why Do Some Countries Pollute More Per Person? - 10 min

Ask your students to look at the two lists you made. Did the order change?

Key Explanation: Some countries have a lot of people, so even if they pollute a lot in total, each person's share is smaller. Other countries have fewer people, but each person uses more energy, so their pollution per person is bigger.

Pizza Example for Students: Imagine you and your friend both get a pizza. If your friend has 4 people to share with, each person gets a smaller piece. If you eat alone, you get the whole pizza! Pollution works the same way—countries with more people spread their pollution out, so each person's amount is smaller.

Real-World Examples: China and India have a lot of pollution, but they also have billions of people. That means the pollution is spread out, so each person's share is smaller. The United States has fewer people, but each person uses more energy (cars, electricity, factories), so their pollution per person is higher.

Extra Tip: You could also encourage students to think about what changes could be made to reduce per capita emissions, especially in countries where people pollute more individually. This would promote critical thinking around possible solutions.

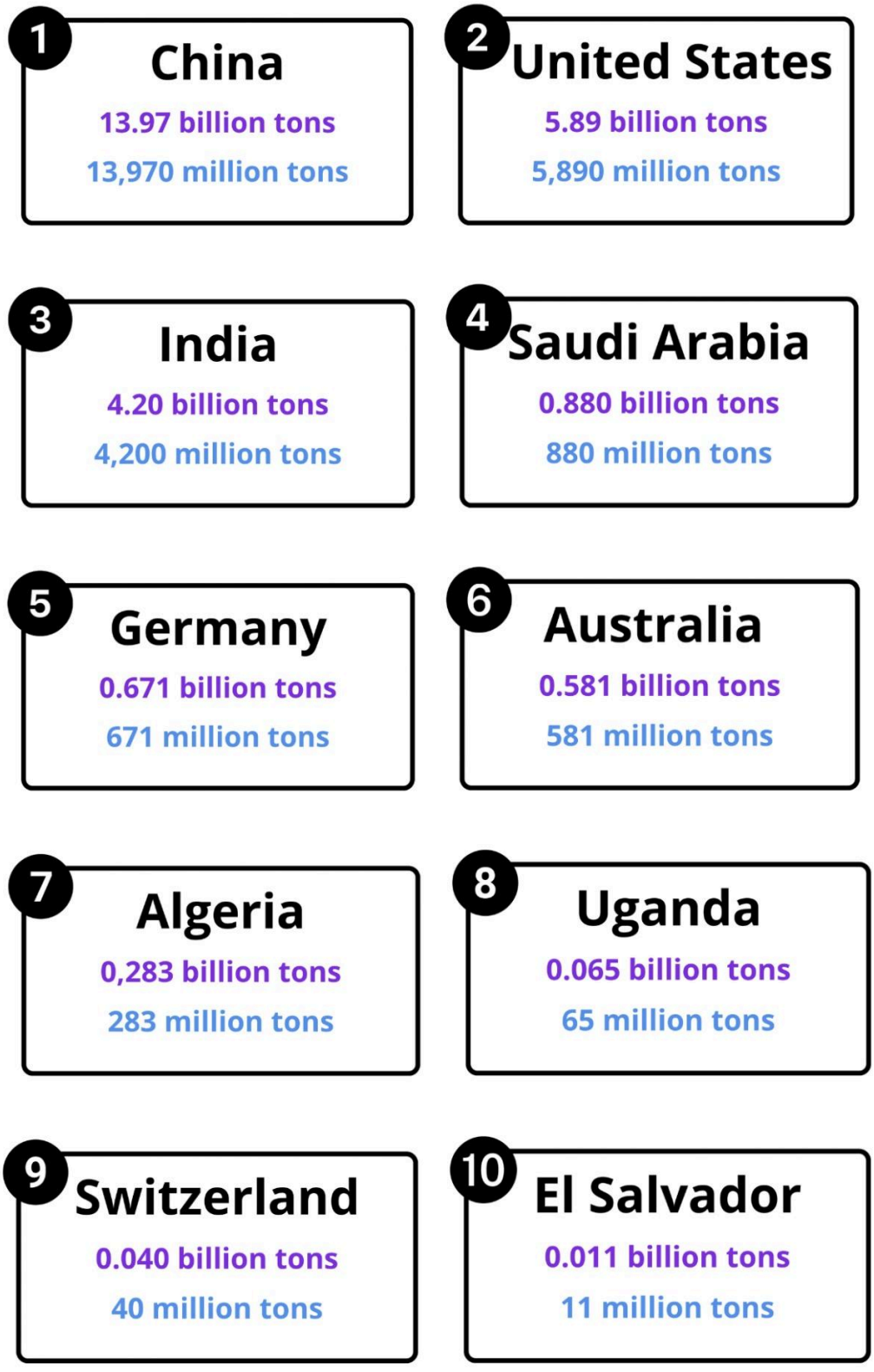
6. Wrap-up - 5 min

It may be helpful to add a short wrap-up or reflection at the end of the lesson. For example, ask students to share one thing they learned or how they would talk to others about pollution and climate change after this lesson.

Cards with all conversions

India 4.20 billion tons 4,200 million tons	**Germany** 0.671 billion tons 671 million tons
Algeria 0,283 billion tons 283 million tons	**Uganda** 0.065 billion tons 65 million tons
China 13.97 billion tons 13,970 million tons	**El Salvador** 0.011 billion tons 11 million tons
Saudi Arabia 0.880 billion tons 880 million tons	**United States** 5.89 billion tons 5,890 million tons
Switzerland 0.040 billion tons 40 million tons	**Australia** 0.581 billion tons 581 million tons

Cards of total emissions in order



Cards of per capita emissions in order

1 **Saudi Arabia**

26.4 tons per person

2 **Australia**

22 tons per person

3 **United States**

17.2 tons per person

4 **China**

9.8 tons per person

5 **Germany**

7.9 tons per person

6 **Algeria**

6.1 tons per person

7 **Switzerland**

4.5 tons per person

8 **India**

2.9 tons per person

9 **El Salvador**

1.7 tons per person

10 **Uganda**

1.3 tons per person

SET 1 - Cards with total emissions to print (think about how many groups you are going to do to know how many sets of cards you need)

Australia

_____ billion tons

581 million tons

India

_____ billion tons

4,200 million tons

Germany

0.671 billion tons

_____ million tons

El Salvador

_____ billion tons

11 million tons

China

13.97 billion tons

_____ million tons

Algeria

_____ billion tons

283 million tons

Uganda

0.065 billion tons

_____ million tons

Saudi Arabia

_____ billion tons

880 million tons

United States

5.89 billion tons

_____ million tons

Switzerland

0.040 billion tons

_____ million tons

SET 2 - Cards with per capita emissions to print (think about how many groups you are going to do to know how many sets of cards you need)

El Salvador

1.7 tons per person

United States

17.2 tons per person

China

9.8 tons per person

India

2.9 tons per person

Uganda

1.3 tons per person

Algeria

6.1 tons per person

Germany

7.9 tons per person

Saudi Arabia

26.4 tons per person

Switzerland

4.5 tons per person

Australia

22 tons per person