



Classroom Activity

10 Big Question: How does the earth work?

How much energy?

All living beings convert energy from food into energy that we use for motion, body-heat, and biochemical reactions. The average adult eats 8700 kilojoules (kJ) per day to fulfil these needs. But how much energy is the human population consuming? Let's find out.

Begin by researching definitions and formula for the following terms:

- > Energy
- > Power
- > Joule
- > Watt

Now attempt the following calculations. Answers are over the page.

Questions

1. What is the rate of power consumption in watts for the average adult assuming they are consuming all 8700 kJ?
2. Given the world's population today, what is the total power consumption of the human race?
Visit a population clock online to find the current world population:
<http://www.census.gov/cgi-bin/ipc/popclockw>
3. How does this compare with the global power loss from cooling of the Earth?
4. Since it is a significant fraction of the Earth's total power loss, where does the energy stored in plants originate?

Answers

1. Power = Energy / Time. In this scenario this is 8700 kJ / day.
Now we need to convert this number to watts using the formula: $1 \text{ W} = 1 \text{ J/s}$. To do this we will first need to convert our units into the correct form.
kJ into joules: $8700 \text{ kJ} \times 1000 = 8,700,000 \text{ J}$
1 day into seconds: $24 \text{ hrs} \times 60 \text{ min} \times 60 \text{ s} = 86400 \text{ s}$
Therefore, Power = $8,700,000 \text{ J} / 86400 \text{ s} = 100 \text{ W}$
2. The world's population is about 7.1 billion people so the total food power consumption is:
 $7,100,000,000 \text{ people} \times 100 \text{ W} = 710,000,000,000 \text{ W}$ or 0.71 TW
3. The Earth's power consumption is between 44 and 47 TW. Since the human food consumption is 7.1 TW, the Earth's rate of heat loss is approximately 6 to 7 times larger.
4. The energy we obtain from our food is in the form of carbohydrates (sugars), proteins and fats. In plants, most energy is stored as carbohydrates that are the product of photosynthesis. Hence, most of the energy stored in plants comes from sunlight converted to sugars.