

When you buy a gallon of gas, over 60 percent of the energy you pay for goes out the radiator in the form of waste heat? That's why you have a radiator in your car in the first place.

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SES 194

Energy in Everyday Life

Order of Magnitude Estimate

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**What is the total length of all the
thread used to make the clothing
you are wearing?**

Our guidelines for making an order-of-magnitude estimate:

- * **Guess**
- * ***Talk to your gut***
- * ***Divide and conquer***
- * ***Lie skillfully***
- * ***Punt***
- * ***Use guerrilla warfare***
- * ***Lower your standards***
- * ***Cross-check***

Guessed!

I'll guess I'm wearing about 1 m² of clothing and each square meter of cloth contains 5000 threads top-bottom and 5000 threads left-right, so 10,000 threads total.

So the length of thread is 10,000 m. This is about 1/4 the circumference of the Earth. Seems large, but maybe not.

I'll choose to refine my wild guess pathway - clothing area of a human and the thread count of the clothing.

Humans, with wide variation, are ~ 2 m tall, ~ 0.5 m across, and ~ 0.2 m thick. The surface area of this box is
 $\sim 2 \times [(2 \times 0.5) + (0.5 \times 0.2)]$
 $\sim 2 \text{ m}^2$.

Alternatively, human are approximately cylinders about 2 m tall and $1/3$ m in radius. The surface area of the cylinder is $2\pi \times \text{radius} \times \text{height}$

$\sim 6 \times 2 \times (1/3)^2$
 $\sim 12/9 \text{ m}^2$
 $\sim 1.5 \text{ m}^2$

These are close, so I'll keep the round 2 m^2 area.

I know bedding sheets have thread counts of 100 threads/in to nearly 1000 threads/in.

I'll assume clothes have similar thread counts and use a mean thread count of 300 threads/in.

Trust your
Hunches

Converting to meters, (300 threads/in) x (1in/2.5 cm)
~ 100 threads/cm ~ 10^4 threads/m

Since threads run up-down and left-right,
we have 2×10^4 threads in 1 square meter of cloth.

People wear a different number of layers of clothes depending on where they live, from undergarments and sweaters to t-shirts and shorts.

I'll punt and just assume on each person wears one layer of clothes covering most of their body.



**The distance covered by the threads is then
 $2 \text{ m}^2 \times (2 \times 10^4 \text{ threads/m}^2) = 40,000 \text{ meters.}$**

This is about the circumference of the Earth(!) and four times larger than my initial guess, but within an order of magnitude.