

The JETS Challenge

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Challenge 71 – The Oil Spill Challenge

Problem:

It was recently discovered that human hair is very good at soaking up oil spills in the environment, absorbing 15% of its own weight in oil. An average human hair measures 0.002 inches in diameter and grows about 0.5 inches between haircuts. An average brunette has 1.05×10^5 hairs on their head. The density of human hair (mass per volume) is 82 pounds per cubic foot.

How many haircuts worth of hair must be saved to soak up a 2,000-pound oil spill?

Solution:

Volume of hair after 1 haircut

$$V = .5\pi r^2$$

$$V = .5\pi(.001)^2$$

$$V = \pi(.5)(1 \times 10^{-6})$$

$$V = \pi(5 \times 10^{-7})$$

$$V \approx (1.5707963 \times 10^{-6})(1.05 \times 10^5)$$

$$= 0.164933614 \text{ in}^3$$

$$x \text{ ft}^3 = 0.164933614 \text{ in}^3 \times \frac{1 \text{ ft}}{12 \text{ in}} \times \frac{1 \text{ ft}}{12 \text{ in}} \times \frac{1 \text{ ft}}{12 \text{ in}} = 9.54476 \times 10^{-5} \text{ ft}^3$$

Mass after 1 haircut

$$\frac{82 \text{ lbs}}{1 \text{ ft}^3} \times 9.54476 \times 10^{-5} \text{ ft}^3 = 0.0078267 \text{ lbs.}$$

Weight of hair needed

$$\frac{2,000}{.15} = 13,333.333 \text{ lbs.}$$

Number of haircuts

$$\frac{13,333.333 \text{ lbs.}}{0.0078267 \text{ lbs.}} = 1,703,570.2$$