Thought Lab 1.1: Analyzing Energy Transfers Answer Key

Answers to Analysis Questions

1. First chain = 0.2%; second chain = 0.02%; third chain = 0.00002%

2. Land that is used for grazing (if it is arable) can feed many more people if it is used to grow grain.

3. Earth could support a much larger population if most people ate a grain-based diet.

4. Sample answer based on a hypothetical school with a population of 5.00×102 students:

   $$\text{energy for rice field} = 5200 \frac{\frac{kJ}{m^2}}{yr}$$

   $$\text{energy for chicken farm} = 800 \frac{\frac{kJ}{m^2}}{yr}$$

   minimum daily human energy consumption = 2400 kJ

   $$\text{energy required per student population per year} = \left(5.00 \times 10^2\right)\left(2400 \frac{kJ}{d}\right)\left(365 \frac{d}{yr}\right) = 4.38 \times 10^8 \frac{kJ}{yr}$$

   $$\text{land needed to support population on rice diet} = \frac{4.38 \times 10^8 \frac{kJ}{yr}}{5200 \frac{\frac{kJ}{m^2}}{yr}} = 84\ 230.77 \text{ m}^2$$

   $$\text{land needed to support population on chicken diet} = \frac{4.38 \times 10^8 \frac{kJ}{yr}}{800 \frac{\frac{kJ}{m^2}}{yr}} = 547\ 500 \text{ m}^2$$

   84 230.77 m^2 of land is required to support a population of 500 students on a grain diet for one year (8.4×10^4 m^2 to correct significant digits), while 547 500 m^2 is required to support the same number of students on a chicken diet (5×10^5 m^2 to correct significant digits).