

Quiz 1

Enter your student number!

Circle final answers. All answers and calculations must be on question sheet. If you need more space, use the back of the information sheet.

You have until 6:45 pm. I'll review the answers at that time.

The answer to part C depends on the answer to part B. If you can't do part B, assume the answer is 1.9%/y.

Quiz 1 Solutions

- A. Express total U.S. emissions of CO₂ in 2002 in units of gigatons of carbon per year.

molecular weight of CO₂ 12 + 2(16) = 44 g/mole

$$\left[5,782,363 \text{ Gg}_{\text{CO}_2} \right] \left[\frac{12 \text{ g}_C}{44 \text{ g}_{\text{CO}_2}} \right] \left[\frac{\text{t}}{10^6 \text{ g}} \right] = 1.577 \text{ Gt}_C$$

$$\approx 1.6 \text{ Gt}_C$$

Quiz 1 Solutions

- B. Calculate the average growth rate of total U.S. CO₂ emissions over this period, in %/y.

$$\bar{r} = \frac{\ln\left(\frac{S_{t_2}}{S_{t_1}}\right)}{t_2 - t_1} = \frac{\ln\left(\frac{5,782,363}{5,002,325}\right)}{2002 - 1990} = \frac{\ln(1.156)}{12 \text{ y}} = \frac{0.1449}{12 \text{ y}} = \frac{0.0121}{\text{y}}$$

$$\bar{i} = \left(\frac{S_{t_2}}{S_{t_1}}\right)^{\frac{1}{t_2 - t_1}} - 1 = (1.156)^{\frac{1}{12}} - 1 = 1.0121 - 1 = 0.0121$$

$$\approx 1.2 \frac{\%}{\text{y}}$$

Corresponds to a doubling time of 57 y

Quiz 1 Solutions

- C. If U.S. population growth averaged 1.1 %/y over this period, what was the average growth rate of per-capita CO₂ emissions?

$$r_{\text{pop}} + r_{\frac{\text{CO}_2}{\text{person}}} = r_{\text{CO}_2}$$

$$r_{\frac{\text{CO}_2}{\text{person}}} = r_{\text{CO}_2} - r_{\text{pop}} = 0.0121 - 0.011 = 0.0011$$

$$\approx 0.11 \frac{\%}{\text{y}}$$