Multiple Choice
Chapter 8

1. From Table 8.1, the total energy use is 26.364 QBtu ≈ 26% of our consumption ⇒ **d)**

6. **d)**

7. **a)**

13. $\left(\frac{\$19.65}{1\text{ mile}}\right)\left(\frac{15\text{ miles}}{1\text{ hour}}\right)\left(\frac{1\text{ passenger}}{\$0.75}\right) = 393\ \frac{\text{passengers}}{\text{hour}}$ ⇒ **d)**

14. From Table 8.6, airline is safest by vehicle-miles, and takes the most passengers ⇒ **b)**

Questions and Problems
Chapter 9

9. 20 GW from coal plants only.

a) $\left(\frac{20\times10^9\text{ J}}{1\text{ s}}\right)\left(\frac{24\cdot365\cdot3600\text{ s}}{1\text{ year}}\right)\left(\frac{1\text{ ton of coal}}{2.81\times10^{10}\text{ J}}\right)\left(\frac{1}{0.38}\right) \approx 59$ million tons of coal per year ← efficiency

b) Assuming the 1% of sulfur refers to mass, then about 0.59 million tons of sulfur will be released.
Since SO_2 has half its mass from sulfur ⇒ ≈ 1.2 million tons of SO_2 are released per year.

c) $\left(\frac{0.1\text{ lbs}}{10^6\text{ Btu}}\right)\left(\frac{20\times10^9\text{ J}}{1\text{ s}}\right)\left(\frac{24\cdot365\cdot3600\text{ s}}{1\text{ year}}\right)\left(\frac{1\text{ Btu}}{1055\text{ J}}\right)\left(\frac{1\text{ ton}}{2000\text{ lbs}}\right) \approx 29892$ tons/year. Including efficiency ⇒ ≈ 79,000 tons/year

d). $C + O_2 \rightarrow CO_2$ So 1 ton of burned carbon releases $(1+\frac{32}{12}) \approx 3.67$ tons of CO_2

⇒ $\left(\frac{59\times10^6\text{ tons coal}}{1\text{ year}}\right)\left(\frac{3.67\text{ tons of }CO_2}{1\text{ ton of coal}}\right) \approx 2.2\times10^8\ \frac{\text{tons of } CO_2}{\text{year}}$ or about 220 million tons of CO_2 per year

Online Questions

1. From Table 8.6, for automobiles, we have $\frac{1.5\text{ deaths}}{10^6\text{ miles}}$ versus $\frac{0.313\text{ deaths}}{10^6\text{ hrs}}$ for planes. Note these are vehicle-miles.
Using vehicle-miles as a comparison, $\left(\frac{1.5\text{ deaths}}{10^6\text{ miles}}\right)(50\text{ miles}) \approx 7.5\times10^{-5}$ $\left(\frac{0.313\text{ deaths}}{10^6\text{ hrs}}\right)(2000\text{ hrs}) \approx 6.26\times10^{-4}$

⇒ You're $\frac{6.26\times10^{-4}}{7.5\times10^{-5}} \approx 8.35$ times as likely to die on the flight.

(If we use passenger-miles, and estimate that the plane carries around 250 passengers, then you're $\frac{250}{8.35} \approx 30$ times more likely to die on the car ride.)

2. From lecture notes, the adiabatic lapse rate is about 3°F/1000 ft ⇒ $70°F - \left(\frac{3°F}{1000\text{ ft}}\right)(14500\text{ ft}) = 26.5°F$

3. From page 309, one can try burning coal with less sulfur content, removing the sulfur before burning the coal, or removing SO_2 from emitted waste gas.

4. **d)**, from lecture.

5. Haemoglobin preferentially binds to CO versus O_2, effectively blocking your oxygen intake.

6. NO_x causes the brownish haze and the smell (some of the scent comes from O_3).

7. There are quite a few things to mention, but the main difference is that CO can be solved on a local scale; global warming affects everyone on the planet with far-reaching consequences.