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Chapter 2: Fossil Fuels

Odd-numbered problems

•Problem 2.5 : Global oil per person

From Table 2.9, remaining oil in U.S. $= 220 \times 10^9\ bbl$

In U.S., per person: $\dfrac{220 \times 10^9}{300 \times 10^6} = 733\ bbl/person$

Page 35, Edwards global oil estimate $= 1792 \times 10^9\ bbl$

Globally, per person: $\dfrac{1792 \times 10^9}{7 \times 10^9} = 256\ bbl/person$, or about 1/3 the U.S. amount.

•Problem 2.7: Cost of home heating

See Example 2.1: $\dfrac{10^6 Btu}{0.6} \times \dfrac{\$14.39}{10^6 Btu} = \$23.98$per day

•Problem 2.11: Tons of oil shale per day

For one barrel of oil: $42\ gal \times 7\dfrac{lbs}{gal} = 294\ lb$

$25,000\ ft \times 294\ lb = 7.35 \times 10^6 ft \cdot lb$

$1.36\dfrac{j}{ft \cdot lb} \times 7.35 \times 10^6 ft \cdot lb = 10 \times 10^6 j$

$\dfrac{10 \times 10^6 j}{6.12 \times 10^9 j/bbl} = 0.0016\ bbl$ oil equivalent heat energy

$\therefore$ Heat energy content is much greater that potential energy.

Multiple choice problems

•Problem 2.1: Bacterial colony in a jar

Answer: g)

$1 \Leftarrow 1/2 \Leftarrow 1/4 \Leftarrow 1/8 \Leftarrow 1/16$

12:00 11:59 11:58 11:57 11:56

•Problem 2.3: Energy consumption per year

Answer: b)

Total energy: $100\ QBtu = 100 \times 10^{15} Btu$

$$\frac{100 \times 10^{15} Btu/yr}{300 \times 10^{6} people} \times \frac{1\ bbl}{5.8 \times 10^{6} Btu} = 57.5 \frac{bbl}{person \cdot yr}$$

•Problem 2.5: Petroleum Q_∞

Answer: d)

Page 33: $Q_\infty(oil) \approx 420 \times 10^{9} bbl$

•Problem 2.7: Water required for oil shale

Answer: c)

See page 51

•Problem 2.9: Energy content ratio of U.S. fossil fuels

Answer: a)

See Table 2.9: $oil \quad gas \quad coal$

$1 \quad 1.78 \quad 5.58$

•Problem 2.11: Coal - oil shale comparison

Answer: a)

See page 51

•Problem 2.13: Oil imports

Answer: c)

See page 33, 34. Imports = 1/2 of consumption: $\frac{6 \times 10^{9} bbls}{2} = 3 \times 10^{9}$

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•Problem 2.15: U.S. petroleum use

Answer: d)

See page 33

•Problem 2.17: Remaining recoverable petroleum

Answer: c)

$$\frac{220 \times 10^9 bbl}{6.1 \times 10^9 bbl/yr} = 36\ yrs, \text{ assuming no imports}$$

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