

10: 16, 32, 34

11: 17, 24, 27, 31

10.16 Statement is unknown

see table 10.5, page 186 for value of minerals. Need to know how much it would cost to remove the minerals from ~~a~~ 10⁶ gal's. Guessing it would cost > \$6,500

10.32

Calculate lifetimes, using 2000 use rates & 1968 reserves. Compare to tab. 10.3 → from 10.1

Mat'l	Reserves (kt)	2000 use (kt/yr)	Life time
Co	2,400	11	220
Fe	9.7 × 10 ⁷	7.6 × 10 ⁴	1280
Mn	7.4 × 10 ⁵	800	925
Mg	5400	22	245
Ni	15,000	160	469
Al	1.2 × 10 ⁶	7900	152
Mg	2.6 × 10 ⁶	180	>1000
Ti	1.4 × 10 ⁵	1200	117
Cu	3.1 × 10 ⁵	3100	100
Fl	39,000	610	64
P	2.2 × 10 ⁷	40,000	550
K	1.1 × 10 ⁸	5,000	>1000

E & E Hook # (2)
4

10.34 Molybdenum

$$2000 \text{ use rate} = 22 \text{ kt/yr} = N_0$$

$$1968 \text{ reserves} = 5,400 \text{ kt}$$

years after 2000 \rightarrow t \rightarrow (1/yr)

$$\text{Amt used} = \int_0^t N_0 e^{Gt} dt = \frac{N_0}{G} \exp(Gt)$$

$$1.07 = \exp(G)$$

$$\ln(1.07) = G = .0677 \text{ 1/yr}$$

$$5,400 = \frac{22}{.0677} \exp(Gt)$$

$$\ln\left(\frac{(5,400)(.0677)}{22}\right) = t$$

.0677

$$41.5 \text{ years} = t$$

Cliffside coal-fired RP.

2 x 800 MW

How much CO₂ produced? (Assume 90% online)

$$= (1.6 \times 10^9 \text{ W}) (365 \times 0.9 \times 86,400) \frac{\text{J}}{\text{s}} \frac{\text{s}}{\text{yr}}$$

$$\text{Energy out put} = 4.54 \times 10^{16} \text{ J}$$

Assume 35% 1st-law efficiency

$$\text{Energy input} = \frac{4.54 \times 10^{16} \text{ J}}{0.35} = 1.30 \times 10^{17} \text{ J}$$

$$\begin{aligned} \text{Average coal heat of combustion} &= 26.0 \frac{\text{MJ}}{\text{kg}} \\ \text{(table 6.1)} &= 26 \times 10^6 \text{ J/kg} \end{aligned}$$

$$\text{Mass coal burned (kg)} = \frac{1.3 \times 10^{17} \text{ J}}{26 \times 10^6 \text{ J/kg}}$$

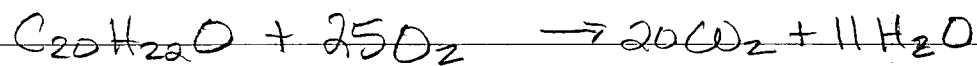
$$\text{Mass burned (kg)} = 4.99 \times 10^9 \frac{\text{kg}}{\text{yr}}$$

$$1 \text{ metric ton} = 1000 \text{ kg} = 4.99 \times 10^6 \frac{\text{metric tons}}{\text{yr}}$$

HWK # 4

(4)

E 3 E



$$20 \times 12 = 240$$

$$\begin{array}{r} 22 \\ 16 \\ \hline \end{array}$$

$$278 \text{ g Coal} = 240$$

$$\underline{640}$$

$$900 \text{ g } CO_2$$

$$\text{Amt } CO_2 = \left(5 \times 10^6 \frac{\text{mt}}{\text{yr}} \right) \left(\frac{900}{278} \right)$$

$$= 1.62 \times 10^7 \frac{\text{tons } CO_2}{\text{yr}}$$

16 million tons/yr