The mathematics of series shows that for very large alkanes this ratio must approach 2/1 as a series limit. (When n is very large, 2n+2/n ≅ 2.)

Making Connections

7. (a) $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)} + 395\ kJ\ (0.395\ MJ)$

$$n_C = 1.0\ \cancel{MJ} \times \frac{1\ mol}{0.395\ \cancel{MJ}}$$
$$n_C = 2.53\ mol$$
$$n_{CO_2} = 2.53\ mol \times \frac{1}{1}$$
$$n_{CO_2} = 2.53\ mol$$

or

$$n_{CO_2} = 1.0\ \cancel{MJ} \times \frac{1\ \cancel{mol\ C}}{0.395\ \cancel{MJ}} \times \frac{1\ mol\ CO_2}{1\ \cancel{mol\ C}}$$
$$n_{CO_2} = 2.53\ mol$$

Releasing 1.0 MJ of energy from burning coal produces 2.53 mol of carbon dioxide.

$$CH_{4(g)} + 2\ O_{2(g)} \rightarrow CO_{2(g)} + 2\ H_2O_{(g)} + 803\ kJ\ (0.803\ MJ)$$

$$n_{CH_4} = 1.0\ \cancel{MJ} \times \frac{1\ mol}{0.803\ \cancel{MJ}}$$
$$n_{CH_4} = 1.25\ mol$$
$$n_{CO_2} = 1.25\ mol \times \frac{1}{1}$$
$$n_{CO_2} = 1.25\ mol$$

or

$$n_{CO_2} = 1.0\ \cancel{MJ} \times \frac{1\ \cancel{mol\ CH_4}}{0.803\ \cancel{MJ}} \times \frac{1\ mol\ CO_2}{1\ \cancel{mol\ CH_4}}$$
$$n_{CO_2} = 1.25\ mol$$

Releasing 1.0 MJ of energy from burning methane produces 1.25 mol of carbon dioxide.

(b) Methane releases half the amount of carbon dioxide that coal does, for equal energy production. If evaluated on that basis, methane would be considered the better fuel.

8. Information about the specific heats of combustion would be more useful, because ordinarily, fuel tank capacities and vehicle mileages are calculated in terms of mass and volume units, not of amount units (moles).

12.4 OUR USE OF FOSSIL FUELS

PRACTICE

(Page 593)

Understanding Concepts

1. Since 1950 the use of coal has greatly decreased, and the use of oil and gas has greatly increased in Canada.
2. Much of Canada's electricity is produced by burning fossil fuels. Conservation of electricity makes more fossil fuels available for petrochemicals.
3. The U.K. has a lower living standard, a much warmer climate, and much shorter transport and travel distances than Canada.
4. Products produced from ethylene include pipe, tile, fabrics, antifreeze, and all sorts of plastic products.
5. (a) Economic perspective — con
   (b) Ecological — con
   (c) Social — con
   (d) Economic — pro
   (e) Ecological — pro
   (f) Social — pro

Making Connections

6. Consumer products from propylene include antifreeze, cellophane, solvents, perfumes, colouring agents, coolants, hydraulic fluids, preservatives, cleansing creams, pharmaceuticals, brake fluids, detergents, and synthetic lubricants, to name just a few. It is probable that any of these products can be manufactured from other materials — but is also probable that such a substitution would result in a product that was more expensive and/or less effective.

SECTION 12.4 QUESTIONS

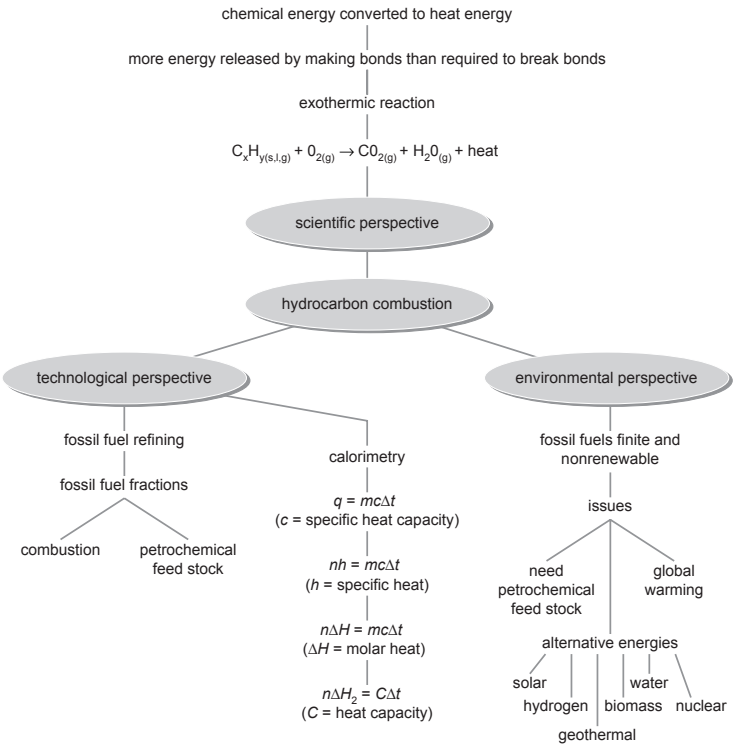
(Page 594)

Understanding Concepts

1. The burning of fossil fuels has applications for: producing electricity; heating homes and offices; and for powering automobiles, trucks, ships, and planes.
2. Burning hydrocarbons creates pollution and global warming risks, but is far and away the cheapest current source of energy for society.
3. About 95% of fossil fuel is burned for energy, and about 5% is used for petrochemicals.
4. A majority of all the consumer products used in our society originate with petrochemicals.
5. Plastics make durable, lightweight, and inexpensive consumer products. They also do not biodegrade, in most cases, and so present a long-term disposal problem.

CHAPTER 12 SUMMARY

(p. 595)



CHAPTER 12 REVIEW

(Page 596)

Understanding Concepts

1. Energy from food digestion keeps us alive; energy from combustion heats our homes and powers our vehicles.