

Answer key

Homework Chapter 4

1, 2, 4, 6, 9, 12, 22, 32

1. coal, oil, natural gas

2. No, the heat content is greater in the one with the greatest mass.

4. Heart rate 80 beats/min
1 beat = 1 J of energy

$$70 \text{ Calories} = 70 \text{ kcal} = 70000 \text{ cal}$$

$$70000 \text{ cal} \left(\frac{4.184 \text{ J}}{1 \text{ cal}} \right) = 292800 \text{ J} = 292800 \text{ beats}$$

$$(292800 \text{ beats}) \left(\frac{1 \text{ min}}{80 \text{ beats}} \right) = 3660 \text{ min} \quad \text{or } 61 \text{ hours.}$$

This assumption is a very high estimate, as we can only extract about 30% of the energy in food.

6. High entropy = plate of spaghetti (it is more disordered).



$$\left(4817 \frac{\text{kJ}}{\text{mol}} \right) \left(\frac{1 \text{ mol}}{100.198 \text{ g}} \right) \left(250 \text{ g} \right) \left(\frac{1000 \text{ g}}{\text{kg}} \right) = 1.20 \times 10^7 \text{ kJ}$$

$$\text{molar mass heptane} = (12.01)7 + (1.008)16 = 100.198 \text{ g/mol}$$

12. a) exothermic (gives off heat)
b) endothermic (water absorbs heat)
c) endothermic (ice absorbs heat)
d) exothermic.

$$22. a) \frac{650000 \text{ kcal}}{\text{day}} \times \frac{365 \text{ day}}{\text{year}} = 2.37 \times 10^8 \frac{\text{kcal}}{\text{year}}$$

$$2.37 \times 10^8 \frac{\text{kcal}}{\text{year}} \times \frac{1 \text{ year}}{65 \text{ barrels oil}} = 3.65 \times 10^6 \frac{\text{kcal}}{\text{barrel oil}}$$

$(3.7 \times 10^6 \frac{\text{kcal}}{\text{barrel}})$

b) 1 barrel = 42 gallons

$$\left(3.7 \times 10^6 \frac{\text{kcal}}{\text{barrel}} \right) \left(\frac{1 \text{ barrel}}{42 \text{ gallons}} \right) = 86904 \frac{\text{kcal}}{\text{gallon}}$$

or

$$\boxed{8.7 \times 10^4 \frac{\text{kcal}}{\text{gallon}}}$$

c) $2.37 \times 10^8 \frac{\text{kcal}}{\text{year}} \left(\frac{1 \text{ year}}{16 \text{ tons}} \right) = 1.48 \times 10^7 \frac{\text{kcal}}{\text{ton}}$

$$\boxed{1.5 \times 10^7 \frac{\text{kcal}}{\text{ton}}}$$

d) $1.5 \times 10^7 \frac{\text{kcal}}{\text{ton}} \left(\frac{1 \text{ ton}}{2000 \text{ pounds}} \right) = 7406 \frac{\text{kcal}}{\text{pound}}$

$$7.4 \times 10^3 \frac{\text{kcal}}{\text{pound}}$$

32. a) Liquid \rightarrow ice decrease

b) NaCl + H₂O increase

c) 16 C hydrocarbon is cracked increase.