How much energy does it cost to break down sucrose?

$$C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_2 + 11H_2O$$
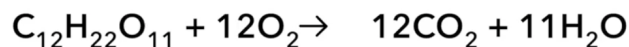
C-C = 346 kJ/mol x 10 bonds = 3460 kJ/mol   C-C Bonds 10
C-H = 411 kJ/mol x 14 bonds = 5754 kJ/mol   O-H Bonds 8
O-H = 459 kJ/mol x 8 bonds = 3672 kJ/mol   C-H Bonds 14
C-O = 358 kJ/mol x 14 bonds = 5012 kJ/mol   C-O Bonds 14
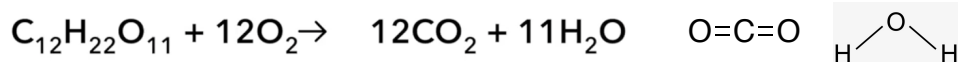
                   17,898 kJ/mol   from sucrose

O=O = 485 kJ/mol x 12 bonds = 5,820 kJ/mol   from O_2

                   23,718 kJ/mol

cost of energy to
break bonds in sugar

mol = 6.02×10^{23}

How much energy do we release?

$$C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_2 + 11H_2O \qquad O=C=O$$

C=O = 803 kJ/mol x 24 bonds = 19272 kJ/mol
H-O = 459 kJ/mol x 22 bonds = 10098 kJ/mol

                   29370 kJ/mol

29370 kJ/mol – 23718 kJ/mol = 5, 652 kJ/mol

net release of energy
from break down of
sugar

But how do we get 4 cal/g of carbs?

Energy gain = 19272+10098 – 23718 = 5,652 kJ/mol

$$\frac{5{,}652\ kJ}{342\ g} = 16.5\ \frac{kJ}{g}$$

Carbohydrates

4 Calories / gram