Let’s see how we can use these two different ways of quoting chemical energy and convert the result into something we can use.

# 15.1.1 Example: Bond energy expressed in eV

Back in chapter 13, we saw that the bond dissociation energy of the H-H bond was 4.52 eV/bond. How much energy is released by converting 6.000g of monotomic H into 6.000g of H2?

## Solution

Also at <https://youtu.be/jBQGwjokX14>

We have 6.000g of monotomic hydrogen. The molar mass of hydrogen is 1.008g/mol. Therefore we have

Each molecule of H2 requires two H atoms so we can make

We know, from the table that each bond releases 4.52 eV, so

which we can convert to Joules

# 15.1.2 Example: Bond energies expressed as enthalpies

The enthalpy of dissociation of CO2 → CO + O is . How much *energy* is required to break up 20g of CO2 into CO and O assuming the reaction occurs at constant pressure?

## Solution

Also at <https://youtu.be/SE_SN3plzbY>

We need to convert from enthalpy *H* into energy. The definition of enthalpy is (from section 13.8)

At constant pressure, the change in enthalpy is

Using the first Law of Thermodynamics

Recalling from section 13.8 the argument that, under constant pressure, the work and are of equal magnitude, but opposite sign, we have

(This is the exact same reasoning we did in 13.8 to show that, under constant pressure , we are just repeating the steps to reinforce the logic).

Now, we know that the *enthalpy* change is the same as the *heat* . Since the heat is positive we must add heat to make the process go; one mol of CO2 going to CO and O will need 532 kJ of energy.

**Instructor’s note:** There are three different quantities in that last sentence: enthalpy, energy, and heat. Furthermore, all three have units of Joules! Make sure you understand the distinctions between these three concepts!

Now, all we need to do is determine the amount required to break up the 20g of CO2 in the problem. From the periodic table we see that the molar mass of CO2 is:

Now to get the total energy that we must add as heat:

We must add 241 kJ to break up 20g CO2 into CO and O.