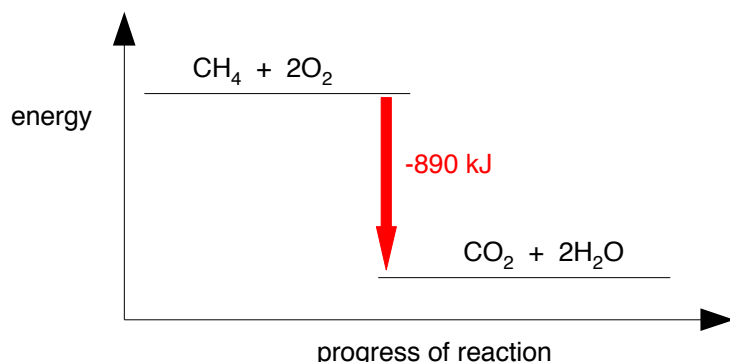


Chemguide – answers

AN INTRODUCTION TO CHEMICAL ENERGETICS

1. a)



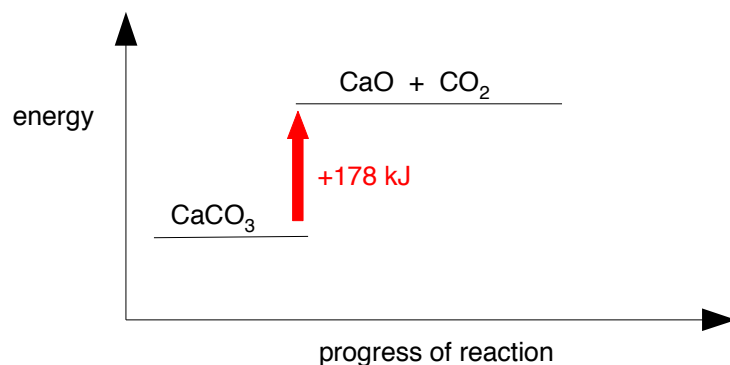
b) The negative sign in front of the number shows that the change is exothermic.

c) Breaking bonds absorbs energy; making bonds releases energy. The stronger the bonds, the more energy is absorbed or released. The new bonds must be stronger than the old ones, because more energy is released in making the new ones than was absorbed in breaking the old ones. That extra energy released makes the reaction exothermic.

d) It is thermodynamically unstable in the sense that a mixture of methane and oxygen has a higher energy than a mixture of carbon dioxide and water (as shown in the diagram). Methane and oxygen are kinetically stable in the sense that a mixture of methane and oxygen at ordinary temperatures has no tendency to convert to carbon dioxide and water. That is because there is a very high activation energy for the reaction (due to the strength of the bonds that first need to be broken).

2. a) The reaction is said to be endothermic.

b)



c) The calcium carbonate - it is at the lower energy level.

d) If the calcium oxide / carbon dioxide mixture is kinetically unstable, there can't be much activation barrier to stop it converting back to calcium carbonate again, releasing energy in the process and becoming more energetically stable. 178 kJ mol⁻¹ would be evolved. (What matters is simply the energy gap between the two levels. If you have to put in 178 kJ to go in one direction, you will get out exactly the same amount of heat when you return in the opposite direction.)