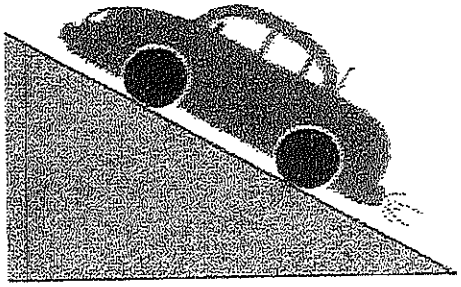
Energy in many forms?

A car driving up a hill, represents what type of energy?



Energy Before → Energy After

Chemical → Potential (height) Kinetic (moving)

Q: Is this process exothermic or endothermic?

add energy to go up

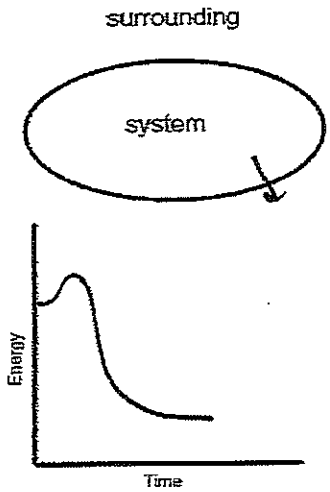
Q: When bonds are broken, is energy required or is energy released?
(circle your general answer)

General Bonding review: Draw a line from the property to the bond type

a. Contains only a sigma bond → Single bond
b. Highest energy → Triple bond
c. 4 electrons → Double bond
d. Shortest bond → Triple bond
e. Sigma and 2 pi bonds → Triple bond

Conservation of Energy: Complete the charts below.

Exothermic Reaction



Circle one

Bonds Broken ⇒ (Energy required/ Energy released)

Bonds Formed ⇒ (Energy required/ Energy released)

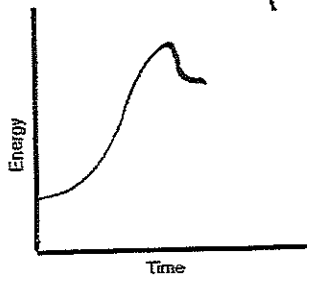
Exothermic Reaction: Products Released more energy
Reactant bond energy (< > =) Product bond energy

Endothermic reactants consumed more energy
Reactant bond energy (< > =) Product bond energy

Endothermic reaction

surrounding

system



A reaction that only forms bonds is

(Exothermic/endothermic) Releases energy

A reaction that only breaks bonds is

(Exothermic/endothermic) consumes energy

Draw a line from the property to the appropriate side

Reactants ⇒ Products

← Bond broken

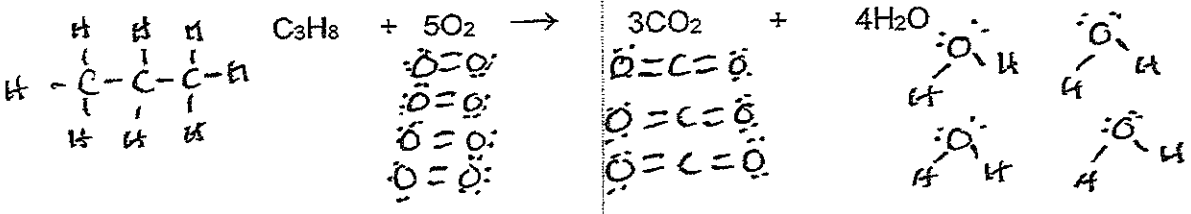
← Energy In (endothermic)

Energy Out (exothermic) →

Bonds formed →

Propane (although not gasoline) is a common fuel used in some cars, forklifts and other machines.

Sketch out each structure and tally up all the bonds and energies that are being broken and being formed.



C-C 2 * 83 = 166

H-C 8 * 99 = 792

O=O 5 * 119 = 595

C=O 6 * 192 = 1152

O-H 8 * 111 = 888

Calculate the Enthalpy change for this process:

ΔH = Bonds Broken − Bonds formed

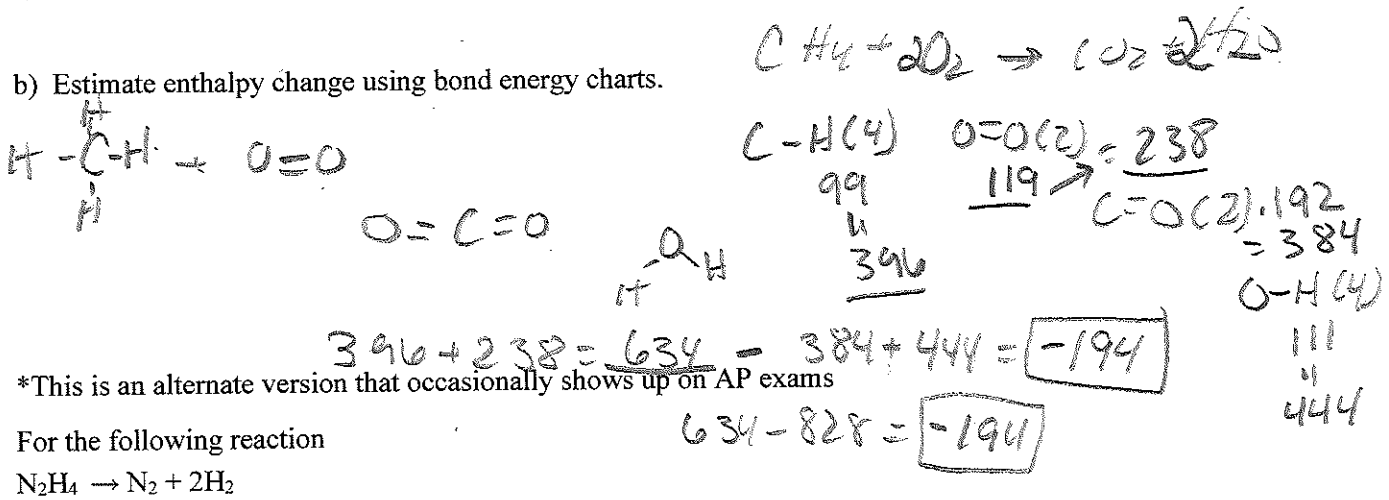
1553 − 2040

ΔH = −487 KJ/Rxn

1. Methane (CH_4) burns in oxygen to produce carbon dioxide and water.

   a) Write out Lewis structures of each reactant and product.

   b) Estimate enthalpy change using bond energy charts.

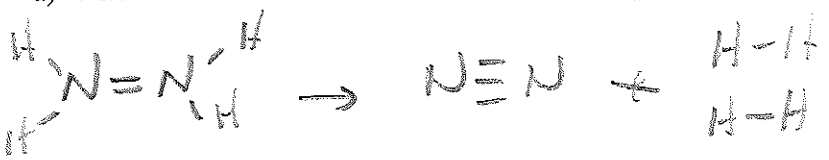


   *This is an alternate version that occasionally shows up on AP exams

2. For the following reaction

   $N_2H_4 \rightarrow N_2 + 2H_2$

   a) Write out Lewis structures of each reactant and product.



   N-H = 93J/mol N≡N = 226J/mol H-H = 104J/mol

   b) Using the following Bond energies, solve for the bond energy of the N=N bond