

## Section 3C Review

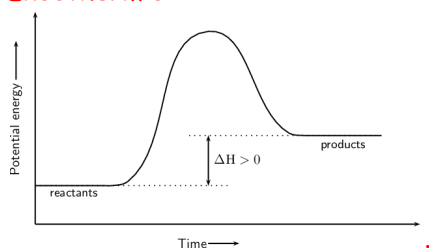
Name \_\_\_\_\_

1) Explain the difference between endothermic and exothermic reactions. Draw a rough sketch of a graph of each.

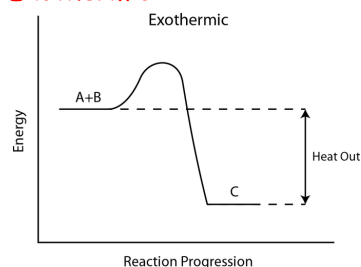
Exothermic reactions are reactions that release heat energy. In general, they get hot, and the internal energy of the reactants have more energy than the products, so the extra energy is released.

Endothermic reactions are reactions that absorb heat energy. In general, they get cold, and the internal energy of the reactants have less energy than the products, so the energy that makes the outside cold is absorbed into the bonds of the reaction

### Endothermic



### Exothermic



2) In terms of energy gain and release, explain how breaking and building bonds differ.

Breaking a bond requires energy, so the breaking of bonds gains energy, which is endothermic.

Building bonds will happen to stabilize atoms. Since atoms will come together, that releases energy, which is exothermic.

3) For each of the following situations, tell whether the reaction is exothermic or endothermic.

a) Reaction flask gets hot

exothermic

b)  $+\Delta H$

endothermic

c) energy is a product

exothermic

d)  $2 \text{H}_2\text{O} + 14.7 \text{kJ} \rightarrow 2 \text{H}_2 + \text{O}_2$

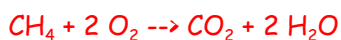
endothermic

4) Explain what a limiting reactant is.

A limiting reactant is the reactant of the reaction that runs out first. Once you run out of this reactant, the reaction stops, and no more product can form until more of the limiting reactant is added.

5) Write out balanced equations for the combustion of:

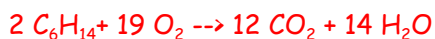
a) Methane



b) Ethane



c) Hexane



d) Decane



6) If the molar heat of combustion of a fuel is 1200. kJ/mol and 4 moles of the fuel is burned, what is the total number of kilojoules of energy produced?

$$4 \text{ moles } (1200 \text{ kJ/mol}) = 4800 \text{ kJ}$$

7) Explain what incomplete combustion means.

Incomplete combustion is the burning of the fuel with not enough oxygen to burn all the fuel completely. As a result, the CO<sub>2</sub> that is supposed to be made will only be CO, which is a more toxic substance.

8) Use the following equation to answer the questions below.



a) If 4 moles of C<sub>7</sub>H<sub>16</sub> are burned, how much energy will be released?

$$4 \text{ moles C}_7\text{H}_{16} \left( \frac{9634 \text{ kJ}}{2 \text{ mol C}_7\text{H}_{16}} \right) = 19268 \text{ kJ}$$

b) If 8 moles of C<sub>7</sub>H<sub>16</sub> are burned, how many moles of water will be produced?

$$8 \text{ moles C}_7\text{H}_{16} \left( \frac{16 \text{ mol H}_2\text{O}}{2 \text{ mol C}_7\text{H}_{16}} \right) = 64 \text{ moles H}_2\text{O}$$

c) How many moles of oxygen are needed to react completely with 10 moles of C<sub>7</sub>H<sub>16</sub>?

$$110 \text{ moles oxygen}$$

d) If you have 10 moles of C<sub>7</sub>H<sub>16</sub>, 200 moles O<sub>2</sub>, 20 moles CO<sub>2</sub>, and 300 moles H<sub>2</sub>O, which is your limiting reactant?

$$10 \text{ moles of C}_7\text{H}_{16} \text{ is the limiting reactant.}$$

9) List several things that cause an increase of carbon dioxide in the atmosphere. Explain why this is a problem.

- burning of more fossil fuels
- deforestation - cutting down trees
- increased human population

All of these put more CO<sub>2</sub> into the atmosphere, which contributes to the greenhouse effect and can cause more acid rain and higher acidity in water sources.

10) If 25 grams of water is heated from 28°C to 49°C, how much heat is gained by the water? (Specific heat of water = 4.2 joules/gram °C) Use the equation: thermal energy = mass of water x 4.184 x change in temperature of the water. Show all work.

$$49 - 28 = 21$$
$$25 \times 4.184 \times 21 = 2197 \text{ J}$$

11) How much heat is produced by the combustion of 200.0 grams of hexane? The heat combustion of hexane is 48.2 kJ/gram.

$$200.0 \text{ g } (48.2 \text{ kJ/g}) = 9640 \text{ kJ}$$

12) If 3000 joules are released as 0.55 g of paraffin wax burns, what is the heat of combustion in kilojoules per gram?

$$3000/0.55 = 5455 \text{ J/g} = 5.455 \text{ kJ/g}$$