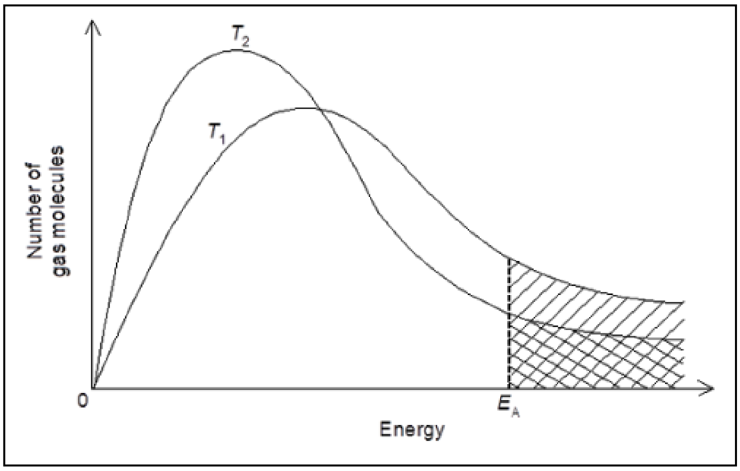
Friday Worksheet **Name: ………………**

Enthalpy worksheet 7



1) Consider the energy distribution graphs shown on the right. With reference to these graphs and the Particle theory, answer the following questions.

a) Explain why an increase in temperature increases the rate of a reaction.

More reactant particles have the required activation energy.

b) Is the statement "All molecules have an increased kinetic energy at higher temperatures" true or false? Explain.

False. Not all molecules possess greater energy. At higher temperatures the average kinetic energy increases only.

c) Which of the following increase with higher temperature? Explain

i. Activation energy. No, the activation energy of a reaction does not change with temperature. At higher temperatures a greater number of molecules will have the required activation energy to undergo fruitful collisions.

ii. Average kinetic energy of particles. Yes. The above energy distribution diagram shows T_1 and T_2. T_1 is at a greater temperature than T_2 and so more particles possess a higher energy and hence the average kinetic energy is greater.

iii. Frequency of collisions. Yes. This will increase as a result of a higher average kinetic energy.

2) Consider the reaction below.

$2H_2(g) + O_2(g) \Rightarrow 2H_2O(g)$ ΔH = -484 kJ/mol

3.50 grams of hydrogen gas and 40.0 grams of oxygen gas were mixed and ignited. The energy released was captured and used to heat 2.300 kilograms of water at 25.0 ^oC to a final temperature of 69.1^oC. Assuming no energy is lost, calculate the ΔH of the reaction above.

Step 1Which is the limiting reactant.

=> H_2

Step 2 Calculate the mol of H_2

=> 3.50 /2.00 = 1.75 mol

Step 3 Calculate the amount of energy given off

=> E = 4.18 J/g/C X 2,300g X (69.1 – 25.0)

=> 424 KJ

Step 3 Calculate the energy released per mol of H_2

=> 424 / 1.75 = 242 kJ/mol

Since there are two mol of H_2 in the equation the ΔH = -484 kJ/mol

3) Given the following bond energies **H-H**, 436kJ/mol. **O=O**, 499 kJ/mol and O-H, 463 kJ/mol,

draw an energy profile diagram on the set of axes below.

Clearly label the following.

- activation energy

Activation energy is the energy required to break all bonds. Hence to break a H-H bond requires 436 kJ/mol and to break an O=O bond requires 499 kJ/mol. Since, in the equation, we have 2 mol of H_2 we require 2 X 436 kJ and 499 kJ to break one mol of O_2 gas.

A total of 1371 kJ is required as activation energy. Since energy is given out when bonds form 4 X 464 kJ of energy will be given out since there are 2 O-H bonds per water molecule and there are 2 water molecules produced, according to the equation. 1856 kJ is released.

- ΔH

- activation energy of the backward reaction.

$2H_2O(g) \Rightarrow 2H_2(g) + O_2(g)$