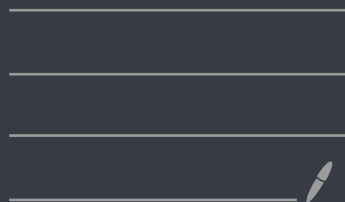
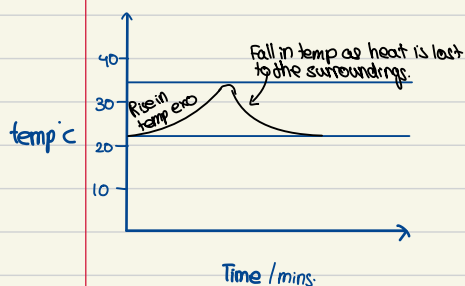
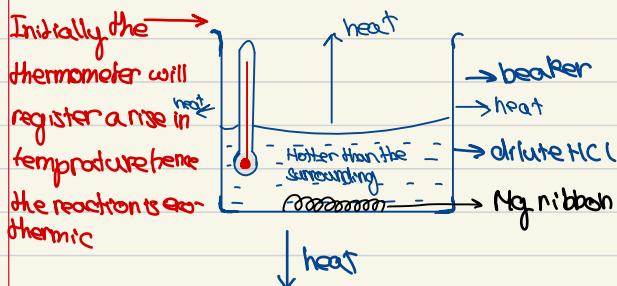
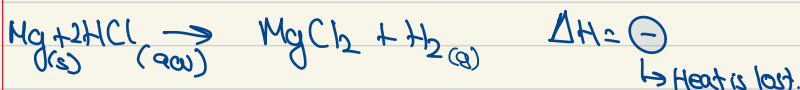


CHEMICAL ENERGETICS



Energy released. Exothermic Reaction



Characteristics of Exothermic Reaction

- 1= Heat energy is lost to the surroundings.
- 2= The temperature of the reaction mixture rises.
- 3= Container may feel warm to touch.
- 4= In exothermic reactions the reactants have greater enthalpy or higher energy contents than products.

What is enthalpy?

It is the total energy or heat content associated with the materials that react.

What is the symbol for Enthalpy?

The symbol is 'H'

What is Enthalpy change?

It is the heat gained or lost at a constant pressure.

More energy than products

so when reaction occurs

Energy in reactants

heat energy is given to the surroundings.

Energy in products

What is the symbol for Enthalpy Change?

' ΔH '

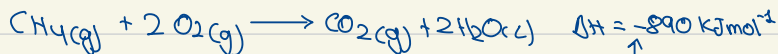
↳ A Greek symbol representing change in quantity.

How can the Enthalpy change (ΔH) be calculated?

$$\Delta H = H_{\text{products}} - H_{\text{reactants}}$$

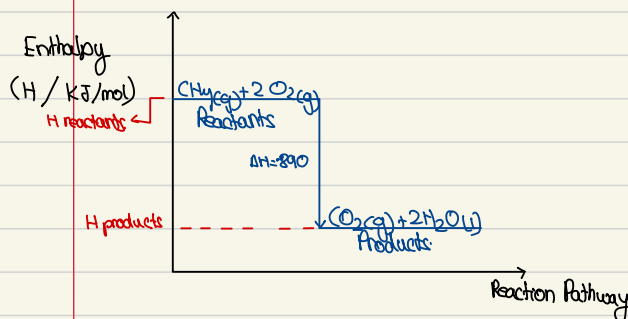
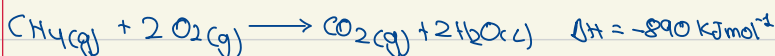
(enthalpy of products) - (enthalpy of reactants)

unit of enthalpy change = kJ/mol OR kJ mol^{-1}



negative sign \uparrow shows it is exothermic.

Simple energy profile diagram of an exothermic reaction.



How does the above profile diagram show that the reaction is exothermic?

1. Negative sign of enthalpy change.
2. The reactants have greater enthalpy or higher energy content than the products.

What is Activation Energy?

It is the minimum energy needed for the particles to react when they collide.

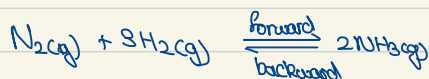
Note A = As temperature increases the reactant particles will have greater kinetic energy and as a result of this greater number of particles will have energy equal to or greater than the activation energy therefore many more particles would be able to cross the barrier of energy.

Note B = Temperature does not impact Activation energy?

What is the role of a catalyst in a chemical reaction?

1. It increases the rate of a chemical reaction by lowering the Activation Energy.
2. A catalyst does this by making it possible for the particles to react by an alternative mechanism and this alternative route has lower activation energy.

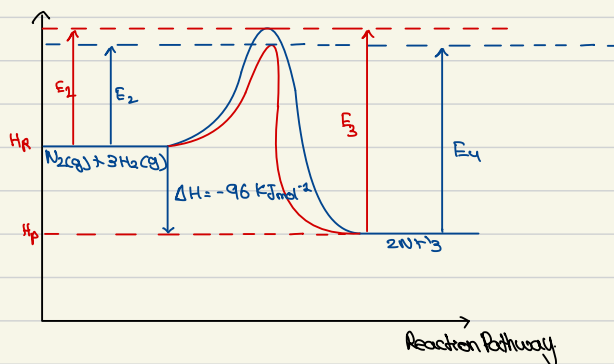
Energy profile diagram of an exothermic reaction which is reversible.



$$\Delta H = -96 \text{ kJ mol}^{-1}$$

↳ Forward reaction is exothermic.

Enthalpy (H)
kJ mol⁻¹



key

E_1 = energy of activation in absence of catalyst for the forward reaction.

E_2 = energy of activation in presence of catalyst for the forward reaction.

E_3 = energy of activation in absence of catalyst for the backward reaction.

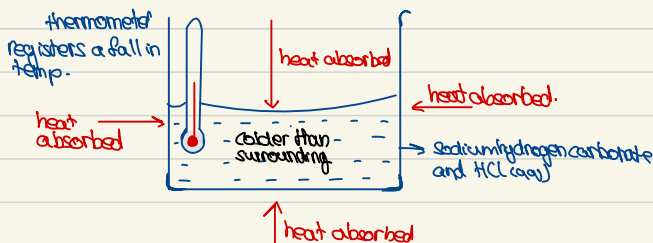
E_4 = energy of activation in presence of catalyst for the backward reaction.

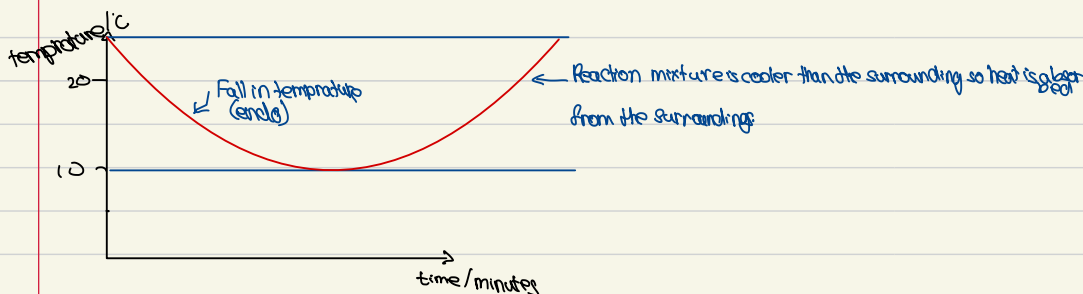
ΔH = enthalpy change

H_r = energy content of the reactants

H_p = energy content of the product.

Endothermic Reactions

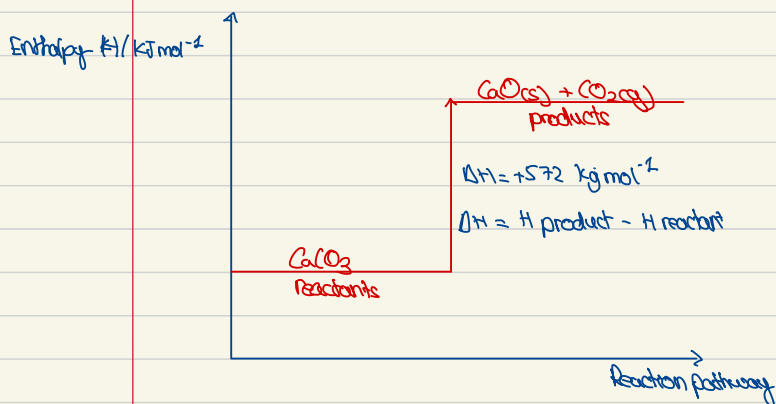




Endothermic Characteristics

1. It is a reaction in which the temperature of the reaction mixture decreases & container may feel warm to touch.
2. In this reaction heat energy is absorbed from the surroundings.
3. In this reaction products have greater enthalpy or higher energy content.

Simple energy profile diagram for endothermic reaction.



How does this profile diagram show that the reaction is endothermic?

1. The sign of ΔH is +ve
2. The products have greater enthalpy or higher energy content