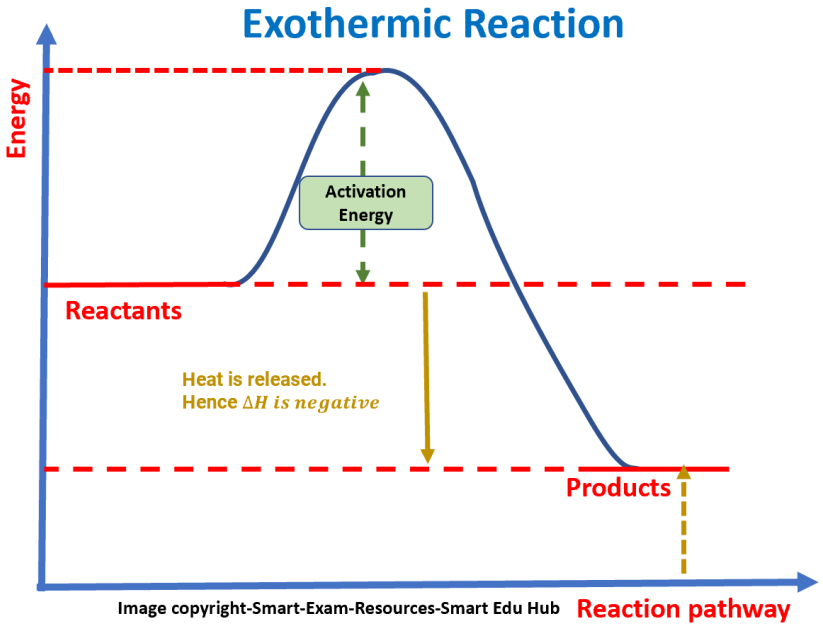
Energy level diagrams



Activation energy: It is the minimum amount of energy needed for the reaction to occur.

Activation energy can be lowered using a catalyst.

Interpreting the graph:

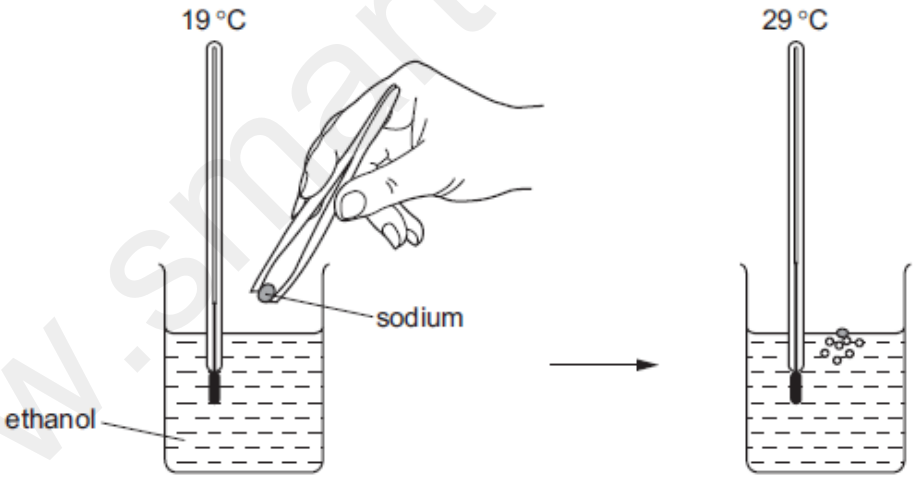
- Going from the reactants to the top of the curve, we are going up the energy axis of the graph. Here the heat energy is being put in to break the bonds in the reactants.
- At the top of the curve, the bonds in the reactants have been broken. The minimum amount of energy needed by the colliding particles to react is the activation energy.
- Going from the top of the curve to the products, we are going down the energy axis of the graph. Heat energy is given out as bonds form in the products.

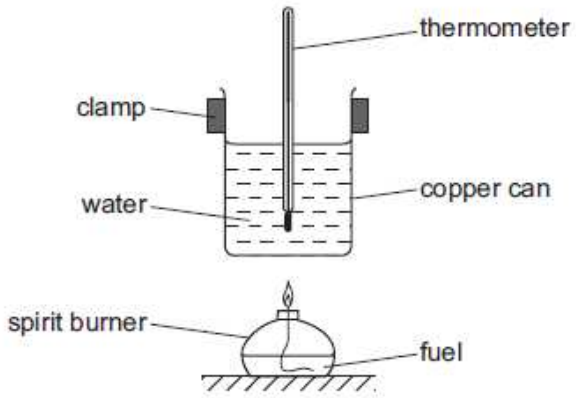
Overall:

- The reactants are higher up the energy axis than the products.
- The amount of energy put in is less than the amount of energy released.
- The difference in the energy levels of the reactants and products are given by the symbol ΔH
- ΔH is known as the enthalpy change and is the amount of heat taken in or given out during a chemical reaction.
- ΔH = -ve for exothermic reactions
- ΔH = +ve for endothermic reactions

This experiment is exothermic

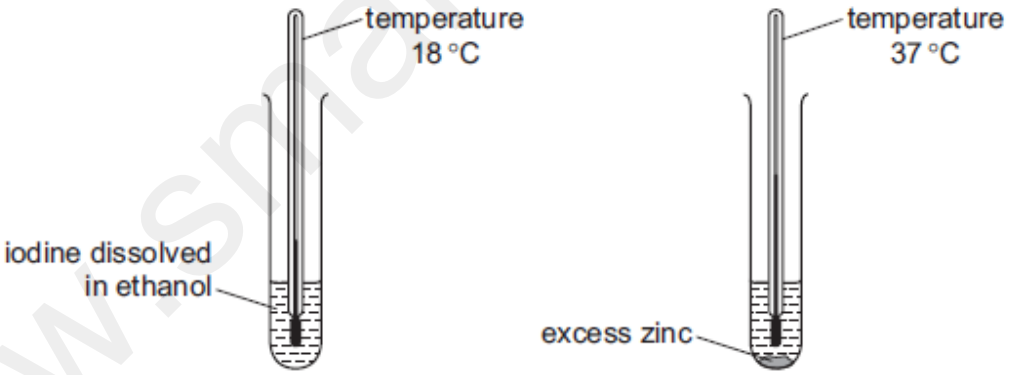
A small piece of sodium is added to some ethanol. The temperature was measured before and after the sodium was added.





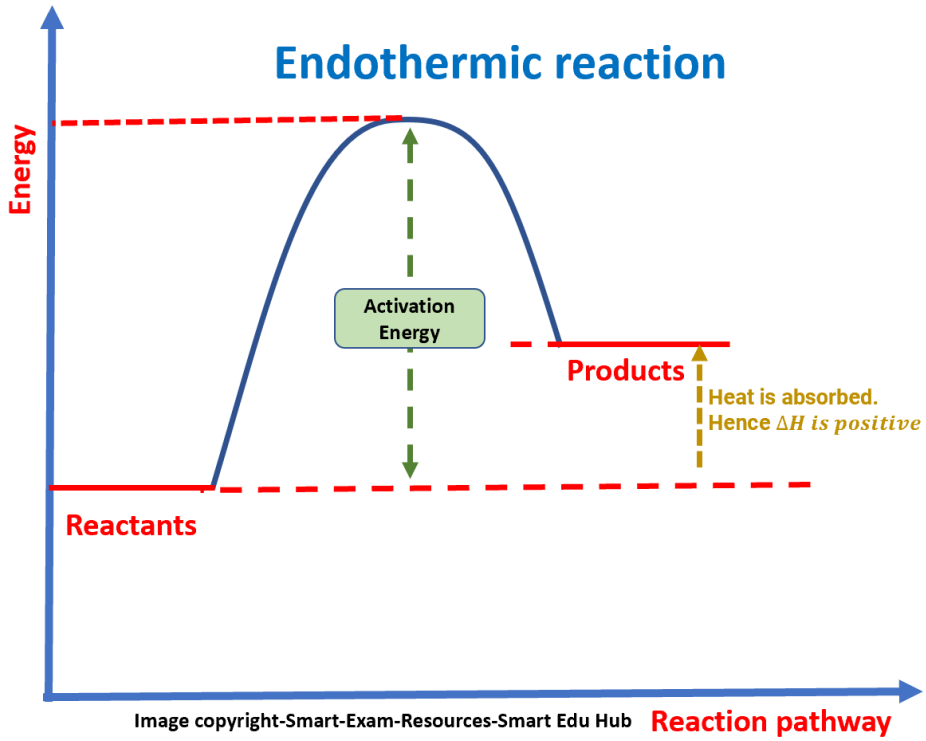
This is an exothermic reaction as more heat is given out than what is taken in.

(b) One use of ethanol is as a solvent.
A pupil studied the reaction of iodine with zinc.
She first dissolved a few crystals of iodine in ethanol and recorded the temperature of the solution.
The temperature was 18 °C.
She then added excess powdered zinc and recorded the temperature again.
The new temperature was 37 °C.



Exothermic reaction as temperature increases

Endothermic reactions



△H = +ve as the amount of energy put in is more that the amount of energy released during a chemical reaction.

Note :

- A similar method of explaining is used to explain endothermic reactions.
- Bond breaking is always endothermic
- Bond making is always exothermic

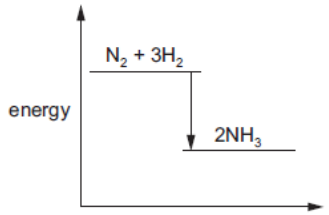
You may be asked to draw energy level diagrams for endothermic and exothermic reactions using the data provided.

Examples:

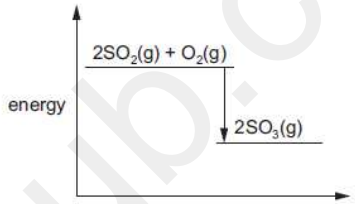
(c) The energy level diagram for this reaction is shown.

Is this reaction exothermic or endothermic?

Give a reason for your answer.



The energy level diagram for the reaction is shown.



Is this reaction exothermic or endothermic?

Give a reason for your answer.

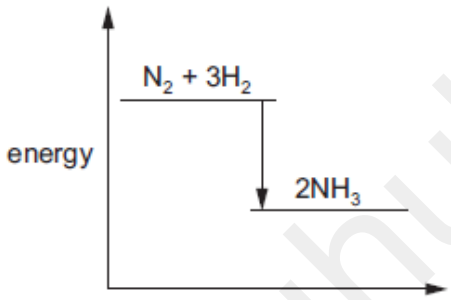
These are exothermic reactions as the products have less energy than the reactants.

Core -question for reference only[M/J/16-P31-Q6C]

(c) The energy level diagram for this reaction is shown.

Is this reaction exothermic or endothermic?

Give a reason for your answer.



This is an exothermic reaction as products have less energy than the reactants

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