Exothermic, endothermic reactions and energy profile diagrams

Answer all the questions below then check your answers

1. What is bond breaking?
2. Is bond formation exothermic or endothermic?.
3. What happens to the energy of the surroundings during an exothermic reaction?
4. Give two example of an endothermic reaction.

a. Give two examples of exothermic reactions.

5. What is the main characteristic of an endothermic reaction in terms of energy?
6. Define an exothermic reaction. Burning methane gas (CH_4) is an exothermic reaction, write a word and balanced symbolic equation for this exothermic reaction.
7. What is an energy profile diagram?
8. Describe the energy changes that occur during bond breaking and bond formation.
9. Draw energy profile diagrams for an exothermic and an endothermic reaction and explain how an energy profile diagram differs for exothermic and endothermic reactions.

10. Compare and contrast the energy changes and energy profile diagrams of exothermic and endothermic reactions.

a. What is the main characteristic of an endothermic reaction in terms of energy?

b. What does the peak of an energy profile diagram represent?

c. Why does an endothermic reaction feel cold to the touch?

d. Explain why bond breaking is considered an endothermic process.

e. State the difference in energy between the reactants and products in an exothermic reaction.

f. State the difference in energy between the reactants and products in an endothermic reaction.

g. What is the activation energy in a chemical reaction?

Answers

1. What is bond breaking?

   Answer: Bond breaking is the process of separating atoms that are connected by chemical bonds, requiring energy input.

2. Is bond formation exothermic or endothermic?

   Answer: Bond formation is exothermic because it releases energy.

3. What happens to the energy of the surroundings during an exothermic reaction?

   Answer: During an exothermic reaction, the energy of the surroundings increases as heat is released.

4. Give two example of an endothermic reaction.
   Thermal decomposition of calcium carbonate, photosynthesis.

a. Give two examples of exothermic reactions.

   Combustion (burning) of fuels, neutralization reactions between acids and alkalis.

5. What is the main characteristic of an endothermic reaction in terms of energy?
   An endothermic reaction absorbs energy from its surroundings.

6. Define an exothermic reaction. Burning methane gas (CH_4) is an exothermic reaction, write a word and balanced symbolic equation for this exothermic reaction.

Answer: An exothermic reaction is a chemical reaction that releases energy to the surroundings, usually in the form of heat.

Methane + oxygen → carbon dioxide + water

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

7. What is an energy profile diagram?

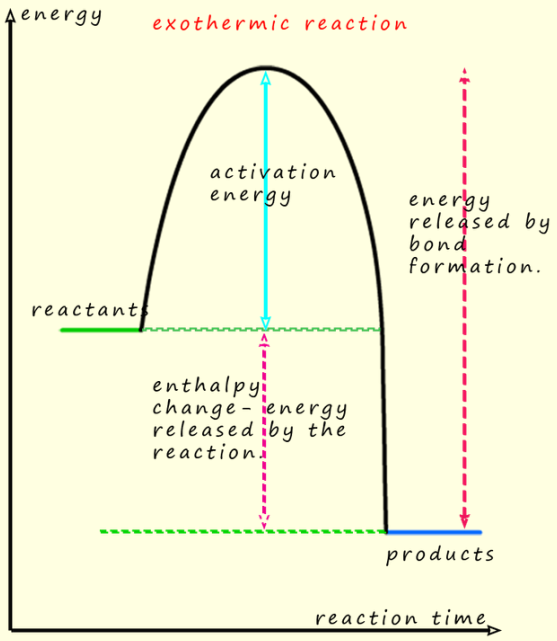
Answer: An energy profile diagram is a graph that shows the energy changes during the course of a reaction, indicating the energy of the reactants, products, and the activation energy.

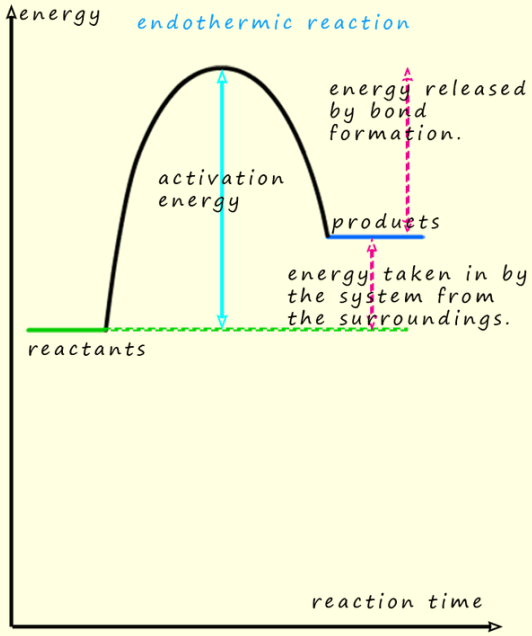
8. Describe the energy changes that occur during bond breaking and bond formation.

Answer: During bond breaking, energy is absorbed to overcome the attractive forces between atoms, making it an endothermic process. Conversely, during bond formation, energy is released as new bonds are created, making it an exothermic process.

9. Draw energy profile diagrams for an exothermic and an endothermic reaction and explain how an energy profile diagram differs for exothermic and endothermic reactions.

Answer: In an exothermic reaction energy profile diagram, the energy of the products is lower than that of the reactants, indicating a release of energy. For an endothermic reaction, the energy of the products is higher than that of the reactants, indicating absorption of energy.





10. Compare and contrast the energy changes and energy profile diagrams of exothermic and endothermic reactions.

Answer:

Both exothermic and endothermic reactions involve energy changes and can be represented using energy profile diagrams. In an exothermic reaction, energy is released to the surroundings, and the energy profile diagram shows reactants starting at a higher energy level and products at a lower energy level, with the difference representing the released energy. Conversely, in an endothermic reaction, energy is absorbed from the surroundings, and the energy profile diagram shows reactants at a lower energy level and products at a higher energy level, with the difference representing the absorbed energy. Both diagrams feature a peak representing the activation energy needed to initiate the reaction, which is the same regardless of whether the reaction is exothermic or endothermic.

a. What is the main characteristic of an endothermic reaction in terms of energy?
An endothermic reaction absorbs energy from its surroundings. The system that is the reacting chemical has more energy than the reactants.

b. What does the peak of an energy profile diagram represent?

The peak of an energy profile diagram represents the activation energy of the reaction. That is the energy needed to break the chemical bonds in the reactant molecules.

c. Why does an endothermic reaction feel cold to the touch?

An endothermic reaction feels cold to the touch because it absorbs heat from the surroundings and your hand is part of the surroundings, an endothermic reaction reducing the temperature of the immediate environment.

d. Explain why bond breaking is considered an endothermic process.

Bond breaking is considered an endothermic process because it requires energy to break the covalent bonds holding the atoms together in a molecule.

e. State the difference in energy between the reactants and products in an exothermic reaction.

In an exothermic reaction, the products have lower energy than the reactants.

f. State the difference in energy between the reactants and products in an endothermic reaction.

In an endothermic reaction, the products have higher energy than the reactants.

g. What is the activation energy in a chemical reaction?

Activation energy is the minimum amount of energy required for reactants to collide with enough energy to break the bonds holding the reactant molecules together.