Combined Science - Chemistry - Key Stage 4

Energy Changes

Exothermic and endothermic reactions

Mrs. Begum

Independent task

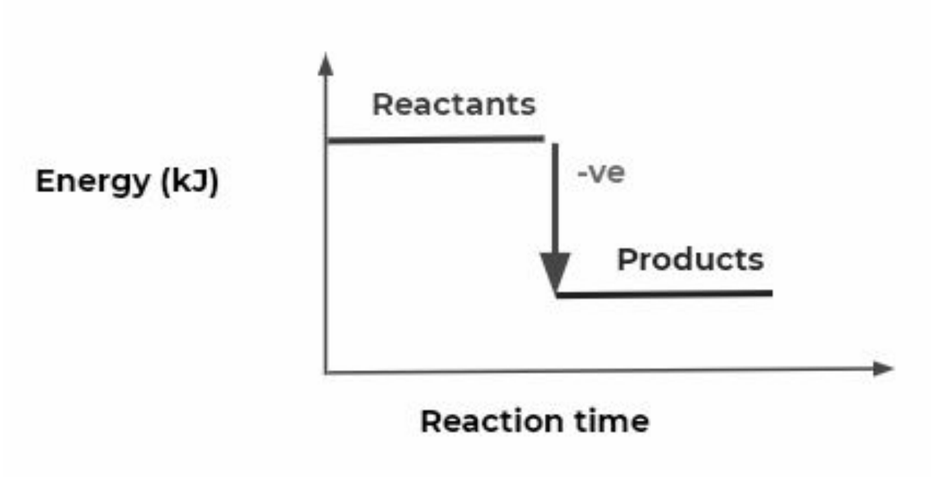
Answer the questions below in full sentences.

1. Give the definition of an exothermic reaction.
2. Draw an energy diagram to represent an exothermic reaction.
3. Give the definition of an endothermic reaction.
4. Draw an energy diagram to represent an endothermic reaction.
5. How can we determine if a reaction is endo- or exothermic?

Independent task answers

1. Give the definition of an exothermic reaction.
   In an exothermic reaction energy is transferred to the surroundings, which causes the temperature of the surroundings to increase.

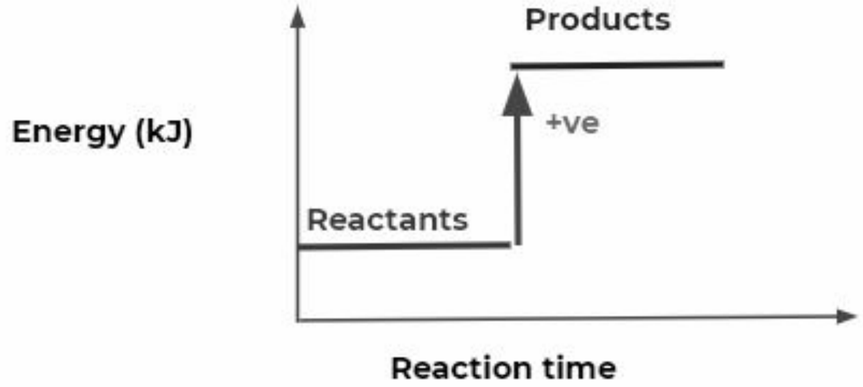
2. Draw an energy diagram to represent an exothermic reaction.



3. Give the definition of an endothermic reaction.

A reaction where energy is taken in from the surroundings, which causes the temperature of the surroundings to decrease.

4. Draw an energy diagram to represent an endothermic reaction.



5. How can we determine if a reaction is endo- or exothermic?

We can measure the temperature before and after to determine temperature change. If the temperature increases the reaction is exothermic, if the temperature decreases the reaction is endothermic.

Independent task

Determine the temperature change for each reaction and decide if it is endothermic or exothermic. You may use a calculator if needed.

Reaction	**Start temp (° C)**	**End temp (°C)**	**Change in temp (°C)**	**Endo or exo?**
zinc + sulfuric acid → zinc (II) sulfate + hydrogen	21	51		
nitric acid + sodium hydroxide → sodium nitrate + water	22	28		
potassium hydrogen carbonate + hydrochloric acid → potassium chloride + water + carbon dioxide	21	9		
silver (I) nitrate + copper → silver + copper (II) nitrate	20	25		
calcium + hydrochloric acid → calcium chloride + hydrogen	19	57		

Independent task answers

Reaction	Start temp (° C)	End temp (°C)	Change in temp (°C)	Endo or exo?
zinc + sulfuric acid → zinc (II) sulfate + hydrogen	21	51	**+30**	**exo**
nitric acid + sodium hydroxide → sodium nitrate + water	22	28	**+6**	**exo**
potassium hydrogen carbonate + hydrochloric acid → potassium chloride + water + carbon dioxide	21	9	**-12**	**endo**
silver (I) nitrate + copper → silver + copper (II) nitrate	20	25	**+5**	**exo**
calcium + hydrochloric acid → calcium chloride + hydrogen	19	57	**+38**	**exo**

Evaluate 2 different types of hand warmers

	Disposable hand warmer	**Reusable hand warmer**
Contents of each hand warmer	Iron powder, sand, carbon, salt, water	Sodium ethanoate, water
Source of heat	Oxidation of iron	Crystallisation of a saturated solution
Highest temperature reached	70°C	50°C
Temperature after 5 hours	60°C	21°C
Reuse	Cannot be reused	Heat the hand warmer in boiling water and allow to cool
Cost of each hand warmer	50p	£4

Evaluation review

- There are more reactants in the disposable hand warmer, making its manufacture **more** complicated.
- The maximum temperature of 70°C might be too high and could cause skin burns, so the reusable one may be **safer**.
- The disposable hand warmer reaches a **20°C higher** maximum temperature than the reusable one and is **3x warmer** 5 hours later so it stays **warmer for longer**.
- The disposable one is **8x cheaper** than the reusable one, but cannot be used again, whereas, after 8 uses, the reusable one would be **better value**.