

What is Activation Energy?

Worksheet

Activation energy is the energy required to start a chemical reaction - the height of the energy barrier on a reaction-coordinate diagram. Lowering E_a (via a catalyst) speeds up reactions without changing H .

Questions

1. A reaction has $H = 50$ kJ and $E_a = 200$ kJ. At room temp?
 - A) Very fast
 - B) Very slow
 - C) Exothermic and fast
 - D) Impossible
2. A catalyst lowers E_a . What else changes?
 - A) H decreases
 - B) H increases
 - C) Nothing else; only pathway
 - D) Reactants disappear
3. Why do hot reactants react faster?
 - A) H decreases
 - B) E_a increases
 - C) More molecules have $E \geq E_a$
 - D) Catalyst forms
4. Activation energy is
 - A) Always negative
 - B) Related to H only
 - C) Independent of H
 - D) Never affected by catalysts
5. A reaction has $E_a = 50$ kJ/mol and $H = 100$ kJ/mol. Is it exothermic? Will it be fast?
6. Adding a catalyst lowers E_a from 80 kJ/mol to 30 kJ/mol. Does H change?
7. Why doesn't wood burn at room temperature even though combustion is highly exothermic?
8. Define: What is activation energy?
9. Define: How does E_a relate to reaction speed?
10. Define: How do catalysts work?

Answer Key

1. B) Very slow - High E_a means slow (molecules lack energy). H is favorable but E_a is the barrier.
2. C) Nothing else; only pathway - Catalysts only change the pathway (lower E_a), not the overall energy change (H).
3. C) More molecules have $E \geq E_a$ - Higher temperature more kinetic energy more molecules overcome E_a faster reaction.
4. C) Independent of H - E_a is the pathway height; H is start-to-end. Both are independent.
5. $H < 0$ exothermic (releases energy). $E_a = 50$ kJ/mol is moderate (not very low). Speed depends on E_a , not H . This reaction is thermodynamically favorable but not necessarily fast at room temp.
6. H is the difference: products reactants energy. A catalyst changes the pathway, not the start/end points. H remains the same; only E_a decreases reaction speeds up.
7. Combustion is exothermic ($H < 0$) but has very high E_a . At room temp, molecules lack energy to overcome E_a . Heating (match/spark) provides energy to start the reaction.
8. The minimum energy barrier reactants must overcome to form products. Denoted E_a .
9. Lower E_a faster reaction. Higher E_a slower reaction. E_a is independent of H .
10. Catalysts lower E_a by providing an alternative reaction pathway. They do not change H .

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