

Exercise walk-through

5.5

Collision Model

AP Chemistry

You must be able to

- state the two requirements for a successful collision (**energy** and **orientation**)
- define **activation energy** E_a
- link temperature to the fraction of successful collisions

1

The method

Method — Two requirements

For a collision to react, the particles must collide with:

- 1 at least the **activation energy** E_a (enough energy to break bonds), and
- 2 the correct **orientation** (the right parts must meet).

Most collisions fail one of these, so only a fraction react.

Exercises 2.1-2.3

2.1 State the two requirements for a successful collision. [2]

2.2 Define activation energy. [1]

2.3 Why does raising temperature increase the fraction of successful collisions? [1]

Exercises 2.1-2.3

2.1 State the two requirements for a successful collision. [2]

2.1

- Enough energy (at least E_a); correct orientation
-

2.2 Define activation energy. [1]

2.2

- The minimum energy needed for a collision to lead to reaction
-

2.3 Why does raising temperature increase the fraction of successful collisions? [1]

2.3

- Particles have more kinetic energy, so more of them exceed E_a

Exercise 3.1

3.1 The activation energy is the

[1]

☐

A energy released by the reaction

B minimum energy needed for a collision to react

C average energy of the particles

D energy of the products

Exercise 3.1

3.1 The activation energy is the

[1]

☐

A energy released by the reaction

B minimum energy needed for a collision to react

C average energy of the particles

D energy of the products

3.1 B

- the minimum energy for a collision to react

Exercise 3.2 (a)

3.2 Two gas molecules collide but do not react.

(a) Give two possible reasons.

[2]

Exercise 3.2 (a)

3.2 Two gas molecules collide but do not react.

(a) Give two possible reasons.

[2]

(a)

- Not enough energy (below E_a); wrong orientation

Exercise 3.2 (b)

3.2 Two gas molecules collide but do not react.

(b) Explain how heating the gas would increase the reaction rate.

[2]

Exercise 3.2 (b)

3.2 Two gas molecules collide but do not react.

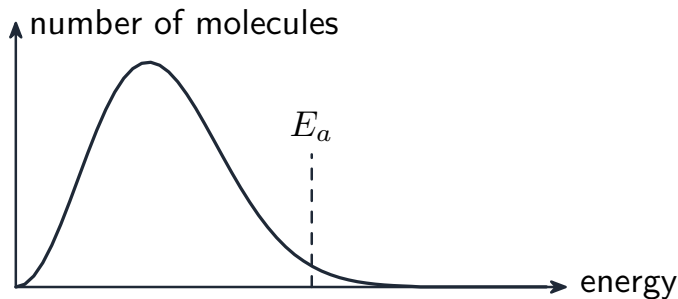
(b) Explain how heating the gas would increase the reaction rate. [2]

(b)

- Heating raises particle energy, so more collisions exceed E_a and collisions are more frequent, increasing the rate

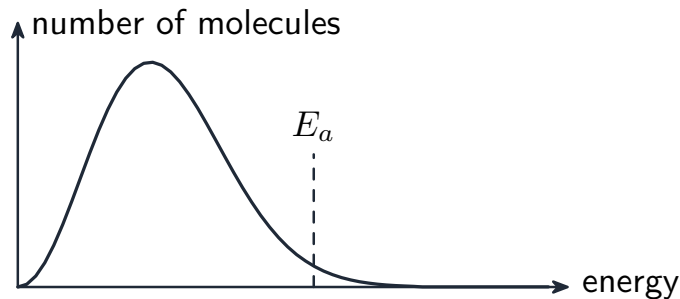
Exercise 3.3

3.3 On a Maxwell-Boltzmann distribution, explain what the area to the **right** of E_a represents and how it changes with temperature. [2]



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3.3

- It represents the fraction of molecules with energy $\geq E_a$ (able to react); heating shifts the curve right so this area grows