Temperature and Rate of Reaction

T-Level Science · Chemistry · A11.2.1–A11.2.3

Name: _____ Date: _____

1. Retrieval

1.1 State the two requirements for a successful collision and define activation energy.

2. Increasing temperature

Complete the table, then write the full causal chain.

Quantity	Effect of increasing temperature	Why
Average kinetic energy		
Particle speed		
Collision frequency		
Proportion with E ≥ Ea		
Rate of reaction		

A11.2 Temperature and Rate of Reaction

2.1 Full explanation

Explain, step by step, why increasing temperature increases reaction rate. Include kinetic energy, collision frequency, activation energy and successful collisions.

2.2 Does increasing temperature remove the need for correct spatial orientation? Explain.

3. Decreasing temperature

Quantity	Effect of decreasing temperature	Consequence for rate
Average kinetic energy		
Particle speed		
Collision frequency		
Proportion with E ≥ Ea		
Successful collisions / time		

A11.2 Temperature and Rate of Reaction

3.1 Low-temperature prediction

Explain why lowering temperature decreases the rate of reaction.

4. Maxwell–Boltzmann distributions

4.1 What do the x-axis and y-axis represent? What does a vertical Ea line represent?

4.2 Describe how a Maxwell–Boltzmann distribution changes when temperature increases.

4.3 What does the area to the right of Ea represent, and why is it larger at higher temperature?

4.4 What stays constant

For the same uncatalysed reaction, does increasing temperature change Ea? Explain.

5. Distribution interpretation

Curve A is tall and narrow. Curve B has a lower peak and is broader toward higher energies.

5.1 Identify the higher-temperature curve and justify.

5.2 Use the curves to explain which sample has the greater reaction rate.

6. Error detective

6.1 ‘Heating lowers activation energy.’

6.2 ‘The Maxwell–Boltzmann peak becomes higher when temperature increases.’

6.3 ‘Only collision frequency changes when temperature increases.’

6.4 ‘Every collision with energy above Ea must react.’

7. Exam-style questions

A reaction mixture is heated from 298 K to 318 K.

7.1 [2] Explain the effect on average kinetic energy and collision frequency.

7.2 [2] Explain why the proportion of successful collisions increases.

7.3 [3] Describe the change in the Maxwell–Boltzmann distribution.

7.4 [3] Explain why heating increases reaction rate using collision theory.

A11.2 Temperature and Rate of Reaction

8. Final knowledge check

8.1 How does higher temperature affect average kinetic energy?

8.2 How does it affect collision frequency?

8.3 How does it affect the proportion with E ≥ Ea?

8.4 What happens to the Maxwell–Boltzmann peak at higher temperature?

8.5 What happens to rate when temperature decreases, and why?

8.6 Does temperature alone change Ea for the same reaction?