INKCHEMISTRY FLASHCARDS

# Kinetics

Unit C05 · 29 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions to learn and misconceptions to correct. These cards, and a check-yourself question for every lesson, run on the website with spaced-repetition scheduling, at inklearning.co.uk/chemistry/flashcards.

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**DEFINITION**

Define: Rate of reaction.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

Define: Initial rate.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

Define: Activation energy.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

Define: Successful collision.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

Define: Collision frequency.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

Define: Transition state.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

Define: Enthalpy profile.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

Define: Mean rate.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

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**DEFINITION**

The rate of reaction at the start, when t = 0, found from the gradient of the tangent to a concentration–time graph at t = 0.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

The change in the concentration of a reactant or a product per unit time, measured in mol $dm^{-3}$ $s^{-1}$.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

A collision between particles that have at least the activation energy and are in the correct orientation, so that it leads to a reaction.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

The minimum energy that colliding particles must have for a reaction to take place.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

The highest-energy arrangement of atoms on the route from reactants to products, in which bonds are partly broken and partly formed.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

The number of collisions between reactant particles per unit time in a given volume.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

The total change in the amount or concentration of a substance divided by the time interval over which it changed.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

A diagram of enthalpy against the progress of a reaction, showing the reactants, the transition state at the peak and the products, from which Ea and ΔH are read.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

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**DEFINITION**

Define: Tangent.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**SPOT THE ERROR**

Say what is wrong with this claim:

Heating, stirring, crushing and concentrating all speed a reaction up for the same reason: the particles hit each other harder.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

Define: Maxwell–Boltzmann distribution.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

Define: Most probable energy.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

Define: Mean energy.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

Define: Activation energy.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

Define: Catalyst.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

Define: Heterogeneous catalyst.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

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**SPOT THE ERROR**

Only heating makes collisions more energetic. Crushing a solid, raising a concentration or pressure, and stirring all raise the number of collisions per second at the same energy: the same fraction succeed, but there are more of them. A catalyst lowers the activation energy, so a larger fraction succeed.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

A straight line that touches a curve at one point without crossing it there; its gradient is the rate at that moment.

COLLISION THEORY, ACTIVATION ENERGY AND THE RATE OF REACTION

**DEFINITION**

The energy at the peak of the Maxwell–Boltzmann distribution, the energy possessed by the greatest number of molecules.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

The distribution of the energies of the molecules in a gas at a given temperature, shown as the number of molecules with each energy.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

The minimum energy that colliding particles must have for a reaction to take place.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

The average energy of the molecules, which lies to the right of the most probable energy because the distribution is not symmetrical.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

A catalyst in a different phase from the reactants, such as solid iron in the Haber process.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

A substance that increases the rate of a reaction without being changed in chemical composition or amount, by providing an alternative reaction route with a lower activation energy.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

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**DEFINITION**

Define: Homogeneous catalyst.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**SPOT THE ERROR**

Say what is wrong with this claim:

Heating a reaction speeds it up because the molecules move faster and so collide more often.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

Define: Continuous monitoring.

MEASURING THE RATE OF A REACTION

**DEFINITION**

Define: End point.

MEASURING THE RATE OF A REACTION

**DEFINITION**

Define: Independent variable.

MEASURING THE RATE OF A REACTION

**DEFINITION**

Define: Dependent variable.

MEASURING THE RATE OF A REACTION

**DEFINITION**

Define: Control variable.

MEASURING THE RATE OF A REACTION

**DEFINITION**

Define: Calibration curve.

MEASURING THE RATE OF A REACTION

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**SPOT THE ERROR**

A 10 °C rise makes molecules collide only about 2% more often, but roughly doubles the rate. What changes is the energy distribution: the curve flattens and spreads to the right, so the fraction of molecules with at least the activation energy rises sharply, and a larger proportion of collisions succeed.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

A catalyst in the same phase as the reactants, such as iodide ions dissolved with hydrogen peroxide.

THE MAXWELL–BOLTZMANN DISTRIBUTION, TEMPERATURE AND CATALYSTS

**DEFINITION**

The moment at which a fixed, observable change has taken place, such as a cross disappearing, when the timing is stopped.

MEASURING THE RATE OF A REACTION

**DEFINITION**

Following a single reaction mixture by reading a property that changes, at intervals, through the whole reaction.

MEASURING THE RATE OF A REACTION

**DEFINITION**

The variable that is measured in each run to see the effect of the change.

MEASURING THE RATE OF A REACTION

**DEFINITION**

The variable that is deliberately changed from one run to the next.

MEASURING THE RATE OF A REACTION

**DEFINITION**

A graph of a measured property, such as absorbance, against known concentrations of a substance, used to convert a reading into a concentration.

MEASURING THE RATE OF A REACTION

**DEFINITION**

A variable kept the same in every run so that it cannot affect the result.

MEASURING THE RATE OF A REACTION

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**DEFINITION**

Define: Resolution.

MEASURING THE RATE OF A REACTION

**DEFINITION**

Define: Random error.

MEASURING THE RATE OF A REACTION

**DEFINITION**

Define: Systematic error.

MEASURING THE RATE OF A REACTION

**DEFINITION**

Define: Percentage uncertainty.

MEASURING THE RATE OF A REACTION

**SPOT THE ERROR**

Say what is wrong with this claim:

If a reaction gives off a gas, its rate can always be followed by standing the flask on a balance and watching the mass fall.

MEASURING THE RATE OF A REACTION

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**DEFINITION**

An error that makes repeated readings scatter unpredictably on both sides of the true value; its effect is reduced by repeating the measurement and taking a mean.

MEASURING THE RATE OF A REACTION

**DEFINITION**

The smallest change in a quantity that an instrument can show, such as 0.01 g on a balance reading to two decimal places.

MEASURING THE RATE OF A REACTION

**DEFINITION**

The uncertainty in a measurement divided by the measured value and multiplied by 100.

MEASURING THE RATE OF A REACTION

**DEFINITION**

An error that shifts every reading from the true value in the same direction by a similar amount; repeating the measurement neither reveals it nor reduces it.

MEASURING THE RATE OF A REACTION

**SPOT THE ERROR**

Mass loss works only when the gas is heavy enough to register. Carbon dioxide, Mr 44, from marble and acid gives a clear fall; hydrogen, Mr 2, from magnesium and acid loses so little mass that the balance cannot resolve it. For a light gas, collect it in a gas syringe or over water and follow the volume instead.

MEASURING THE RATE OF A REACTION

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