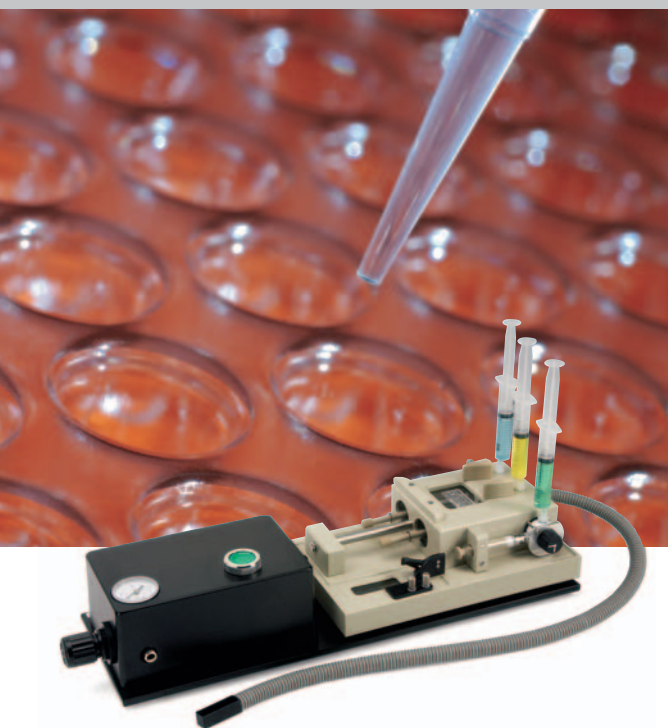


The Evolution™ 300 has the fastest data acquisition rate of available double beam UV-Visible spectrophotometers – sampling data every 20 ms. This fast data acquisition rate combined with our Rapid Mixing accessory forms a system for measuring fast kinetic reactions by UV-Visible absorption.

Rapid Mixing Accessory

Measure millisecond reactions by UV-Visible absorption spectroscopy



For researchers studying kinetics, the Evolution 300 spectrophotometer equipped with a Rapid Mixing accessory is a perfect fit for your laboratory. Featuring the fastest data acquisition rate of any available double-beam spectrophotometer, the Evolution 300 allows up to 50 data points to be collected per second on a single cell. This fast data rate makes this spectrophotometer ideal for studying reactions occurring on the millisecond to second timescale.

The Rapid Mixing accessory provides a very low dead time of 8 ms, giving you access to reactions that occur up to 1000 times faster than those visible to manual mixing experiments. The Rapid Mixing accessory triggers the start of the reaction monitoring, providing the best resolution of the time-zero initial conditions. Using an electronic trigger provided by the Rapid Mixing accessory, the software begins acquiring data as soon as the reactants are injected into the mixing cell.

Easy Operation

The pneumatic drive accessory allows you to start reactions with the touch of a single button. Syringes containing the reactants are driven by a pneumatic mechanism to initiate the reaction. This in turn triggers the start of the data acquisition on the instrument, delivering precise data on the initial reaction steps. Alternatively, the reaction can be initiated by manually driving solution into the mixing cell.

Complete Temperature Control

Most reactions are temperature sensitive and maintaining temperature control

throughout the system is critical to accurate data. The Rapid Mixing accessory features a fully thermostatable flow circuit that maintains complete temperature control over the entire fluid circuit of the system. The recirculating fluid not only surrounds the drive syringes, but also jackets the exterior of the tubing leading to the mixing cell. This keeps your samples at the proper temperature throughout the entire system. Constant temperature readings are provided with a digital temperature display. Use one of our Peltier accessories to keep tight control over the temperature of the reactants inside the mixing cell.

Monitor Low Volume Reactions

Using as little as 100 μL of each reactant, the Rapid Mixing accessory allows you to measure low volume reactions. This feature is particularly useful if your reactants are expensive or difficult to produce in large quantities. The low volume requirement also allows you to test multiple lots of enzyme to monitor activity from batch-to-batch.

Highly concentrated reactants are easily accommodated by the mixing cell, which features both a 2 mm and standard 10 mm pathlength option. The mixing cell is designed in such a way that both pathlengths are accommodated by a single cell. Use the 2 mm pathlength for measuring concentrated samples and the 10 mm pathlength if the concentration is lower. The Evolution 300 also provides excellent noise performance, even on highly absorbing data. More information is provided in the experimental data shown on the following page.

Rapid Mixing Accessory Specifications

Mixer:	Twin-jet mixer integrated in mixing cell
Dead Time:	8 ms
Pathlength:	2 and 10 mm, dual pathlength
Reaction Volume:	60 μL
Minimum Reactant Volume:	100 μL
Mixing Ratio:	1:1 Standard, other ratios with additional syringes
Temperature Range:	4 to 60°
Flow Circuit:	Chemically Inert (quartz mixing cell, glass syringes, and fluorocarbon tubing)

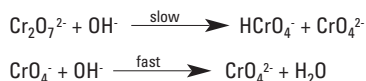
Oxygen Sensitive Sample?

The optional Anaerobic accessory for use with the Rapid Mixing accessory allows you to study reactions that are oxygen sensitive. The Anaerobic accessory consists of a manifold, which is mounted over the base of the drive syringes and is purged with a steady stream of inert gas. This maintains an oxygen-free environment in the region between the syringe-barrels and the pistons, thus preventing the diffusion of oxygen across the Teflon® syringe tips. Included with the Anaerobic accessory are 3-way valves for sample introduction without exposing the sample to the outside environment.

Experimental Data

The rapid hydrolysis of dichromate provides an excellent model system for demonstrating the capabilities of the Rapid Mixing accessory when used with the Evolution 300 spectrophotometer.

The bimolecular reaction proceeds in two steps as shown below. The first step of the reaction occurs slowly as the dichromate is reduced to chromate. This is followed by a second faster step where the chromate is further reduced to chromic acid

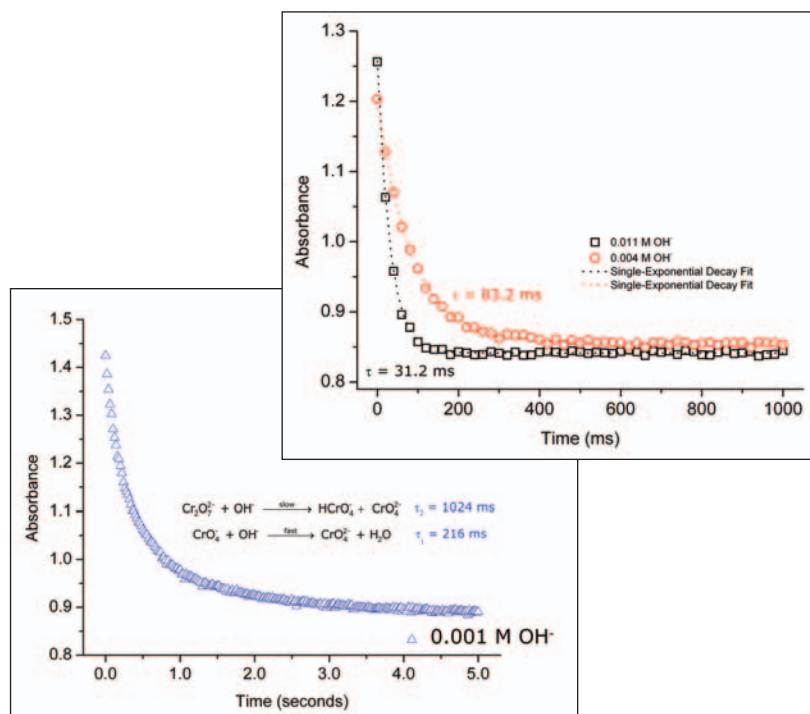


Conveniently, this reaction can be monitored by UV-Visible spectrophotometers as the reaction causes a color change from orange to yellow, which can be tracked by measuring the absorption at 475 nm. The rate of dichromate hydrolysis is directly proportional to the concentration of hydroxide, as shown below:

$$\text{Rate} = - \frac{d[\text{Cr}_2\text{O}_7^{2-}]}{dt} = k [\text{Cr}_2\text{O}_7^{2-}][\text{OH}^-]$$

When the hydroxide ion is in large excess, the reaction is pseudo first order. This is demonstrated by the excellent agreement of the reaction data to a single-exponential decay. The half-life of a reaction performed with a large excess of hydroxide is also shown in the figure below. The half-life of the fast reaction can be determined even though the reaction is complete in ~200 ms. Additionally, the signal-to-noise ratio is very good, given the large absorption background for this reaction.

When the concentration of hydroxide is reduced, both the fast and slow steps of the reaction are visible and fit to a two exponential decay, yielding half-life values of 216 and 1024 ms.



Product Information

Product	Part Number
Rapid Mixing Accessory with Pneumatic Drive*	222-234400
Rapid Mixing Accessory*	222-234300
Evolution 300 UV-Visible Spectrophotometer with 50 Points/second data acquisition rate	10300XXX
Smart Peltier Thermostatted Single Cell Holder; Temperature range 5 to 110 °C	10010301
VISIONpro™ software	10040101
VISIONlife™ software; Enables the kinetics module of VISIONpro software	10040201

*Contact your sales representative for more information on the Anaerobic accessory.

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Thermo Electron Scientific Instruments LLC.
Madison, WI USA is ISO Certified.

PS51481_E 09/07M

Australia +61 2 8844 9500
Austria +43 1 333 50340
Belgium +32 2 482 30 30
Canada +1 800 532 4752
China +86 10 5850 3588
Denmark +45 70 23 62 60

France +33 1 60 92 48 00
Germany +49 6103 408 1014
India +91 22 6742 9434
Italy +39 02 950 591
Japan +81 45 453 9100
Latin America +1 608 276 5659

Netherlands +31 76 587 98 88
South Africa +27 11 570 1840
Spain +34 91 657 4930
Sweden/Norway/Finland
+46 8 556 468 00
Switzerland +41 61 48784 00

UK +44 1442 233555
USA +1 800 532 4752

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