

CEM Academic Solutions

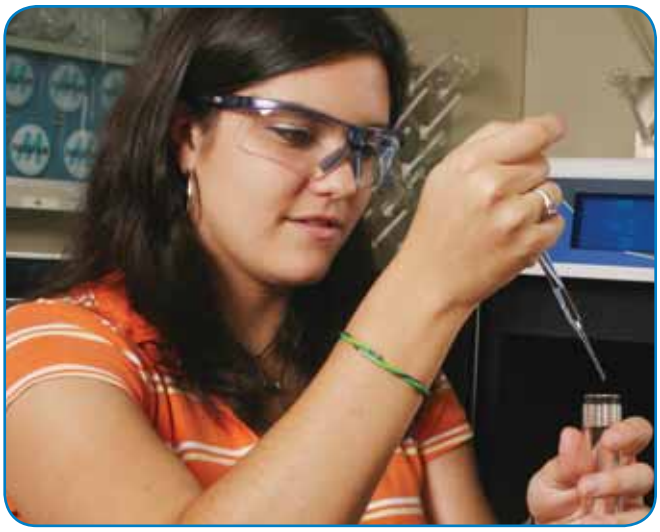
Microwave Synthesis Systems, Teaching Materials & Funding Opportunities

for Graduate Research and Undergraduate Instruction

CEM

Advancing Technology for Today's Students and Tomorrow's Researchers

Someday, she may discover the cure for cancer.

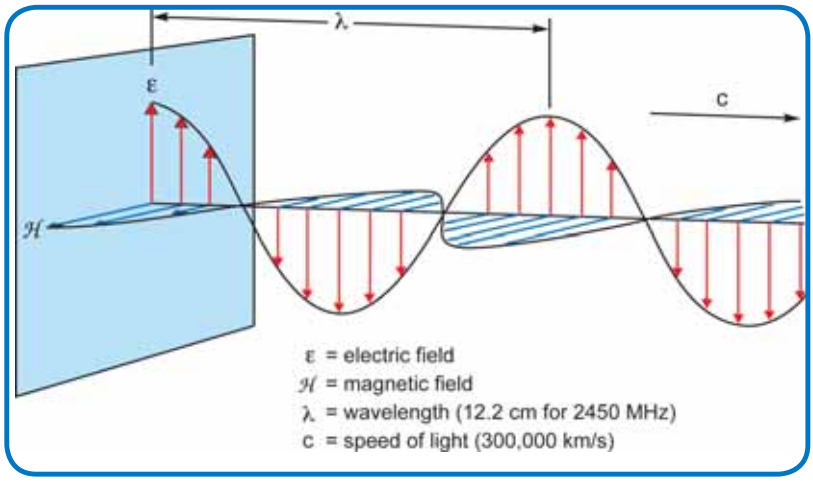


Today, she's your student and you have a relatively short amount of time to teach her as much as you can about the methods and chemistries upon which she'll build her own research.

- How do you give her a good start in learning the technologies that she'll be using in the workplace?
- How do you keep her attention and help ensure that she doesn't get discouraged?
- How do you make the most of the lab time you have?



DISCOVER
Microwave-Accelerated Reactions



Microwave synthesis significantly reduces the time needed to drive reactions to completion. For example, nucleophilic aromatic substitutions, typically requiring 60-90 minutes reflux in toluene, are completed in less than 10 minutes in an aqueous solution with microwave heating, providing a cleaner alternative to traditional methods and giving students more time for purification, product identification, and learning new chemistries.

- 10 – 1,000 times faster than conventional heating
- Greater yields/ fewer side reactions
- Green chemistry – Microwave reactions use less solvent than conventional methods. In some cases, you can even use water as a solvent and still get great results.
- Safe – The monitoring and control capabilities of CEM systems ensure safety and reproducibility.

We can help.

We're the microwave chemistry experts of CEM.



As the leading provider of microwave laboratory systems in the world, we have more than 30 years of experience designing and building microwave systems for the laboratory. CEM holds more than 300 patents for microwave technology. Our applications chemists and support technicians are well known for their expert and timely assistance. Indeed, we've helped thousands of chemists and researchers around the world get the results they need, ***fast***.

Microwave University Online Learning Center

As a CEM customer, you have full access to the unique CEM Learning Center. The Learning Center gives you direct access to all microwave synthesis publications and citations via key word searches. In addition, you have special access to CEM chemistry staff to answer questions on any experiment or research you are performing. The Learning Center allows you to stay abreast of the latest in microwave chemistry.



Installation & Training

All CEM Microwave Systems include on-site set up, installation, and training on all facets of microwave synthesis.



Teaching
A State of the Art Microwave Synthesis System for Your Laboratory



MARS 6

- Largest microwave cavity allows for greatest range of reaction vessels
- Energy distribution system ensures the highest and most reproducible yields
- Large, color, high-resolution touchscreen interface
- View built-in training and support videos on the touchscreen
- Programmable method library
- Fiberoptic temperature control
- Solid, high-grade stainless steel construction with flex-view door for maximum safety

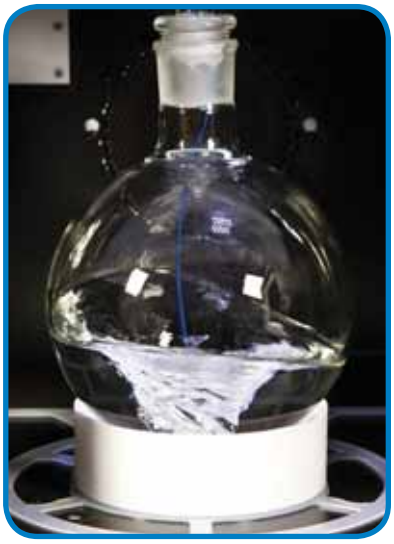
The MARS 6 Synthesis System is the perfect solution for teaching inorganic, analytical, organic, and general chemistry in the undergraduate chemistry laboratory. Using patented waveguide technology, it delivers the most uniform field of any multimode system available, eliminating the need for diffusers or attenuators. In fact, CEM's MARS series is the only line of multimode microwave reaction systems to have won the prestigious R&D 100 Award.



Easy-to-Use Software

Accurately monitor and control the temperature of the reaction. Simply enter the desired temperature, ramp time and hold time. MARS does the rest! The software also allows the pre-programming of methods for One Touch operation.

Enhanced stirring for homogenous sample mixing.



Vessel Options for the MARS 6 Synthesis System				
Vessel Type	**Max. number of vessels per run**	**Volume**	**Max. Temp. (°C)**	**Max. Pressure (psi)**
Open flask	1	Up to 5L	Reflux	----
GlassChem	24	20 mL	180	200
GreenChem	14	100 mL	200	200
EasyPrep	12	100 mL	310	1500

Introduce your students to the latest techniques

The MARS 6 Synthesis System vessels will process up to 24 samples simultaneously in under 10 minutes, allowing you to focus your lab on complex multi-step reactions or on purification and identification of compounds. Step-by-step procedures for over 30 undergraduate experiments using the MARS System are featured in the CEM lab manuals.







5-L Vessel

3-L Vessel



Atmospheric Vessel Kit

Each kit includes a 3-L and a 5-L vessel. Also included are extenders, adapters (specific to each vessel) and a vessel stand. The adapters' side port allows for placement of the temperature probe in the reaction vessel to control the reaction conditions.

GlassChem Vessels

The **GlassChem™** vessels are engineered with a simple screw cap design for ease of use while still providing the temperature and pressure capabilities necessary to perform the full range of experiments in the CEM lab manuals.

This simple to use vessel permits reaction conditions of up to 180 °C and 200 psi. It is designed for undergraduate teaching as well as research. These vessels are available in starter kits of 8, 16 and 24 vessels. Each kit includes a control vessel to provide precise control of reaction conditions.





GlassChem
20-mL vessel
with Stir Bar

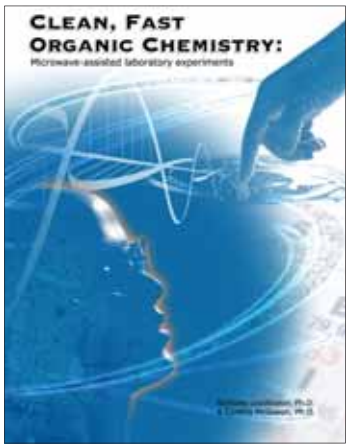
GlassChem
20-mL control
vessel

Teaching Materials

Transform your undergraduate organic laboratory into a state-of-the-art learning experience

Clean, Fast Organic Chemistry:
Microwave-Assisted Laboratory Experiments

by Nicholas Leadbeater, PhD & Cynthia McGowan, PhD

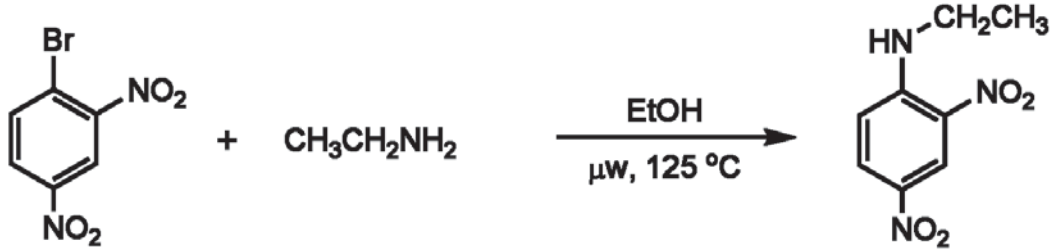


Microwave synthesis has become the standard in the modern pharmaceutical and industrial organic laboratory. In order to better prepare students for the work environment, universities need to expose students to this technique as part of the undergraduate curriculum. CEM, the world leader in mirowave reaction systems, has teamed up with the authors of ***Clean, Fast Organic Chemistry*** to provide eleven undergraduate experiments and convert them step by step to use microwave assisted techniques. This powerful teaching tool covers microwave theory, reagents and quantities, instrument programming, expected yields and even lab questions for each experiment. It's everything you need to start teaching microwave synthesis at your academic institution.

CEM laboratory experiments for General, Analytical & Inorganic Chemistry are also available.

Make the most of your lab time

By reducing reaction times, students can spend time on more complex reactions or on derivitization, purification and characterization of compounds.



Reagent	MW (g/mol)	mmol	Mass (g)	Density (g/mL)	Vol (mL)	MP / BP (°C)
1-bromo-2,4-dinitrobenzene	247	1.20	0.298			71-73
ethylamine (70% aqueous)	45.1	4.80	0.308	0.796	0.380	17
ethanol					5.0	

Microwave vs. Conventional Reflux Heating for Organic Experiments

Experiment Type	Reflux conditions	Microwave conditions
Diels-Alder	90 minutes in DMF	10 minutes in H_2O
Williamson Ether Synthesis	60 minutes in H_2O	10 minutes in H_2O
Aldol Condensation	23 hours in H_2O	15 minutes in H_2O
Bromination	45 minutes in HOAc	8 minutes in HOAc
Nucleophilic Aromatic Substitution	60-90 mins in Toluene	10 minutes in EtOH / H_2O
Hydrolysis	34 hours in MeOH / H_2O	9-15 minutes in MeOH / H_2O



Research

Discover the flexibility of Focused Microwave Synthesis



Discover SP



Discover BenchMate

Discover
Focused Microwave Synthesis Systems

The Discover® line of Focused™ Microwave Synthesis Systems combines unmatched versatility and award-winning performance in the most affordable, compact, and easy-to-use platform available.

CEM's Discover BenchMate™ is the entry level system with features typically found on higher-priced equipment. As the only truly modular platform for microwave synthesis, the Discover system is easily upgradeable with a wide range of options including automation, low-temperature (to –80 °C) chemistry, peptide synthesis, and scale-up.

The Discover SP™ with ActiVent™ Technology redefines expectations for leading performance. Advanced technology and best-in-class features make it the microwave synthesis system of choice for research. The SP performs pressurized reactions in both 10-mL and 35-mL glass vials and provides fully automated pressure control that allows you to choose how you vent your reactions. As with all Discover systems, the SP accepts all of the line's options and accessories, and also expands the automation capabilities to include both a 48- and 96-position autosampler.

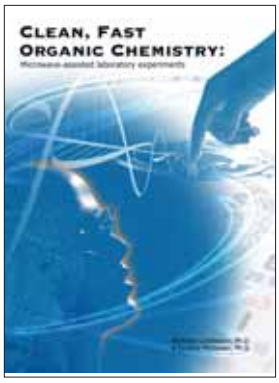


- Perform atmospheric & pressurized reactions
- Vials employ easy-to-use pop-on caps. No need for crimping tools
- Temperature and pressure control
- Temperature range from ambient to 300 °C
- Easily upgradeable with CEM's signature modular options

	Discover BenchMate	Discover SP
Atmospheric reactions	125 mL	125 mL
Temperatures to 300 °C	X	X
Stirring	X	X
Pressure management	X	X
ActiVent pressure control		X (fully automated)
Pressurized vessel capabilities	10 mL	10, 35 mL
Scale-up option	X	X
Low-temperature option	X	X
Peptide synthesis option	X	X
Automation options	24-position	12-, 48-, 72- & 96-position
Camera option		X

Your partner in academic research and teaching.

CEM is a company driven by scientists and their vision. As such we understand the challenges facing today's academic researchers and students. We are committed to support educational initiatives aimed at helping students and professors achieve outstanding results in their laboratory.



Getting Started This Semester

Teaching undergrauate microwave chemistry has never been easier. With a benchtop microwave system and the new lab manual, you are ready to teach. And CEM has numerous programs for academic grants and discounts available to help you get started. Contact our academics solutions team to discuss your requirements and get the process started. Our chemists are always available to assist you in fine tune your experiments or add others to your curriculum. Contact CEM at 800 726-3331 and ask for the Academic Solutions Team or email academicsolutions@cem.com. Your students will be glad you did.

CEM Microwave-Enhanced Chemistry Grant



Provides professors active in research and/or teaching who wish to include microwave-enhanced chemistry in their program the opportunity to receive awards for new CEM microwave systems and accessories: up to $4,000* for new research systems, up to $2,000* for teaching systems, and up to $1,500* for accessories or upgrading current CEM instrumentation.

*Award amounts listed are for grants to professors at colleges in the United States only. International award amounts may vary. Please contact CEM for information on amounts available in your region.

CEM Corporation
PO Box 200
Matthews, NC 28106
Tel: 800-726-3331
Tel: 704-821-7015
Fax: 704-821-7894
Email: info@cem.com
www.cem.com

United Kingdom
CEM Microwave Technology Ltd.
2 Middle Slade
Buckingham Industrial Estate
Buckingham MK181WA
Tel: (44) 1280-822873
Fax: (44) 1280-822873
Email: info.uk@cem.com
www.cemmicrowave.co.uk

Germany
CEM GmbH
Carl-Friedrich-Gauss-Str.9
47475 Kamp-Lintfort
Tel: (49) 2842-9644-0
Fax: (49) 2842-9644-11
Email: info@cem.de
www.cem.de

Italy
CEM S.R.L.
Via Dell' Artigianato, 6/8
24055 Cologno al Serio (Bg)
Tel: (39) 35-896224
Fax: (39) 35-891661
Email: info.srl@cem.com
www.cemmicroonde.it

France
CEM µWave S.A.S.
Immeuble Ariane
Domaine Technologique de Saclay
4, rue Rene' Razel
91892 ORSAY Cedex
Tel: (33-1)69 35 57 80
Fax:
Email: info.fr@cem.com
www.cemfrance.fr

Japan
CEM Japan K.K.
2-18-10 Takanawa
Minato-ku, Tokyo
108-0074
Tel: +81-3-5793-8542
Fax: +81-3-5793-8543
Email: info@cemjapan.jp
www.cemjapan.co.jp

Ireland
CEM Technology (Ireland) Ltd.
Sky Business Centre
9a Plato Business Park
Damastown
Dublin 15
Tel: +353 (0) 1 885 1752
Fax: +353 (0) 1 885 1601
Email: info.ireland@cem.com
www.cemmicrowave.co.uk

B052.5